AVF1

Natural History of Stasis-Induced Deep Vein Thrombosis in a Murine Model and Application in the Clinical Setting: A Histochemical Approach

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Objective: Deep vein thrombosis (DVT) can have chronic, painful, and potentially even fatal consequences. Treatment strategies include anticoagulation, physical activity, smoking cessation, compression, and sometimes venous stenting. Currently, there is no histological correlation to predict reocclusion. This study employed Lendrum's MSB stain, which visualizes erythrocytes, fibrin and platelets, and connective tissue, to evaluate murine clot natural history and apply those findings to humans.

Methods: Deep vein tissue biopsies from a murine venous stasis model and from 42 patients undergoing venous stenting between 2013 and 2016 at a single center were stained using a modified MSB protocol. Murine thrombi were formed via inferior vena cava ligation and harvested at 2, 4, 8, 14, and 21 days postoperatively. Mice did not receive any anticoagulant or anti-inflammatory medications. Patient clinical characteristics and H&E biopsy interpretations were identified via retrospective chart review. Patient venous biopsies were obtained during follow-up surveillance venograms approximately 6 months after initial stenting. Images were quantified and statistically analyzed in NIH ImageJ and Graphpad Prism respectively, using ANOVA with post-hoc analysis.

Results: In the murine thrombi, relative erythrocyte content was greatest on postoperative day 2, gradually decreasing to very low levels by days 14 and 21 (one-way ANOVA, $p < 0.0001$). Fibrin/platelet content peaked on day 8 but remained elevated throughout the time course, while collagen levels were insignificant on days 2 and 4 but rose to a peak at day 21 (Figure 1, mean+SEM, one-way ANOVA, $p = 0.0423$, 0.0003, respectively). All patients were on antiplatelet and anticoagulant therapy post stenting. Biopsies from human stented veins occluded by 1 year post-stent implantation (8/42; 19%) tended to have higher proportions of erythrocytes but lower proportions of collagen when compared to that of stenosed or fully patent stents (Figure 2, mean+SEM, one-way ANOVA, $p = 0.0112$, 0.0070). Fibrin/platelet deposition was variable and seen in all stented groups.

Conclusion: The MSB stain demonstrates the natural history of stasis-induced murine DVT, with early thrombus characterized as erythrocyte-rich, mid-term thrombus as fibrin/platelet-rich, and late term thrombus as collagen-rich. While the increased proportion of collagen over time was mirrored in patients, the continuous presence of fibrin/platelet deposits in both species suggests that variable, ongoing thrombus formation occurs over time, and may be able to inform anticoagulant decisions.

Figure 1: Murine % Collagen Timeline

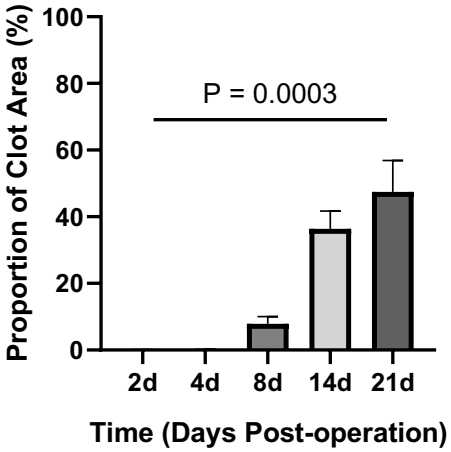

Figure 1: Murine % Collagen Timeline

Figure 2: Human 1 Year Collagen

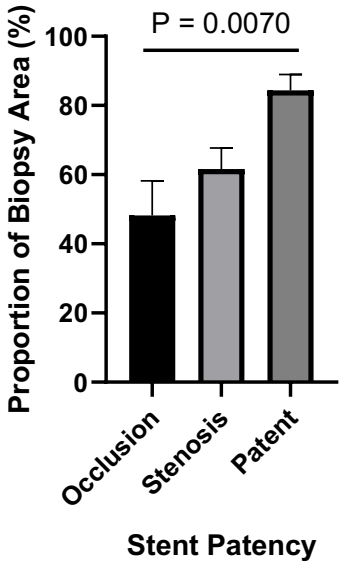

Figure 2: Human 1 Year Collagen

Author Disclosure: A Gordon: Nothing to disclose; **J Nicklas**: Nothing to disclose; **C Luke**: Nothing to disclose; **D Gordon**: Nothing to disclose; **A Obi**: Nothing to disclose; **D Williams**: Nothing to disclose; **P Henke**: Nothing to disclose

AVF2

First Use of a Novel PAI-1 Inhibitor (MDI-2268) in Animal Model of Deep Vein Thrombosis and Attempts of Combined Antithrombotic Therapy

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Objective: Anticoagulation remains the mainstay of treatment of acute venous thromboembolism. Patients may not respond to appropriate therapeutic anticoagulation suffering from proximal extension of deep vein thrombosis (VT), new episode of VT, or symptomatic pulmonary embolism. Major bleeding is a known complication of anticoagulation that affects up to 2% patients and requires IVC filter implantation. There have been ongoing attempts to improve efficacy and safety profile of modern anticoagulation. A novel PAI-1 inhibitor, MDI-2268, has been recently developed. The aim of the study was to evaluate the antithrombotic properties and safety of the MDI-2268 compared to enoxaparin in the animal model of VT. We also evaluated antithrombotic effect of combined therapy using MDI-2268 and a reduced enoxaparin dose.

Methods: C57BL/6 mice, 10-12 weeks old, weighing 20-25g were used in electrolytic EIM model of VT. Five experimental groups, each for 5 animals, were studied: MDI-2268 1.5 mg/kg (group 1), MDI-2268 3 mg/kg (group 2), enoxaparin 7.3 mg/kg (group 3), MDI-2268 3 mg/kg plus reduced dose of enoxaparin 1.8 mg/kg (group 4), and dimethyl sulfoxide (DMSO) vehicle (control group).All agents were administered 4 hours after VT induction. Enoxaparin was then introduced subqutaneously every 12 hours for 4 doses total. MDI-2268 was administered intraperitoneally every 8 hours for 6 doses total. Animals were harvested at 48 hours after VT induction. Animals were sacrificed, IVC with incorporated thrombus was harwested, weighted, and sent for histology. White blood cells were counted on hematoxylin and eosin staining. Tail bleeding time was measured.

Results: IVC+thrombus weight was 19.8±4.4 (P>.05), 16.3±1.5 (P=.019), 12.6±2.0 (P=.001), and 14.3±2.6 mg (P=.005) for groups 1,2,3, and 4, respectively, compared to 25.2±7.3 mg in control animals. The difference between groups 2,3 and 4 was not significant. Bleeding time was not significantly affected by MDI-2268, regardless of the dose used. Average neutrophil count was 370±70 (P>.05) and 318±66 (P=.032) for groups 1 and 2, respectively, compared to 587±175 in control animals. Combination of MDI-2268 3 mg/kg with enoxaparin 1.8 mg/kg did not result in further reduction in thrombus size.

Conclusion: MDI-2268 is a novel PAI-1 inhibitor, a pro-fibrinolytic agent that demonstrate strong antithrombotic properties in murine model of VT. The antithrombotic potential of MDI-2268 is comparable to anticoagulant enoxaparin but may be associated with a lower risk of bleeding. MDI-2268, or its analogs, may be considered a novel therapeutic agent for treatment of VT. Larger groups may be needed to evaluate benefits of combined therapy with MDI-2268 and reduced dose of enoxaparin.

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AVF3

Infrared thermography (IRT) confirms inflammatory differences in refluxing versus competent lower extremity veins

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Objective: A segment of patients with primary venous insufficiency and no history of previous DVT is at risk for developing venous leg ulcers (VLU). Venous inflammation may be an etiologic factor in this process. We have previously shown dysregulated networks of inflammatory markers in patients with primary reflux without ulcer. In this study, we evaluated not only markers of inflammation in blood within refluxing veins, but also overlying skin temperature as a surrogate for underlying vein wall inflammation. We hypothesized that patients with varicose veins have local inflammation, even in the absence of VLU.

Methods: Patients undergoing endovenous ablation or sclerotherapy were first imaged with infrared thermography (IRT) using a forward-looking infrared camera (FLIR ®) one meter from the subject in a temperature-regulated room. Control subjects underwent similar imaging of great saphenous vein distribution. The temperature of the underlying vein was recorded. Blood was collected into EDTA coated tubes directly from refluxing veins in patients or from the saphenous at the ankle in control subjects. Inflammatory mediators were assessed in serum using Luminex™. Demographics including age, gender, body mass index (BMI), CEAP clinical class (C), and venous clinical severity score (VCSS) was recorded for both groups. Statistical significance was determined using Students t-test between control and patient groups.

Results: VCSS and C scores were significantly higher in patients (N=6) than controls (N=5; $p<0.05$ and $p<001$, respectively). IRT demonstrated warmer temperatures over sampled vein in patients compared to controls (34.56°C ± 0.50 vs. 32.70°C±0.15; $p=0.01$). Correspondingly, eotaxin (288.17 ± 36.92 vs. 142.47 ± 20.24, $p<0.01$) and monocyte chemoattractant protein-1 (MCP1; 592.67±95.29 vs. 280.80 ±59.16, $p<0.03$) were significantly higher in patients than controls. GM-CSF, IFNa, IFNg, IL-10, IL 12, IL-17A, IL1-ra, IL1b, IL-2, IL5, IL6, and IL were significantly lower in patients (p range <0.01 to <0.05) consistent with our previous findings of dysregulation in these patients (Table 1).

Conclusion: The role of inflammation in varicose veins has not been a focus of research, but is likely to be critically important for progression to VLU. This study documents significant markers of inflammation not only in blood, but also associated with external temperature of refluxing veins. Additionally, we note low values of many inflammatory mediators, which supports our theory that dysregulated inflammatory networks exist in varicose veins disease. Temperature assessment and endoluminal studies may help diagnose patients who are at risk of progressing to VLU and will be our focus for future studies.

	Age	G	C	VCSS	BMI	Temp (°C)	Eotaxin	GM-CSF	IFNa2	IFNg	IL-10	IL-12P4	IL-12P7	IL-13	IL-15	IL-17A	IL-1RA	IL-1b	IL-2	IL-4	IL-5	IL-6	IL-7	IL-8	IP-10	MCP-1	MIP-1a	MIP-1b	TNFa
PATIENT	38	F	2	2	28,4	33,1	296,00	2,12	11,55	1,45	2,21	0,00	0,50	0,00	0,76	0,00	3,74	0,97	0,00	0,00	0,00	0,00	4,61	0,90	400,00	478,00	0,00	14,71	6,03
	77	F	4	2	29,4	35,4	383,00	2,12	10,04	1,03	0,00	0,00	0,50	0,00	0,00	3,78	33,94	0,56	0,00	0,00	0,00	0,00	3,94	4,58	886,00	929,00	0,00	48,85	13,03
	67	F	4		36,7	34,6	195,00	0,00	0,00	0,00	0,00	0,00	3,93	0,00	1,32	9,55	8,70	0,00	0,00	0,00	0,00	0,00	1,16	6,34	174,00	451,00	0,00	69,41	34,24
	37	M	4	8	30,2	34,2	176,00	1,64	15,86	7,17	0,68	0,00	2,07	0,00	2,06	5,78	2,37	0,84	0,00	0,00	0,00	0,00	2,85	1,14	608,00	326,00	0,00	36,16	10,07
	41	F	3	4	22,8	36,6	288,00	7,03	26,30	2,89	1,40	0,00	3,20	0,00	1,42	0,00	4,35	1,78	0,00	0,00	0,53	0,00	3,58	1,36	430,00	549,00	0,00	54,87	15,61
	68	F	3		25,6	34	391,00	3,05	6,82	2,89	6,43	0,00	2,58	0,00	0,00	0,00	12,65	0,97	0,00	0,00	0,00	0,00	3,58	4,83	1236,00	823,00	0,00	116,00	28,80
	58,00		3,60	4,67	28,95	34,65	288,17	2,66	11,76	2,57	1,79	0,00	2,13	0,00	0,93	3,19	10,96	0,85	0,00	0,00	0,09	0,00	3,29	3,19	622,33	592,67	0,00	56,67	17,96
			0,55	3,06	5,28	1,216141	90,43	2,36	8,88	2,51	2,43	0,00	1,41	0,00	0,83	3,95	11,88	0,58	0,00	0,00	0,22	0,00	1,19	2,34	383,08	233,41	0,00	34,43	11,11
			0,24	1,37	2,36	0,496488	36,92	0,97	3,62	1,03	0,99	0,00	0,57	0,00	0,34	1,61	4,85	0,24	0,00	0,00	0,09	0,00	0,49	0,95	156,39	95,29	0,00	14,06	4,53
CONTROL	35	F	0	2	23,2	32,7	159,00	24,40	52,30	36,47	33,81	59,48	18,42	278,00	6,97	4,80	82,11	4,30	1,32	861,00	24,91	84,29	11,19	58,97	905,00	181,00	47,03	47,59	18,17
	48	F	1	1	20,3	32,2	67,34	41,80	103,00	38,52	46,31	210,00	34,65	17,91	16,09	21,57	227,00	18,46	5,85	56,26	7,02	9,79	29,81	9,45	400,00	209,00	0,00	43,30	44,38
	21	F	0	0	22,7	32,6	135,00	35,27	83,39	36,28	37,53	117,00	31,29	31,12	18,32	20,47	222,00	15,19	5,98	75,63	5,45	18,28	25,31	12,28	201,00	506,00	0,00	44,85	40,77
	32	F	0	0	21,9	32,9	180,00	20,95	71,54	35,83	33,29	94,94	17,44	314,00	12,58	24,16	113,00	5,09	3,72	865,00	36,09	64,44	11,19	64,77	275,00	291,00	63,27	70,08	15,61
	31	M	1	1	26,7	33,1	171,00	0,00	10,04	1,45	0,00	0,00	0,50	0,00	0,43	1,62	2,37	0,84	0,56	0,00	0,00	0,00	2,46	0,28	739,00	217,00	0,00	38,69	12,11
Average	33,40		0,40	0,80	22,96	32,70	142,47	24,48	64,05	29,71	30,19	96,28	20,46	128,21	10,88	14,52	129,30	8,78	3,49	371,58	14,69	35,36	15,99	29,15	504,00	280,80	22,06	48,90	26,21
StDev	9,71		0,55	0,84	2,37	0,34	45,27	16,03	35,36	15,83	17,66	77,44	13,51	154,10	7,24	10,48	95,84	7,61	2,51	449,47	15,19	36,86	11,26	30,27	304,59	132,29	30,75	12,27	15,15
SEM	4,34		0,24	0,37	1,06	0,15	20,24	7,17	15,82	7,08	7,90	34,63	6,04	68,91	3,24	4,68	42,86	3,40	1,12	201,01	6,79	16,49	5,03	13,54	136,22	59,16	13,75	5,49	6,77
P	0,0422		0,0001	0,04	0,03	0,01	0,0099	0,0088	0,0064	0,0024	0,0034	0,0131	0,0087	0,0694	0,0082	0,0355	0,0143	0,0302	0,0073	0,0709	0,0411	0,0415	0,0215	0,0634	0,5906	0,0269	0,1093	0,6454	0,3243

Table 1. Raw data from patients and control subjects demonstrate absolute values of inflammatory mediators as well as demographic data. Green shading represents averages. Blue shading represents values that were higher in patients. Yellow shading demonstrates significant p value (<0.05)

Mediator Values

Author Disclosure: U Sachdev: Nothing to disclose; **L Vodovotz**: Nothing to disclose; **D Barclay**: Nothing to disclose; **Y Lin**: Nothing to disclose; **R Zamora**: Nothing to disclose; **J Bitner**: Nothing to disclose; **E Avgerinos**: Nothing to disclose; **Y Vodovotz**: Nothing to disclose

AVF4

Outcomes of IVC Filter Placement in Patients with Perceived Contraindications to Anticoagulation

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Objective: Patients with prolonged periods of immobilization including those that have undergone recent surgery, spinal trauma, and stroke are at particularly high risk for the development of DVT and subsequently pulmonary embolism. Current PE prevention strategies include prophylactic anticoagulation or IVC filter placement. Those patients at highest risk for DVT induced PE frequently have contraindications for chemical prophylaxis and therefore meet an accepted indication for IVC filter placement. The aim of this study was to evaluate incidence of PE in patients with DVT who were treated with anticoagulation alone vs those treated IVCF placement and/or delayed anticoagulation after resolution of perceived contraindication to anticoagulation.

Methods: Matched case control study completed including hospitalized patients who were diagnosed with VTE either prior or during their hospital stay who also were found to have high risk for PE (Geneva score > 8). The study group included 33 patients who received IVC filters with a control group of 165 patients who did not receive IVC filters. Participants were matched by age, sex, BMI, revised Geneva score and D-dimer level at presentation. Patients were followed during hospitalization and for 90 days after discharge from the hospital. PE diagnosis was defined as symptomatic episode that was confirmed with imaging study.

Results: The initial DVT was diagnosed prior to hospitalization in 15% of study group (n = 5) and in 16% of control group (n = 27, p = 0.6). Active cancer was present in 6% of study group (n = 2) and in 13% of control group (n = 22, p = 0.2). 80% of study group IVCF patients (n = 27) were started on anticoagulation within 3 days of IVCF placement despite initially perceived contraindications. remaining 20% of study group IVCF patients (n = 6) did not receive anticoagulation during their hospital stay due to noted recent active bleeding (n =4) and heparin induced thrombocytopenia (n = 2). The incidence of PE during hospital stay and within 90 day after discharge was 33% in the IVCF group (n = 11), and 25% in the control group (n = 41, p =0.2).

Conclusion: The 90-day incidence of symptomatic PE was not different between patients with and without IVCF. The majority of patients with initially stated contraindication to anticoagulation received anticoagulation within 3 days from IVCF placement.

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AVF5

PROSTHETIC VALVE FOR POST-PHLEBITIC SYNDROME

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Objective: 2.4 million people are affected with CVI (Chronic Venous Insufficiency) in the United States. Nearly one million people a year are treated for venous stasis ulcers determined by the Medicare data base. There are few options for those patients who develop post thrombotic disease secondary to deep venous reflux. These options include compression, elevation and wound care

Methods: A new venous prosthetic valve, the VenoValve®, has been developed to be surgically implanted into the deep venous system of patients with C5-C6 disease. This device is a combination of a Stainless-steel frame and porcine aortic monocusp leaflet.
15 patients in Bogota, Colombia have undergone implant of this device into the femoral vein in a First in Man study in patients with C5- C6 disease. All surgeries were performed in an ambulatory surgery center.

Results: Results of 9-month data demonstrates: a dramatic decrease in reflux time in 5 out of 6 patients, whom have reached the 9 months follow up period; 68% improvement in reflux time as compared to pre-operative values. Significant improvement in VCSS scores, VAS scores and VEINES QoL scores were also noted. Remaining patients with a mean follow up of 6 months, and continue to demonstrate similar improvements. All patients were maintained on long term anticoagulation. Two patients who had venous stasis ulcers for over 2.5 years demonstrated near healing within 90 days of implants. Surgical implant technique has also been perfected during the course this study.

Conclusion: Results of a First in Man study, using a venous prosthetic valve, appear promising with improvement in clinical outcomes as well as quality of life evaluation and marked reduction in pain in these complex and difficult to treat patient population.

Author Disclosure: J Ulloa: Hancock Jaffe Labs.; **M Glickman**: Hancock Jaffe Labs.; **M Glickman**: Hancock Jaffe Labs.

AVF6

Contralateral limb improvement in patients undergoing iliofemoral venous stenting

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Objective: Symptoms of chronic venous insufficiency secondary to obstructive iliofemoral disease are often bilateral. The impact of iliofemoral stenting of the more symptomatic lower extremity on clinical outcomes in the less affected contralateral extremity is not clear. Such benefit, secondary to offloading of collaterals, may potentially be of the magnitude that the contralateral extremity does not require intervention.

Methods: A retrospective review of contemporaneously entered EMR data on 369 patients/limbs with initial unilateral ilio-caval stents (241 Left / 128 Right) placed over a 3-year period from 2015 to 2017 was performed. Patients who underwent simultaneously bilateral stenting or had occlusive disease were excluded. Of the remainder, the impact of stenting on contralateral leg symptoms were evaluated by analyzing Visual Analog Scale (VAS) pain score (1-10), Grade of swelling (1-3) and Venous Clinical Severity Score (VCSS). The duration of any improvement and need for intervention on the contralateral side were also appraised. Kaplan Meier analysis was used to assess stent patency post intervention while paired T-tests were used to examine clinical outcomes.

Results: Of the 369 limbs that underwent stenting (Wallstent-Z stent combination) for stenotic lesions , 307 had contralateral symptoms (202 Left / 105 Right) including 91 men and 216 women. Etiology was PTS in 232 limbs and MTS/ NIVL in 75 limbs. In this contralateral group, at 12 months, the VAS pain score improved from 5 to 0 (p=<0.0001); the grade of swelling (GS) went from 3 to 1 (p=<0.0001) and VCSS went from 5 to 3 (p=<0.0001) following stenting of the ipsilateral side. Over the median follow up duration of 20 months, 17 contralateral limbs underwent stenting. Median time to stenting of the contralateral limb after ipsilateral stenting was 11 months. The median VAS pain score, GS and VCSS score in this group pre stenting were 6.5, 2 and 5 compared to 0 (p=<0.0001), 1 (p=0.27) and 3 (p=0.0021) in those members of the contralateral group who did not require stenting. Primary and primary assisted patencies at 12 months following contralateral stenting were 75% and 100% respectively. There were no stent occlusions following contralateral stenting.

Conclusion: Patients with bilateral obstructive iliofemoral venous lesions often experience improvement of the contralateral limb symptoms (94%) following stenting of the worse ipsilateral limb. Only 17/307 (6%) of symptomatic contralateral limbs had to undergo stenting over the follow up period due to a worsening clinical picture. This represents an improvement (from 20%) when compared to use of Wallstents alone. Based on this, a staged approach to iliofemoral stenting in patients with bilateral symptoms focusing initially on the more symptomatic limb is suggested.

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AVF7

Deep Venous Stenting is the Only Therapy to Improve Healing of Venous Leg Ulcerations in Patients with Deep Vein Stenosis

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Objective: Venous leg ulceration (VLU) can arise from deep, superficial, or perforator vein pathology or some combination thereof. Our objective was to determine whether the presence of deep venous stenosis (DVS) affects wound healing prognosis in patients with VLU, and to identify treatment strategies which affect ulcer healing in patients with DVS.

Methods: A multicenter retrospective study was conducted, enrolling patients presenting with VLU between 2013 and 2017. Attention was focused on the cohort with DVS (involving the femoral or iliac veins or inferior vena cava, diagnosed by CT, MR, or conventional venography). Baseline characteristics, anatomy of venous pathology and wounds, treatments performed, and wound healing trajectories were studied. The primary outcome was successful healing of the largest index ulcer.

Results: We identified 832 patients across 11 centers. Among these, 134 (16.1%) had stenosis in the deep venous system. Patients with DVS were more likely to have a history of deep vein thrombosis (DVT; 47.0% vs. 23.6%, $P < .001$), hypercoagulable state (27.6% vs. 10.7%, $P < .001$), and to be on anticoagulation (71.6% vs. 25.5%, $P < .001$). On average, DVS patients were more likely to have multiple ulcers (20.2% vs. 9.9%, $P = .002$) which were of similar size (5.85 vs. 5.47 cm^2, $P = .57$) compared to those without DVS. All DVS patients had concomitant superficial vein reflux and 35 (26.1%) had refluxing perforator veins. Stenting was performed in 95 (70.9%), truncal ablation in 60 (44.8%), and perforator ablation in 28 (20.9%). When both stenting and truncal ablation were performed, stenting was performed first in 53.5% of cases. Patients who underwent deep vein stenting healed wounds faster than those with untreated deep vein stenosis (HR 2.46, 95% CI 1.49 – 4.06, $P < .001$; higher HR indicates faster healing). In a multivariate model, deep venous stenting was the only treatment modality that improved wound healing (HR 2.48, 95% CI 1.46 – 4.24, $P = .001$), with no benefit derived from truncal or perforator ablation (Table).

Conclusion: VLU secondary to deep venous stenosis represents a distinct class of patients who require a unique treatment paradigm. Stenting improved wound healing rates but ablation of pathologic superficial or perforator veins did not. Routine imaging of the iliocaval segment may help to pursue early deep venous stenting in order to maximize ulcer healing and avoid unhelpful truncal and perforator interventions.

Predictor	Multivariate HR	95% CI	P-value
Deep venous stenting	2.48	1.46 – 4.24	.001
Truncal ablation	1.14	0.72 – 1.81	.59
Perforator ablation	0.81	0.47 – 1.39	.44
Anticoagulation	1.89	1.08 – 3.32	.03
History of DVT	0.41	0.26 – 0.65	< .001

Multivariate Predictors of Ulcer Healing

Author Disclosure: A Mohapatra: Nothing to disclose; **K Salem**: Nothing to disclose; **E Avgerinos**: Nothing to disclose; **P Lawrence**: Nothing to disclose; **E Hager**: Nothing to disclose

AVF8

Comparison of Two Clinical Scales to Assess the Post-Thrombotic Syndrome: Secondary Analysis of a Multicenter Randomized Trial of Pharmacomechanical Catheter-Directed Thrombolysis for Deep Vein Thrombosis

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Objective: Post-thrombotic syndrome (PTS) occurs in 20-50% of patients following proximal deep vein thrombosis (DVT), despite anticoagulation treatment. The International Society on Thrombosis and Haemostasis recommends using the Villalta scale to standardize the diagnosis of PTS and to quantify its severity. However, many investigators use the Venous Clinical Severity Score (VCSS) to assess PTS. Different to the Villalta score, the VCSS was developed as a measure for chronic venous disease and not PTS specifically.
The aim of the study was to determine which of Villalta and VCSS best captures clinically important PTS and PTS severity by analyzing the relationship of each to QoL scores in the Acute Venous Thrombosis: Thrombus Removal with Adjunctive Catheter-Directed Thrombolysis (ATTRACT) trial study population.

Methods: A secondary analysis of the ATTRACT randomized controlled clinical trial was conducted. 621 ATTRACT patients with symptomatic proximal DVT are included in this analysis. Correlations of the Villalta and VCSS scores with QoL scores (Short-Form Health Survey-36 physical component score/mental component score [SF-36 PCS/MCS]; the Venous Insufficiency Epidemiological and Economic Study-QoL/Symptoms [VEINES-QoL/Sym] questionnaire) were examined at study visits. The correlation of the random intercept (mean scores) and random slope (rate of change of the scores) between the Villalta, VCSS and the VEINES-QoL/Sym scores was assessed using a multivariate longitudinal model.

Results: As seen in Table 1, the Villalta scale had a strong negative correlation with VEINES-QoL and VEINES-Sym, a moderate negative correlation with SF-36 PCS, and a weak negative correlation with SF-36 MCS. Conversely, the VCSS had a weak negative correlation with VEINES-QoL, VEINES-Sym and SF-36 PCS, and a very weak negative correlation with SF-36 MCS. Adjustment for age, sex, ethnicity, race, extent of DVT and previous ipsilateral DVT did not change our findings.
The correlations between random effects in the multivariate longitudinal model had a similar pattern, and impact from covariate adjustment by age, sex and BMI was minor.

Conclusion: For all measures, the Villalta scale has a substantially higher correlation with QOL than the VCSS. Our findings support the use of the Villalta scale to assess PTS in preference to VCSS, as it better captures the impact of PTS on patient reported QoL, a key consideration in patients with chronic PTS.

QoL Scale	Visit	Pearson Correlation Coefficient (r)			
		Villalta Score		VCSS Score*	
		Estimate	*95% CI*	*Estimate*	*95% CI*
VEINES-QoL	Baseline	**-0.51**	-0.56, -0.45		
	1 m	**-0.61**	-0.65, -0.56		
	6 m	**-0.68**	-0.72, -0.63	**-0.37**	-0.44, -0.30
	12 m	**-0.73**	-0.77, -0.69	**-0.39**	-0.46, -0.31
	18 m	**-0.68**	-0.73, -0.63	**-0.39**	-0.46, -0.31
	24 m	**-0.70**	-0.75, -0.66	**-0.39**	-0.46, -0.31
VEINES-Sym	Baseline	**-0.50**	-0.55, -0.44		
	1 m	**-0.66**	-0.70, -0.61		
	6 m	**-0.70**	-0.74, -0.66	**-0.36**	-0.43, -0.29
	12 m	**-0.76**	-0.79, -0.72	**-0.41**	-0.48, -0.33
	18 m	**-0.71**	-0.76, -0.67	**-0.40**	-0.47, -0.32
	24 m	**-0.74**	-0.78, -0.70	**-0.41**	-0.49, -0.33
SF-PCS	Baseline	**-0.35**	-0.41, -0.28		
	1 m	**-0.46**	-0.52, -0.40		
	6 m	**-0.49**	-0.55, -0.42	**-0.31**	-0.38, -0.23
	12 m	**-0.54**	-0.60, -0.48	**-0.32**	-0.39, -0.24
	18 m	**-0.54**	-0.60, -0.48	**-0.32**	-0.40, -0.23
	24 m	**-0.52**	-0.58, -0.45	**-0.31**	-0.40, -0.23
SF-MCS	Baseline	**-0.21**	-0.28, -0.14		
	1 m	**-0.27**	-0.34, -0.20		
	6 m	**-0.31**	-0.38, -0.24	**-0.14**	-0.22, -0.06
	12 m	**-0.38**	-0.45, -0.30	**-0.15**	-0.23, -0.06
	18 m	**-0.31**	-0.39, -0.23	**-0.12**	-0.21, -0.03
	24 m	**-0.32**	-0.40, -0.24	**-0.12**	-0.21, -0.02

* VCSS not measured at Baseline or 1 month

Correlation between Villalta, VCSS and QoL Scores

Author Disclosure: A Lee: Nothing to disclose; **C Gu**: Nothing to disclose; **V Suresh**: Bayer Healthcare, Coviden, Genentech, BSN medical; **C Kearon**: Nothing to disclose; **M Blostein**: Nothing to disclose; **S Kahn**: BMS Pfizer, Sanofi, Aspen

AVF9

Quality of Life Outcomes For Patients Undergoing Deep Venous Stenting For Chronic Deep Venous Disease: A Tertiary Centre Experience Using The VEINES-QoL/Sym

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Objective: To measure changes in venous-disease-specific quality of life using the VEINES-QoL/Sym before and after deep venous stenting and identify factors associated with improvement.

Methods: A retrospective analysis of VEINES-QoL/Sym questionnaires completed on paper at baseline and follow-up (6-24mnths) by 50 consecutive patients stented for symptomatic occlusive post-thrombotic disease . Item responses were re-coded using the intrinsic method described previously to calculate a score out of 100.

Results: Fifty patients with a median follow-up of 6mths (median age 41yrs, range 19-54yrs) were identified. From this group, 26/50 (52%) were female and the majority, 42/50 (84%), were treated for post-thrombotic disease, 8 (16%) for NIVL (non-thrombotic iliac vein lesion). In 8/50 (16%) patients, disease extended to the inferior vena cava and 10/50 (20%) had bilateral intervention. Questionnaires were categorised as either baseline or follow-up. The most recent follow-up was used where multiple sources were available: at 6mths 27/50 (54%); 12mths 18/50 (36%); and 24mths 5/50 (10%). Fourteen (28%) patients required re-intervention prior to their follow-up, and 3/50 (6%) patients had occluded stents that were unable to be recanalized. Overall primary, primary assisted and secondary patency were 72%, 80%, 94%, respectively. Median Villalta score was 11.5 (range 3-32) at baseline and follow-up 8.5 (range 0-26).

Overall mean VEINES-QoL/Sym score was 35.52 (SD 21.81, 95%CI 29.32-41.72) at baseline and 63.21 (SD 25.46, 95% CI 55.97-70.44) at follow-up ($p<0.0001$). Villalta score was moderately correlated with VEINES-Qol/Sym score at follow-up ($r = -0.631$). Correlation with baseline VEINES-Qol/Sym score was weaker ($r=-0.389$). Subgroup analysis of patients with patent stents at follow-up (47/50) found patients with up to 30% in-stent stenosis (27/47) as measured by duplex ultrasound had improved VEINES-QoL/Sym compared to patients with >30% stenosis (20/47) (mean 67.03 vs 48.81), $p=<0.05$. There was no statistically significant difference in post-stenting VEINES-QoL/Sym scores between patients who had a re-intervention prior to follow-up and those who had maintained primary patency (53.90 vs 66.48), $p=0.1314$.

Conclusion: Venous-disease specific quality of life scores improve significantly after deep venous stenting. Patients with up to 30% in-stent stenosis at follow up have better quality of life scores post-operatively than those with greater than 30% stenosis. Patients who required a re-intervention to maintain patency did not have a statistically significant difference in quality of life outcome compared with those who did not require re-intervention.

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AVF10

Miniinvasive Robotic Surgery for Nutcracker Syndrom

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Objective: The nutcracker syndrome (NCS), when symptomatic, must be treated first of all to embolise pelvic varicose veins. The transposition of the left renal vein (LRV) into the inferior veina cava (IVC) and the LRV-IVC bypass are the two most used techniques, simple stenting has not proved its effectiveness. We propose mini-invasive technique using the Da Vinci robot, purpose of this study is to present the first 13 cases and results.

Methods: Each intervention has been fully realized with robot Da Vinci models Si and Xi. Under pneumoperitoneum at 14 mmHg, the surgical way first was transpperitoneal allowing the release of the LRV over its length after the section of the adrenal vein, and control of the IVC. Based on anatomical criteria, a transposition of the LRV or a LRV-IVC bypass with a venous allograft was decided. Within a variable postoperative period, an embolization of pelvic varicose veins or varicocele was carried out, allowing the absence of a renocave gradient to be verified and, where appropriate, the association of allograft vein stenting. The main criteria for judgment were the percentage of technical success, primary permability, assisted primary and secondary permeabilities studied by CT or duplex within 6 months post-operative and annually thereafter. Secondary judgment criteria were morbidity with early and late complications.

Results: From December 1st, 2012 to December 31, 2018, 13 patients (11 women and 2 men) were treated for a symptomatic NCS. The average age was 32.8 years (17-49 years). The robotic procedure was successful in 100% of patients, with no conversion required. Transposition and bypass surgery were performed in 8 and 5 patients respectively. Nine embolizations of the pelvic varicoseveins and 3 veinous stenting were made. Morbidity at 30 days was 23% with 3 procedure-related complications (2 small intestine perforations requiring first resection with ileostomy at post-operative J1, and second with small intestione suture under coelioscopy at post-operative J3; and hemorrhage on a trocar hole that required coelioscopic hemostasis at post-operative J3). The average follow-up period was 30 months (6 - 52 months). Primary permeability was 100% to 6 months and 1 year and 85.7% to 3 and 5 years with a case of stenting of the allograft bypass at 2 years post-operative. The assisted primary and secondary permeabilities were 100% to 5 years.

Conclusion: Despite the early procedural complications explained by the learning curve, this study shows the feasibility of treating NCS with the robot, offering a first mini-invasive solution to these young patients. The long-term results will allow us to better define the ideal technique and the choice between simple transposition or bypass.

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AVF11

CEAP stages C0 – C1: What´s happening prior to symptoms and varices?

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Objective: Since earlier ultrasound investigations did not reveal relevant vein damage in most of CEAP C0-C1 cases, there is little insight in the pathomorphology and pathophysiology of early stages of valve malfunction. Most of the explanations of venous insufficiency have been derived from studies on later stages, CEAP C2 – C6. Therefore, venous insufficiency is still misinterpreted as being chronic and incurable. Better knowledge should now come from studies on the very early stages.

Methods: In a prospective study in young patients, 4 – 30 years of age (n = 482, 297 f, 185 m, mean age: 17.3 y.), 660 cases (legs staged CEAP C0-C1) were collected from consecutive candidates presenting due to A) invitation (4-18 y/o, Berlin kids study, n = 220), B) esthetic vein issues (reticular veins, n = 110 or telangiectasia, n = 110, 18-30 y/o), or C) contralateral C2 vein issues (n = 220, 18-30 y/o). High-resolution transcutaneous ultrasound analysis (16 – 23 MHz) of vein valves was performed, with focus on valve lesion analysis in saphenous veins, perforators and tributaries.

Results: Relevant valve damage concerning saphenous veins was found in 280/660 legs (42.4%), CEAP C0: 163/354 legs (46.0%), and in 115/306 legs (37.6%) staged C1. In the age group of 4 – 18 years, 36.8% (81/220) of the legs had relevant valve lesions, 97.5% of these (79/81) were asymptomatic. In the age group of 19 – 30 years, 45.2% of the cases (199/440) had relevant valve lesions, 96.5% of these (192/199) were asymptomatic. Comparing the two age groups (4-18 vs. 19-30), relevant reflux was related to a single failing valve (42/81, 51.9% vs. 83/199, 41.7%), 2 valves (24/81, 29.6% vs. 67/199, 33.7%), 3 valves (11/81, 13.6% vs. 35/199, 17.6%) or more than 3 valves (4/81, 4.9% vs. 14/199, 7.0%) in a row. Stasis-related valve destruction was not observed in both age groups, and specific indicators (permanent sinus aggregates) were rare (4-18y.: 3/81, 3.7%, 19-30 y.: 19/199, 9.5%). The source of reticular veins and telangiectasias (largest spot) were saphenous veins (41/220, 18.6%), tributaries (54/220, 24.5%), or perforators (125/220, 56.8%).

Conclusion: Relevant vein disease is present even in the youngest and asymptomatic parts of the population, presumably due to embryonic valve lesions and pressure-related deterioration. C0-C1 is not a small vessel disease, although small vessels may be involved. The definition of CEAP stages C0-C1 is greatly misleading as it denies major vein damage, which clearly exists. In future, there should be no way to improve patient´s fates more effectively than by detecting early stages and by preventing C2-C6 stages with novel, cost-effective strategies.

Author Disclosure: C Ragg: Nothing to disclose

AVF12

Saphenous Sparing Segmental Radiofrequency Ablation For Small Saphenous Vein Reflux Treatment

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Objective: Small Saphenous Vein (SSV) reflux treatment remains a topic lacking strong evidence-based data.
The need of further investigations is testified also by the related guidelines heterogeneity. While in 2011 American Venous Forum recommended a high ligation and stripping (grade 1B), in 2012 the International Union of Phlebology indicated thermal tumescent (TT) ablation (grade 1A). Yet, in 2015, European Society of Vascular Surgery recommended TT with grade 2B. In 2016 American Vein & Lymphatic guidelines recommended TT with grade 1B, while Latin America guidelines didn't mention laser, rather radiofrequency ablation (grade 1C). Publications on SSV radiofrequency (RF) ablation are limited, with a declared data collection need. Aim of this study is to assess the feasibility of a saphenous sparing segmental RF ablation for SSV chronic venous disease (CVD). Up to our knowledge, this investigation represents the first report on SSV RF segmental ablation in a hemodynamic strategy.

Methods: Thirty-six patients affect by sapheno-popliteal incompetence (M/F:13/23; mean age:53.3±5.7 ; C2-3EpAsPr; BMI:23.4±1.8) were enrolled. All the patients underwent a RF segmental shrinkage ablating 3 cm of the SSV, 3 cm from the sapheno-popliteal junction. Incompetent tributaries along the leg were flush ligated. SSV reflux time and diameter were measured at 8 cm from the popliteal skin crease in standing. Aberdeen Varicose Vein Questionnaire (AVVQ) score was calculated. Peri-procedural pain was scored by the patient (visual analogue scale (VAS)) ranging from 0 (no pain) to 10 (maximum pain ever experienced). The same assessment was performed at 1 week and 1 year after the procedure.

Results: Peri-procedural pain was 1.8±1.2. At 1 week, SSV caliber was reduced from 4.4±0.8 mm to 2.4±0.6 ($p<.00001$). Pre-operative mean reflux time was 2.8±0.7 sec. In 35/36 cases (97.2%) reflux was suppressed. In 1 case a SSV thrombosis was identified distal to the shrunk tract. At 12±1 months mean follow up, the SSV caliber was 2.6±0.5 mm ($p<.00001$) and the reflux was suppressed in 34 cases (94.5 %). The SSV thrombosis case had a total recanalization including the shrunk tract with reflux recurrence. Another patient had a sapheno-popliteal junction recanalization. AVVQ score was 17.3±4.5 pre-operatively and 5.1±3.7 post-operatively ($p<.00001$)
No nerve function impairment was reported

Conclusion: Saphenous sparing SSV radiofrequency ablation is safe and feasible. Short term follow up indicates clinical efficacy. Ablation of all the SSV might not be needed always, while more long-lasting and numerous data collection, in a randomized comparative study design, are encouraged, together with homogeneous international recommendations on the topic.

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AVF13

12-Month Results of a Clinical Feasibility Study for Endovenous Valve Formation (EVF) to Treat Deep Vein Reflux

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Objective: Chronic Venous Insufficiency (CVI), due to superficial reflux, deep vein reflux (DVR) and venous obstruction, is widespread and associated with significant morbidity. Historically, therapeutic approaches to DVR, which contributes to some of the most severe symptoms, have involved invasive surgeries or unsuccessful implants. Here, we assess the safety and effectiveness of endovenous formation of autogenous deep vein valves in subjects with DVR and significant associated symptoms. The study is ongoing, and results are presented for the first 13 treated subjects.

Methods: Subjects with DVR and correlating symptoms of CVI (CEAP classification C4-C6) not responsive to conservative therapies were treated with endovenous valve formation (EVF) in 5 centers in New Zealand, Australia and Canada. Subjects with outflow obstruction were excluded. Retrograde percutaneous access was obtained through the CFV, and venography/IVUS were used to identify potential treatment sites. If the subject was deemed eligible, the 16Fr study device was introduced and used to form monocuspid valves in femoropopliteal vein segments spanning 7-11mm in diameter. IVUS and venography were used to assess valve functionality. Post procedurally, subjects were prescribed 7 days of LMWH injections, followed by 6-months of anticoagulation. Follow-up included DUS, physical examination, and rVCSS.

Results: The subjects were clinical class C4 (n=2), C5 (n=5) and C6 (n=6), and of both primary (n=9) and secondary (n=3) etiology, with n=1 undetermined. One or more monocuspid valves were successfully formed in 12/13 (92%) subjects. One (1) valve formation was completed in 6 subjects, 2 formations in 5 subjects, 3 formations in 1 subject, and the anatomy did not accommodate successful valve formation in 1 subject. Follow-up ranged from 30 days to 12-months. During this time, no occlusive DVT were reported. Non-symptomatic mural thrombus was detected in 3 subjects, but all resolved by 90-days. Additionally, 6 subjects experienced access site AEs, and one subject experienced symptomatic AVF, which resolved with compression. For subjects who had a successful procedure and completed their 210-day and 12-month follow-up had a mean rVCSS improvement of 4.9 points (n=10) and 6.4 points (n=8), respectively. Additionally, 8/10 (80%) and 6/8 (75%) experienced a ≥ 4-point improvement at these follow-ups, and all subjects improved at least 3 points. Reflux time (RT) was not shown to correlate to clinical improvement – further study of appropriate hemodynamic metrics is ongoing.

Conclusion: While further research is required, endovenous valve formation (EVF) in the deep venous system is feasible, and clinical improvement results in this initial cohort are sustained to 12-months in the majority of patients.

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AVF14

Mass Spectrometry Analysis Demonstrates A Differential Metabolic Signature Dependant On Chronic Venous Disease Stage

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Objective: Chronic venous disease (CVD) is associated with a significant clinical, quality of life and socioeconomic burden. Despite research investigating the biology of CVD, the underlying mechanistic pathways involved in disease development and progression remain poorly characterised. Metabonomics is relatively novel technology that can help explore in greater detail the mechanistic pathways involved in CVD. Previous work has shown its applicability to CVD patients, with biofluid analysis via nuclear magnetic resonance spectroscopy revealing statistically significant trends in energy metabolites across CEAP stages. The aim of this study was to explore the metabolic phenotype as detected by mass spectrometry (MS) lipid profiling platforms in the same cohort of patients with CVD.

Methods: A total of 517 symptomatic patients and 105 asymptomatic controls were recruited into the study. Serum samples were collected and stored at -80C. Following sample pre processing, untargeted reversed-phase ultra-performance liquid chromatography coupled mass spectrometry (RP-UPLC-MS) was performed. The data was analysed via multivariate statistical analysis. Statistical significance was defined by p value < 0.0001.

Results: Multivariate analysis demonstrated a differential lipid signature between asymptomatic participants versus patients with C3 disease, asymptomatic versus patients with C6 disease, and patients with C3 versus C6 disease using lipid profiling electrospray ionisation positive mode. Also, there was a trend for a difference between asymptomatic participants vs C4 disease patients ($p = 0.014$).

Conclusion: This is the first mass spectrometry study to demonstrate a systemic serum lipid signature associated with CVD severity. This provides further evidence for the applicability of metabolic phenotyping platforms in chronic venous disease and their use as future potential diagnostic and prognostic tools.

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AVF15

Randomised Clinical Trial of Mechanochemical Ablation Versus Cyanoacrylate Adhesive for The Treatment of Varicose Veins (MOCCA)

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Objective: Endovenous thermal ablation has become the first line treatment for superficial venous reflux. Recently, Novel non-thermal techniques such as mechanochemical ablation (MOCA) and cyanoacrylate embolization (CAE) have been developed. Previous work has shown that MOCA is less painful than radiofrequency ablation (RFA). RFA and CAE have been shown to have a similar post-operative pain profile. This randomised clinical trial was undertaken to assess the degree of pain resulting from MOCA compared with CAE.

Methods: Patients with saphenous vein incompetence were randomised to either MOCA or CAE. The primary outcome measure was maximum and average pain score immediately following completion of truncal ablation, measured by a 100mm visual analogue scale (VAS) and number scale (0-10). The secondary outcome measures include entire treatment pain scores, clinical scores and quality of life scores. Additional assessments also include ecchymosis scores, occlusion rates, time to return to usual activities/work at two weeks. Patients are reviewed at 2 weeks, 3 months, 6 months and 12 months.

Results: One hundred fifty-six patients with unilateral truncal saphenous vein incompetence have been recruited. Fifty-eight percent of the patients were women with a mean age of 56 years. The treated vein was the great saphenous vein in 85% of cases and 49.4% of the cases were randomised to MOCA. Both study groups were comparable at baseline. The maximum pain score using VAS did not differ significantly between groups (CAE median 21.0 mm (interquartile range 8.3–43.2 mm) versus MOCA 26.0 mm (interquartile range 13.0–44.5mm); p = 0.131) and number scale (CAE median 3.0 (IQR 1.5-5.1) versus MOCA median 4.0 (IQR 2.5-5.5); p = 0.200). Average pain score also did not differ significantly between groups (see table). No difference was observed between groups in the post-procedure ecchymosis score, recovery time, and time return to normal activity at 2 weeks. Similar clinical and quality of life score improvements were seen at 2 weeks, 3, 6 and 12 months in both groups.

Conclusion: There is no difference between the CAE and MOCA in terms of pain profile, quality of life and clinical severity score.

		CAE	MOCA	P
Maximum pain score (VAS)	Mean (SD)	27.4 (21.6)	30.2 (21.8)	P=0.856
	Median (IQR)	21.0 (8.2–43.2)	26.0 (13.0–44.5)	P=0.131
Average pain score (VAS)	Mean (SD)	21.1 (15.8)	17.7 (15.73)	P=0.518
	Median (IQR)	18.3 (5.7-30.5)	13.5 (3.9-29.6)	P=0.609

Maximum pain score and average pain score

Author Disclosure: A Belramman: Nothing to disclose; **R Bootun**: Nothing to disclose; **T Yip Tang**: Nothing to disclose; **T Lane**: Nothing to disclose; **A Davies**: Nothing to disclose

AVF16

Reflux volume increases caudally from sapheno-femotral junction to the distal leg

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Objective: Current definition of reflux is based on reflux time and is a dichotomous variable that not allow to quantify the severity of reflux. Reflux volume as a combined parameter of reflux duration, vein' cross-section area, and average linear velocity, also has weak relation to clinical disease severity. However, the anatomical extend of reflux has been shown to correlate with clinical severity. One possible explanation of the discrepancy between anatomical and physiological characteristics of reflux severity is a single point reflux measurement that was done in the majority of studies.

We hypothesize that the reflux volume in great saphenous vein increases caudally from sapheno-femotral junction to the distal leg.

The aim of the study was to compare simultaneously measured reflux volume in the upper thigh segment of the GSV and GSV at knee level.

Methods: 70 limbs of patients with primary incompetence of the great saphenous vein (GSV) with varicose tributaries located only beneath knee level were included in the study.

The cross-section area of the upper point (S_1-GSV, cm^2) and the distal point (S_2-GSV, cm^2) was measured by duplex ultrasound at 5 cm distal from SFJ and 5 cm above knee level, respectively. The cross-section area of each tributary joined with GSV between these points were measured and their total cross-section area was calculated ($\sum S_{trib} = S_1 + S_{2..} + S_n$). The measurement of the retrograde flow parameters was performed at both points of GSV simultaneously by two identical ultrasound machines and two researchers. The time average mean velocity and reflux duration were measured. The distal cuff compression-decompression 120 mm Hg was used as provocation maneuver. The reflux volume RV, ml (RV = TAMEAN × S × RT) was calculated for each GSV points (RV_1 and RV_2.) The difference of RV, ml ($_{\Delta}RV_{1-2}$) was calculated as the subtracting between two observed values ($_{\Delta}RV_{1-2} = RV_2 - RV_1$)

Results: The main results are present in the Table I. The sample was divided into two groups: the incompetent ostial valve ($FsOV_1$) and competent ostial valve ($FsOV_2$) included 37 and 33 lower limbs, respectively. The groups had statistically significant difference in RV ($FsOV_1$ 26.78 ± 14.48 and $FsOV_2$ 13.48 ± 9.53 ml) and had no difference in $\sum S_{trib}$ ($FsOV_1$ 0.161 ± 0.08 and $FsOV_2$ 0.167 ± 0.07 cm^2). However, $FsOV_1$ and $FsOV_2$ were statistically significant differences in $_{\Delta}RV_{1-2}$ (9.87 ± 8.28 and 5.41 ± 4.81 ml respectively)

Conclusion: Reflux volume increases caudally from sapheno-femotral junction to the distal leg. The magnitude of this increase is higher in the limbs with incompetent ostial valve compared to limbs with competent ostial valve.

Table I Reflux parameters of the two points of measurements

Parameters	Point 1 (Upper)	Point 2 (Lower)	*p*
S-GSV cm^2	0.34 ± 0.17	0.33 ± 0.17	0.9
TAMEAN cm/sec	7.33 ± 3.87	11.42 ± 5.68	<0.0001
RV ml	12.74 ± 8.43	20.51 ± 14.01	<0.0001
$_{\Delta}RV_{1-2}$ ml	7.77± 7.18		
$_{\Delta}RV_{1-2}$ %	65.25 ± 41.01		
$\sum S_{trib}$ cm^2	0.164 ± 0.08		

Note: data are presented as a mean and standard deviation; *p* value for ANOVA and Tukey HSD tests; * - statistical significance was defined as $p < 0.05$; S-GSV = cross-section area; TAMEAN = time average linear velocity; RV = reflux volume; $_{\Delta}RV_{1-2}$ = difference of reflux volume; $\sum S_{trib2}$ = total cross-section area of all tributaries between point 1 and 2.

Reflux parameters of the two points of measurements

Author Disclosure: R Tauraginskii: Nothing to disclose; **R Tauraginskii**: Nothing to disclose; **S Simakov**: Nothing to disclose; **R Agalarov**: Nothing to disclose; **K Mazayshvili**: Nothing to disclose; **D Borsuk**: Nothing to disclose; **F Lurie**: Nothing to disclose; **F Lurie**: Nothing to disclose

AVF17

Outcomes of a single-center experience of endothermal heat-induced thrombosis after endovenous ablation in superficial venous disease

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Objective: Introduction: The introduction of endovascular thermal ablation techniques set up a a new paradigm in superficial venous insufficiency treatment. Given the benefits in postsurgical recovery times and the reduction of comorbidities compared with conventional techniques, they quickly became the new gold standard in phlebology practice. However, the development of different and new complications accompanied its benefits such as heat induced thrombosis (EHIT) described by Kabnick, with an incidence of 0.2 to 5.1 % according to published evidence. We retrospectively analyze a single-center experience during a 2 years period.

Methods: Materials and methods: the study included all patients undergoing endovascular thermal ablation for the treatment of superficial venous insufficiency, from January 2017 to December 2018. Clinical control was performed at 24 hours, 7 and 30 days postoperatively. All postoperative patients had a Doppler ultrasound (DUS) performed during the first month, to determine the occlusion rate and the presence of thrombotic events: Deep vein thrombosis (DVT) and EHIT. EHIT events were classified in 4 grades and the follow-up and treatment was performed depending on each patient, according to the Institution's protocol.

Results: Results: from January 2017 to December 2018, 274 endovascular ablations were performed, either radiofrequency or laser (327 limbs in total). At the DUS performed during the first month, EHIT was identified in 11 patients: 8 EHIT (72%) grade 1 and 3 EHIT (28%) grade 2. Only one patient became symptomatic and only one patient had an associate DVT. No isolated DVT was recorded. In the group of patients with EHIT, DUS follow-up was performed at 1-2 weeks to evaluate progression of thrombosis, which was not observed. In most patients regression was seen a month after de diagnosis. Treatment chosen in grade 1 was clinical follow-up and in grade 2 anticoagulation with low molecular weight heparin (LMWH) or oral anticoagulation. There were no complications related to anticoagulation.

Conclusion: Conclusion: after endovascular thermal procedures, EHIT occurred in 3.3% and DVT in 1.2% of patients , with no progression of thrombosis after treatment. DUS control during the first month is important for the early detection of EHIT, since most of the patients were asymptomatic. Once detected, an adequate treatment and follow-up is recommended in order to avoid possible associated complications.

Author Disclosure: m loson: Nothing to disclose; **m dotta**: Nothing to disclose; **f rodirguez santos**: Nothing to disclose; **c marquez fosser**: Nothing to disclose; **r katsini**: Nothing to disclose; **c pared**: Nothing to disclose; **h bauza moreno**: Nothing to disclose; **h martinez**: Nothing to disclose

AVF18

Hybrid treatment for venous popliteal aneurysm

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Objective: Popliteal Venous Aneurysm are the second most frequent type of venous aneurysm defined as persistent isolated dilatation at least twice the normal diameter. In order to prevent deep venous thrombosis and pulmonary embolism, surgical treatment is recommended when aneurysm diameter >20 mm and turbulent flow on duplex ultrasound is found. Herein, we present a novel technique for the treatment of popiteal venous aneurysm with surgical resection and venoplasty with collagen matrix.

Methods: We describe the case of a 53 years old men with popliteal aneurysm in association with chronic venous disease categorized as CEAP class C4 in his left limb. Duplex ultrasound showed a venous aneurysm of the left popliteal vein with a diameter of 30 mm and significant turbulent flow. Phlebography imaging confirmed the fusiform aneurism in the popliteal fossa. No thrombus was shown neither with ultrasound duplex nor flebography.
Tangential aneurysmectomy and lateral venorraphy was performed with subsequent circumferential placement of a collagen matrix.
The patient was followed up with duplex ultrasound on the 15, 30, 60 and 90 postoperative day and ascendent phlebography was perform 3 months after surgery. During this period anticoagulation and elastic compression therapy was indicated.

Results: Popliteal venous diameter correction was shown after 3 months surgery was performed. No complication occurred subsequently. Until 4 months after treatment, no recurrence was observed.

Conclusion: Surgery approach for popliteal venous aneurysm in addition to the placement of a collagen matrix seems to be an encouraging and promising treatment in short terms. More cases are requested in order to issue final long term conclusion.

Author Disclosure: M Amore: Nothing to disclose

AVF19

Migraine: A Common and Unknow Symptom of Pelvic Congestion Syndrome

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Objective: In 2007 Scholbach, T. published the paper From the nutcracker-phenomenon of the left renal vein to the midline congestion syndrome as a cause of migraine, headache, back and abdominal pain and functional disorders of pelvic organs (Med Hypotheses. 2007;68(6):1318-27) where describes that patients with the Nutcracker Syndrome can present Migraine and exposes a possible mechanism. According to the International Association for the Study of Pain (IASP) page the prevalence of Migraine in the adult women is about 13-18% of the population and 2% suffer chronic migraine (15 or more days a month). If Migraine occur in the nutcracker-phenomenon, it can be occur in another forms of pelvic congestion syndrome (PCS).

Methods: Since January 2015 to July 2019 we diagnosed 362 patients with PCS. As a part of clinical exploration, we searched for the presence of migraine. If the answer was yes, we asked about the intensity, the frequency, the medical treatment and results. We repeated the question 6 to 18 months after the PCS treatment.

Results: Of the 362 patients with PCS, 123 (33.98 %) presented migraine as a part of the syndrome. Their ages were from 26 to 74 years with an average of 49.3. The migraine was present from two to five years. Thirty-two patients had a mild migraine (26.02%) and 91 (73.98%) suffered severe migraine (two or more episodes a week), of these 45 (almost the half of severe migraines and 36.6% of all patients) suffered it daily. In all the patients it appeared in every moment and didn´t have a relation with the menstrual period (inclusive the age average is over the postmenopausal age). All had medical treatment with analgesics, NSAIDs, ergotamine or sumatriptan, that alleviated the acute symptoms but the migraine episodes remain. Only in 93 patients the PCS treatment and the minimal follow up period of 6 months was completed. The symptoms disappeared in 72 patients (77.42%), 9 present just eventual and mild attacks that are easy controlled with mild analgesic (9.68%) and 12 remain with the same symptoms (12.9%), it means a positive response in the mid-term in 87.1% of the patients against 0% with medical treatment.

Conclusion: In some unknown way the PCS associated with venous outflow obstructions produces migraine as a symptom of the syndrome in 33.98% of patients(it means almost 2 to 3 times the prevalence in the general population) and this symptom had a rapid and permanent response in the mid-term to the correction of the PCS cause in 87.1% against the well-known results of medical therapy that control only the acute symptoms.

Author Disclosure: R Rosenberg: Nothing to disclose; **R Rosenberg**: Nothing to disclose; **M Menes**: Nothing to disclose; **M Menes**: Nothing to disclose

AVF20

ULTRASOUND ANATOMY OF DERMAL AND SUBDERMAL VENOUS PLEXUS

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Objective: Anatomical studies have shown the drainage of dermal and subdermal venous plexus to deeper system. Some authors like Weiss demonstrated the direct relationship between telangiectasia and reticular varicose veins with dermal- subdermal plexus venous reflux.

Methods: Using a high frequency US transducer

Results: With the advent of new technologies as high frequency ultrasound transducers it is possible to understand the anatomy of this complex area and to identify clearly the reflux sources and therefore the huge clinical implications that this entails. The use of this technology makes up one of the corner stones of the present telangiectasia and reticular varicose veins treatment.

Conclusion: The present communication shows the ultrasound anatomy, the drainage and mapping of the venous dermal and subdermal plexus.

Author Disclosure: A Orrego: Nothing to disclose; **A Orrego**: Nothing to disclose

AVF21

Do patients with isolated symptomatic varicose veins (C2 disease) improve following truncal ablation?

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Objective: Many insurance payers are hesitating to cover interventional treatments in patients with isolated symptomatic varicose vein's (C2). In the current study, we sought to determine the outcomes of patients with varicose veins (C2) who were treated with venous ablation alone or ablation plus phlebectomy using the Vascular Quality Initiative Varicose Vein Registry (VVR).

Methods: Utilizing data from the VVR between January 2015 and March 2019, we investigated immediate post-operative, as well as long term clinical and patient-reported outcomes (PROs), among patients with documented C2 disease undergoing truncal endovenous ablations alone and combined ablation and phlebectomy. Pre-procedural and post-procedural comparisons were performed using t-test, χ^2, or non-parametric tests when appropriate. Multivariable ordinal logistic regression was performed on ordinal outcome variables.

Results: We identified 3514 patients with C2 disease documented in the treated leg. The median follow-up was 45 days (IQR 9-86 days). Median age was 54 years (IQR 42-63), 76% were female (2,657), 82% were Caucasian and the median BMI was 26.6 (IQR 23.5-30.9). Most patients had never undergone previous varicose treatment (37.4%). The median VCSS score was 6 (IQR 5-7). 43.5% of patients (1532) underwent isolated truncal ablation and 56.5% (1989) underwent ablation and phlebectomy. Complications overall were low (6.8%) and varied between 6.3% and 7.0% in patients undergoing ablation-alone and ablation plus phlebectomy ($p=0.47$). The most common complication noted was paresthesias, 2.5% overall, and occurred more commonly following ablation and phlebectomy (3.3%) versus ablation-alone (1.3%), $p<0.001$. 84.3% of patients experienced an improvement in VCSS (median change in VCSS was 4 points (IQR 2-5)), with an improvement of 3 points among patients undergoing ablation-alone (IQR 0-5) and 5 among patients undergoing ablation and phlebectomy (IQR 3-5), $p<0.001$. When examining patient-reported outcomes, 91.7% of patients experienced an improvement in overall symptoms (median improvement 10 points (max =30) with more significant decreases among patients undergoing ablation and phlebectomy (median 12, IQR 7-17) as compared to ablation-alone (median 8.5, IQR 5-13), $p<0.001$. These differences were observed across all 7 domains of heaviness, aching, itching, throbbing, swelling, appearance, and impact on work. When examining patient-reported pain, 78.3% of patients experienced a decrease in pain, (median change 2, IQR 1-2), with slightly more improvement among patients undergoing ablation and phlebectomy (median change 2, IQR 1-2) versus ablation-alone (median change 1, IQR 0-2), $p<0.001$.

Conclusion: Among patients with isolated symptomatic varicose veins (C2 disease), ablation or ablation and phlebectomy are safe and effective in improving both patient-reported

outcomes and clinical severity (VCSS). Additionally, improvements were observed when comparing ablation and phlebectomy to ablation-alone. Given this data, payers should continue to cover these treatments.

Author Disclosure: N Osborne: Nothing to disclose; **C Brown**: Nothing to disclose; **A Obi**: Nothing to disclose; **J Cronenwett**: Nothing to disclose; **L Kabnick**: Nothing to disclose; **T Wakefield**: Nothing to disclose

AVF22

EPS: A new etiology-based classification of vein insufficiency

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Objective: Novel high-resolution ultrasound systems (16 – 32 MHz) allow new insights in venous anatomy, physiology and pathophysiology, in particular for small structures like vein valves and low-flow phenomena (B-flow mode). As the etiology of lesions should have a big impact on therapy strategies, the aim was to differentiate the mechanisms involved in vein valve failure and to suggest stages of clinical importance.

Methods: 1300 consecutive patients, age 6 – 92 y., were examined with high-resolution ultrasound systems (16 – 23 MHz: Zonare One Pro, Mindray M9; Siemens Juniper 16 MHz, Vevo MD – peak 32 MHz), with focus on saphenous veins and their valves. Video loops of the intra- and epifascial system were recorded for evaluation by three independent investigators. Endpoints were the detection of repetitive morphological and dynamic patterns of vein valves and their correlation with physical forces.

Results: Three groups of valve lesions of different origins could be sonographically detected. First, lesions appearing as commissural mismatch, incomplete cusps or missing cusps. Such lesions were detected in 47.4% of candidates 6 – 8 years of age, comprising just one or two valves in 78.2% of the cases. By exclusion of destructive forces these lesions were assumed congenital, or embryogenic (class E). They appeared in similar shape but enlarged in patients during adolescence (9 – 18 y.) and could even be identified in age groups of 18 – 40 years, usually with larger diameters or focal eccentric bulging. A second mechanism was pressure-related valve decompensation (class P), marked by focal, segmental or general dilatation and loss of functional cusp reserve. It was seen after the age of 25 y., mainly concerning terminal GSV valves or medial perforators (76.1%). A third mechanism was stasis-related valve degeneration (class S), with a typical sonographic marker called “persistent aggregates” blocking the valve sinus unto onset of reflux (stage S4). Stages S5-S6 describe degression and finally loss of valve structures. The detected valve patterns were sufficient to explain the saphenous vein status unto the age of 40, while above this age interactions of effects increasingly blurred their true origin.

Conclusion: High-resolution transcutaneous ultrasound allows identification of three different types of primary vein valve lesions related to insufficiency, in particular in preclinical stages. While embryonic lesions and pressure-related decompensation will react to internal compression or external compression, stasis-related damage seems to require flow improvement and anti-inflammatory medication in S1 - S4, but ablation for S5 - S6. Future leg vein analysis by assessment of E, P and S class patterns may serve as a basis for lesion-specific modalities in prevention and therapy.

Author Disclosure: C Ragg: Nothing to disclose

AVF23

Comparison of Unilateral vs Bilateral and Staged Bilateral vs Concurrent Bilateral Truncal Endovenous Ablation in the Vascular Quality Initiative

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Objective: Venous insufficiency is commonly bilateral, and patients often prefer single episode care compared to staged procedures. Few studies have investigated clinical outcomes following unilateral versus bilateral venous ablation procedures or between staged and concurrent bilateral procedures. Here, we report data from the Vascular Quality Initiative regarding truncal venous ablation for chronic venous insufficiency.

Methods: Utilizing data from the Vascular Quality Initiative, we investigated immediate post-operative as well as long term clinical and patient reported outcomes (PROs) among patients undergoing unilateral versus bilateral truncal endovenous ablation from 2015-2019. We further investigated outcomes between staged bilateral and concurrent bilateral ablations. Pre-procedural and post-procedural comparisons were performed using t-test, χ^2, or their non-parametric counterpart when appropriate. Multivariable ordinal logistic regression was performed on ordinal outcome variables.

Results: A total of 5,080 patients were included, of which 3826 (75.3%) underwent unilateral procedures. Median follow up was 93.5 days (IQR 14-195 days). Unilateral patients were less likely to be female (67.1% vs 70.4%, p=.033), Caucasian (86.4% vs 91.2%, p<0.001) and had lower BMI (30.3±7.3 vs 31.8±7.6, p<0.001) compared to patients undergoing bilateral procedures. Additionally, unilateral patients had fewer prior varicose vein treatments (23.1% vs 15.7%, p<0.001), were less likely to have ≥ C4 disease (35.7% vs 40.0%, p=0.006), and had higher median pre-procedural VCSS scores (8 (IQR 6-10) vs 7 (IQR 5.5-9), p<0.001). No difference was seen in complications (6.9% vs 8.1%, p=0.292) and systemic complications were rare in both groups. Those undergoing unilateral procedures had a slight improvement in VCSS score (median 3 (IQR 1-6) vs median 3 (IQR 1-5), p=0.046). After controlling for significant confounders, bilateral patients were more likely to have an improvement in VCSS (OR 2.67, 95% CI 1.85-3.85). When comparing staged to concurrent bilateral procedures, there was no difference in overall complications (7.5% vs 12.2%, p=0.144). Staged bilateral patients were older (56.8±13.3 vs 54.2±12.9 years, p=0.002), less likely to have had prior varicose vein treatment (14.3% vs 19.9%, p=0.018) and more likely to be therapeutically anticoagulated (10.8% vs 6.4%, p=0.023) compared to concurrent bilateral patients. Staged patients also have higher pre-procedural VCSS scores compared to concurrent patients (median 8 (IQR 6-9.5) vs 6.5 (IQR 5-8), p<0.001). In multivariable analysis, there was no difference in the likelihood of VCSS improvement for staged compared to concurrent procedures (OR 1.33, 95% CI 0.51-3.45).

Conclusion: Truncal ablation is a safe and highly effective treatment for chronic venous insufficiency and can be completed bilaterally during a single procedure with good patient reported outcomes that are similar to unilateral procedures and staged bilateral procedures.

Author Disclosure: C Brown: Nothing to disclose; **N Osborne**: Nothing to disclose; **G Kim**: Nothing to disclose; **D Sutzko**: Nothing to disclose; **T Wakefield**: Nothing to disclose; **A Obi**: Nothing to disclose; **I Koleilat**: Nothing to disclose

AVF24

Correlation Between Restless Leg Syndrome And Superficial Venous Reflux; A Single Center Retrospective Review

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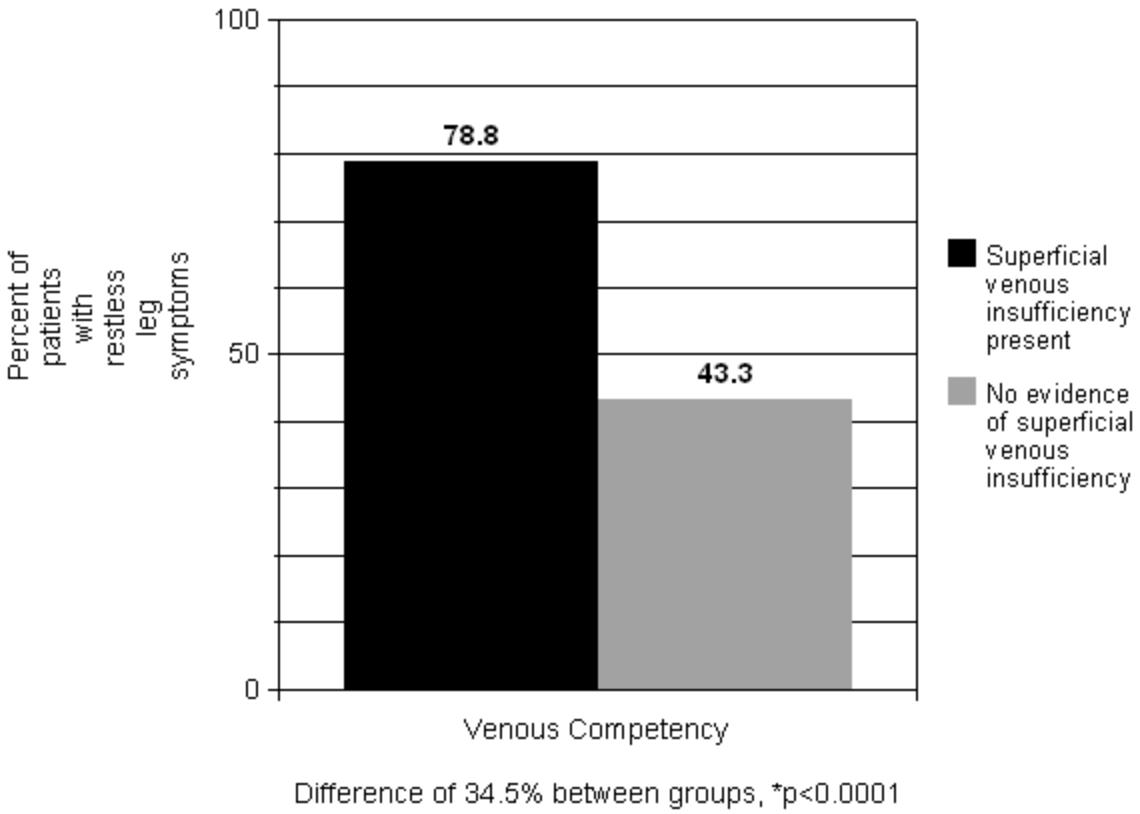
Objective:
Venous reflux is a common condition caused by venous valvular incompetence. Studies have begun to identify a correlation between restless leg syndrome (RLS) and superficial venous insufficiency (SVI). There has been evidence to suggest successful treatment of RLS by methods such as endovenous laser ablation in those with concurrent RLS and duplex proven SVI. However, to date these studies are limited. Our study aims to investigate the association of SVI in patients with RLS symptoms

Methods: A retrospective chart review was performed from a single vein center for patients seen between December 2018 and February 2019. All patients who presented with symptoms of venous disease for which duplex ultrasound was performed, were included in the study. Patients were routinely questioned during their initial visit about the presence of RLS symptoms. Data collection included; presence or absence of RLS, presence or absence of SVI on duplex ultrasound defined as >0.5 seconds, Clinical-Etiology-Anatomy-Pathophysiology (CEAP) classification, and demographic information. Data was then analyzed in R Package (Version 3.53) using a chi-square test of independence and a 2-sample test for equality of proportions to identify the Correlation between RLS symptoms and duplex proven SVI.

Results: We analyzed 207 patients with duplex ultrasound who reported varicose vein symptoms during the study period. On ultrasound, 137 of the 207 patients were found to have of SVI, and 70 patients had no findings of SVI. Compared to the number of patients with RLS symptoms and confirmed SVI on ultrasound 108/137 (78.8%), only 31/70 (44.3%) patients in the cohort without SVI reported RLS symptoms [Figure 1]. This represented a statistically significant difference in the proportion of those reporting RLS symptoms, 34.5% ($p<0.0001$), 95% CI [20.0%, 49.1%].

Conclusion: Although one might have expected patients with signs and symptoms of SVI who did not have superficial reflux to be more likely to have alternative diagnoses such as RLS, our study shows a statistically significant 34.5% higher prevalence of RLS symptoms in patients with duplex proven SVI. This correlation is clinically relevant and should be considered by those who treat RLS. and may support the use of Duplex ultrasound in the initial evaluation of RLS. Future studies are warranted to clarify the association of venous disease and RLS, and to evaluate after the impact of treating SVI on RLS symptom relief.

Figure 1: Prevalence rates of restless leg syndrome in those with and without duplex proven superficial venous insufficiency



Restless Leg Syndrome Rates By Venous Competency

Author Disclosure: A Dezube: Nothing to disclose; **A Dezube**: Nothing to disclose; **J Rauh**: Nothing to disclose; **M Dezube**: Nothing to disclose; **M Iafrati**: Nothing to disclose; **M Iafrati**: Nothing to disclose; **P Muto**: Nothing to disclose; **P Muto**: Nothing to disclose

AVF25

Outcomes of Patients at Risk for Deep Vein Thrombosis Undergoing Endovenous Ablation on Systemic Anticoagulation

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Objective: There is much debate about the care of patients who are at high risk for Deep Vein Thrombosis (DVT) and significant venous reflux disease. The purpose of this study is to evaluate the outcomes of patients undergoing endovenous ablation while on short-term or long-term systemic anticoagulation therapy as compared to patients undergoing endovenous ablation not on anticoagulation therapy.

Methods: Patients were prospectively enrolled based on their Caprini Thrombosis Risk Factor Assessment score, and anticoagulation therapy status. All patients underwent venous ablation. Patients already on an anticoagulant continued with their prescribed therapy. Patients with high risk factors were started on anticoagulation therapy using a standard Lovenox protocol. These anticoagulated patients (Group A) were compared to non-anticoagulated patients (Group B). Data collection was performed approximately 3 months post-procedure. The full dataset includes 70 patients in Group A, and 276 patients in Group B. Patient groups were matched 1:1 based on the nearest neighbor propensity scoring method. Descriptive statistics were performed on the patient groups as well as univariable analysis. An alpha level of 0.05 was used for all statistical tests.

Results: After propensity matching, 69 patients were included in each group. Univariable analysis showed a higher presence of history of DVT in Group A 19.7% (N = 13) than in Group B 1.40% (N = 1), p <0.001, and a higher presence of prior pulmonary embolism (PE) in Group A 63.2% (N = 43), than in Group B 2.90% (N = 2), *p* <0.001. Caprini Score was similar for both groups as Group A mean = 9.0 (8.0- 11.0), and Group B mean = 9.0 (9.0-9.0), *p* = 0.902. For post-procedure variables, phlebectomy procedures were found to be performed significantly more in Group B 43.5% (N= 30), than in Group A 1.40% (N= 1), *p* <0.001. Ultrasound guided sclerotherapy was found to be performed more in Group A 82.6% (N= 57), than in Group B 59.4% (N= 41), *p* =0.005. There was no statistically significant difference in vein closure success as determined by ultrasound between Group A 94.1% (N=64) and Group B 98.6% (N=68), *p* = 0.208.

Conclusion: Vein closure rates were the same regardless if the patients were on anticoagulation or not at the time of the procedures. No post-procedure DVT or PE were noted and no major bleeding complications were reported. A standardized anticoagulation protocol is safe and does not reduce the effectiveness of the procedure. Patients who are on a blood thinner do not need to interrupt therapy for ablation procedures to be effective.

Author Disclosure: J Watson: Nothing to disclose; **M Mansour**: Nothing to disclose; **W Shell**: Nothing to disclose; **C Hopps**: Nothing to disclose; **J LaForge**: Nothing to disclose; **M Lypka**: Nothing to disclose; **E Ringwald**: Nothing to disclose; **J Johnson**: Nothing to disclose

AVF26

Value and Limitations of Post-operative duplex checks after Endovenous Thermal Ablation (EVTA).

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Objective: Endovenous thermal ablations have a defined incidence of occurrence. Currently, there is no clear protocol as to when follow-up duplexes should be performed. Our aim is to try to determine whether there is a particular time period when post-operative duplexes should be performed to allow us to best diagnose recanalizations.

Methods: A retrospective analysis of 9,565 procedures in 3,033 patients with venous insufficiency due to insufficient greater, small and accessory saphenous veins (GSV, SSV, ASV, respectively) from 2012 to 2018 was conducted. Perforator veins were excluded from this study. All 9,565 procedures were performed using endovenous ablation in patients who failed to respond to initial conservative management. Postoperative duplex ultrasound scans were performed within 3 to 7 days. Successful obliteration was defined as lack of color flow on postoperative scan. Symptomatic recanalization was defined as presence of reflux on duplex ultrasound in the targeted vessel at follow-up. Follow-ups were conducted every 3 months in the first year and every 6 months thereafter.

Results: Ages ranged from 15 years old to 103 years old. The average age of the patients was 62.5 ±15.6. Average overall follow up was 25.8 ± 12.9 months. The presenting symptoms of the Clinical, Etiology, Anatomy, and Pathophysiology (CEAP) class of the patients were: C1, 0; C2, 0; C3, 42; C4, 56; C5, 13; and C6, 32. 3,769 procedures were performed in the above knee GSV, 2,614 were performed in the below knee GSV, 2.569 procedures were performed in the SSV, and 613 procedures were performed in the ASV. 143 redo procedures were performed after diagnosing patients with symptomatic recanalization with 56 being performed in the above knee GSV, 39 in the below knee GSV, 38 in the SSV, and 10 in the ASV. Timeline from initial procedure to redo procedure can be seen in Table 1.

Conclusion: The majority of patients had their redo procedure performed within the first year after the initial procedure. However, there was a large variability as to when redo procedures were performed, as a whole. Given that there is no defined pattern as to when these symptomatic occurrences arise, it may not be necessary to perform post-operative duplex checks after endovenous thermal routinely, but rather when a patient came back after the procedure with symptoms such as swelling.

Table 1: Timeline between Initial and Redo procedures.

Months between Initial and Redo Procedures	Number of patients
0-3	14
3-6	13
6-9	12
9-12	9
12-15	9

15-18	10
18-21	8
21-24	9
24-27	7
27-30	8
30-33	6
33-36	8
36-39	8
39-42	6
42-45	5
45-48	9
>48	2

Timeline between Initial and Redo procedures.

Author Disclosure: P Kibrik: Nothing to disclose; **J Chait**: Nothing to disclose; **M Arustamyan**: Nothing to disclose; **A Alsheekh**: Nothing to disclose; **S Rajaee**: Nothing to disclose; **N Marks**: Nothing to disclose; **A Hingorani**: Nothing to disclose; **E Ascher**: Nothing to disclose

AVF27

Reflux Duration Reference Data from the Vascular Lab

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Objective: There have been several population studies describing the incidence and prevalence of chronic venous disease (CVD). These studies typically describe pathology in terms of obstruction or reflux, deep or superficial, but a thorough description on reflux duration has never been done. This study was designed to demonstrate the prevalence of reflux duration and associate this with other CVD factors.

Methods: Consecutive patients presenting to a university vascular clinic with C2 or higher venous disease regardless of symptoms or cosmetic concerns were included in the study. Every patient received a detailed history and physical exam by vascular surgeon including all demographic information. All patients then had a bilateral lower extremity venous ultrasound assessing all veins from distal external iliac vein to ankle. The findings were de-identified and entered into a local database. The data was exported to a spreadsheet program for further analysis.

Results: 250 patients were included in analysis. 32.8% were male and 67.2% female. 70.4% of patients had only unilateral disease while 29.6% had bilateral disease. Of the cohort, axial reflux duration in seconds of 0.5 to <1 was present in 2.42% (n=9), 5.91% (n=22) of patients had 1 to <2, 12.6% (n=47) had 2 to <3, 22.0% (n=82) had 3 to <4, 26.3% (n=98) had 4 to <5 and 30.6% (n=114) had 5 or more. The longer the reflux duration, the larger the vein diameter the longer the CVD duration and the presence of both reflux and obstruction were associated with disease severity. Other factors such as restricted mobility, obesity, family history of skin damage due to CVD were also important factors.

Conclusion: The study's blinding to treatment and patient status allows an unbiased interpretation of reflux duration. Through application of this data we can see that 70% of patients with chronic venous disease have less than 5 seconds of reflux. More importantly reflux duration by itself is not the sole determinant of disease severity as many other factors influence this.

Author Disclosure: J Crawford: Nothing to disclose; **A Gasparis**: Nothing to disclose; **N Labropoulos**: Nothing to disclose

AVF28

"Patient Preferences for Thermal Ablation vs. Non-thermal, Non-Tumescent Varicose Vein Treatments: A Choice-Based Conjoint (CBC) Analysis"

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Objective: Shared decision making is increasingly important in the delivery of high-quality health care services. This study measured patients' preferences for six key attributes associated with thermal (radiofrequency/laser) ablation (TA) and non-thermal, non-tumescent (NTNT) varicose vein treatments: the number of injections, the number of visits, post-operative pain, risk of an adverse event, return to normal activities, and out of pocket expenses using Choice-Based Conjoint (CBC) analysis.

Methods: Data were collected from an electronic patient preference survey given to 70 adult participants at two Center for Vein Restoration (CVR) clinics in New Jersey. Survey participation was voluntary and anonymous. Participants ranged from those just considering treatment to patients at the end of their treatment protocol. Patients were shown 10 consecutive screens that displayed three hypothetical treatment scenarios with different combinations of the six attributes of interest; the final scenario presented the choice to not have the procedure. CBC analysis estimates the relative importance of different aspects of care, the trade-offs between these aspects, and the total satisfaction (or utility) that respondents derive from different healthcare procedures. Finally, a market simulation was performed comparing clusters of attributes that mimic TA and NTNT treatments.

Results: Of the six attributes studied, out-of-pocket expenditure was the most important to patients (37.2%), followed by post-operative pain (17.1%), risk of adverse events (16.3%), return to normal activity (11%), number of injections (10%) and number of visits per episode (8.4%). Willingness-to-pay for the five non-monetary attributes was $65.5 for avoiding post-operative pain, $62.6 for avoiding the risk of adverse events, $42 for faster return to normal activity, $38.2 for reducing the number of injections, and $32.2 for reducing the number of visits per episode. The market simulation analysis found that, regardless of level of out-of-pocket spending, between 3 and 4 in every 5 respondents favored attribute combinations that correspond to NTNT procedures over attribute combinations that correspond to TA. Less than 1% of participants would forgo treatment under no cost-sharing, 6% would forgo treatment under a $50 copay, and 13.6% would forgo treatment under a $150 copay.

Conclusion: Our analysis documents high sensitivity to out-of-pocket costs for minimally-invasive varicose veins treatment and relatively high willingness to pay for reduction in adverse events, post-operative pain, the number of injections, the number of visits, and faster return to normal activity. Market simulation overwhelmingly favored NTNT procedures over thermal ablation technologies when factors in this analysis alone were considered.

Author Disclosure: P Pappas: BTG; **C Gunnarsson**: BTB; **G David**: BTG

AVF29

Use of Advanced Therapies in Pulmonary Embolism: A Single Center Experience

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Objective: Advanced therapies (AT) currently available for acute Pulmonary Embolism (PE), beyond systemic anticoagulation, include: systemic thrombolysis, surgical pulmonary embolectomy, catheter-directed thrombolysis, and extracorporeal membrane oxygenation. Due to a rapid evolution of the field, therapeutic options have expanded ahead of reliable data to guide selection of treatment options. We report our experience with ATs in acute PE at a single institution. The indications, and clinical outcomes are examined with the aims of offering guidance on treatment-selection and of identifying gaps in knowledge.

Methods: A retrospective chart-review was performed of patients admitted with acute PE from October 2015 to December 2017 at the University of Maryland. Patients were identified through billing data, and clinical information was collected through their medical records. The AHA clinical classification of PE (massive, sub-massive and low-risk) at the time of diagnosis was used to assign severity. Pertinent risk-factors, treatment details and outcomes were recorded. The decision to initiate anticoagulation alone versus AT, and the type of preferred AT was made by the treating physicians and was based on disease severity and clinical judgment.

Results: A total of 770 patients were admitted with PE in the study-period. The mean age was 57.7±17.8 years, 52.97% were male, and the mean BMI was 28.0±10.1 Kg/m^2. Cancer and recent surgery were the most common risk-factors, present in 26.7% and 32.0% respectively. Advanced therapies were used in 121patients (15.7%); most commonly in massive PE (60%), and less frequently in sub-massive (20.7%) or low-risk PE (3.4%). Inferior vena cava filters were used in 58.5% of massive PE and less commonly in sub-massive (23.5%) or low-risk PE (14.3%). Clinical outcomes are described in Table IA. The mortality among patients on anticoagulation only was 5.8% while in those requiring AT was 11.5% (Table IB). In a logistic regression model for patients with massive PE, AT showed a trend towards lower mortality (OR 0.5; 95%CI 0.141-1.772; p=0.28), however there was no trend in the sub-massive or low-risk PE groups.

Conclusion: Advanced therapies are more likely to be used in patients with massive or sub-massive PE. Patients with massive PE have a higher mortality than sub-massive or low-risk patients. Advanced therapies improve outcomes in massive PE patients. Based on our clinical experience we propose a standardized clinical algorithm for treatment of acute PE.

Table I.

A. Clinical outcomes and complications in 770 patients with acute PE by clinical classification

B. In-hospital mortality in 770 patients with acute PE by type of therapy

A. Outcomes of 770 patients with Pulmonary Embolism by clinical classification				
	Total N (%)	Low-Risk PE N (%)	Sub-massive PE N (%)	Massive PE N (%)
Number of patients	770	382 (49.6%)	318 (41.2%)	70 (9.0%)
Normal right ventricle at discharge	142 (57.0%) total=249	63 (82.8%) total=76	56 (43.0%) total=130	23(53.4%) total=43
Hospital stay (days)	8 (4, 16)	8 (4, 17)	7 (4, 14)	12 (6, 26)
Readmissions	263(34.4%)	152(40.4%)	83(27.2%)	22(33.8%)
Recurrent pulmonary embolism	54 (7.0%)	29 (7.5%)	20 (6.2%)	5 (7.1%)
Major Bleeding	60 (7.7%)	32 (8.3%)	16 (5.0%)	12(17.1%)
Hospital mortality	64 (8.2%)	18 (4.7%)	31 (9.7%)	15 (21.1%)

B. Hospital mortality of 770 patients by type of therapy		
Type of therapy	Total patients	Mortality, N (%)
Standard therapy		
Anticoagulation alone	562	33(5.8%)
Advanced Therapies used alone		
Systemic thrombolysis	16	7 (43%)
Surgical pulmonary embolectomy	40	1 (2.5%)
ECMO	16	2 (12%)
Catheter directed thrombolysis	31	2 (6.4%)
Advanced Therapies used in combination		
Systemic thrombolysis + Surgical pulmonary embolectomy	3	0 (0%)
Systemic thrombolysis + CDT	1	1 (100%)
Systemic thrombolysis + ECMO	5	0 (0%)
ECMO + Surgical pulmonary embolectomy	6	0(0%)
ECMO, + CDT + Surgical pulmonary embolectomy	1	0 (0%)
ECMO + CDT §	2	1 (50%)
Total	121	14 (11.5%)
No Standard or Advanced therapy		
No candidate for Anticoagulation or advanced therapies	87	15(17.2%)

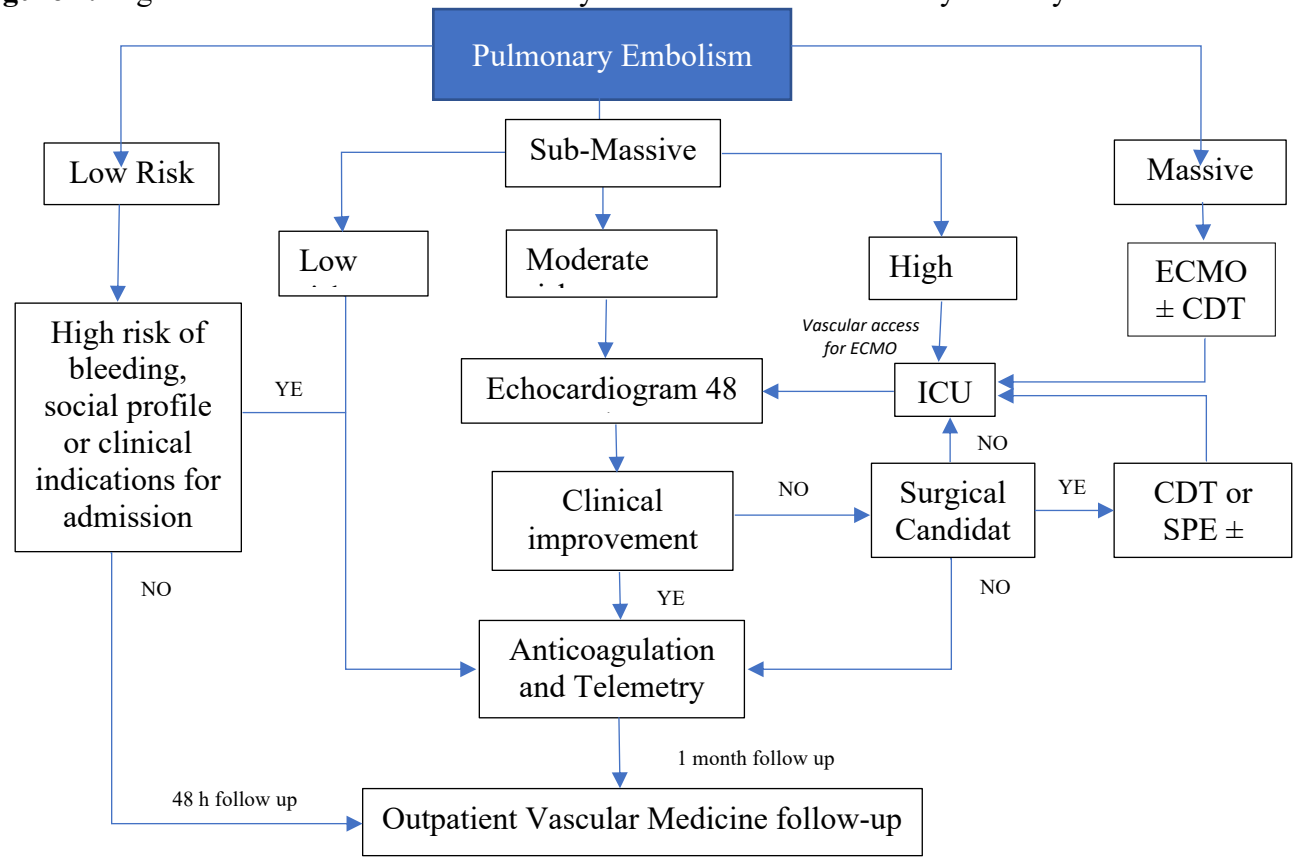
CDT= Catheter directed thrombolysis; ECMO= Extracorporeal membrane oxygenation

§ Death occurred when ECMO was used as a rescue therapy for patient undergoing CDT.

Major Bleeding: Fatal bleeding, bleeding in a critical area or specific organ such as intracranial, intraspinal, intraocular, retroperitoneal, intra-articular, pericardial or intramuscular with compartment syndrome, or a fall in hemoglobin of $20gL^{-1}$ or more requiring two units or more blood transfusion.

A. Outcomes by classification B. Mortality by therapy

Figure 1. Algorithm for treatment of Pulmonary Embolism at the University of Maryland.



ECMO team= Extracorporeal Membrane Oxygenation team; CDT = Catheter directed thrombolysis; SPE= Surgical Pulmonary Embolectomy; ICU= Intensive care unit.
Pulmonary embolism American Heart Association clinical classification: Massive; Sub-Massive and Low-Risk pulmonary embolism.
Sub-Massive Pulmonary embolism was sub-classified using Bova Score.

Figure 1. Algorithm for treatment of Pulmonary Embolism

Author Disclosure: R Cires-Drouet: Nothing to disclose; **S Toursavadkohi**: Nothing to disclose; **K Deatrick**: Nothing to disclose; **D Kaczorowski**: Nothing to disclose; **R Madathil**: Nothing to disclose; **L Alston**: Nothing to disclose; **K Motwani**: Nothing to disclose; **K Cosetti**: Nothing to disclose; **Z Strumpf**: Nothing to disclose; **P Chekka**: Nothing to disclose; **K McHale**: Nothing to disclose; **K Elizalde**: Nothing to disclose; **M Donohue**: Nothing to disclose; **A Kumar**: Nothing to disclose; **K Sun**: Nothing to disclose; **C Pasrija**: Nothing to disclose; **M Carlin-Mayorga**: Nothing to disclose; **J Sorkin**: Nothing to disclose; **J Sorkin**: Nothing to disclose; **B Lal**: Nothing to disclose; **B Lal**: Nothing to disclose

AVF30

Inferior Vena Cava Filter Placement and Removal Trends in United States: 6-Year Review of Medicare Provider Utilization and Payment Database

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Objective: Inferior Vena Cava (IVC) filter placement and retrieval are widely utilized procedures that is done by different specialties including vascular surgery, radiology, cardiology and in different settings including office based labs, in hospital and at surgical centers. Reason for this growth is multifactorial likely including the short procedure time, multiple retrieval techniques, and differing application of indications for placement). In this study the national trends in both the placement and retrieval of IVC filters are evaluated. The Medicare Provider Utilization and Payment (MPUP) Database was used to evaluate these practice trends in Medicare beneficiaries.

Methods: The MPUP Database was evaluated for IVC filter placement and retrieval CPT codes 37191 and 37193: from 2012 through 2017. These results were imported into a relational database program. Queries were designed to discover the utilization rates for IVC filter placement and retrieval procedures of all providers, inclusive of all specialties and analysis for IVC placement and/or retrieval per region and analyze the trend of the utilization rates from 2012 to 2017.

Results: Most IVC filter placement was done by Radiology 71%, Vascular Surgery 18% , and most IVC filter retrieval was done by Radiology 72%, Vascular Surgery 19% . Regional variation is significant with most of the IVC placement and retrieval done in southwest and midwest states respectively, 26% and 30%. Majority of providers in the highest rated regions both for IVC placement and retrieval are Radiologists 65% and 69% respectively. Average number of services per provider for IVC placement from aggregate data was 16 and for IVC retrieval was 17. There was almost linear increase of IVC retrieval in midwest region of US which was haltered in 2017, on the contrary, we have linear decrease of IVC insertion in southwest regions of US, with the lowest drop in 2016 and 2017.

Conclusion: IVC placement and retrieval procedures are performed by a wide variety of subspecialists with different levels of formal training for the management of chronic venous disease. Most IVC filter procedures were performed by Interventional radiology. There was a significant linear decline in IVC placement over the years in southwest region of US, though still remaining the region with the highest number of services. This data analysis can help to identify better practices for IVC placement and retrieval procedure by focusing investigation into areas with significant use. As the US healthcare system shifts from a fee-for-service to a value-based system, and taxpayer-funded resources in Medicare patients become less available, it is important that practice trends be scrutinized using data-driven initiatives.

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AVF31

Evolution and Usage of Catheter Directed Interventions For Acute Pulmonary Embolism

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Objective: Catheter Directed Interventions (CDIs) are increasingly performed for acute Pulmonary Embolism (PE). The evolving catheter types and treatment algorithms impact the utilization and outcomes of these interventions. This study aims to investigate the changes in CDI practice and its impact on outcomes.

Methods: Patients who underwent CDIs for PE between 2009 and 2018 were included from a prospectively maintained database. A PE team was launched in 2012, and in 2014 was established as an official Pulmonary Embolism Response Team (PERT). CDI annual usage trends and clinical failures were recorded. Clinical failure was defined as major bleeding, perioperative stroke or other major adverse event procedure-related, decompensation for sub-massive or persistent shock for massive PE, need for surgical thromboembolectomy or death. Major bleeding was defined as requiring a blood transfusion, a surgical intervention, or suffering from an intracranial bleed.

Results: 328 patients received a CDI for acute PE during the study period: age 59.1±15.4 years, males 164 (50.0%), sub-massive PE 300 (91.5%). Catheter utilization showed a steep increase in the early PERT years, peaking in 2016 with a gradual decline in 2017 and 2018. Ultrasound-assisted thrombolysis was the predominant CDI technique peaking at 84% of all CDI in 2014. Suction thrombectomy utilization peaked at 15.2% of CDI in 2018. Mean alteplase dose decreased from 26.8±12.5mg in 2013 to 13.9±7.5mg in 2018 (P<.001). Mean lysis time decreased from 17.2±8.3 hours in 2013 to 11.3±8.2 hours in 2018 (P<.001).
Clinical failure for the entire and the submassive PE cohorts was 11.9% and 8.7% respectively; the major bleed rate was 7.0% and 5.7%. There was no statistically significant difference in adverse events over the years, however there were two major peaks, one in 2012-2013 mirroring our technical learning curve and one in 2016 coinciding with our highest annual volume and mirroring a potentially inappropriate patient selection; the 2018 peak was primarily derived from benign blood transfusions due to acute blood loss during suction thrombectomy. (Graph)

Conclusion: CDIs for acute PE have rapidly evolved with high success rates. However, appropriate center expertise is essential for the success of catheter interventions given the associated learning curves.

Table: Distribution of CDI Types between 2009 and 2018

		Time (Years)									
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
CDI Types	S-CDI	2 (100%)	1 (100%)	5 (100%)	9 (64.3%)	6 (27.3%)	8 (16.0%)	15 (23.4%)	16 (19.5%)	13 (23.6%)	7 (21.2%)
	US-CDI	0	0	0	3 (21.4%)	16 (72.3%)	42 (84.0%)	49 (76.6%)	58 (70.7%)	34 (61.8%)	21 (63.6%)
	ST	0	0	0	2 (14.3%)	0	0	0	8 (9.8%)	8 (14.5%)	5 (15.2%)
Total		2	1	5	14	22	50	64	82	55	33

S-CDI: Standard Catheter Directed Interventions, US-CDI: Ultrasound-assisted Catheter Directed Interventions, ST: Suction Thrombectomy

Distribution of CDI Types between 2009 and 2018

Author Disclosure: A Abou Ali: Nothing to disclose; **Z Saadeddin**: Nothing to disclose; **G Al-Khoury**: Nothing to disclose; **B Rivera-Lebron**: Nothing to disclose; **C Toma**: Nothing to disclose; **R Maholic**: Nothing to disclose; **R Chaer**: Nothing to disclose; **E Avgerinos**: Nothing to disclose

AVF32

Incidental Findings Discovered During Lower Extremity Venous Duplex Studies

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Objective: Venous duplex imaging provides dedicated information on venous pathology both acute/chronic, occlusive/insufficiency, but can also provide additional information that can explain symptoms and aid in patient management. There has been scarce emphasis regarding ancillary findings and potential impact on care. This study aims to define the prevalence of ancillary findings and association to primary study indication and risk factors.

Methods: A ten-year query of our accredited Vascular Laboratory database (In Record Time) of all lower extremity venous duplex studies for comments regarding ancillary findings, primary study indication, and likely risk factors.

Results: There are 52,215 venous exams preformed during this time with 15,810 studies having positive venous findings while 36,405 demonstrating no venous pathology. There were 875 (5.5%) positive studies with comments of which 559 demonstrated enlarged lymph nodes, 179 had findings consistent with a popliteal synovial cyst (Baker's cyst), 47 with incidental arterial aneurysms/occlusions, 44 hematomas, 22 wounds/cellulitis so extensive to obscuring duplex imaging.

There were 3130 (8.6%) negative studies with comments of which 2258 demonstrated enlarged lymph nodes, 626 consistent with Baker's cyst, 59 arterial aneurysm/occlusion, 156 hematomas and 49 with wound/cellulitis.

Chi Square analysis demonstrated statistically more comments overall in negative venous studies ($p < 0.05$) with similar statistical findings when studied individually for enlarged lymph nodes, Baker's cysts and hematomas but with no difference regarding extensive infections while there were statistically more arterial occlusions/aneurysms in venous positive studies. Regarding the primary indication for study in those with comments, an example is the Baker' cyst, which was statistically more common on the symptomatic side whether a positive or negative venous study but more skewed to the symptomatic side in those with a negative venous study.

As an example of the impact of associated risk factors, recent trauma/surgery was less common in those with a hematoma and positive venous study (13.4%) than negative venous studies (22.3%) but not significantly different. The presence of cancer and enlarged lymph nodes was statistically no different whether the venous study was positive (6.6%) or negative (7.0 %).

Conclusion: Incidental findings found during venous duplex imaging are not rare (overall 7.7%) and may provide an explanation of the patient's symptoms especially in studies without venous pathology noted. The most common findings are enlarged lymph nodes, Baker's cyst, and hematoma.

Author Disclosure: M Dalsing: Nothing to disclose; **M Dalsing**: Nothing to disclose; **L Timsina**: Nothing to disclose; **D Rollins**: Nothing to disclose; **A Gonzalez**: Nothing to disclose; **A Gonzalez**: Nothing to disclose

AVF33

Management of Inferior Vena Cava Thrombosis with FlowTriever and ClotTriever Systems without Pharmaco-thrombolysis

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Objective: Although inferior vena cava (IVC) thrombosis is infrequently encountered, it carries a significant risk of post-thrombotic syndrome (PTS) and pulmonary embolus (PE). Recent studies show no difference in the incidence of PTS in patients with iliofemoral deep venous thrombosis (DVT) treated with pharmaco-thrombolysis (PT) versus anti-coagulation (AC) alone, however, there is an associated increased risk of bleeding. The treatment of IVC thrombosis is less well studied and the hemodynamic changes may be more significant with PT, although the bleeding risk remains. The ClotTriever and FlowTriever systems remove thrombus from veins without the use of thrombolytics. Our study evaluates outcomes of patients undergoing mechanical thrombectomy for the treatment of IVC thrombosis using the ClotTriever and FlowTriever devices.

Methods: A retrospective chart review was performed to identify consecutive patients who underwent mechanical thrombectomy for the treatment of IVC thrombosis using the ClotTriever and/or FlowTriever systems from November 2018 to June 2019 at 4 data sharing institutions. The decision of which device(s) to use was at the discretion of the surgeon. Patient demographics, symptomatology, and imaging characteristics were captured at presentation and follow-up.

Results: A total of 15 patients met the inclusion criteria; eleven were male, and the average age was fifty-eight years old. The majority of patients were symptomatic at presentation (n=13), had a prior history of DVT (n=13), and had a pre-existing IVC filter (n=8). Ten patients presented with acute onset (<1 week) of symptoms, whereas five patients had chronic (>2 weeks) symptoms. Most patients had an associated iliofemoral DVT (n=13) and were treated with both ClotTriever and FlowTriever (n=8), while others were treated with either ClotTriever or FlowTriever alone (n=5/2, respectively). No patient required concomitant lytic therapy or post-operative intensive care monitoring (n=0). Furthermore, there were no post-operative bleeding events, myocardial infarctions, PEs, renal impairments, or deaths (n=0). The average length of stay was 3.4 days, excluding two patients who were admitted to the hospital with chronic disease processes unrelated to the IVC thrombosis. Patients underwent post-operative follow-up (n=12), as well as long-term follow-up (>6 months; n=5). A single patient, who had a history of multiple thrombotic events while on anti-coagulation, had evidence of residual IVC thrombus on follow-up duplex imaging but remained asymptomatic. All other patients were asymptomatic without evidence of re-occlusion of the IVC on follow-up imaging.

Conclusion: The ClotTriever and FlowTriever systems allow safe and effective mechanical thrombectomy of IVC thrombosis that does not require PT, resulting in decreased risk of bleeding complications and eliminating the need for post-operative intensive care surveillance. This may lead to decreased length of stay and lower overall cost.

Author Disclosure: N Shah: Nothing to disclose; **B Wible**: Nothing to disclose; **J Paulisin**: Nothing to disclose; **M Zaki**: Nothing to disclose; **P Lamparello**: Nothing to disclose; **M Sadek**: Nothing to disclose; **T Maldonado**: Nothing to disclose

AVF34

Clinicians' Opinion on the ATTRACT Trial – Results of an International Survey

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Objective: Acute deep venous thrombosis can be complicated by post-thrombotic syndrome which is associated with significant morbidity and healthcare costs. ATTRACT was the largest and most controversial randomised controlled trial evaluating the use of pharmaco-mechanical catheter-directed thrombolysis for the prevention of post-thrombotic syndrome after acute deep vein thrombosis. This study aimed to evaluate clinicians' opinion on the ATTRACT trial and its impact on clinical practice.

Methods: Online survey consisting of ten core multiple choice items and maximum five follow-up open-ended questions was delivered to vascular surgeons, interventional radiologists, haematologists and interventional cardiologists affiliated to ten international societies between 23 April and 1 July 2019. Clinicians' views on the main limitations of the ATTRACT trial, its impact on patient selection for thrombolysis and the need for a new trial were evaluated.

Results: Out of 15 650 contacted clinicians, 451 (3%) completed the survey, with 74% being vascular surgeons, 24% interventional radiologists, 2% haematologists and 0.2% interventional cardiologists. The majority of respondents (79%) were aware of the results of the ATTRACT trial prior to completing the survey and routinely performed pharmaco-mechanical catheter-directed thrombolysis in their centres (70%). Only 20% of clinicians considered ATTRACT to be a well-designed and well-performed trial. The inclusion of femoro-popliteal DVT was reported as the main limitation of the trial by 55% of respondents. Despite half of the participating clinicians reporting no change in their clinical practice, equal number of clinicians (14%) were encouraged and discouraged from treating iliofemoral DVT. More than half of the respondents thought that the use of pharmaco-mechanical catheter-directed thrombolysis would be defensible in a court of law despite the increased risk of bleeding reported in the study. Nearly two thirds of participating clinicians recommended performing a trial limited to iliofemoral DVT, with a follow-up period of five years, quality of life as the primary outcome measure and standardisation of the thrombolysis protocol across the trial sites.

Conclusion: ATTRACT, owing to significant methodological issues, failed to provide the long-awaited indisputable evidence on the use of pharmaco-mechanical catheter-directed thrombolysis. A new trial is needed to guide clinical practice.

Author Disclosure: A Staniszewska: Nothing to disclose; **S Onida**: Nothing to disclose; **T Lane**: Nothing to disclose; **A Davies**: Nothing to disclose

AVF35

Outcomes of endovascular venous stenting in patients on direct oral anticoagulants and antiplatelet therapy: a single center experience

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Objective: Endovenous revascularization is the new gold standard in the management of acute thrombotic, post-thrombotic, and non-thrombotic iliocaval and iliofemoral obstruction. The last few years have seen tremendous improvement in clot removal strategies and stent technology. However, similar advances in our understanding of the ideal post-procedural anticoagulation are lacking. Primary and secondary patency rates related to warfarin therapy are available (1). However, only a small-single-center study (n=9) reported direct oral anticoagulant (DOAC) related outcomes in this patient population (2). Anecdotal experiences of "DOAC failures" has resulted in preferential use of enoxaparin and warfarin therapy over DOACs. Herein, we present our single-center patency outcomes with the DOAC use, to add to the existing knowledge in this space.

Methods: This is a retrospective analysis of 100 consecutive patients who underwent endovenous stenting of the iliocaval and iliofemoral veins at our institution between 1/1/2014 and 4/30/18. Patients treated with rivaroxaban, apixaban, or dabigatran with or without antiplatelet therapy were identified. Demographic, procedural, patency rates, and follow-up data collected. Stent patency was evaluated using duplex Doppler ultrasound or contrast venography.

Results: We screened a total of 100 consecutive patients. 71 patients were treated with DOAC therapy. Indication for treatment included acute thrombosis (39 patients), non-thrombotic iliac vein obstruction (11 patients), and chronic post-thrombotic obstruction (21 patients) . Out of the 71 treated with DOACs,16 (23%) were lost to follow up, leaving 55 (77%) for analysis. The mean follow-up was 14 months (range 1-43 months). 32 (58%) patients were followed 12 months or longer, 10 (18%) patients were followed 6-12 months, 2 (4%) patients were followed 3-6 months, and 11 (20%) patients were followed for 3 months or less. Primary patency was 87% FIGURE 1. Only seven of the 55 patients required a secondary intervention. Secondary intervention was required within the first 3 months in 2 patients, within 6-9 months in 2 patients, and after 12 months of the incident procedure in 2 patients. One patient developed contralateral iliac vein thrombosis requiring additional intervention. All, except 1of the patients requiring secondary intervention were treated with apixaban post-procedurally while remaining 1 patient was treated with rivaroxaban.

Conclusion: Seager et al noted a primary patency rate range of 32% to 98% in their systematic review of endovenous stenting from14 studies. The post-procedural antithrombotic regimen for these studies consisted of short duration (<5 days) low molecular weight heparin followed by Warfarin therapy, with or without an antiplatelet agent. Our retrospective analysis demonstrates acceptable primary patency rates with DOAC therapy compared to those treated with vitamin k antagonists.

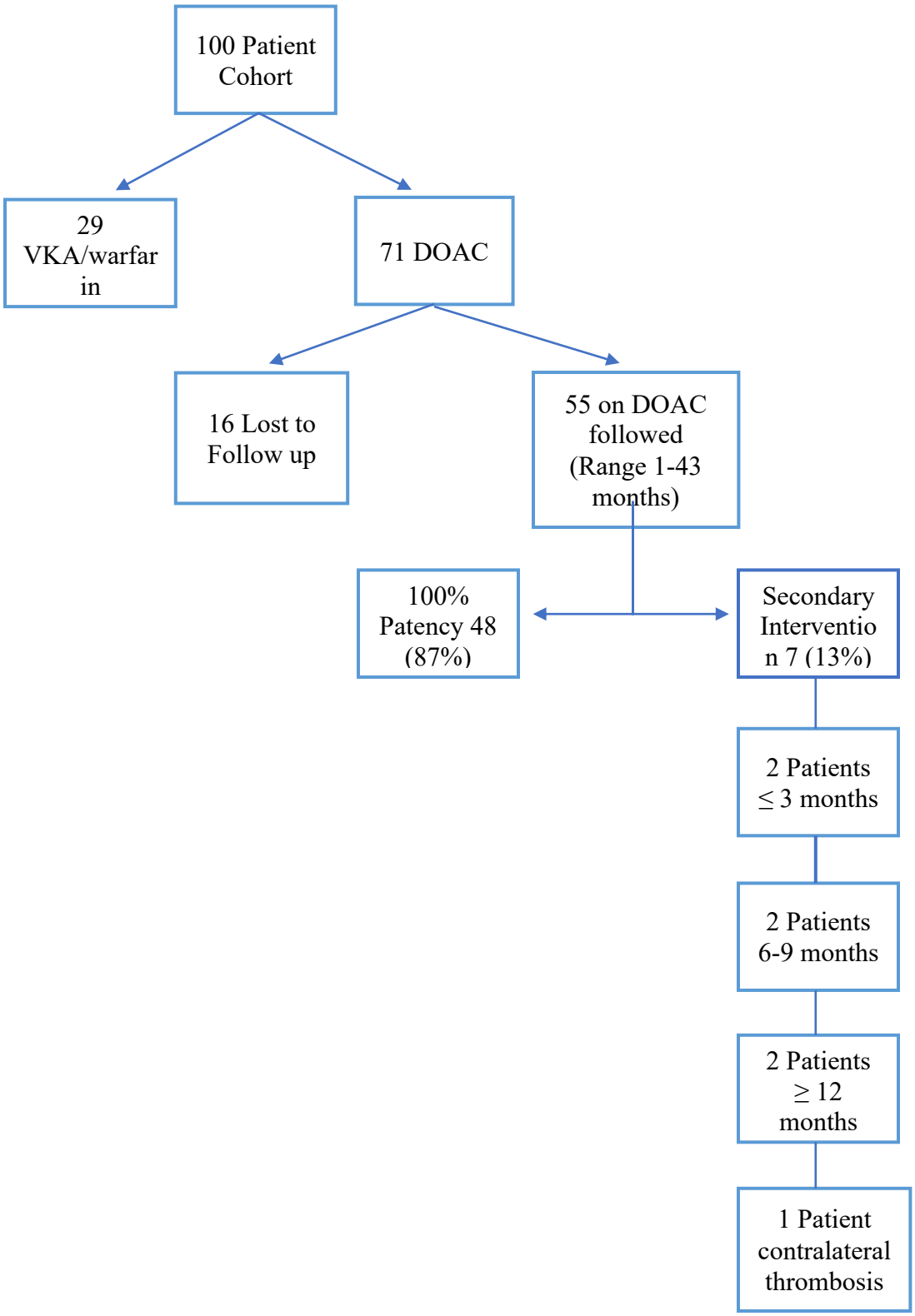

FIGURE 1. Cohorts, Results, and Outcomes

Cohorts, Follow Up, and Outcomes

Author Disclosure: K Hays: Nothing to disclose; **M Jolly**: Nothing to disclose; **R Kolluri**: Nothing to disclose

AVF36

Clinical Practice Trends of Inferior Vena Cava Filter Utilization at a Single Tertiary Care Center over an 18 Year Period

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Objective: To investigate clinical practice trends of inferior vena cava filter (IVCF) utilization at a single institution over an extended time period and identify potential factors affecting clinical decision for placement, follow-up, and retrieval.

Methods: An institutional database was queried for all IVCFs placed from 2000-2017 based on CPT codes. A retrospective chart review was performed to evaluate demographics, economic status, placement indication, filter type, follow-up evaluation for retrieval, and retrieval success rates. Statistical analysis was performed using SPSS, employing t-tests for continuous variables and $\chi 2$ for categorical variables.

Results: A total of 3,824 IVCFs were placed from 2000-2017 at a single tertiary institution. Overall, 985 (25.8%) permanent filters and 2,839 (74.2%) retrievable filters were deployed. The placement of filters steadily increased from 2000 to 2010, with a maximum of 371 filters placed in 2010. Since 2010, the number of filters placed has steadily declined until 2016 when 87 filters were placed with slight increase to 154 in 2017 (Figure 1). Clinical indications for filter placement have shifted with IVCF placement for prophylaxis decreasing since 2013 (prophylaxis indication remained 25% or less except during 2008-2013 when it was between 35-45% [Figure 2]). Prior to dedicated efforts at retrieval visits, follow-up evaluations raters were~1% from 2000-2006, increasing to ~10% from 2007-2015. Subsequent more active scheduling for IVCF follow-up led to an increased rate of retrieval evaluations of 42.5% in 2016 and 55.2% in 2017. Predictors for lack of IVCF retrieval evaluation included length of stay ($p=0.002$) and distance from our institution (<0.001).

Conclusion: The use of IVCF over the past 18-years at our institution has shown how the pendulum has shifted from increased utilization (2000-2010) to decreasing total volume and parallel reduced use for prophylaxis since 2013. Corresponding retrieval rates have increased corresponding to more active retrieval efforts.

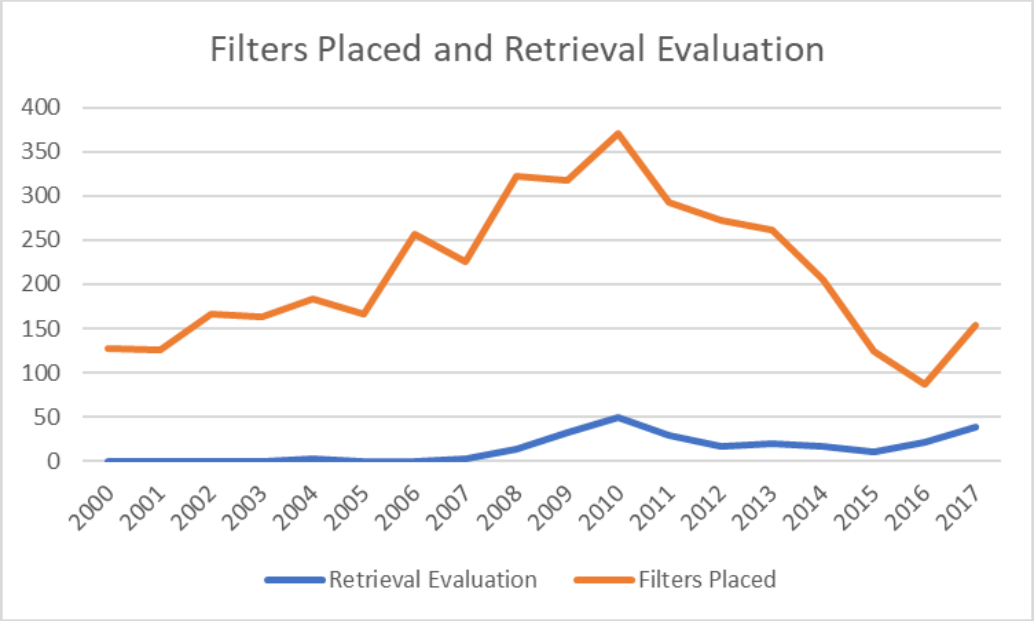

Figure 1: IVCF Placements and Retrieval Evaluation

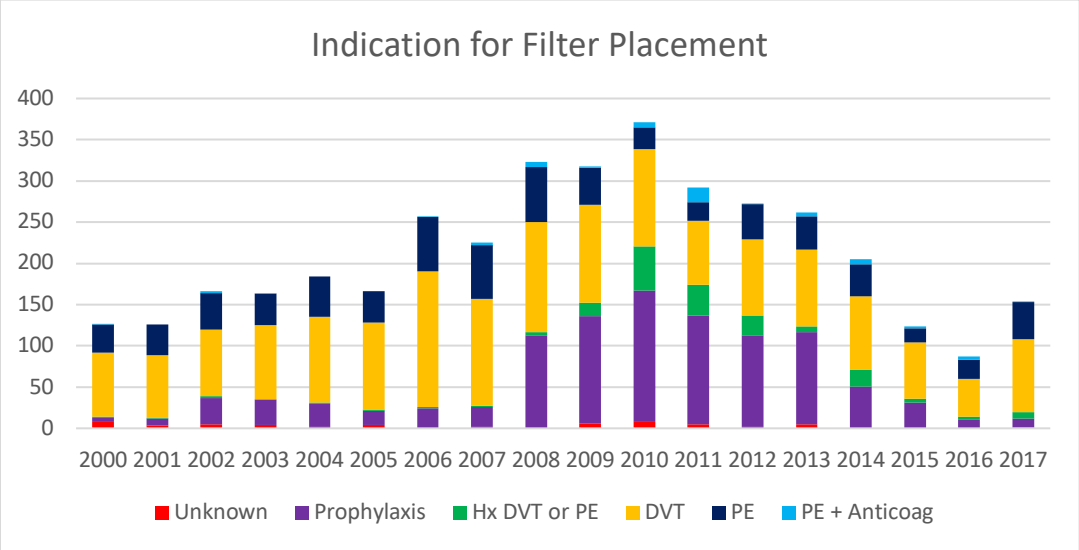

Figure 2: Indication for Filter Placement

Author Disclosure: J Axley: Nothing to disclose; **M May**: Nothing to disclose; **Z Novak**: Nothing to disclose; **V Aucoin**: Nothing to disclose; **E Spangler**: Nothing to disclose; **G McFarland**: Nothing to disclose; **D Sutzko**: Nothing to disclose; **B Pearce**: Nothing to disclose; **M Patterson**: Nothing to disclose; **A Beck**: Nothing to disclose; **M Passman**: Nothing to disclose

AVF37

Contemporary Management of Chronic Indwelling IVC filters: A Single Institutional Experience

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Objective: Despite increasing retrieval rates of inferior vena cava (IVC) filter, less than one-third are removed within the recommended timeline. Prolonged filter dwell times may increase the technical difficulty of retrieval and filter related complications. We sought to evaluate contemporary outcomes of patients with chronic indwelling IVC filters at a tertiary care center.

Methods: From 2015-2019, a retrospective analysis was performed of all patients who were referred for removal of prolonged IVC filter with a dwell time greater than six years. Descriptive analyses were used to evaluate patient characteristics and procedural outcome via electronic medical records. Data was expressed as the mean and standard deviation (SD), median with interquartile range (IQR), or number and percentage, as appropriate.

Results: During the study period a total of 45 patients were identified with a median filter dwell time of 9.0 years (IQR 6-13); 32 patients underwent removal of IVC filter and 13 patients refused retrieval. The median age of patients was 55.3 (IQR 42.6-66.5); majority were female (55.6%) and white (60.5%). Co-morbidities included history of venous thromboembolism (80%), hypercoagulable state (13.3%), hypertension (55.6%), diabetes (24.4%), hyperlipidemia (31.1%), chronic kidney disease (11.1)%, and active smoking status, (11.1%). IVC filters removed included 12 (26.7%) Gunter Tulip; 5 (11.1%) Celect; 4 (8.9%) G2; 2 (4.4%) Greenfield; 1 (2.2%) Simon Nitinol; 1 (2.2%) Optease; and 1 (2.2%) Recovery. The most common indication for filter placement was high-risk despite anticoagulation (52.4%), followed by VTE prophylaxis (21.4%) and inability to be anticoagulated (19.0%). The majority of the patients were symptomatic (66.7%). If symptomatic, the most common reason for retrieval was filter migration (62.1%) and chief complaint was pain (51.7%). The time from first clinic visit or consultation until IVC filter removal was 34.0 days (median, IQR 14.8-62.8). Retrieval success was 95% (SD 0.20) with a median length of stay of 0 days. The majority of retrievals were performed through an endovascular approach and interventional radiology performed the majority of retrievals (n=24, 75.0%). None of the patients who underwent retrieval (n=32) developed a postprocedural complication.

Conclusion: Despite prolonged dwell times, IVC filter retrieval can be performed safely and effectively in carefully selected patients at a tertiary referral center.

	N (%)	Mean (sd)	Median (IQR)
Patient Demographics			
Age (years)		54.1 (15.4)	55.3 (42.6-66.5)
Female Gender	25 (55.6)		
Race			
Caucasian	23 (51.1)		
African American	15 (33.3)		
Current smoker	5 (11.1)		

Independent functional status	42 (93.3)		
History of venous thromboembolism	36 (80.0)		
Hypercoagulable disorder	6 (13.3)		
Hyperlipidemia	14 (31.1)		
Chronic kidney disesase	5 (11.1)		
Dialysis dependence	0 (0)		
Congestive heart failure	4 (8.9)		
Coronary artery disease	9 (20.0)		
Diabetes mellitus	11 (24.4)		
Hypertension	25 (55.6)		
Height (cm)		169.2 (12.0)	170 (158.5-180.0)
Weight (kg)		101.5 (32.2)	96.0 (74.0-115.0)
BMI in kg/m^2		36.1 (12.3)	35.2 (27.4-43.3)
Preprocedural ASA		2.7 (0.6)	3.0 (2.0-3.0)
Creatinine (mg/dL)		0.9 (0.3)	0.9 (0.8-1.0)
GFR (ml/min/1.73m^2)		83.3 (23.4)	85.0 (67.0-102.0)
Inferior vena cava (IVC) filter details			
Dwell time in years		9.3 (5.3)	9.0 (6-13)
Diagnosis at placement			
Acute venous thromboembolism (VTE)	28 (62.2)		
High risk for VTE	9 (20.0)		
Recurrent VTE	4 (8.9)		
Other	3 (6.7)		
Indication for placement			
High risk despite anticoagulation	22 (48.9)		
VTE prophylaxis	9 (20.0)		
Inability to anticoagulate	8 (17.8)		
Other	3 (6.7)		
Filter type			
Gunter Tulip	16 (35.6)		
Celect	6 (13.3)		
G2	6 (13.3)		
Greenfield	5 (11.1)		
Simon Nitinol	2 (4.4)		
Optease	1 (2.2)		
Recovery	1 (2.2)		
Select	1 (2.2)		
Trapeze	2 (4.4)		
Symptomatic			
Yes	30 (66.7)		
No	15 (33.3)		
Filter complication			

Filter dysfunction	5 (11.1)		
Filter migration	18 (40.0)		
Other	6 (13.3)		
Pain symptoms			
Yes	15 (33.3)		
No	14 (31.1)		
Details related to IVC retrieval			
Time from first clinic or consult to removal (days)		71.6 (178.2)	34.0 (14.8-62.8)
Removal method			
Endovascular	31 (68.9)		
Robotic	1 (2.2)		
Specialty of interventionalist			
Interventional radiology	24 (53.3)		
Vascular Surgery	7 (15.6)		
Combined (vascular surgery/urology)	1 (2.2)		
Retrieval attempts		1.0 (0.2)	1.0 (1-1)
Retrieval success (%)		95 (0.2)	1.0 (1-1)
Length of stay (days)		0.4 (1.0)	0 (0-0)
Discharge destination			
Home	30 (66.7)		
IPR	1 (2.2)		
Assisted living	1 (2.2)		

Patient Characteristics and Retrieval Outcomes

Author Disclosure: T Ivanics: Nothing to disclose; **P Williams**: Nothing to disclose; **H Nasser**: Nothing to disclose; **S Leonard-Murali**: Nothing to disclose; **S Schwartz**: Nothing to disclose; **J Lin**: Bard

AVF38

Combined Use of N-Butyl-Cyanoacrylate and Foam Sclerotherapy in Great Saphenous Vein Truncal Ablation: Preliminary Experience.

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Objective: To assess advantages, safety, feasibility and mid-term clinical and instrumental outcomes of the use of n-butyl-cyanoacrylate (NBCA) glue combined with foam sclerotherapy for great saphenous vein (GSV) truncal ablation.

Methods: Between June and December 2018, all consecutive patients with truncal GSV incompetence and varicose veins underwent total chemical GSV ablation with first NBCA and then foam (Polydocanol 0.5%) injection. Foam (0.5% or 0.25%) was also used for collaterals. CEAP classification, pre and postoperative AVVQ and CDUS control were evaluated preoperative, 1 month, 3 months and 6 months after the intervention for each patient. VAS scale was used to assess pain during and at discharge.

Results: Eighty limbs in 77 patients were enrolled (64 C2, 6 C3, 8 C5, 2 C6). Average GSV diameter was 9±2 mm. Average NBCA and foam amount used for single patient were 0.8±0.1 cc and 4.8±1.1 cc, respectively. Average operation time was 17±4 minutes. Occlusion rate was 100%, 100% and 96,2% at 1-month, 3-month and 6-month follow-up time, respectively. Preoperative AVVQ was 19, while at 1-month and 6-month follow-up time was 8 and 7, respectively ($p<.001$ between pre and 1-month AVVQ). Average VAS was 2 during ablation and 1 at discharge (p=ns). No anesthesia was require, except for percutaneous GSV cannulation. Elastic stockings (23-32 mmHg) were used for 1 week.

Conclusion: The use of concomitant NBCA and foam seems to be a valid, safe and durable technique. Further studies are required to assess long-term results and to compare this technique with other ablative intervention.

Author Disclosure: A Giovanni: Nothing to disclose; **D Bissacco**: Nothing to disclose

AVF39

Improvement of Neuropathy after Venous Ablation

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Objective: Neuropathic pain and numbness are not considered symptoms of chronic venous insufficiency (CVI). Improvement in these symptoms after closure of incompetent GSV has not been reported. After noting that some patients with CVI and neuropathy spontaneously reported improvement in their symptoms after venous ablation this preliminary study was undertaken to determine how often this occurs.

Methods: Over the course of two years 20 patients with CEAP C3 or C4a CVI who reported neuropathic pain, numbness or paresthesias in their routine Review of Symptoms (ROS) were prospectively studied. All underwent successful laser ablations of incompetent GSV. None had arterial occlusive disease. None underwent objective neurological testing. Eight (40%) had diabetic neuropathy and 12 (60%) had neuropathy from spinal disease. All of the procedures were performed only to treat the venous disease. Possible improvement of the neuropathy was not discussed with the patients since it was not considered to be secondary to CVI. All patients were evaluated clinically and with duplex scans at 3 months and one year.

Results: At one year all of the 20 GSV remained closed. Thirteen (65%) of the patients noted improvement of their neuropathic symptoms on ROS at three month follow-up. Four were diabetic and nine had spinal problems. Seven of these patients noted subjective improvement of their symptoms and six reported total relief of symptoms. At one year the seven patients still had persistent improvement of their symptoms. Two patients had return of symptoms that had previously resolved. They noted that their symptoms were better than before their ablations. The other four patients remained asymptomatic.

Conclusion: In this preliminary, observational study 65% of patients with CEAP C3 or C4a disease and neuropathy noted improvement or resolution of their neuropathic symptoms after successful closure of incompetent GSV. The mechanism and durability of this improvement is unknown. A large scale trial with possible inclusion of objective neurological testing or inclusion of neuropathic symptoms in registries is suggested to determine whether the results of this observational study are reproducible and can be applied to clinical practice.

Author Disclosure: L Dobson: Nothing to disclose; **P Collier**: Nothing to disclose

AVF40

Retrograde Administration of Ultrasound-Guided Endovenous Microfoam Chemical Ablation vs Endovenous Laser Ablation for the Treatment of Superficial Venous Insufficiency

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Objective: This study measured patient outcomes among symptomatic patients with superficial chronic venous insufficiency who were treated with retrograde ultrasound-guided polidocanol microfoam 1% or endovenous laser ablation in a community setting.

Methods: Between October 2013 and March 2019 1,030 symptomatic patients with C2- C6 chronic venous insufficiency received either polidocanol microfoam 1% or endovenous laser treatment and were followed for 23.4 +/- 13.2 months (polidoconal group) and 36.4 +/- 19.8 months (EVLT group). Of the 517 patients treated with microfoam polidocanol twenty-eight patients (5%) had skin ulcer, and 116 (22.4%) were treated previously with thermal or surgical intervention. All patients underwent a duplex ultrasound venous incompetence study to map perforators and veins to be treated. Incompetent veins were accessed with a micropuncture needle distal to the midthigh perforator, approximately 10 cm above the knee fold. For the patients treated with polidocanol microfoam 1 % (517 patients), the leg was then elevated 45 degrees. Under ultrasound guidance, the incompetent greater saphenous vein was closed with polidocanol microfoam 1%. A second injection was administered through the same catheter directing the microfoam to flow in a retrograde fashion through the incompetent venous valves to the ankle. 513 patients were treated with endovenous laser ablation in the usual manner.

Results: All patients completed the initial treatment: In the polidocanol group, 112 (21%) required planned secondary treatment during the follow-up period for residual venous reflux in the below-knee greater saphenous vein. In the endovenous group 45 (9%) required subsequent treatment for recurrent reflux. Complete elimination of venous valvular reflux and symptomatic improvement was documented in 486 patients (94%) in the polidocanol group and 450 (88%) patients in the EVLT group ($p < 0.01$). 12%of the patients in the EVLT group recurred and required treatment with polidocanol for recurrent symptoms.

Conclusion: Retrograde administration of polidocanol microfoam 1% is a safe and effective treatment with important clinical benefits for superficial venous insufficiency in a community practice. Based on the results of this study polidocanol microfoam 1% chemical ablation is just as effective as thermal ablation (EVLT) for the treatment of superficial venous insufficiency and can be used in patients who might not be candidates for thermal ablation.

Author Disclosure: S Deak: Nothing to disclose

AVF41

Socioeconomic Status and Clinical Stage of Patients Presenting for Treatment of Varicose Veins

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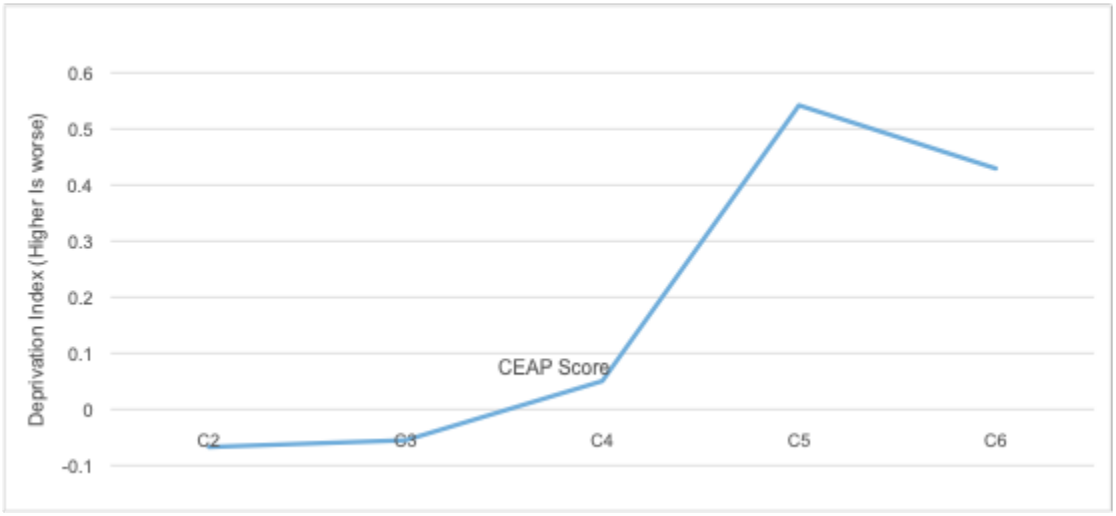
Objective: The Association between socioeconomic status (SES) and chronic venous insufficiency has not been rigorously studied. This study aimed to determine the influence of SES on the clinical stage of patients presenting for chronic venous disease (CVD) therapy.

Methods: Using the local Vascular Quality Initiative (VQI) varicose vein registry at our tertiary referral center, all patients undergoing therapy for varicose veins between January 2015 and June 2019 were queried. SES was quantified using the Neighborhood Deprivation Index (NDI). This is a standardized and reproducible index used in research which summarizes 8 domains of socioeconomic deprivation. It is based on census tract data derived from the patients' addresses at the time of the operation. The higher the number the worse off the patients' SES is. The association between SES and severity of the vein disease at presentation was studied using bivariate ANOVA and linear regression analysis.

Results: A total of 449 patients had complete SES and CEAP data and were included in the study. The mean age was 58 years. Sixty seven percent were female, and 60% were Caucasian. CEAP class included C2=22%, C3=50%, C4=15%, C5=5% and C6=8%. The average NDI was 0.03 (min -1.45, max 2.89). There was a linear correlation between the CEAP score at presentation and the NDI ($p<0.05$) (Figure 1). SES was not associated with history of DVT, prior vein treatment, use of compression therapy, or VCSS score.

Conclusion: CEAP class at presentation for treatment of CVD is associated with SES. This may reflect that patients in lower SES wait longer before seeking medical therapy for venous disease.



Graph 1. Association between CEAP and Socioeconomic status defined by the Neighborhood deprivation index.

Association between CEAP and Socioeconomic status (NDI)

Author Disclosure: A Rteil: Nothing to disclose; **J Lin**: Nothing to disclose; **M Weaver**: Nothing to disclose; **S Ahsan**: Nothing to disclose; **A Lee**: Nothing to disclose; **L Kabbani**: Nothing to disclose

AVF42

Trends of Surgery for Varicose Veins in the Elderly

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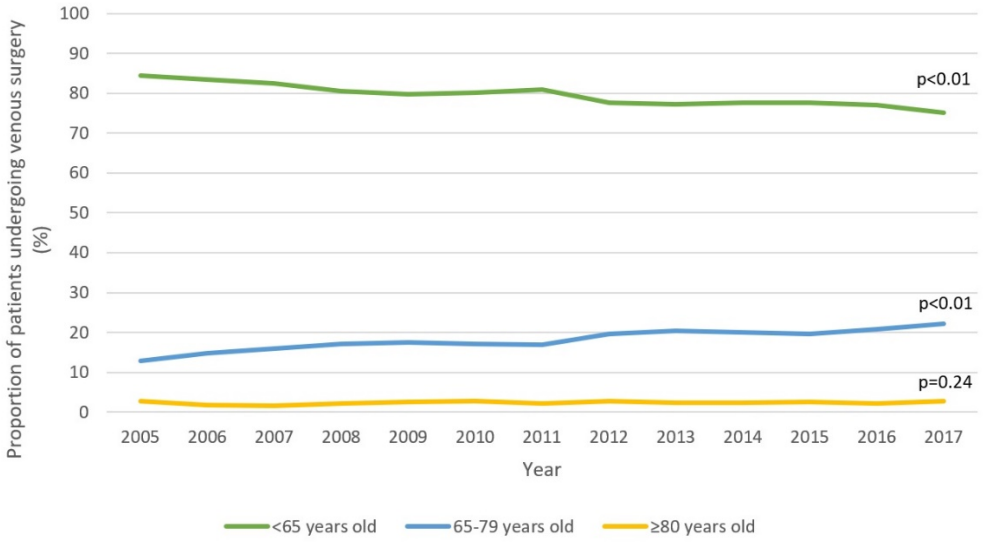
Objective: Over the past decade, treatment of varicose veins has shifted from the operating room to the office. While recent studies demonstrate the safety of office-based venous ablation in the elderly, there is paucity of published data on the contemporary outcomes of surgery for varicose veins in the operating room. This study analyzes the trends and outcomes for varicose vein surgery in the elderly using a large national database.

Methods: The ACS-NSQIP database (2005 -2017) was reviewed. Patients undergoing vein ablation or open surgery (high ligation, stripping, and phlebectomy) for venous insufficiency were identified based on CPT codes and principal diagnosis. Patients were stratified into three age groups <65, 65 – 79, and ≥80 years old. Preoperative and operative characteristics, as well as outcomes were compared. Logistic regression was performed to identify risk factors associated with any adverse event defined as any morbidity or mortality.

Results: There was a total of 48,615 venous surgeries, 18.9% (N=9,177) were performed in patients aged 65-79 and only 2.4% (N=1,180) were in octogenarians. The proportion of patients in the 65-79 age group steadily increased over this period from 12.8% in 2005/6 to 22.3% in 2017 (p<.01), while the proportion of octogenarians remained stable (p=0.23). (Figure) Octogenarians had significantly higher comorbidities, were more likely to undergo vein ablation alone (p<.01) for ulceration (p<.01) and less likely to receive general anesthesia (p<.01) compared to younger age groups. Overall morbidity increased significantly with increased age group (P<.01) but remained low (2.48%). Mortality was very low (.02%) and not significantly different between groups. (Table) Factors independently associated with any adverse event were dialysis (OR= 7.12 [3.25-15.64]), American Society of Anesthesiologists (ASA) classification per unit increase (OR= 1.16 [1.02-1.32]), use of general anesthesia (OR= 1.19 [1.00-1.41]), and combined venous ablation and open procedures compared with venous ablation alone (OR= 1.27[1.03-1.54]) , while age was not associated with adverse events (OR = 1.00 [.99-1.01]).

Conclusion: Varicose vein surgery is safe in all age groups and is being increasingly offered to the elderly. High risk patients may benefit from staging of ablation and open procedures while avoidance of general anesthesia may minimize adverse events. Conservative measures should be exhausted prior to surgery in the dialysis population.

Figure. Trends in the proportion of patients receiving venous surgery in ACS-NSQIP by age



Proportion of venous surgery in ACS-NSQIP by age

Table. Demographic and operative characteristics of patients receiving venous surgery in ACS-NSQIP by age

	Total	<65 years old	65-79 years old	≥80 years old	P value
	N=48,615	N=38,258	N=9,177	N=1,180	
Demographics					
Male sex	15,778 (32.46%)	12,438 (32.51%)	2,906 (31.67%)	434 (36.78%)	0.09
White race	37,585 (77.31%)	29,165 (76.23%) [a, b]	7,414 (80.79%) [a, c]	1,006 (85.25%) [b, c]	<0.01
Body Mass Index	29.39 ± 8.04	29.60 ± 8.22 [a, b]	29.80 ± 7.30 [a, c]	27.11 ± 6.81 [b, c]	<0.01
Hypertension	14,804 (30.45%)	8,858 (23.15%) [a, b]	5,115 (55.74%) [a, c]	831 (70.42%) [b, c]	<0.01
COPD	716 (1.47%)	370 (0.97%) [a, b]	288 (3.14%) [a, c]	58 (4.92%) [b, c]	<0.01
CHF	81 (0.71%)	43 (0.11%) [a, b]	26 (0.28%) [a, c]	12 (1.02%) [b, c]	<0.01
Diabetes mellitus	3,375 (7.03%)	2,197 (5.80%) [a, b]	1,034 (11.51%) [a]	144 (12.46%) [b]	<0.01
Current smoker	6,114 (12.58%)	5,493 (14.36%) [a, b]	589 (6.42%) [a, c]	32 (2.71%) [b, c]	<0.01
Stroke	245 (1.17%)	113 (0.67%) [a, b]	102 (2.89%) [a, c]	30 (5.91%) [b, c]	<0.01
Dialysis	59 (0.12%)	33 (0.09%) [a, b]	20 (0.22%) [a, c]	6 (0.51%) [b, c]	<0.01
Bleeding disorder	1148 (2.36%)	622 (1.63%) [a, b]	397 (4.33%) [a, c]	129 (10.93%) [b, c]	<0.01
Independent functional status	48,272 (99.70%)	38,055 (99.84%) [a, b]	9,074 (99.41%) [a, c]	1,143 (97.44%) [b, c]	<0.01
ASA classification	1.99 ± 0.66	1.90 ± 0.64 [a, b]	2.29 ± 0.58 [a, c]	2.63 ± 0.57 [b, c]	<0.01
Operative characteristics					
Indication					<0.01
Venous insufficiency without ulceration	45,329 (93.24%)	35,996 (94.09%) [a, b]	8,380 (91.32%) [a, c]	953 (80.76%) [b, c]	
Venous ulceration	2,116 (4.35%)	1,374 (3.59%) [a, b]	561 (6.11%) [a, c]	181 (15.34%) [b, c]	

Venous disease not specified	1,170 (2.41%)	888 (2.32%) [a, b]	236 (2.57%) [a, c]	46 (3.90%) [b, c]	
Type of procedure					<0.01
Venous ablation	13,972 (28.74%)	10,403 (27.19%) [a, b]	2,985 (32.53%) [a, c]	584 (49.49%) [b, c]	
Open venous procedure	24,071 (49.51%)	19,390 (50.68%) [a, b]	4,270 (46.53%) [a, c]	411 (34.83%) [b, c]	
Venous ablation and open venous procedure	10,572 (21.75%)	8,465 (22.13%) [a, b]	1,922 (20.94%) [a, c]	185 (15.68%) [b, c]	
Operative time	64.80 ± 38.92	66.03 ± 38.88 [a, b]	61.27 ± 39.62 [a, c]	52.65 ± 30.37 [b, c]	<0.01
General Anesthesia	33,507 (68.96%)	29,980 (70.56%) [a, b]	5,904 (64.36%) [a, c]	623 (52.80%) [b, c]	<0.01
Outcomes					
Return to operating room	834 (1.72%)	640 (1.67%) [b]	155 (1.69%) [c]	39 (3.31%) [b, c]	<0.01
Surgical site infection	475 (0.98%)	360 (0.94%)	99 (1.08%)	16 (1.36%)	0.20
Deep vein thrombosis	491 (1.01%)	394 (1.03%)	91 (0.99%)	6 (0.51%)	0.21
Pulmonary embolism	107 (0.22%)	77 (0.20%) [a, b]	30 (0.33%) [a, c]	0 (0.00%) [b, c]	0.02
Stroke	12 (0.02%)	6 (0.02%) [a]	3 (0.03%) [a]	3 (0.25%)	<0.01
Myocardial infarction	5 (0.01%)	2 (0.01%) [a, b]	1 (0.01%) [a, c]	2 (0.17%) [b, c]	<0.01
Cardiac arrest	4 (0.01%)	1 (0.00%)	3 (0.03%)	0 (0.00%)	0.04
Morbidity	1,205 (2.48%)	905 (2.37%) [b]	260 (2.84%) [c]	40 (3.39%) [b, c]	<0.01
Mortality	10 (0.02%)	6 (0.02%)	3 (0.03%)	1 (0.08%)	0.12
Any adverse event	1210 (2.49%)	908 (2.37%) [a, b]	261 (2.84%) [a, c]	41 (3.47%) [b, c]	<0.01

COPD: chronic obstructive pulmonary disorder, CHF: congestive heart failure, ASA: American Society of Anesthesiologists
[a, b, c] denotes post-hoc test with significant p value of < 0.05
Data presented as number (percentage) for categorical variables and mean ± standard deviation for continuous variables

Demographic and operative characteristics of patients by age

Author Disclosure: T Kim: Nothing to disclose; **Y Zhang**: Nothing to disclose; **R Guzman**: Nothing to disclose; **C Ochoa Chaar**: Nothing to disclose

AVF43

Long-Term Saphenous Vein Occlusion Rate Following Endovenous Ablation

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Objective: To review long-term clinical and outcomes and saphenous vein occlusion rate after endovenous venous ablation (EVA) for varicose veins of patients entered in a multi-center registry.

Methods: A retrospective review of our multi-center EVA database from January 1998 to December 2018 was performed in patients with at least three year of sonographic follow-up. The primary end point was saphenous vein closure rate after EVA. The secondary end points were early endothermal heat-induced thrombosis (EHIT) and CEAP/VCSS scores at time of ablation and on long-term follow-up.

Results: In four hundred thirty-nine patients and 542 limbs evaluated, 305 (70%) patients were female. Mean age was 57.0±13.8 years. One seventeen limbs were CEAP class 2, 94 limbs were CEAP class 3, 28 limbs were CEAP 4, 20 limbs were CEAP 5 and 28 limbs were CEAP 6. Mean VCSS score was 7.9±3.3 prior to ablation. Six hundred eighty-one veins were treated, 358 had radiofrequency (RF) and 323 had laser ablations (LA), respectively; 542 great saphenous veins (GSV), 106 small saphenous veins (SSV) and 33 anterior accessory saphenous veins (AASV) were treated. Mean diameter of vein treated was 8.4±6.4mm for GSV, 4.6±1.9mm for SSV and 6.9±3.0 for AASV. Mean reflux time of vein treated was 6481.4±4103.3ms for GSV, 4491.9±3421.2ms for SSV and 5706.9±3364.6ms for AASV. Following ablation, EHIT was identified in 11 (2%) legs, which were treated with oral anticoagulation for 76.9±53.3 days. Postoperative complications were rare, pain was reported with 27 limbs and hematoma with 5. Follow-up was 5.6±2.3 years; 508 (74.6%) veins were occluded, 53 (7.8%) partially occluded and 120 (17.6%) were patent. There was no difference between patients treated with RF and LA. On follow-up, there were 98 limbs with CEAP 2, 70 limbs with CEAP 3, 24 limbs with CEAP 4, 16 limbs with CEAP 5 and 18 limbs with CEAP 6 with a VCSS score of 6.2±3.8 ($p<0.05$).

Conclusion: Our real-world multicenter experience with saphenous vein ablations revealed 5-year closure and partial closure rates of 74.6% and 7.8%, respectively; lower than previously reported. Perioperative thrombotic complications were minor and resolved after 76.9±53.3 days. Saphenous ablation for varicose veins using either RF or LA was safe, effective and resulted in durable clinical improvement, although 1 of 4 ablated veins reopened by five years.

Author Disclosure: Y Erben: Nothing to disclose; **I Vasquez**: Nothing to disclose; **Y Li**: Nothing to disclose; **P Gloviczki**: Nothing to disclose; **M Kalra**: Nothing to disclose; **G Oderich**: Nothing to disclose; **R De Martino**: Nothing to disclose; **H Bjarnason**: Nothing to

disclose; **M Neisen**: Nothing to disclose; **J Moore**: Nothing to disclose; **J Da Rocha Franco**: Nothing to disclose; **M Sanchez-Valenzuela**: Nothing to disclose; **G Frey**: Nothing to disclose; **B Toskich**: Nothing to disclose; **H Farres**: Nothing to disclose; **W Oldenburg**: Nothing to disclose; **J Gomez-Perez**: Nothing to disclose; **J Yarbrough**: Nothing to disclose; **M Adalia**: Nothing to disclose; **S Money**: Nothing to disclose; **W Stone**: Nothing to disclose; **V Davila**: Nothing to disclose; **A Meltzer**: Nothing to disclose; **A Hakaim**: Nothing to disclose

AVF44

Quality and Readability of Online Patient Resources for Varicose Veins - Do We Know What is Out There?

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Objective: Patients are increasingly seeking information on their conditions from the Internet. This study aims to evaluate quality and readability of freely available online patient resources for varicose vein.

Methods: An internet search for "varicose veins" were conducted on meta-search engines Yippy and Dogpile with a cleared-cache web browser in July 2019. Two separate raters scored websites on the dimensions: accountability, interactivity, structure, and content. Discrepancies were discussed and consensus was reached. Readability was calculated with Flesch Grade Level and SMOG formula. Statistical analysis was performed with SPSS using ANOVA.

Results: A total of 103 websites met inclusion criteria. Reason for exclusion included: duplications 64, lack lower extremity varicose vein related educational content 23, website not accessible 8, physician oriented 2. Website type included: open access 54 (52.4%), hospital/healthcare organization 38 (36.8%), Governmental 7 (6.8%), professional organization 3 (2.9%), industry-sponsored 1 (1%). Format of content included: webpages 60 (58.3%), articles 40 (38.8%), webpages and articles 2 (1.9%), personal blog 1 (1%). Total quality score was 22.5±5.9 (total 42). Subcategory website quality score were: accountability 5.7±4.5 (n=16), interactivity 2.4±0.9 (n=6), structure 3.6±0.8 (n=5), content 11.6±3.8 (n=15). Overall accountability of websites was poor: 32% disclosed authorship, 39% used citations and 51% neither had a date of creation or modification. Most websites (80%) described conservative management. Sclerotherapy (66%) was the most common described procedure followed by endovenous laser ablation (63.1%), radiofrequency ablation (51.5%), ambulatory phlebectomy (39.8%), ligation and stripping (35.9%), and surface laser (21.4%). Government (28.6±4.5) and industry-sponsored (29.2) websites performed better on accountability, interactivity, structure, and content than hospital/healthcare organization (20.6±4.6), professional organization (21.3±5), and open access site (23.1±6.4) (P=0.008). Importantly, open access websites had significantly lower accuracy (2.9 ±1.4) compared to government (4.6±0.2), hospital/healthcare organization (4.1±0.5), professional organization (4.5±0.5), industry-sponsored 5 (P≤0.001). Overall readability was low with average FK grade level 10±2, SMOG grade level 10±1. Government-sponsored sites while having the highest total score also were most readable (FK grade 8±1, SMOG grade 8±1) compared to open access (FK grade 10±2, SMOG grade 9±1), professional organization (FK grade 9±2, SMOG 9±2), Hospital/healthcare organizations(FK 11±2, SMOG 10±1), and industry-sponsored (FK 11, SMOG 10) (P≤0.001).

Conclusion: Quality of online patient resources on varicose vein is highly variable and readability for a patient is poor. Government sponsored websites have the highest quality while remaining most readable. Providers are advised to provide a list of appropriate websites to their patients to avoid confusion and ensure appropriate delivery of accurate and readable information.

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AVF45

Advanced Pneumatic Compression : Continued improvement in Quality of Life beyond initial early benefits of decreased limb girth

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Objective: The purpose of this study is to evaluate the effect of an advanced pneumatic compression device (APCD) in improving symptoms and quality of life in patients with lower extremity lymphedema.

Methods: A total of 178 patients with lower extremity lymphedema were prospectively enrolled in this multi-center (4 Veterans Administration Hospitals) from 2016-2019. This study represents analysis of the first 74 subjects who have completed 52 weeks of APCD treatment. Demographics and patient characteristics (limb girth, BMI and stage of lymphedema) were collected at baseline. Primary endpoints include both generic Quality of Life (QoL) assessment (SF-36) and disease- specific (LYMQOL) at 12, 24, and 52 weeks follow-up. Secondary endpoints compare changes in limb circumference and skin assessment (lymphedema stage) at each follow-up interval visit. Complications including cellulitis episodes, number of clinic visits and hospital admissions associated with cellulitis were recorded for the 52 weeks prior to enrollment and compared to similar events within the 52 weeks of treatment with APCD.

Results: Patient demographics and include: Mean age 67.0 years of age +/- 11.4; Male gender (n=70); BMI 32.8 +/- 5.9. Most patients had secondary lymphedema (n=71; 95.9%) of which the most common cause was chronic venous insufficiency (n=53; 71.6%). The majority of patients presented with stage 1 or 2 lymphedema (n=70; 94.6%); There was a significant decrease in limb girth noted at 12 weeks compared to baseline (28.1 vs 27.3cm; p=0.002) which then plateaued for the remainder of the study period. The SF-36 questionnaire showed a trend towards QoL improvement in all areas at 52 weeks (Physical component 39.9 vs 41.7 (p=0.1); Mental component 49.3 vs 51.3 (p=0.2)). LYMQOL-LEG scores showed significant continued improvement at each time point ($p<0.0001$). 18/74 (24.3%) patients had a history of cellulitis in the 52 weeks prior to enrollment compared with 7/74 (9.5%) following one year of APCD treatment (p=0.01). Among this cellulitis cohort there was significant decrease in number of episodes per patient (0.3 vs 0.1; p=0.01), total clinic visits (19 vs 6; p=0.0003), number of clinic visits per patient (2.2 vs 0.7; p=0.06), and number of hospital admissions per patient (0.05 vs 0.1; p-0.047).

Conclusion: APCD for treatment of lymphedema appears to result in a continued linear improvement in QoL at least up to one year beyond the initial clinical benefit of decreased limb girth. A significant decrease in the number of episodes of cellulitis as well as fewer associated clinic and hospital visits may explain the noted improvement in QoL for patients and can represents significant cost savings to the health care system

Author Disclosure: T Maldonado: Tactile Medical; **F Padberg**: Nothing to disclose; **V Rotella**: Nothing to disclose; **G Jacobowitz**: Nothing to disclose; **H Miller**: Nothing to disclose; **T Berland**: Nothing to disclose; **M Sadek**: Nothing to disclose

AVF46

Examination of the Aetiology of Re-intervention Following Deep Venous Stenting for Acute Iliofemoral Deep Venous Thrombosis.

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Objective: Acute iliofemoral deep venous thrombosis (DVT) is strongly associated with the development of post thrombotic syndrome (PTS). Thrombolysis and deep venous stenting can, however, restore vessel outflow and reduce PTS in accordance with the open vessel hypothesis. For a proportion of treated patients re-occlusion or stenosis will occur and a further intervention is required. In this study our aim was to determine the causes of re-occlusion and stenosis following deep venous interventions for acute iliofemoral DVT.

Methods: A retrospective single centre cohort study of patients successfully lysed for treatment of iliofemoral DVT between November 2013 and 2017 was carried out. Patient records and imaging were examined for: baseline demographics, risk factors, extent of DVT, extent of vessel clearance, stents inserted, quality of in-flow, time to and success of re-intervention, anticoagulation compliance, and secondary vessel patency. Failure was classified as either technical, haematological, flow related or mixed. Technical causes were further subdivided into lack of stenting, failure to address inflow or outflow and device related failure.

Results: 143 limbs were identified: 95 without further intervention and 48 limbs (34%) requiring re-intervention. Median time to re-intervention was 45 days with 45% of cases occurring in the first 6 weeks. A total of 31 cases (67%) had successful re-intervention. This was achieved in all cases managed prior to complete vessel occlusion compared to 8/25 (32%) of those presenting with complete occlusion (p=0.001).

Need for re-intervention was associated with IVC involvement (13% vs. 35%, p=0.002), presence of a stent across the inguinal ligament (15% vs. 38%, p=0.002) and a younger median age (44 vs. 31, p=0.002). Post-procedurally, non-compliance with anticoagulation was found to be strongly associated with re-occlusion: relative risk 3.17 (95%CI 0.29-0.91, p=0.0001). Technical problems were observed in 54% of re-intervention cases. Only four were due to stent fracture or compression. Haematological issues were observed in 33% of re-intervention cases, flow-related issues in 44%% of re-intervention cases, and in 27% of cases, problems were multifactorial. Overall vessel salvage was achieved in 71% of cases with a single causative factor compared to 54% of cases classified as multifactorial. This did not translate into a statistically significant difference in secondary patency.

Conclusion: A large proportion of patients required re-intervention due to potentially preventable factors. This study emphasises the need for precision in stenting technique, for post-procedural surveillance and adherence to anticoagulation in order to optimise patient outcome.

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AVF47

Lessons Learned from Revising Chronically Occluded Iliac Stents 2006-2019

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Objective: There is an epidemic of chronically occluded iliac vein stents world wide. The number of failed stents is an unknown proportion of the stents placed in the iliac veins annually. This trend reflects inexperience and lack of knowledge about pelvic veins among some physicians who perform endovascular procedures. Techniques for restoration of stent patency are in a state of evolution. Designated tools and methods for this procedure are lacking. We have reviewed our results of treating patients with symptomatic venous hypertension due to occluded iliac stents. The findings are intended to help prevent stent failure.

Methods: Patients were referred for treatment of chronically occluded iliac vein stents after initial unsuccessful attempts elsewhere. The severity of venous hypertension was documented with CEAP, Villalta Score, and Veines QOL Questionnaire. IVC/lower extremity duplex exams were obtained. Patients selected for revision were examined with venography, CT and IVUS. If indicated, CDT Alteplase was infused. Laser and rotational thrombectomy catheters were used create a lumen. Tissue samples were obtained in 30% of patients. Stains for smooth muscle were performed. High-pressure balloons were used to dilate existing stents. Additional stents were placed if IVUS revealed poor angioplasty results.

Results: Between 2006-12019, 45 patients, 16M/29F, mean age 43, range 21-57 years, were treated. Technical failure occurred in 11/45 (24%), one revision succeeded in 10/45 (25%) and 24/45 (53%) underwent 2 or more procedures to achieve patency. The duration of occlusion ranged from 2-30 months. Primary patency of revised stents was 20-30% at one year, but assisted patency was 74%. The histological findings often revealed findings consistent with hyperplasia and smooth muscle. Guidewire traversal of the firm occlusive material was ultimately possible in 34/45(81%) of cases. Successful stent revision required an average of 3.5 procedures. Nitinol, open-cell design stents were identified in the majority of failed stents.

Conclusion: Wire traversal of the chronically occluded iliac stent is the most difficult technical aspect. Laser is a promising device for coping with the stubborn obstruction. We currently have no means of removal of the firm accumulated substance that occludes these stents. Optimizing the residual lumen is frustrating, as additional stents may look good and increase the lumen, but they add more metal. Advancement of a wire or device through the curve of the iliac vein is also hard. The importance of good inflow and outflow can not be underestimated . Inadequate identification and stenting of lesions in the external iliac and proximal femoral segments can jeopardize iliac stent patency as much as placement of the proximal stent margin too low or too high.

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AVF48

Value and Limitations of Post-Operative Duplexes for Iliac Vein Stenting

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Objective: Iliac vein stenting is a new procedure that is being explored in the treatment for chronic venous insufficiency. While the risks and benefits have been examined in prior literature, the timing of surveillance of duplex ultrasounds of iliac vein stents has not been examined. We've reviewed our experience with routine transcutaneous duplex imaging of iliac vein stents.

Methods: We reviewed our database of 3025 consecutive iliac vein Wallstents from September 2012 to August 2018. Nonthrombotic patients with greater than 50% stenosis on intravascular ultrasound as measured by diameter or area reduction who failed conservative therapy underwent iliac vein stenting. Patients underwent post-operative transcutaneous duplexes every three months for the first year and every six months thereafter. Stents were examined for partial and complete thromboses.

Results: The total database of iliac vein stent patients consisted of 3025 procedures. The average age of these patients was 66.3±13.8 years(SD). 35.9% were male.

Out of the 3025 patients, a total of 18 presented with full thrombosis in follow-ups. The average age of these patients was 67.4±11.2 years(SD). 27.8% of the patients were male. The presenting symptoms by CEAP classification were C3:6, C4:9, C6:3. Fourteen (78%) of the stents were on the left. No recurrent full thromboses were noted. The average duplex follow-up was 42.4±23.4 months(SD). The average number of months until complete thrombosis was noted was 8.3±11.1 months(SD). 50% thrombosed in the first three months, 11% within 3 to 6 months, 11% 6 to 9 months, and 22% 24 months of more after the procedure.

Out of the 3025 patients, a total of 16 presented with partial thrombosis in follow-ups. The average age of these patients was 66.0±8.1 years. 18.8% of the patients were male. The presenting symptoms by CEAP classification were C3:6, C4:9, C6:3. Twelve (75%) of the stents were on the left. None of the partial thromboses progressed to full thromboses. The average duplex follow-up was 23.9±12.8 months(SD). The average duplex follow-up was 7.75±13.1 months(SD). 63% thrombosed in the first three months, 6% within 3 to 6 months, 13% 6 to 9 months, and 29% 30 months of more after the procedure.

Conclusion: These data question the used of routine use of transcutaneous duplex imaging after iliac vein stenting as none of the partial stent thromboses became complete. All the of the patients with complete stent thrombosis were symptomatic and none of the partial thromboses were symptomatic. Although the first 3 months after stent placement are associated with the highest incidence of stent thrombosis, the stents remain at risk of thrombosis even up to 24 months.

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AVF49

Popliteal Vein Compression, Obesity and Chronic Venous Insufficiency (CVI)

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Objective: In some patients with obesity the skin changes of advanced CVI are seen despite minimal or no evidence of deep or superficial venous dysfunction. It has been suggested these changes may be associated with increased fat content and increased pressure in the popliteal fossa causing popliteal vein compression. Decompression of the popliteal fossa has been offered as a treatment. However, the prevalence of popliteal vein compression in the limbs of those who are obese is not known. Popliteal vein compression is best demonstrated by ultrasound imaging with the knee in hyper-extension. Those who are obese often stand with knees hyper-extended to increase stability. This study examines the prevalence of popliteal vein compression in obese (BMI>30) and non-obese volunteers and patients attending a vascular clinic.

Methods: Each subject had a clinical exam for venous disease, and when present a full venous ultrasound examination was carried out. All subjects had ultrasound interrogation of the popliteal fossa of both legs to determine the prevalence of popliteal vein compression during the hyper-extension of the knee in the standing position (PVC(lock)). The presence of compression was also documented with full weight bearing bilateral toe stand (PVC(toe)). Each maneuver was recorded for subsequent video analysis.

Results: A total of 226 limbs were examined, 136 obese (BMI 43 ± 8 kg/m^2) and 90 non-obese (BMI 26 ± 3 kg/m^2). PVC(lock) occurred in 12% of the non-obese limbs but was more common in the obese limbs (36%, $p<0.0001$). In the obese limbs with C4-6 skin changes (n=77) and median VCSS 9, PVC(lock) was present in 40% compared to 31% in those without skin changes (p=0.28). However in 10% of those with CVI skin changes popliteal vein compression was the only venous abnormality to be identified in the leg. In all groups, the compression occurred most frequently in the upper popliteal fossa (78% above Knee Skin Crease only). PVC(lock) was not associated with sex and was bilateral PVC(lock) in 50-75%.
In comparison, PVC(toe) occurred in the majority of limbs (74%) and predominantly in the lower half of the popliteal fossa suggesting involvement of the contracting heads of the gastrocnemius muscles. There was no association with skin changes, but compression with toe stand was more likely with obesity (RR 1.27, p=0.03).

Conclusion: Popliteal vein compression is far more common in the limbs of the obese and may be a contributing factor to obstructive venous hypertension and the associated otherwise unexplained skin changes sometimes seen in obesity. It is infrequently the only factor.

Author Disclosure: A van Rij: Nothing to disclose; **R Millen**: Nothing to disclose; **K Thomas**: Nothing to disclose; **G Hill**: Nothing to disclose; **M Versteeg**: Nothing to disclose

AVF50

Single Session Therapy for Symptomatic Proximal Upper Extremity Deep Venous Thrombosis

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Objective: Catheter-directed thrombolysis (CDT) provides an effective method for clearing deep venous thrombosis(DVT). Unfortunately, CDT is associated with hemorrhagic complications. We assessed the technical success of the various endovascular therapies including a new mechanical aspiration thrombectomy device for the treatment of upper extremity acute deep venous thrombosis.

Methods: This was a single-center retrospective review of patients with acute symptomatic proximal upper extremity deep venous thrombosis. Patients were treated with a variety of methods including Catheter directed thrombolytics(CDT), Ultrasound assisted thrombolysis(USAT), Rheolytic thrombectomy(RT) and Aspiration thrombectomy(AT). We evaluated the from 2013 to 2019. We evaluated two groups, Aspiration Thrombectomy(AT) and Non-Aspiration Thrombectomy(NAT). The primary end point was technical success, defined as resolution of >70% of thrombus. The secondary end point was the ability to complete the therapy in a single session.

Results: There were 22 patients who had endovascular management of their symptomatic proximal upper extremity DVT. All 22(100%) patients were successfully treated with greater than 70% thrombus resolution. 10 patients were treated with AT, of which 5(50%) had single session therapies. 12 patients underwent NAT of which 5 had CDT or USAT alone, 2 underwent USAT with Rheolytic Thrombectomy(RT) and 5 had CDT followed by RT. 1(8.5%) of the 12 in the NAT group had single session therapies. The average total dose of thrombolytics was 10mg in the AT group compared to 19mg in the NAT group. All but one of the patients went on to have successful first rib resections.

Conclusion: We observed a technical success of 100% for acute symptomatic proximal upper extremity DVT therapies. Aspiration thrombectomy technology allows for treatment in a single session thereby minimizing a patient's risks of bleeding complications. Further research is needed to further define the role of this new technology in the treatment paradigm of upper extremity DVT management.

Author Disclosure: T Fuller: Nothing to disclose; **E Neville**: Nothing to disclose; **A Kulwicki**: Nothing to disclose; **B Kuhn**: Nothing to disclose; **M Recht**: Nothing to disclose; **P Muck**: Penumbra

AVF51

Nutrition Evaluation in Ambulatory Patients with Chronic Wounds

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Objective: Most data correlating nutrition and wound healing stems from acute wounds in the hospital setting. There is little data regarding nutrition and chronic wound healing in ambulatory patients. Standardized nutrition assessment is rarely undertaken in ambulatory wound clinics. We investigated the use and convergence of different nutritional survey tools and potential biomarkers to assess nutrition in ambulatory wound patients.

Methods: We enrolled ambulatory patients with chronic wounds (at least 6 weeks duration) from two outpatient wound clinics. Nutrition status was determined using the Subjective Global Assessment (SGA) and Mini Nutritional Assessment (MNA). Serum albumin, pre-albumin, transferrin, and CRP results were collected as potential biomarkers of nutritional status. Statistical analyses included computing standard diagnostic parameters (e.g., sensitivity) and non-parametric correlations (biserial, kappa).

Results: In 81 enrolled patients, MNA scores indicated that 11% patients were malnourished, 32% were at risk for malnourishment, and 57% had normal nutritional status. SGA scores indicated that 27% patients were malnourished (3% with severe malnutrition and 25% with moderate malnutrition) and 73% were well nourished. The kappa correlation coefficient showed fair to moderate agreement between the SGA and MNA assessments (Cohen's K = .40, $p < 0.001$). To evaluate the diagnostic accuracy of MNA for identifying patients that require nutritional intervention, we dichotomized MNA and SGA scores into "impaired nutrition" and "normal nutrition" statuses. Using SGA as the gold standard, accuracy, sensitivity, specificity, and PPV and NPV of MNA were 72%, 77%, 70%, 49%, and 89%, respectively.
Among the biomarkers analyzed: mean albumin levels were 3.70 ± .57 g/dL; mean prealbumin was 20.69 ± 6.18 mg/dL; mean CRP was 2.31 ± 3.45; and mean transferrin was 220.74 ± 83.32 mg/dL. Higher levels of albumin were associated with better nutritional status on both the SGA ($r_{pb} = .31$, $p = .014$) and MNA ($r_{pb} = .48$, $p < .01$). Prealbumin was not associated with nutritional status using either assessment (ps > .05). Findings were incongruent between the inflammatory biomarkers. CRP was negatively related to MNA ($r_{pb} = -.31$, $p = .03$) but not SGA scores ($r_{pb} = -.01$, $p = .94$), whereas transferrin was positively related to SGA ($r_{pb} = .29$, $p = .04$) but not MNA scores ($r_{pb} = .17$, $p = .24$).

Conclusion: A substantial number of ambulatory wound patients are malnourished. MNA may substitute for SGA as a more convenient tool for nutritional assessment. Albumin may be a reliable biomarker of nutritional status in this population. Further investigation may identify and correlate other potential biomarkers and help determine the impact of nutrition on chronic wound healing in this population.

Author Disclosure: A Clay: Nothing to disclose; **T Truong**: Nothing to disclose; **T Fisher**: Nothing to disclose; **J Janes**: Nothing to disclose; **T Lewis**: Nothing to disclose; **T Carman**: Nothing to disclose; **T Carman**: Nothing to disclose

AVF52

Pre-operative Evaluation of the Subclavian Vein with Venography and IVUS in Paget Schroetter Syndrome

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Objective: To characterize patient demographic, angiographic findings; and describe quantifiable intravascular ultrasound (IVUS) data of the subclavian vein in symptomatic venous thrombosis secondary to venous thoracic outlet syndrome (vTOS).

Methods: vTOS patients were studied with catheter venography and IVUS. Data collected included angiographic findings (stenosis, collateralization, post-phlebitic changes), and quantitative IVUS data (vein diameters, area). For comparison, asymptomatic contralateral subclavian veins were also evaluated. IVUS measurements were taken in neutral and stress position of the arm lateral to the first rib (point 1), and at the point of maximal compression (point 2). Demographic information, vTOS presentation, initial management (thrombolysis, anticoagulation), surgical interventions, and outcome were collected.

Results: Demographics of the 32 patients presenting with subclavian thrombosis are presented in table 1. The average BMI was 24.3, with an average height of 1.71 meters. The majority of patients, 94% were diagnosed with duplex ultrasound. Over half, 70% had preoperative lysis, and 21% presented with a documented pulmonary embolus. Venography demonstrated occlusion in 16% in neutral position, and 54% in stress position. 88% had a venogram after decompression of the thoracic outlet with a 10 millimeter angioplasty balloon most commonly used. Table 2 presents the average subclavian vein areas in the thrombosed, and contralateral limb stratified by gender.

Conclusion: Use of IVUS provides objective characterization of the subclavian vein in symptomatic vTOS patients. We note a range of stenosis in symptomatic veins, and observe a range of narrowing within normal asymptomatic veins.The specific degree of venous compression associated with symptomatic vTOS has never been clearly defined. Our results may help better define those patients who are at risk of recurrent thrombosis and who would benefit from surgical decompression.

Demographics	n=32
Age: years (SD)	33 (18)
Gender (Female)	56%
Laterality (left)	28%
Symptoms to diagnosis: Days (SD)	6.5 (10)
Diagnosis to evaluation: Days (SD)	74 (137)
Evaluation to decompression: Days (SD)	88 (181)
Postoperative length of stay: Days (SD)	1.87 (0.69)
Decompression to postop venogram/IVUS: Days (SD)	27 (32)

Decompression to last followup: Days (SD)	170 (297)

Patient demographics

			Point 1	Point 2
Male	Thrombosed	Neutral	98 (41)	25 (18)
		Stress	84 (23)	6 (10)
	Contralateral	Neutral	130 (31)	65 (35)
		Stress	102 (22)	32 (32)
Female	Thrombosed	Neutral	81 (18)	19 (16)
		Stress	74 (21)	10 (11)
	Contralateral	Neutral	114 (46)	67 (35)
		Stress	93 (28)	34 (30)

IVUS subclavian vein area (mm^2); mean (SD)

Author Disclosure: J Ulloa: Nothing to disclose; **R Patel**: Nothing to disclose; **H Gelabert**: Nothing to disclose

AVF53

United States Intravascular Ultrasound Practice Trends: A 5 year Review of the Medicare Provider Utilization and Payment Database

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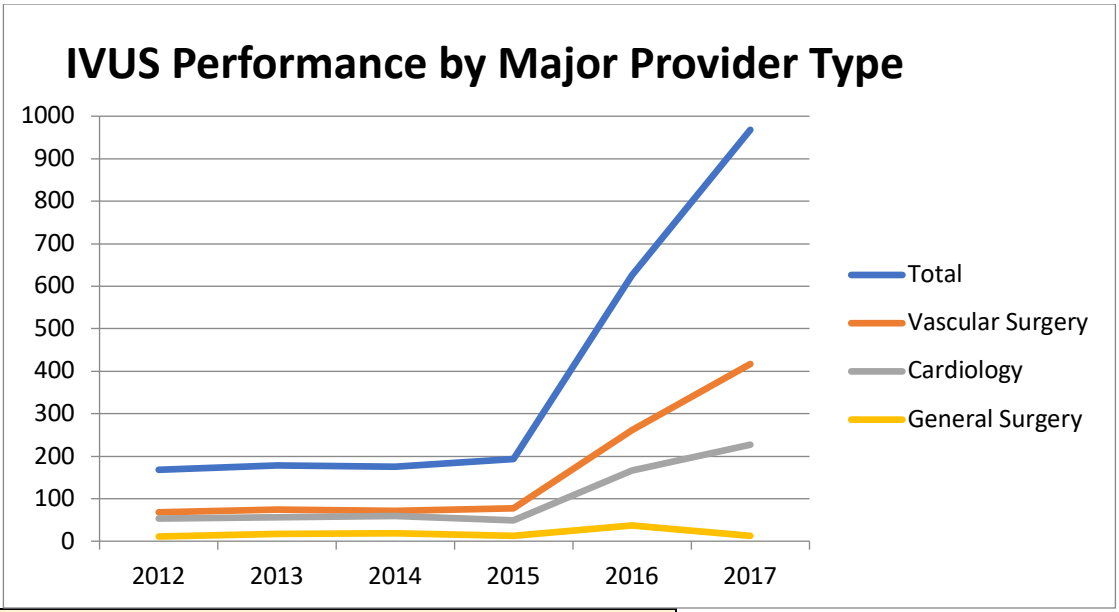
Objective: Intravascular ultrasound (IVUS) has seen a substantial growth in its use in the last few years. This surge in utilization can be attributed to multiple potential factors, although there is certainly concern for overutilization, particularly among vascular societies and payers. To establish an idea of practice trends, the Medicare Provider Utilization and Payment Database (MPUP) was used to give a national view of IVUS use in the Medicare beneficiary population.

Methods: The Medicare Provider Utilization and Payment Database was queried for the IVUS CPT codes: 37250, 37251, 37252, 37253 from 2012 to 2017. These results were imported into a relational database program. Queries were designed to ascertain the practice trends of all providers, inclusive of all specialties, the data exported to a spreadsheet program for analysis. Analysis for IVUS per patient was calculated by assessing the number of beneficiaries that underwent at least 1 IVUS by a provider in relation to the total number of procedures performed by that provider.

Results: Between 2012 and 2107, a total of 2308 providers performed IVUS. Of note, there was a prominent surge in 2016 and 2017, with an average of 777 providers performing IVUS per year compared to 178 providers per year for 2012 to 2015. While a majority of these procedures are performed by vascular surgeons, there are also cardiologists, general surgeons along with assorted other providers (interventional radiologists, internists and cardiac surgeons, etc) who performed IVUS within the search criteria. Looking specifically at 2017, we see that Medicare regions 4, 6 and 9 share a disproportionately heavy use of IVUS, with 21.2, 21 and 19.5% of all procedures performed, respectively. This is in stark contrast to regions 1, 7, 8 and 10 which comprise 2.1, 4, 0.98 and 1.5% of all procedures performed, respectively.

Conclusion: IVUS is performed by multiple subspecialties with different levels of formal training in the interpretation of IVUS. A notable increase was seen annually in the number of providers following 2015, and appears to continue to be increasing. There is significant regional variance which, although partially explained by differences in population density, does show an increase in use along the southern part of the country compared to the north.



IVUS performance by Major Provider Type

Author Disclosure: A Borjon: Nothing to disclose; **M Haffner**: Nothing to disclose; **K Kiely**: Nothing to disclose; **T Qvavdze**: Nothing to disclose; **J Crawford**: Nothing to disclose

AVF54

A Case Series of Plication for Popliteal Vein Aneurysms

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Objective: Popliteal venous aneurysms are a rare vascular anomaly first reported in the 1980s. Inflammatory and smooth muscle cell infiltration into the vessel wall, resulting from trauma or venous hypertension are implicated to be integral steps in the development of these aneurysms. Given the rarity of this clinical entity, significant controversy exists regarding ideal treatment strategies, including the role of observation, medical management with anticoagulation or surgical intervention. Retrospective reviews have demonstrated a failure rate over 40% with anticoagulation alone, with patients often presenting with pulmonary embolism. This has prompted our institutional preference towards surgical management. Surgical management involves tangential repair with lateral venorrhaphy most commonly, followed in prevalence by aneurysm resection and end-to-end anastomosis either primarily or with vein interposition. Herein, we report our results with venous plications, the majority through a novel closed technique.

Methods: We performed a retrospective review of prospectively collected data for 10 patients undergoing popliteal vein plication for treatment of popliteal venous aneurysms. Patient-level characteristics and operative details were examined from periprocedural and follow-up records.

Results: We identified 10 patients undergoing popliteal vein plication, including 9 closed plication and one open plication. The average aneurysm size at presentation was 2.35 +/- 0.69 cm for closed plication and 4.74 cm for the one open plication. Following treatment, the average popliteal vein size was significantly reduced to 1.12 +/- 0.45 cm for the closed plications ($p<0.001$ from preprocedural) and 1.13cm for the open plication with 100% primary patency. Average follow up for patients treated with closed plication was 32 +/- 24 months, during which 7 (78%) patients had a stable, normal popliteal vein size. One patient that recurred was diagnosed with Klippel Trenaunay syndrome (KTS). The other had distal degeneration of his popliteal vein proximal to the previous repair at 39 months after his original operation which required additional plication. The open plication patient experienced a hematoma requiring washout and resulting in a transient peroneal mononeuropathy. There was one case of cellulitis after closed plication but no hematomas within this group.

Conclusion: Closed plication demonstrated favorable primary patency rates and low recurrence rates, avoiding technical issues or need for early institution of systemic anticoagulation associated with tangential repair and venorraphy or resection methods. Closed plication represents an attractive option in patients without luminal thrombus to limit the risk of these postoperative complications and obviates the need for bypass conduit.

Author Disclosure: R Beaulieu: Nothing to disclose; **A Boniakowski**: Nothing to disclose; **C Vemuri**: Nothing to disclose; **D Coleman**: Nothing to disclose; **A Obi**: Nothing to disclose; **T Wakefield**: Nothing to disclose

AVF55

Proximal Common Iliac Vein Stenosis May Mask a More Distal Stenosis: A Phenomenon Unique to Veins

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Objective: We have observed during vein stenting for proximal venous outflow obstruction (PVOO) the appearance of a more distal stenosis in the iliac veins that was not initially observed prior to placement of the more proximal vein stent. We have also observed that a "new" stenosis in the native iliac vein distal to a stent in the common iliac vein was a common finding during secondary re-interventions. This study aimed to elucidate these two observations.

Methods: We identified patients in whom the external iliac vein changed in area measurements and linear dimensions observed on venography and/or intravascular ultrasound (IVUS) during vein stent placement for chronic non-thrombotic PVOO in the iliac veins. The images of these intravascular ultrasounds were subsequently analyzed for the cross-sectional area and linear length/width measurements in the common iliac vein (CIV) and external iliac vein (EIV), before and after placement of a proximal common iliac vein stent.

Results:

A total of 32 limbs that had complete and quality IVUS and venographic images that allowed for measurements pre and post proximal vein stent placement in both the CIV and EIV. This patient cohort was 55% male, mean age 63 y/o (SD +/- 6.1years) and a mean body mass index 27.8 kg/m^2 (SD +/- 7.76 kg/m^2). There were 18 and 14 left and right treated limbs. CEAP class of treated limbs were C4 disease (n=20; 63%), C6 (n=6; 19%), C5 (n=3; 9%) and C3 (n=3; 9%). Prior to ipsilateral CIV stenting, mean EIV cross-sectional area was 87.4 mm^2. Post stenting, mean EIV cross-sectional area was 50.7 mm^2 with a mean reduction of 36.7 mm^2 ($p<0.001$). Mean EIV length pre- and post-CIV stenting was 15.2 mm and 11.1 mm, respectively ($p<0.001$). Mean EIV width pre- and post-CIV stenting was 7.3 mm and 5.8 mm, respectively ($p<0.001$). Change in EIV area, length and width pre- and post-CIV stenting did not correlate with gender, age, laterality, or CEAP classification.

Conclusion:

This study showed that the dimensions of the EIV changed significantly after placement of a proximal stent. A proximal CIV stenosis can potentially lessen the appearance of or completely mask an EIV stenosis. A possible explanation may be distal venous distention resulting from the proximal stenosis. This phenomenon appears unique to venous stenting and the prevalence currently remains unknown. This finding underscores the importance of completion venogram and IVUS after venous stent placement.

Author Disclosure: T Leong: Nothing to disclose; **J Chait**: Nothing to disclose; **K Chun**: Nothing to disclose; **M Marin**: Nothing to disclose; **P Faries**: Nothing to disclose; **W Ting**: Nothing to disclose

Poster 1

Does Kidney Transplantation Increase the Risk of Ipsilateral Deep Vein Thrombosis?

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Objective: There is limited information on the development and laterality of symptomatic deep vein thrombosis (DVT) following kidney transplantation. Recently we showed that arterial limb ischemia developed more frequently on the side of the transplanted kidney. In this study, we wanted define the incidence, and characteristics of DVT in the kidney transplant population and determine if the side of the DVT corresponds to the side of the transplanted kidney.

Methods: We performed a retrospective review of all kidney transplant recipients from January, 2004 to July 2019 at our institution and who subsequently developed symptomatic DVT. Kidney transplant recipients and confirmed DVT patients were queried using two separate databases then were matched to obtain our cohort. Concomitant pancreatic transplants, bilateral kidney transplants, and redo transplants were excluded. Upper extremity DVTs were excluded from the study. We used Cohen's kappa statistic to test the agreement between the surgical incision site of the kidney transplant to the side at which the DVT occurred.

Results: A total of 2,449 kidney transplants were performed during the study period. A total of 1,482 kidney transplant recipients met the inclusion criteria as our total cohort. Six hundred and six patients were screened for DVT, of which 115 patients had a positive result. The incidence of symptomatic DVT in our kidney transplant cohort was 4.7%. The most common period of DVT diagnosis was within the first 4 weeks (Figure 1). Diabetes Mellitus, Heart Failure, Acute MI, Sepsis, COPD/abnormal pulmonary function, and being confined to bed were associated with DVT (p-value <0.05). There was no statistically significant difference in patient sex, race, or age between the two groups (Table 1).The transplant recipients who had DVT confirmed via duplex had higher Caprini scores, p-value <0.05, compared to transplant patients that did not have DVT. Approximately 52.9% of transplant patients with a positive duplex ultrasound had a 1:1 correlation to the side of DVT. A Cohen kappa statistic of 0.02 occurred between the surgical incision site of the kidney transplant and the side of DVT occurrence indicating no correlation between DVT and the side of the transplant.

Conclusion: The incidence of symptomatic DVT in this cohort was 4.7%, which is lower than that reported in the literature. DVT rate was highest during the first four weeks postoperatively. Being confined to bed increases the risk of developing a DVT. The incidence of DVT was not higher on the side of transplantation.

Author Disclosure: S Ahmed: Nothing to disclose; **D Kim**: Nothing to disclose; **L Malinzak**: Nothing to disclose; **A Rteil**: Nothing to disclose; **L Kabbani**: Nothing to disclose

Poster 2

Venous Hypertension and Lymphedema of Lower Limbs ¨The Key Role of Lymph Nodes Veins¨

miguel amore [1,2], Cristobal Papendieck [2]
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Objective: Background: During the past years, several authors described morphological changes at the inguinal lymph nodes after great saphenous vein surgery and these can be consider one of the causes of the recurrence varicose, which may be related to the intranodal venous hypertension.

Aim: is to evaluate the interruption of the venous drainage of the inguinal lymph nodes after great saphenous vein surgery, the dilated of the subcapsular venous sinus, the secondary intranodal venous hypertension and the possible cause to induced a lymphedema.

Methods: Material & Methods: We evaluated 5 (N=5) patients with secondary lymphedema of lower limbs who refered that began the clinical signs of edema after 2 to 6 month after venous surgery. We perform Duplex ultrasound in all cases. Lymphocintigraphy (N=5), ICG lymphography (N=2) and oil lymphography (N=1). in (N=2) we combine with ascending phlebography

Results: Results: With Duplex Ultrasound we observed a hypertrophy of one or two nodes with a dilated subcapsular venous sinus at the groin, the venous reflux and their relation with varicoses veins. by Lymphocintigraphy, ICG lymphography and oil lymphography we observed an hipoplasia of lymph nodes and dermal backflow.

Conclusion: Conclusion: We have enough data about the trauma of the lymph vessels after vein surgery and how can develop a secondary lymphedema.
Its our intention to focus on the inguinal lymph nodes, their pathophysiology changes after interruption the venous drainage and how the venous hypertension of the lymph nodes can develop a disfunction and induced a lymphedema.

Author Disclosure: m amore: Nothing to disclose; **m amore**: Nothing to disclose; **C Papendieck**: Nothing to disclose

Poster 3

Left Renal Vein Transposition for Nutcracker Syndrome in a Patient with Multiple Vascular Entrapment Phenomenon

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Objective: Isolated vascular entrapment syndromes are well represented in the literature despite their relatively low incidence. These syndromes are comprised of superior mesenteric artery (SMA) syndrome, left iliac vein compression syndrome and left renal vein entrapment. Herein, we present a case of a patient suffering from all three vascular entrapment syndromes that required operative repair.

Methods: Case report and review of the literature.

Results: A 55-year old woman with a history of significant weight loss due to abdominal pain, nausea and vomiting as well as severe left lower extremity swelling and hematuria resulting in anemia. She was initially worked up and treated for her abdominal pain and was found to have SMA syndrome. After a failed trial of conservative management, she underwent a laparoscopic duodenodenostomy that relieved her intestinal obstruction and gastrointestinal complaints. She underwent a left iliac vein stent placement for her iliac vein compression, and this relieved her leg swelling but then she began to have pelvic pain and heaviness as well as recurrent urinary tract infections. On further diagnostic work up, she was found to have microscopic hematuria and persistent anemia. A CT angiogram was performed that revealed concern for left renal vein entrapment, also known as Nutcracker syndrome. The patient was taken for a venogram with intravascular ultrasound that demonstrated left renal vein compression of greater than 80% in addition to reproducible pain with wire manipulation. She underwent an open left renal vein transposition. At one month follow up the patient has complete resolution of all symptoms.

Conclusion: There are 10 reported cases of simultaneously occurring symptomatic SMA syndrome and Nutcracker syndrome necessitating surgical intervention. This is the first report of a patient with three vascular entrapment syndromes all requiring intervention. Patients who present with such syndromes often report an amalgamation of symptoms making diagnosis challenging. Clinicians should maintain a high index of suspicion of possible simultaneous processes in patients presenting with entrapment syndromes.

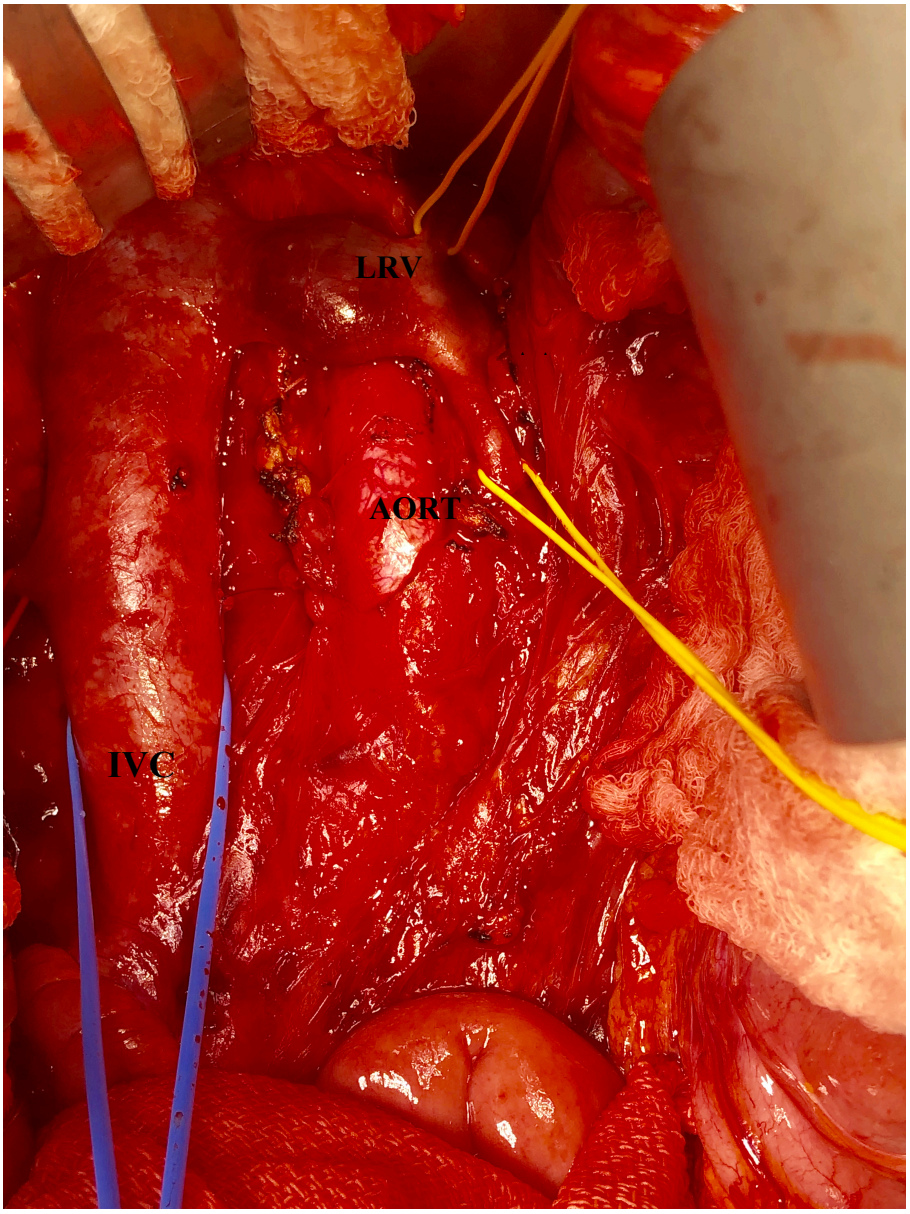

Figure 1: Intraoperative photo demonstrating IVC, aorta and LRV with evidence of venous compression. (IVC – inferior vena cava; LRV – left renal vein)

Intraoperative photo showing left renal vein compression.

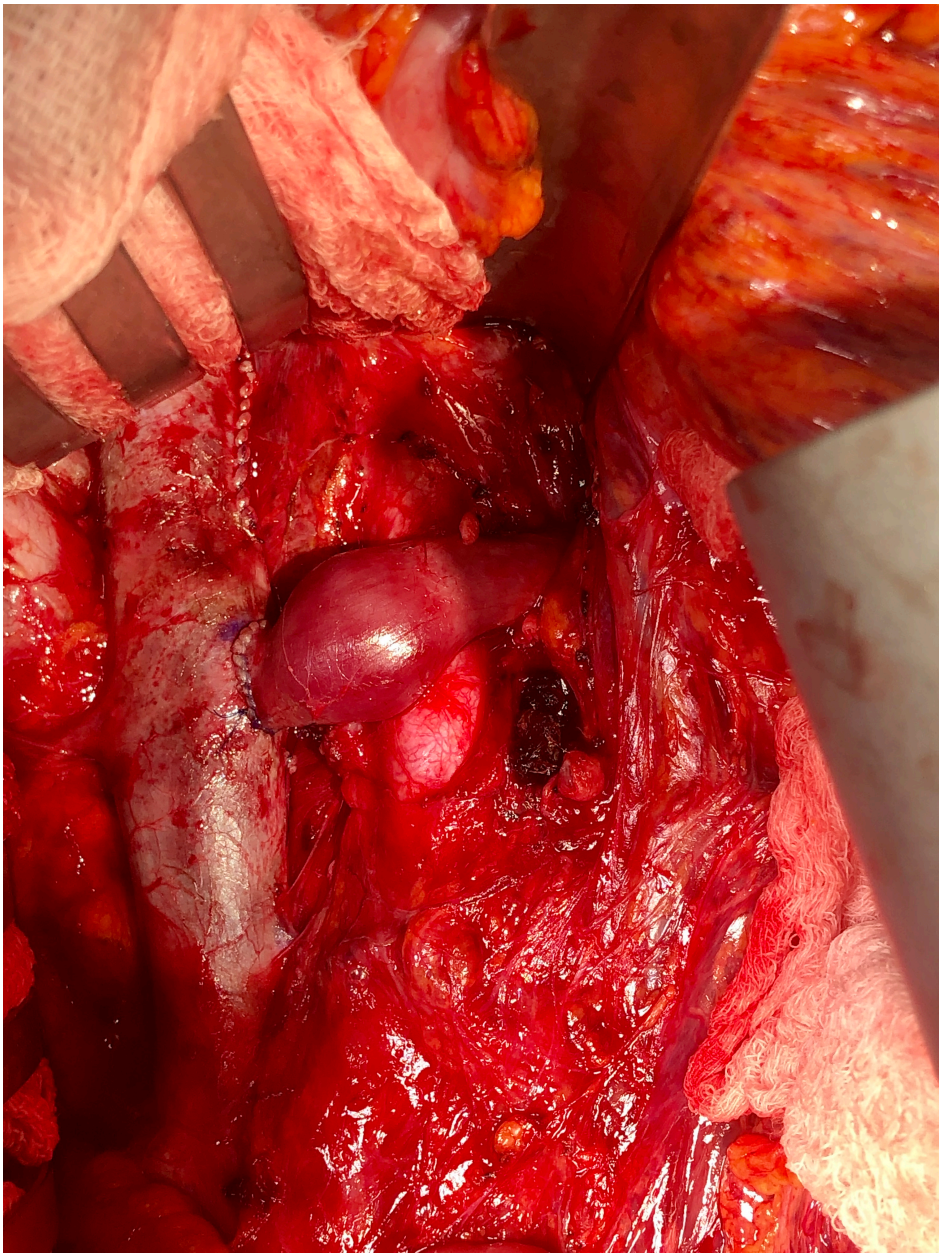

Figure 2: Shows the left renal vein transposed onto vena cava and venotomy repair.

Transposition of left renal vein onto IVC.

Author Disclosure: L Araujo: Nothing to disclose; **K Nagarsheth**: Nothing to disclose

Poster 4

Safety of Compression Therapy in Congestive Heart Failure.

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Objective: Compression therapy is the mainstay of treatment for patients with venous ulcer disease. There exists a lack of certainty as to the safety of compression therapy in patients with congestive heart failure.

Methods: A retrospective review of 95 patients with the diagnosis of congestive heart failure (systolic, diastolic or combined) was performed who underwent compression therapy at the wound care center of a large teaching hospital between Jan 2013 and June 2019. Patient outcomes were compared to the general congestive heart failure population.

Results: With a mean compression period of 310 days, 6 patients (6.3%) underwent diuretic dosage increase and 7 (7.3%) were admitted for CHF exacerbation. Two patients (2.1%) died during the compression period. These endpoints were not significantly different from the general CHF population.

Conclusion: Compression therapy appears safe amongst patients with stable congestive heart failure.

View table

(very weak: R= 0 to 0.2, weak: R= 0.2 to 0.4, moderate: R= 0.4 to 0.7, strong: R=0.7 to 1)
Our results demonstrate a moderate correlation between Villalta and all clinical severity/QOL tools (except Veines-Qol).

Conclusion:

Our results demonstrate that Villalta is similar to CEAP, VCSS, Veines Sym and AVVQ in measuring chronic venous disease severity. These results have potential implications in the assessment of patients with post thrombotic syndrome.

Table 1. Study Outcomes.

Death	12 (12.6%)		
Death during compression period	2 (2.1%)		
Cause of death	Cardiac 6 Non-cardiac 3 Unknown 3		
Weight (kg), pre and post-compression (mean +/-SD)	107.9 (36.1)	108.2 (33.8)	NS

Glomerular filtration rate (mls/min), pre and post-compression (mean +/- SD)	44.7 (19.7)	47.1 (19.7)	NS
Hematocrit (%), pre and post-compression (mean +/- SD)	33.8 (5.2)	35.6 (7.5)	NS
Blood urea nitrogen (mg/dL), pre and post compression (mean +/- SD)	30.6 (18.0)	33.6 (21.1)	NS
Diuretic dose increase	6 (6.3%)		
Hospitalization for CHF decompensation	7 (7.4%)		
Ulcers healed completely, n (%)	Yes 17 (17.9%) No 41 (43.1%) Unknown 37 (39%)		

Patient outcomes data

Author Disclosure: R Attaran: Nothing to disclose; **A Cavanaugh**: Nothing to disclose; **C Tsay**: Nothing to disclose; **T Ahmad**: Nothing to disclose; **C Ochoa-Chaar**: Nothing to disclose; **S Persing**: Nothing to disclose; **H Hsia**: Nothing to disclose

Poster 5

Safety outcomes of Catheter Directed Thrombolysis for Deep Vein Thrombosis.

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Objective: Cather-directed thrombolysis (CDT) has gained increased use over recent years for the treatment of acute deep vein thrombosis (DVT). DVT can lead to both post-thrombotic syndrome (PTS) and pulmonary embolism (PE). Recent data suggests that CDT may reduce the occurrence of PTS when the venous outflow is involved. We sought to determine short-term outcomes for CDT.

Methods: A single-center retrospective study of CDT for DVT from Jan 2013-Jan 2019 at a large teaching hospital was conducted.

Results: A hundred and fifty patients (mean age 53, 51% female) with acute DVT were identified. In 27%, a prior DVT had occurred, 23% had a history of malignancy, 11% had a known hypercoagulable disorder. Three types of CDT device were utilized: rheolytic thrombectomy 6-French (26%) and 8-French (0.7%), and ultrasonic thrombolysis (73.3%). In addition, 63% underwent deep venous stenting.
Thrombus location according to involved segment was common femoral vein 22 (14.7%), external iliac vein 27 (18%), common iliac vein 39 (26%), inferior vena cava 29 (19.3%). Bleeding occurred in 20 patients (13.3%), one of which was a major bleed (0.7%). Eight patients (5.3%) required blood transfusion. Acute renal failure occurred in 9 patients (6%). Mean days-to-discharge for the entire CDT population was 4.7 (+/-4.3). There were no deaths.

Conclusion: CDT is a treatment option for DVT. It carries with it a risk of renal injury and bleeding, though usually minor. This reinforces the importance of appropriate case selection.

Table 1. Study population baseline characteristics.

Number of patients with DVT (n)	150
Age (mean, +/-SD)	53 (16)
Sex, female, n, (%)	77 (51.3)
Weight (kg)	93 (28)
Body mass index (kg/m2)	32.6 (9.6)
Diabetes	27 (18)
Coronary Artery Disease	9 (6)
Congestive heart failure	7 (4.7)
Prior bleed	18 (12)
Prior DVT	40 (26.7)
History of malignancy	34 (22.7)
Hypercoagulable state	17 (11.3)

Patient demographics.

Author Disclosure: A Bhalla: Nothing to disclose; **C Mena-Hurtado**: Nothing to disclose; **R Attaran**: Nothing to disclose

Poster 6

Therapeutic Education Combined with Balneotherapy in Lymphedema Patients

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Objective: Background. Lymphedema is a chronic disabling condition whose prognosis strongly depends upon the ability of the patient to actively participate in his care. Our experience with therapeutic education in patients with advanced chronic insufficiency showed a synergistic effect with balneotherapy resulting in substantial improvement of health-related behaviors, quality of life and health status. We report here the first results obtained with a similar program developed for patients with lymphedema.

Methods: Methods.The education program includes two face to face education consultations before and after a course of three interactive workshops in small groups aiming at improving the knowledge and motivation of the patients, and six training sessions for auto-bandaging and auto-drainage. It is organized during a balneotherapy treatment course of 18 days with four balneotherapeutic sessions per day. Systematic evaluation included the achievement of expected changes in health-related behaviors, quality of life through the ULL27 questionnaire, and multi-level limb perimetry allowing the calculation of the limb volume. Subjects included in this study were patients with ISL stage 2 or 3 lymphedema of upper or lower limbs.

Results: Results.From April 2014 to October 2018, 148 patients (87% females, median age 62 years) were enrolled. At the end of the program, satisfaction was high, with 94% of the patients thinking it would help them to better manage their lymphedema. The mean reduction of limb volume was 183 (+28) ml. Three months after the treatment course, 66% achieved their health-related behavior objective, and the quality of life was significantly improved ($P<0.01$).

Conclusion: Conclusion.These results are promising but have to be confirmed in a controlled study.

Author Disclosure: P Carpentier: Nothing to disclose; **B Satger**: Nothing to disclose; **J Laures**: Nothing to disclose

Poster 7

Multidisciplinary Treatment of Phlegmasia Cerulea Dolens with Pharmacomechanical Intervention

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Objective: Symptoms of acute deep vein thrombosis (DVT) can range from none to phlegmasia cerulea dolens (PCD). Thrombus removal in acute iliofemoral DVT has been shown to maintain valve function, improve quality of life, improve compartment pressures, and reduce risk of recurrence. Pharmacomechanical techniques have the added benefit of shortening treatment times, reducing doses of lytic agents, and reducing length of stay.

Methods: We describe a case of acute DVT causing PCD in a patient with previous VTE successfully treated by pharmacomechanical thrombectomy via a multidisciplinary approach including vascular surgery, interventional radiology, and internal medicine.

Results: A 54-year old female with a history of Protein C deficiency, multiple DVT and PE, status post IVC filter, presented with worsening left leg swelling. The patient had limited mobility due to recent ankle and tibial plateau fractures and was not on any anticoagulation. The patient's left leg was severely edematous with blue discoloration and diminished doppler pedal signals concerning for phlegmasia cerulea dolens. Venous duplex demonstrated occlusive thrombus from the calf veins to the external iliac vein and non-occlusive thrombus in the common iliac vein. The patient was started on a heparin infusion and urgently taken to the Interventional Suite.

Venography was performed that demonstrated a patent IVC and corroborated the ultrasound findings. AngioJet (Boston Scientific; Marlborough, MA) was used, employing first the Power Pulse modality followed by standard pharmacomechanical thrombectomy. Subsequent thrombectomy and balloon venoplasty was performed from the popliteal vein through the common iliac vein. Completion imaging demonstrated significantly decreased thrombus burden, with markedly improved flow throughout the treated portion of the venous system. The patient's lower extremity had immediate improvement in the swelling, discoloration, and doppler signals in the foot. She was ultimately transitioned to Coumadin and discharged with compression stockings.

Conclusion: Without treatment, PCD can progress to compartment syndrome, leading to amputation rates up to 50% and mortality rates from 25-40%, making early recognition and treatment imperative. PCD is a relatively rare clinical manifestation without strict treatment guidelines, and treatment options range from systemic anticoagulation to pharmacomechanical thrombectomy and surgical thrombectomy. Treatment should be tailored to each patient and they may benefit from multidisciplinary approaches to ensure early diagnosis, expedient intervention, and appropriate long-term follow-up.

Author Disclosure: A Cheema: Nothing to disclose; **A Syal**: Nothing to disclose; **R Ahuja**: Nothing to disclose; **N Awad**: Nothing to disclose; **E Deutsch**: Nothing to disclose; **R Choudry**: Nothing to disclose

Poster 8

Incidence and clinical outcomes of patients with Upper-Extremity Deep Vein Thrombosis

Rafael Cires-Drouet [1], Frederick Durham [1], Jashank Sharma [1], Praveen Cheeka [1], Zachary Strumpf [1], Erica Cranston [1], Cynthia Xu [1], Minerva Mayorga-Carlin [1], John Sorkin [1,2], Brajesh Lal [1,2]
[1] University of Maryland, Baltimore, MD, USA, [2] Veterans Affairs Medical Center, Baltimore, MD, USA

Objective: The use of Intravenous Devices (IVD) is essential in the treatment of critically ill patients. Upper extremity deep vein thrombosis (UE-DVT) is a common complication in patients with IVD's. The aim of this study is to identify the incidence of UE-DVT, baseline risk factors, prophylaxis, thrombus morphology, treatment modalities, and clinical outcomes.

Methods: This is a 2 ½ year retrospective chart review of patients diagnosed with UE-DVT at the University of Maryland. The total number of hospital admissions was obtained through the financial department. Electronic medical records were used to collect demographics, risk factors, thrombus morphology and complications. Descriptive statistics are reported as mean, percentage and standard deviation. Univariate analysis compared UE-DVT patients with and without IVDs; p-values were obtained by Student t-test or Pearson's Chi-Square test.

Results: There were 76,058 patients admitted during study period. The incidence of acute UE-DVT was 1.6% (1,291 cases), Figure 1. The most common indication was pain and swelling of the arm. We are reporting 506 patients from 2016. The patients mean age was 59.1 SD±16.8 years, 59.1% were male, 51.3% Caucasian. The mean BMI was 29.5±7.7 kg/m^2. Most of the patients (57.1%) were in the intensive care unit at the time of diagnosis. The median hospital stay was 26 days (IQR 13-44). The most important risk factor is the presence of an IVD (83.4%). Other risk factors are in Table I. Most of the patients were on DVT prophylaxis (73.3% pharmacological, 7.3% mechanical), and few were on anticoagulation (26.7%) at the time of diagnosis. The right internal jugular vein was most frequently affected (56.5%). Anticoagulation was started in 83.0% of patients after diagnosis, but only 64.5% were discharged on anticoagulants. Only 26.8% IVDs were removed, and 21.7% were replaced. Mortality was 10.1% at 30 days and 14.6% at 1-year. Recurrent UE-DVT occurred in 10.0% at 30 days and 15.1% at 1 year. Non-fatal pulmonary embolism was 3.1% and 16.0% had a major bleeding.

Conclusion: The incidence of UE-DVT is 1.6%. UE-DVT is a common complication in patients with IVD's. DVT prophylaxis seems ineffective for UE-DVT. Therapeutic approaches lack standardization. Bleeding is a common complication. Recurrent events are infrequent and pulmonary embolism is rare. More prospective randomized trials are needed to improve to standardize prophylaxis and treatment of UE-DVT.

Figure 1. CONSORT flow diagram.

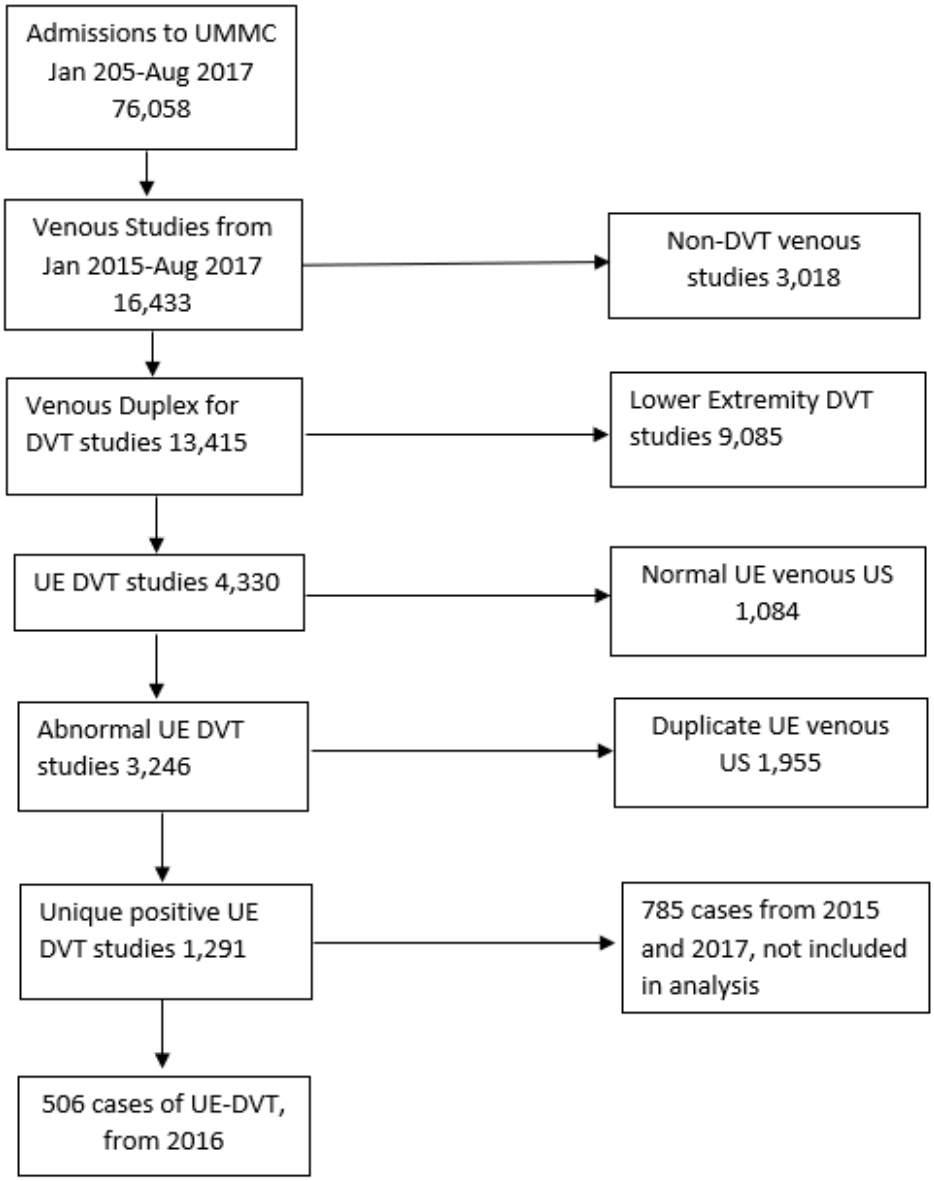

Figure 1. CONSORT flow diagram.

Table I. Demographics and Risk Factors associated with UE-DVT[1]

[1] Upper Extremity Deep Vein Thrombosis = UE-DVT; Intravenous Device = IVD, Lower extremity deep vein thrombosis = LE-DVT; Pulmonary Embolism = PE; Extracorporeal Membrane Oxygenation = ECMO; CKD = Chronic Kidney Disease

	All N (%), mean±SD	*IVD related,* N (%), mean±SD	*Not IVD related,* N (%), mean±SD	*p-value*[2]
Total	506	422 (83.4%)	84 (16.6%)	
Age (years)	58.65 ± 16.79	58.31 ± 17	60.35 ± 15.68	0.31
BMI Mean (kg/m²)	**29.53 ± 7.76**	**30.07 ± 7.91**	**26.84 ± 6.31**	**0.0008**
Male sex	99 (20.89%)	87 (21.86%)	12 (15.79%)	0.23
Caucasian	201 (40.52%)	173 (41.89%)	28 (33.73%)	0.17
African American	**253 (52.06%)**	**220 (54.59%)**	**33 (39.76%)**	**0.0138**
Current Smoker	215 (44.24%)	171 (42.43%)	44 (53.01%)	0.08
Chronic Kidney Disease	**79 (16.88%)**	**69 (17.51%)**	**10 (13.51%)**	**0.0069**
Hypertension	285 (58.04%)	242 (59.17%)	43 (52.44%)	0.26
Coronary Artery Disease	83 (17.01%)	72 (17.73%)	11 (13.41%)	0.34
Diabetes [type 2]	143 (29.12%)	121 (29.58%)	22 (26.83%)	0.62
Hyperlipidemia	148 (30.14%)	122 (29.83%)	26 (31.71%)	0.74
History of Cancer	96 (19.51%)	77 (18.73%)	19 (23.46%)	0.33
Active cancer (cancer on chemo)	23 (5.34%)	20 (5.52%)	3 (4.35%)	0.69
History of UE-DVT	68 (14.02%)	56 (13.73%)	12 (15.58%)	0.28
History of LE-DVT	49 (10.06%)	41 (10.07%)	8 (10%)	0.98
History of PE	34 (6.95%)	30 (7.33%)	4 (5%)	0.45
Concomitant DVT	87 (17.65%)	78 (18.93%)	9 (11.11%)	0.09
ECMO	44 (8.7%)	44 (10.43%)	0 (0%)	1.00
Pregnancy	1 (0.2%)	1 (0.24%)	0 (0%)	1.00
Hypercoagulable states	3 (0.63%)	3 (0.75%)	0 (0%)	1.00

Table I. Demographics and Risk Factors for UE-DVT

Author Disclosure: R Cires-Drouet: Nothing to disclose; **F Durham**: Nothing to disclose; **J Sharma**: Nothing to disclose; **P Cheeka**: Nothing to disclose; **Z Strumpf**: Nothing to disclose; **E Cranston**: Nothing to disclose; **C Xu**: Nothing to disclose; **M Mayorga-Carlin**: Nothing to disclose; **J Sorkin**: Nothing to disclose; **J Sorkin**: Nothing to disclose; **B Lal**: Nothing to disclose; **B Lal**: Nothing to disclose

[2] Bivariate analysis consisted of Pearson χ^2 or Fisher's Exact test for categorical variables, and Student t-test or Wilcoxon rank sum test for continuous variables, as appropriate

Poster 9

Case Report: Cystic Compression of Bilateral Femoral Veins

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Objective: A cyst causing compression of the femoral vein is a rare occurrence. Synovial, ganglion and adventitial cystic disease have been written about as possible causes of femoral vein compression.

Methods: This is a case report of a 23 yo otherwise healthy male who presented initially to an outside hospital with an unprovoked deep venous thrombosis(DVT) of his right lower extremity. As part of the work up for the DVT, he had US and MRI revealing a cystic structure surrounding and compressing the right femoral vein. He underwent right groin exploration and cyst excision at an outside hospital and reportedly had improvement of his symptoms of leg heaviness and swelling. He was appropriately anticoagulated for his right DVT. Less than 6 months later, he reported tightness of his right lower extremity with exercising. Doppler US was negative for DVT, however on contralateral left femoral vein views, a cyst was now seen compressing his left femoral vein. CTA confirmed 2.5cm cyst nearly completely compressing his left femoral vein. He was placed on eliquis prophylactically against DVT and presented to our hospital for surgical opinion. While the patient was asymptomatic, given the extent of compression on his femoral vein from the cyst, he was offered left groin exploration.

Results: The pathology from his right groin was adventitial cystic disease. On exploration of the left groin, he had 2-3 cm cyst that was easily dissected away from femoral vein and ultimately excised. The pathology resulted as a synovial cyst. In both operations the cysts were successfully resected and no venous reconstruction was required. Our patient has been seen in follow up and symptoms have improved and he is off all anticoagulation.

Conclusion: As demonstrated with our patient, femoral vein compression from cystic disease is a rare occurrence yet can be symptomatic requiring intervention. Patients' symptoms can mimic DVT with pain and swelling, and the diagnosis of DVT may also be present. Consider further work up including imaging modalities such as US, CT or MRI to further investigate patients' symptoms or presence of unexplained DVT, as the differential diagnosis is broad. Literature has cited three possible types of cysts causing femoral vein compression: adventitial cystic disease, synovial cysts and ganglion cysts. Our patient had two distinct types. In our experience, consistent with current literature, surgical excision is the preferred method of treatment to help alleviate symptoms and prevent possible future thrombosis and recurrence.

Author Disclosure: M Collins: Nothing to disclose; **H Welch**: Nothing to disclose

Poster 10

Health Insurance Coverage for Endovenous Ablation of the Saphenous Vein in Patients with CEAP Clinical Class 3 (C3) Disease: An Analysis of One State's Insurance Policies

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Objective: vein incompetence can result in some or all of the manifestations of chronic venous insufficiency. In many insurance policies, accepted indications for endovenous ablation (EVA) of the great and small saphenous veins include those patients with CEAP clinical class 2 disease or greater. Alternatively, C3 disease especially without the presence of varicose veins and particularly if bilateral, may have many other etiologies for swelling other than saphenous vein incompetence. In this subset of patients, EVA is likely to be an ineffective and expensive treatment option. In the current healthcare culture, where there is emphasis on eliminating waste and inappropriate use of medical resources, it is important to assess policies that describe coverage for this condition. The primary objective of this study was to assess healthcare coverage for endovenous saphenous ablation therapy to treat C3 disease among private and state-funded health insurance companies in our home state of Connecticut.

Methods: A policy analysis was completed for several large, independent health insurance companies in Connecticut, as well as Connecticut's state sponsored insurance and Medicare (N = 6). We accessed each insurance company's website to procure the medical policy for treatments with EVA. We used the key words "ablation," "endovenous," and "venous insufficiency" to search each provider policy manual. We performed a content analysis to determine if policies permitted the use of EVA for C3 disease even in the absence of varicose veins. We also assessed language similarities and differences across policies for medical necessity of EVA.

Results: All but one insurance company included EVA in the policy for the treatment of varicose veins. The most basic policies required only documentation of valve incompetence through Doppler or duplex ultrasound and symptoms causing functional impairment (i.e. leg edema, leg pain, leg fatigue, thrombophlebitis, skin changes, or bleeding) but did not require that a patient with C3 disease also have varicosities. Two policies actually included the key words "varicose veins" and "saphenous varicosities" in the criteria for ablation. Interestingly, the state-funded policy for Connecticut did not include specific criteria for EVA and venous reflux.

Conclusion: The policies for EVA among health insurance companies in Connecticut vary in specificity and strength in terms of medical necessity. Though the medical literature is clear that EVA is effective in treating varicose veins, its use for the treatment of lower extremity swelling alone is much less certain. To reduce healthcare costs for medically unnecessary and ineffective treatments, insurance companies may wish to review policies for EVA in the treatment of C3 disease to ensure only the most appropriate candidates are approved for such procedures.

Author Disclosure: A Dietzek: Nothing to disclose; **A Dietzek**: Nothing to disclose; **S Stroever**: Nothing to disclose

Poster 11

Endovascular Reconstruction of a Congenitally Absent Inferior Vena Cava

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Objective: Congenital absence of the inferior vena cava (IVC) is an uncommon, but long described and often unrecognized venous anomaly. Patients typically present in the 3rd and 4th decades of life with lower extremity deep vein thrombosis (DVT), new onset edema and pain, or venous ulceration. Although rare, absence of the IVC may account for up to 5% of venous hypertension and DVT in otherwise healthy patients without hypercoagulable risk factors. Historically, treatment algorithms have consisted of medical management with anticoagulation and compression therapy; with catheter-directed thrombolysis reserved for selected patients with significant thrombus burden and intractable pain. We present a case of a patient with congenital absence of the infrahepatic IVC who had failed best medical management and treated with endovascular reconstruction of his IVC and iliac veins.

Methods: A 36 year-old male presented with persistent leg swelling/pain and a chronic left medial malleolus venous ulceration. Diagnostic imaging revealed a congenital absence of the IVC. We offered endovascular reconstruction of his infrahepatic IVC and common iliac veins for definitive treatment. Reconstruction required access of both femoral veins and the right internal jugular vein. Serial balloon dilations were able to establish a channel for stenting and endovascular ilio-caval reconstruction was accomplished with Wallstents (Boston Scientific) to restore inline venous drainage to the right atrium.

Results: The patient was maintained on anticoagulation and compression therapy post procedure. At 30-day follow up, there was patency of the ilio-caval reconstruction and decompression of all previously dilated venous collaterals on CT venogram. Clinically, his leg pain and edema had resolved, and he had achieved near complete resolution of his venous ulceration.

Conclusion: The treatment of patients with sequela of chronic venous hypertension and DVT related to venous anomalies is challenging. Thrombolysis is usually unsuccessful as a stand-alone treatment for this condition in the absence of adequate central venous drainage. Successful endovascular reconstruction can be achieved in cases of extensive venous thrombosis related to DVT with normal venous anatomy, but is rarely attempted in cases of IVC absence. This case illustrates that the same endovascular techniques used to recanalize occluded segments can be adapted to create a 'neo-cava' and that reconstruction can, and should be offered to patients who experience complications related to this rare condition.

Author Disclosure: A Grieff: Nothing to disclose; **R Shafritz**: Nothing to disclose; **W Beckerman**: Nothing to disclose

Poster 12

Risk Factors for Early Iliac Vein Stent Thrombosis for NIVLs

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Objective: Iliac vein stenting is increasingly being investigated as a treatment option for chronic venous insufficiency. To examine factors associated with early (< 90 day) iliac vein stent thrombosis for non-thrombotic iliac vein lesions (NIVL), we reviewed our experience.

Methods: We examined data with iliac vein stent placement in 3025 procedures in 1940 patients performed from Feb 2012 to June 2018 in an office based setting. Patients who failed conservative therapy underwent iliac vein interrogation with IVUS. Patients with >50 % iliac vein area reduction or diameter reduction underwent stenting with Wallstents. Duplex ultrasound was used to monitor the stents within one week, every 3 months for one year and every 6 months thereafter. Age, gender, BMI, presenting symptom (based upon CEAP), laterality, percentage area reduction, duration of procedure, number of stenoses, minimum measured diameter, stent location, date of procedure, number of stents placed, and balloon and stent diameter were examined.

Results: 10 patients suffered from full stent thrombosis within 3 months of the procedure. Patients with thrombosis within 3 months of the procedure statistically had lower presenting symptoms based upon CEAP ($p<0.001$), had smaller minimal diameter at the point of stenosis ($p=0.005$). Procedure duration was inversely associated with stent thrombosis ($p=0.03$). Placement of the stent in the external iliac vein was associated with stent thrombosis ($p <0.0001$). The other factors studied were not associated with early stent thrombosis ($p> 0.1$). Lower BMI tended to be associated with stent thrombosis but the $P=0.05$.

Conclusion: Certain factors are associated with early stent thrombosis with NIVL patients and may alert the interventionalist to higher risk patients. We were not able to demonstrate a learning curve associated with iliac vein stent thrombosis in our data.

Author Disclosure: A Hingorani: Nothing to disclose; **A Hingorani**: Nothing to disclose; **J Chait**: Nothing to disclose; **E Ascher**: Nothing to disclose

Poster 13

Azygous Continuation of The Inferior Vena Cava Presenting as Lower Extremity Deep Vein Thrombosis and Pulmonary Embolism: Case Report and Literature Review

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Objective: Introduction:
Anatomic variants of the Inferior Vena Cava (IVC) are rare accounting for less than 3% of the cases. Amongst these variants the azygous continuation of the IVC accounts for less than 1%. Most of these variants are asymptomatic and identified on imaging for other indications. We present a case of lower extremity symptomatic deep venous thrombosis secondary to azygous continuation of the IVC.

Methods: Case Report:
The patient is a 44 year old male that presented with left lower extremity swelling and pain for 3 days. He denied any medical and surgical history as well as previous episodes of lower extremity swelling. Physical exam revealed left lower extremity with no color changes and normal motor and sensory exam. Right lower extremity was within normal on exam. Extensive deep venous thrombosis of left common femoral, femoral, popliteal and posterior tibial veins as well as venous thrombosis of left great saphenous and small saphenous veins was noted on a lower extremity duplex exam. He also underwent a CT chest which showed bilateral segmental pulmonary embolism. He was managed with heparin drip and catheter directed thrombolysis. The venogram revealed duplicate IVC with thrombosis of left iliac, femoral, popliteal veins. The left femoral vein drained through the left renal vein through gonadal and lumbar veins. The right iliac vein drained through the right renal vein. The thrombolysis was successful with relief of his symptomology.
He was started on oral anticoagulation and further workup outpatient with a CT venogram revealed the presence of a duplicated IVC originating from the azygos vein. The left renal vein originating off the left-sided IVC. The right IVC continued into the pelvis into the right common iliac vein. The left IVC continued in the pelvis into the left common iliac vein. The intrahepatic IVC joined the right renal vein. This is a variant of azygous continuation of the inferior vena cava.

Results: On his follow up six months after the initial visit a repeat duplex showed patent bilateral lower extremity deep veins and further workup for thrombogenic syndromes was negative. Given his history of unprovoked DVT/PE and anatomic variant of IVC lifelong anticoagulation was recommended.

Conclusion: Discussion: Due to the complexity of embryogenesis of the IVC multiple anatomic variants of the IVC are reported in the literature. The incidence of these variants is reported to be around 3%. The important clinical implication of these variations is deep vein thrombosis and pulmonary embolism. Asymptomatic variations do not need treatment but

symptomatic variations should be treated with lifelong anticoagulation in the absence of contraindication to anticoagulation.

Author Disclosure: A Juneja: Nothing to disclose; **J Schor**: Nothing to disclose; **H Khadraoui**: Nothing to disclose

Poster 14

Photoacoustic-guided Endovenous Laser Ablation to Improve Catheter Visualization and Temperature Monitoring: In vivo Canine study

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Objective: Ultrasound (US) imaging is used to guide the ablation catheter tip during endovenous laser ablation (EVLA) procedures. Due to angular dependency and artifacts, US imaging is may error in tracking the fiber tip in tortuous veins. Current EVLA systems lack the ability to monitor the real-time temperature inside the vein. We propose to use Photoacoustic (PA) imaging for accurate fiber tip tracking and real-time temperature monitoring. PA imaging utilizes short, low power laser pulses to excite the tissue. The tissue emits acoustic waves, which is acquired using an US transducer to form PA images, which identifies the fiber tip with high clarity. Real-time temperature monitoring can be achieved by monitoring the variations in PA signal amplitude with increasing temperature.

Methods: We integrated PA imaging into an EVLA system by combining the continuous wave (CW) laser (Angiodynamics Inc.) with a low power pulsed laser (8 ns, 200 µJ/pulse) beam used for PA imaging (integrated PA/EVLA system). Experiments were performed using a live canine model under anesthesia. Transverse and sagittal US/ PA images of the fiber placed inside the canine jugular vein was acquired using a research clinical US system (Vantage 128, Verasonics Inc,). The temperature monitoring capabilities of PA system were evaluated by placing a temperature sensor near the fiber tip to monitor the changes in temperature.

Results: US imaging visualized the body of the ablation catheter (Figure 1a). PA imaging provided a high-contrast, artifact-free, and angle independent images of the fiber tip (Figure 1b). The superimposed US/PA images accurately identified the fiber tip within the background tissue (Figure 1c). The amplitude of the PA signal correlated with the increase in temperature caused by the CW laser (Figure 2).

Conclusion:
The integrated PA/EVLA system enhances catheter tracking. The intensity of the PA signal correlates well with the increase in temperature of the surrounding medium, and enables us to monitor the change in temperature at the tip of the catheter. Combined PA/EVLA system may potentially increase the safety of EVLA procedures and decrease the procedure time.

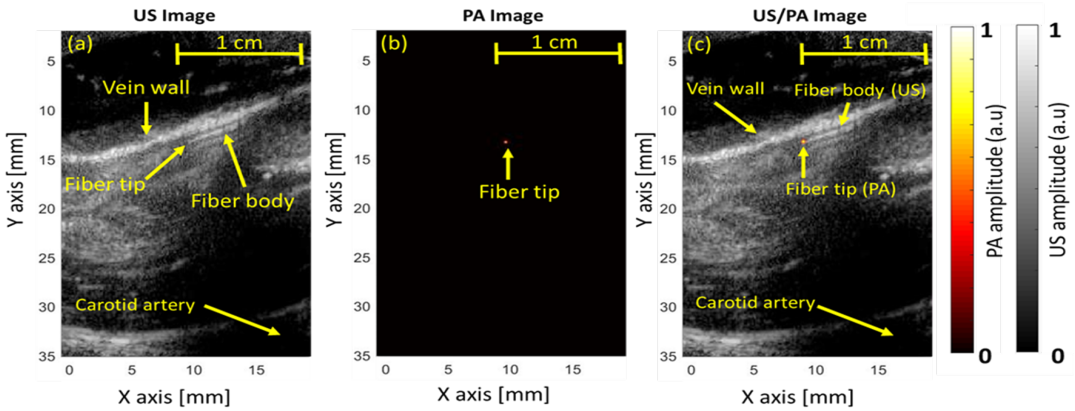

Figure 1: (a) Sagittal US image showing the fiber inside the vein. (b) PA imaging provides background-free images of the fiber tip only. (c) US/PA image shows the fiber body seen using US imaging and fiber tip seen using PA imaging.

Figure 1

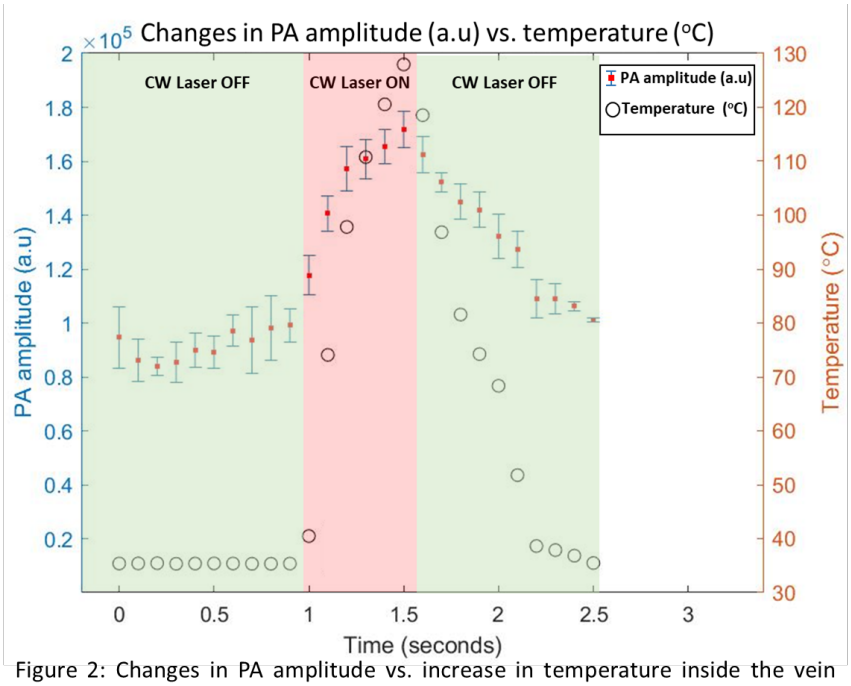

Figure 2: Changes in PA amplitude vs. increase in temperature inside the vein caused by the CW laser. Green panels indicate the duration when the CW laser was turned OFF and the Red panel indicates the duration when the CW laser was turned ON.

Figure 2

Author Disclosure: S John: Nothing to disclose; **M Mehrmohammadi**: Nothing to disclose; **Y Yan**: Nothing to disclose; **L kabbani**: Nothing to disclose

Poster 15

United States Endovascular Venous Stenting Trends: A Review of Medicare Provider Utilization and Payment Database from 2014-2017

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Objective: In 2014, two new venous stent codes were introduced, 32738 and 32739, allowing for codification of angioplasty and stenting procedures performed in a vein. These procedures encompass a wide variety of therapeutic approaches to poor venous outflow, from treating chronic lower extremity venous insufficiency to renal vein stenosis to outflow obstruction of upper extremity dialysis access. These procedures can be, and are, performed by a wide variety of subspecialists. The physicians performing these procedures outside of formal endovascular training raises concerns regarding the appropriateness of these interventions. This is a review of the Medicare Provider Utilization and Payment Database which provides information on coding, billing, and reimbursement trends for venous stent placement between 2014 and 2017.

Methods: The Medicare Provider Utilization and Payment Database was queried iliac vein stenting CPT codes (37238 & 37239) for 2014 through 2017. These results were compiled in a database and analyzed to determine practice trends of all providers in all specialties.

Results: Venous stenting procedures were performed by a wide variety of practitioners. Vascular surgeons had the largest number of individual providers with 683, followed by nephrologists (445), and diagnostic and interventional radiologists (393 and 305, respectively). The greatest number of procedures were performed by nephrologists (17,790 procedures; 20.18%), followed by vascular surgeons (17,738; 20.12%), diagnostic radiologists (13,407; 15.21%), interventional radiologists (12,409; 14.08%), and cardiologists (11,596; 13.15%). Nephrologists had the highest average Medicare payment amount ($2967), followed by interventional radiology ($1977), cardiology ($1641), and vascular surgery ($1502). The top 5 provider states were Florida, Texas, California, New York, and Georgia. The top Medicare regions were Region 4, Region 6, and Region 5.

Conclusion: Venous stenting procedures are being performed by a wide variety of subspecialists, most commonly by nephrologists, vascular surgeons, and radiologists. Although vascular surgeons were the most common practitioners performing these procedures, nephrologists performed a greater number of procedures and had greater average Medicare payments. Individual subspecialties have varying levels of formal training in the management of chronic venous disease. As the US healthcare system shifts forward to a value-based system, these practice trends and reimbursement amounts should be scrutinized, and initiatives instituted for formalized endovascular training.

Author Disclosure: K Kiely: Nothing to disclose; **M Haffner**: Nothing to disclose; **A Bojorn**: Nothing to disclose; **T Qvavadze**: Nothing to disclose; **J Crawford**: Nothing to disclose

Poster 16

Multimodal Treatment of Persistent Chronic Venous Ulceration with Normal Non-Invasive Studies

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Objective: Up to 20% of patients with chronic venous insufficiency (CVI) may develop venous ulcers, and 50% with ulcers may require treatment periods of more than one year. Treatment with lifestyle modification and compression has been shown to be effective in treating venous ulcers; however, adjunctive procedures may become necessary if wounds persist. Invasive procedures may be needed to identify and treat lesions even when non-invasive imaging does not demonstrate any abnormality.

Methods: We describe a case of progressive venous ulceration in a patient after successful radiofrequency ablation (RFA) of an incompetent great saphenous vein (GSV), in addition to maximal conservative treatment with leg elevation, class III compression, Unna boot therapy, compression pump use, and wound debridement. Non-invasive imaging demonstrated no residual deep or superficial venous reflux and normal pelvic venous anatomy.

Results: A 58-year-old man presented to the vascular surgery office with new ulceration to the anterior right lower extremity. He had healed ulcerations in that leg, previously undergone RFA of his right GSV, and was using daily compression for leg swelling. Non-invasive imaging demonstrated a successfully ablated right GSV, no other superficial or deep reflux, and some superficial varicosities near the wound. Pelvic venous ultrasound demonstrated a normal right iliac venous system without compression. Wound debridement was performed in the office and Unna boot therapy was initiated. Despite compliance with Unna boot therapy, the wound continued to degenerate. The patient was provided with compression pumps and again, despite compliance, the wound continued to enlarge. The patient then experienced bleeding from his wound that required treatment in the emergency department. A second bleeding episode two days later prompted admission. The patient underwent pelvic venogram with intravascular ultrasound (IVUS) that revealed 80% stenosis of the right common iliac vein, which resolved after stenting with a 16mm Vici venous stent (Boston Scientific; Marlborough, MA). No further bleeding was noted, and the patient has close follow-up in the office.

Conclusion: Venous ulcers require a multifaceted treatment approach with lifestyle modification and compression that can be complemented with minimally invasive venous interventions. If wounds persist despite maximal treatment, invasive procedures such as venography and intravascular ultrasound may reveal pathology not identified on non-invasive imaging.

Author Disclosure: A Lam: Nothing to disclose; **E Deutsch**: Nothing to disclose; **R Choudry**: Nothing to disclose; **A Ilano**: Nothing to disclose; **G Manis**: Nothing to disclose; **N Awad**: Nothing to disclose

Poster 17

Measurement of Dedicated Venous Stents for Post-thrombotic Iliac Vein Lesion Using Intravascular Ultrasound

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Objective: Recent approval of venous stents by the U.S. Food and Drug Administration (FDA) have allowed widespread use of these stents in the obstructive femoral and iliac vein lesions. The purpose of this study is to analyze the efficacy of the venous stents for iliofemoral vein obstruction by intravascular ultrasound (IVUS).

Methods: From April to August 2019, six patients with suspected iliofemoral vein obstruction underwent venogram, IVUS, and venous stenting of iliofemoral venous obstruction. Bard Venovo or Boston Scientific Vici Venous Stents in 14-18 mm diameter were used in all cases. IVUS provided diameter and area measurements of the veins in the compressed and reference locations. All patients underwent post-stent IVUS measurements of the obstructed venous segments. Patient demographics, access sites, stent location, area measurements, and calculated maximum difference were recorded.

Results: Eleven venous stents were placed in six patients with an average age of 53.7 years, average CEAP C4.2, and average Venous Clinical Severity Score (VCSS) 10.5 via bilateral (67%) or unilateral (33%) venous access. Three patients had chronic occlusion due to previous intravenous drug abuse (IVDA) or post-thrombotic syndrome (PTS) associated with May-Thurner syndrome (MTS). Three patients had acute deep vein thrombosis (DVT) and underwent temporary inferior vena cava filter placement, adjunctive pharmacomechanical thrombectomy using AngioJet via Zelente catheter or ClotTriever device. Average stenosis of lesions treated was 69.9% with average increase area of 97.6 mm^2 or 231% luminal increase from pre-stenting area. All stents are patent with a mean follow up of 1.5 months.

Conclusion: Measurement of FDA-approved venous stents using IVUS leads to area and luminal increase with minimal residual stenosis. Good apposition of the dedicated venous stents with longer follow-up is needed to maximize stent patency in patients with acute or chronic deep vein thrombosis, post-thrombotic syndrome or venous compression syndrome.

Table 1. Measurement of pre-stent, post-stent, area increase, and luminal increase.

Age Sex	CEAP	VCSS	Diagnosis	Stent Used	Stent Location	Stent Size (mm)	Pre-stent (mm^2)	Post-stent (mm^2)	Area Increase (mm^2)	Luminal Increase (%)
67M	C6	12	IVDA	Venovo Venovo	EIV CFV	16x80 14x100	42.2 23.6	140.2 96.8	98.0 73.2	232 310
60F	C4	9	IVDA	Venovo Venovo	EIV CFV	16x60 14x60	48.3 44.5	135.0 125.0	86.7 80.5	180 181
66F	C6	15	PTS MTS	Venovo Venovo	CIV EIV+CFV	18x80 16x120	78.0 24.0	194.0 149.0	116.0 125.0	149 521
32F	C3	9	Acute DVT MTS	Vici Vici	CIV CIV	14x120 14x60	19.8 58.0	58.0 148.0	38.2 90.0	193 155
57F	C3	9	Acute DVT MTS	Venovo	CIV	16x100	80.0	200.0	120.0	150

40F	C3	9	Acute DVT MTS	Venovo Venovo	CIV EIV	18x80 18x80	59.0 45.0	200.0 150.0	141.0 105.0	239 233

Table 1. Patient Demographics and Stent Measurements

Author Disclosure: J Lin: Bard Interventional; **A Morris**: Nothing to disclose; **L Kabbani**: Nothing to disclose; **T Nypaver**: Nothing to disclose

Poster 18

Suprarenal IVF Filter Use is Safe in Peripartum Treatment of Ileofemoral DVT

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Objective: The state of pregnancy results in hypercoagulability, venous dilation and occasional venous obstruction.

Methods: Retrospective chart reviews of six patients who developed proximal extensive DVT in the third trimester of pregnancy were under taken.

Results: The left lower extremity was involved 4 of 6 times. Each patient was treated with therapeutic Lovenox which was converted to Heparin between 36 and 38 weeks. All patients had a suprarenal retrievable IVF Filter placed percutaneously from the right internal jugular veins. Five of six delivered vaginally while one patient had a planned C-Section due to prior C-Section and pelvic/ maternal size issues. All filters were successfully removed 5-15 weeks after delivery. IVUS evaluations were performed as well but 3 of the six showed no stenosis or extrinsic residual extremities compression.

Conclusion: Suprarenal retrievable filter placement can be safely placed in the third trimester of pregnancy. Vaginal delivery is not altered and C-Section is not required. Not all woman who develop proximal DVT in pregnancy have May Thurners but evaluation should be performed with IVUS. This can be done at the time of filter retrevial.

Author Disclosure: J Lohr: Nothing to disclose; **G Zenni**: Nothing to disclose; **A Verma**: Nothing to disclose; **T Brennan**: Nothing to disclose

Poster 19

An Old Age Disease Revisited: Syphilis

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Objective: Syphilis is a sexually transmitted disease that can cause serious health problems if it is not treated. Each stage has different signs and symptoms.

Methods: Case report 27 year old pregnant patient.

Results: She developed an ulcer on her lip and right oral commissure which remained open for almost a year. It was painless with rolled edges. She does not smoke or use chewing tobacco but is an IV drug user with Hepatitis C and history of prostitution. She was treated unsuccessfully with Clindamycin and variety of topical agents. She received three doses of Penicillin for C-Section and noticed significant improvement with decreased size and drainage. Her residual lesion is a scar with firmness and submandibular gland adenopathy. The deformity involves both upper and lower lips and her commissure. No active ongoing infection. She is in an aggressive scar management therapy program.

Conclusion: Syphilis needs to be considered with any painless sore and non-healing wound. This may be transmitted by direct contact with a Syphilis sore during vaginal, anal or oral sex. The stages have different signs and symptoms. It can affect the heart, brain and other organs of the body if untreated and unrecognized. Congenital Syphilis can be prevented if treatment occurs prior to 16 weeks gestation. This disease needs to remain in the differential diagnosis and may have a wide variation in presentation depending on stage of presentation.

Author Disclosure: J Lohr: Nothing to disclose; **K Wilson**: Nothing to disclose; **M Marcotte**: Nothing to disclose; **W Tobler**: Nothing to disclose

Poster 20

Negative Pressure Wound Therapy with Instillation Allows Fascial Suture Repair to Remain In Place In Complex Contaminated Wounds

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Objective: The use of negative pressure wound therapy is rapidly evolving. The latest advancement is the ability to use instillation therapy with variable soak times and volumatic delivery of different agents into complex wounds.

Methods: Retrospective chart review of 6 wound care patients was performed who were treated with instillation therapy

Results: Six patients with complicated abdominal wounds required fascial closure only presented with fibrinous mucopurulent exposed fascial level sutures (PDS or Prolene). All were treated with instillation therapy using Dakin's Solution and then saline. Salvage when possible of all fascial closures with instillation therapy, control of sepsis and nutritional support. All six progressed to complete wound healing with secondary intention.

Conclusion: Instillation negative pressure wound therapy with automated instillation, dwell time and Volumatic control is another useful tool to treat complex wounds. Maintaining fascial closure is critical to decreasing potential for dehiscence and late hernia formation.

Author Disclosure: J Lohr: Nothing to disclose; **J Benter**: Nothing to disclose; **J McGuire**: Nothing to disclose

Poster 21

Outcomes of Chronic Inferior Vena Cava and Iliac Vein Occlusion Treated with Angioplasty Alone

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Objective: Venous stents are permanent implants that carry the potential risk for thrombosis and in-stent stenosis. Young patients and those with thrombophilia or poor venous inflow may be at higher risk for stent failure and repeat intervention. At present, there is limited data on the outcomes of inferior vena cava (IVC) and iliac vein revascularization in the absence of stent placement. The aim of this study was to determine the durability and clinical outcomes of angioplasty alone for chronic IVC and iliac vein thrombotic occlusion.

Methods: This retrospective single institution study reviewed all patients who underwent IVC and/or iliac vein reconstruction with balloon angioplasty without stent placement from 7/2013 to 7/2019. In total, 18 procedures were performed in 17 patients. One patient had recurrent IVC and iliac vein occlusion and underwent repeat angioplasty. Patient and procedural data, including patient demographics, balloon size, post-intervention anticoagulation, and time to revascularization, were obtained from the medical record. Technical success was defined as revascularization of all occlusive lesions with <30% residual stenosis.

Results: Mean age was 25.5±8.5 years. Five (27.8%) patients were female. Of the 17 patients, 14 had leg pain, 13 had lower extremity swelling, 3 had skin discoloration, and 1 had lower extremity ulcers. Mean follow-up time was 11.3±15.0 months. Treatment of the IVC alone was performed in 3 (16.7%) patients, IVC and iliac veins performed in 14 (77.8%) patients, and iliac veins alone in 1 (5.6%) patient. Median balloon diameter was 16 mm (range: 12-20 mm) for IVC reconstruction and 14 mm (range: 12-20 mm) for iliac vein revascularization. Technical success was achieved in 17 (94.4%) procedures. Ten (55.5%) patients had symptom improvement after intervention, including wound healing in the 1 case of lower extremity ulcers. Following intervention anticoagulation was prescribed in 17 cases: 2 (11.1%) enoxaparin, 6 (33.3%) warfarin, 3 (16.7%) apixaban, and 6 (33.3%) rivaroxaban. The 1 patient who was not placed on anticoagulation did not require repeat intervention out to 3.2 months of follow-up. Seven (38.9%) patients underwent reintervention at a mean of 5.0±4.4 months, and in 6 cases a stent was eventually placed.

Conclusion: Revascularization of chronic IVC and iliac vein occlusion with angioplasty alone is a reasonably effective and durable therapy with a high technical success rate. Only 6 of the 17 patients required reintervention with stent placement in the follow-up period. Avoiding or delaying stent placement may be of particular benefit to younger patients and those with thrombophilia or poor venous inflow.

Author Disclosure: R Lopez: Nothing to disclose; **E Takahashi**: Nothing to disclose; **R McBane**: Nothing to disclose; **N Neidert**: Nothing to disclose; **M Neisen**: Nothing to disclose; **I**

McPhail: Nothing to disclose; **C Reisenauer**: Nothing to disclose; **E Knavel-Koepsel**: Nothing to disclose; **H Bjarnason**: Nothing to disclose

Poster 22

The Economic Impact of Infections in Venous Leg Ulcer Patients

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Objective: Numerous studies have shown that venous leg ulcers (VLUs) are the most commonly treated wound in wound centers. VLUs are associated with a high utilization of medical resources, increased cost of care, and loss of productivity. The purpose of this study is to determine in VLU patients the specific impact of infection (INF), the most frequent complication of VLU, on medical resource utilization (MRU) and cost.

Methods: We performed a retrospective case-controlled study of 78 patients with (open) C6 VLUs treated by vascular surgeons, at our wound center. All patients were followed for at least 12 months. To eliminate either minor episodes of INF or incorrectly diagnosed episodes, only patients who had an inpatient admission specifically for the diagnosis of infection comprised the INF group, while elective admissions related to surgery, ablation, or stenting were not included. Medical resource utilization (MRU) was defined as, the number of: clinic visits; VNA visits, and inpatient admissions. The actual cost for treatment was determined using financial data provided by both the hospital and physician organization billing units. The total cost over the 1 year follow up period was comprised of individual cost centers: inpatient and outpatient facility fees, physician fees, and visiting nurse services. Mean MRU and cost data were compared using the two-sample t test.

Results: Of the 78 VLU patients, 9 had at least one inpatient admission for INF related to their VLU in the 1-year treatment period, for a total of 14 admissions. Out of the 69 non-INF patients, only 3 had inpatient admissions, 2 for intractable edema and 1 for a bleeding ulcer. MRU and cost data for the INF cohort vs non-INF cohort are shown in Table 1 and Table 2.

Conclusion: Infections in VLU patients were associated with an overall increase in MRU and cost of care; with the INF cohort requiring both more inpatient admissions and outpatient visits, as well as higher utilization of visiting nurse services. Given the major impact INF has on cost and MRU, better treatment modalities that prevent infection, as well prevention by identifying risk factors for INF in VLU patients would be beneficial.

Table 1. Medical Resource Utilization Per Patient Over 1 Year of Care

	Infection Cohort (n=9)	No Infection Cohort (n=69)	P
Number of Inpatient Admissions	1.56 +/- 0.73	0.04 +/- 0.21	< **0.0001**
Number of Outpatient Wound Center Visits	16.89 +/- 6.41	9.46 +/- 7.77	**0.008**
Number of VNA Blocks	3.89 +/- 2.93	1.94 +/- 2.24	**0.02**

VNA, Visiting Nurse Association
Continuous variables are presented as mean +/- standard deviation. Boldface value indicates statistical significance.

Medical Resource Utilization Per Patient Over 1 Year of Care

Table 2. Total Cost of Care Per Patient Over 1 Year

	Infection Cohort (n=9)	No Infection Cohort (n=69)	P
Total Costs	$27,408 +/- 10,859	$11,088 +/- 9,343	**< 0.0001**
Inpatient Costs	$9,492 +/- 8,328	$255 +/- 1,438	**< 0.0001**
Outpatient Wound Center Costs	$7,961 +/- 9,575	$6,176 +/- 8,397	0.56
VNA Costs	$9,956 +/- 7,650	$4,657 +/- 5,486	**0.01**

VNA, Visiting Nurse Association
Continuous variables are presented as mean +/- standard deviation. Boldface value indicates statistical significance.

Total Cost of Care Per Patient Over 1 Year

Author Disclosure: R Melikian: Nothing to disclose; **T O'Donnell**: Tactile Medical; **T O'Donnell**: Tactile Medical; **H Ma**: Nothing to disclose; **M Iafrati**: Nothing to disclose; **M Iafrati**: Nothing to disclose

Poster 23

A New Association: Red Wine Stains in Left Lower Extremity and May Thurner Syndrome in Children. Diagnosis and Treatment

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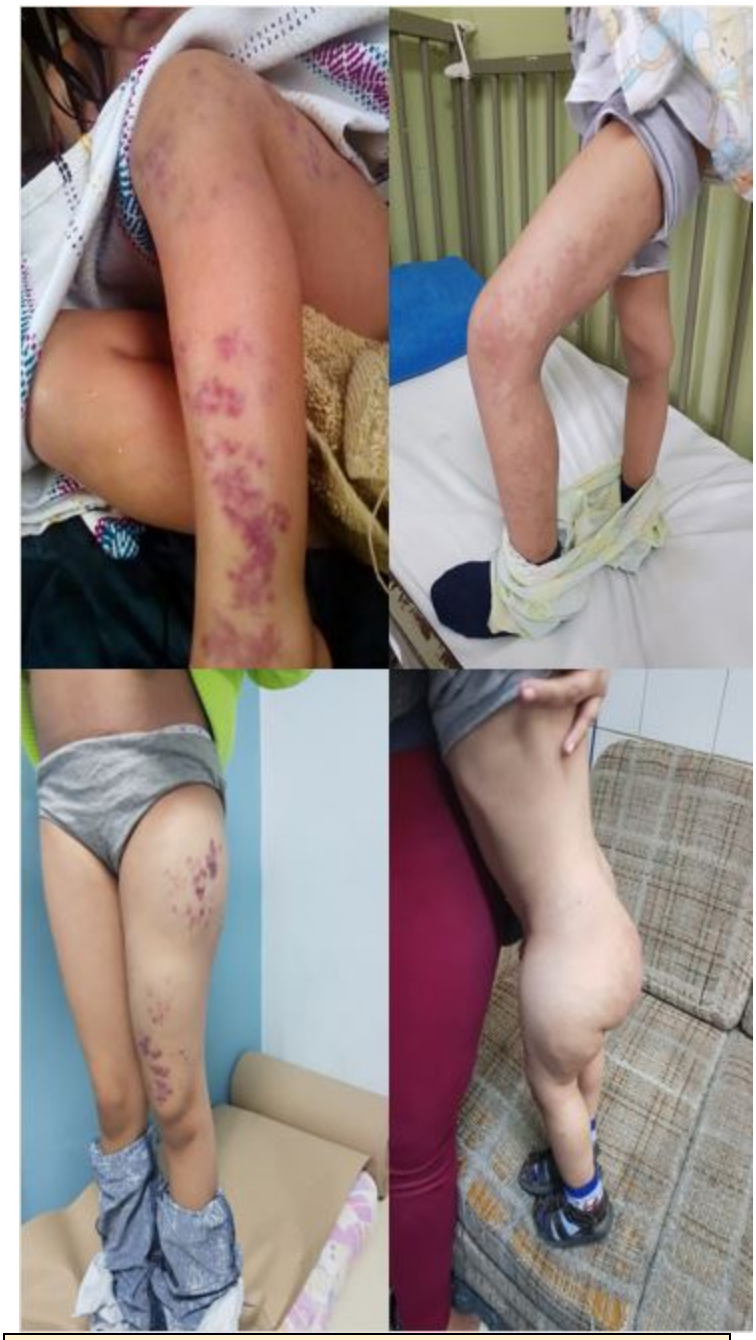
Objective: There are few reports of May Thurner Syndrome (MTS) in children. In the other hand every time are more reports of deep venous thrombosis (DVT) in pediatric patients with a higher incidence of upper body thrombosis due to the use of catheters in the younger, but in the adolescence the pattern is like in the adults: the DVT occurs predominantly in the left lower extremity. Some authors like Stephanie Carr et, al, Feng Chen et.al and Min-Kai Wu showed the there are a direct relation between the stenosis grade or the diameter diminution of the ilio-caval junction and the risk of DVT. So is feasible to think that some of these adolescents with DVT had important ilio-caval stenosis since the early childhood. The question is: how can we detect them? We believe that found at least a way to detect some of these.

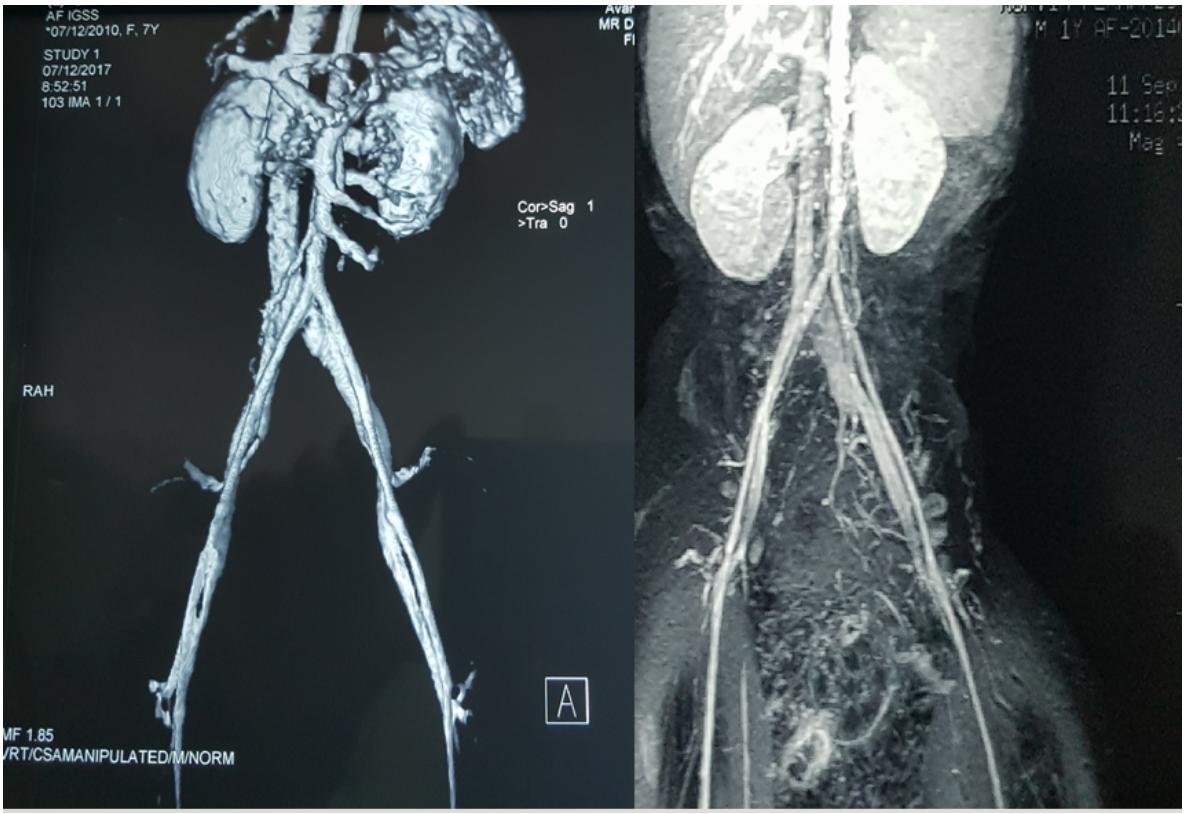
Methods:
Since August 2017 we found 4 kids (14 months ,2 years and two of 4 years old) with red wine stains in the left lower extremity that a dermatologist diagnosed as vascular malformations and like a part of the protocol we performed to all an angiocath in search of more malformations. All of them had a left ilio-caval junction stenosis (MTS) and two, pelvic reflux trough the left hypogastric vein. All of them had history of pain and edema and two had polyuria (the two with pelvic reflux). In all of them we performed a no cutting balloon angioplasty to improve the symptomology and to reduce the risk of later DVT.

Results: All the patients had a relief of the symptoms and in the younger patient that had a deformity in the left buttock, it reduced it size and tension. The first patient had a mild recurrence 1 year after treatment. The stains remain the same.

Conclusion:
The MTS can be present since early childhood and in some patients is associated with vascular malformations with red wine stains in the left lower extremity. It can cause like in adults, pelvic congestion. Is not feasible to place intravascular stents in younger children, but a balloon angioplasty is a safe and effective treatment while the child grows to perform a definitive treatment. This red wine stains can be the clue to detect iliac obstructions in children



Left lower extremity red wine stains vascular malformations



AngioCAT: MTS with and without pelvic reflux

Author Disclosure: M Menes: Nothing to disclose; **M Menes**: Nothing to disclose; **R Rosenberg**: Nothing to disclose; **R Rosenberg**: Nothing to disclose

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Surgical Plication to Treat a Symptomatic Axillary Venous Aneurysm in a Pediatric Patient

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Objective: To demonstrate the efficacy of surgical plication for the management of a primary, symptomatic and atraumatic axillary venous aneurysm in a pediatric patient.

Methods: A 19 year-old female presented for evaluation of an enlarging mass in her right axillae. Although the lesion was painless, it did occasionally swell and induce numbness along the radial forearm when the patient showered or swam long distances. Initial noninvasive vascular imaging revealed venous dilation and evidence of slow flow. Surgical intervention was ultimately planned with the goals of symptom alleviation and improved cosmesis. Pre-operatively, ultrasound was used to precisely localize the aneurysmal dilation of the right axillary vein. The overlying skin was marked and longitudinally incised, allowing for entry of the neurovascular sheath with sharp dissection. The aneurysm was found to be fusiform in nature, and had no intra-luminal thrombus. Circumferential control of the axillary vein did not need to be established, as we planned to plicate the lesion. A series of 5-0 Prolene pledgeted sutures were placed in an interrupted, horizontal mattress fashion to plicate the aneurysm to the size of the proximal and distal portions of the axillary vein. Intra-operative ultrasound was then used to confirm reduction of the aneurysm and phasic flow through the vein.

Results: Intra-operative ultrasound revealed that the aneurysm was successfully reduced from a maximal diameter of approximately 1.3 cm to 0.35 cm. Phasic flow through the vein was also confirmed. The procedure and the patient's post-operative course were uncomplicated. The patient has been asymptomatic since the surgery.

Conclusion: Repair of a primary, symptomatic and atraumatic axillary venous aneurysm with surgical plication approach proved to be efficacious. This case report has significant implications for the future management of venous aneurysms, as these are extremely rare vascular lesions and recommendations for intervention are limited. While historical reconstructive approaches have included total excision or resection with interposition of autologous vein graft, our plication approach did not require circumferential control of the vessel and ultimately posed a lesser risk of thrombosis.

Author Disclosure: M Miller: Nothing to disclose; **M Barrett**: Nothing to disclose; **D Coleman**: Nothing to disclose; **A Obi**: Nothing to disclose; **T Wakefield**: Nothing to disclose; **C Vemuri**: Nothing to disclose

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Pulsatile phrebitis due to micro Arteriorvenous communications

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Objective: As pathogenesis of varicose vein, micro arteriovenous communications (microAVC) has already been argued from 1980s. We will report our operative experience of pulsatile phlebitis due to microAVC.

Methods: We did retrospective study for 151 operative cases.

Results: Case1. 21 years old female had been suffered from leg swelling with frequent phlegmon with Klippel Trenauney syndrome diagnosis. CTA and ultrasound examination detected pulsatile phlebitis due to microAVC. Endovenous laser ablation could treat that symptom.

Case2. 72 years old female had been suffered from lymph edema with elephantiasis and frequent phlegmon for 10 years. Several kinds of conservative therapies were unsuccessful. Ultrasound examination and CTA revealed pulsatile phlebitis due to microAVC. We performed endovenous laser ablation and sclerotherapy for hyper flow vein. Her swelling leg and elephantiasis skin were improved.

Review about 151cases.

About 90% patients had different past histories.

As examination, in CTA, early venous return in arterial phase were detected. MicroAVC was suspected. But those location were not clear. It was difficult to find microAVC by ultrasound. So, we focused on venous pulsation starting points. In most of patients, that was located on the foot or ankle. Reflux was detected in about 70% patients with pulsation. And in literatures, pulsation was detected in almost 80% patients with reflux. Those 2 phenomenon seems to be related closely. About distribution of pulsation and reflux, in 66% patients, pulsation was stronger and wider than reflux. Pulsation influenced the inflammation, more than reflux. Firstly, we check the edema or inflammation around vein by B mode imaging. And on those sites, we checked venous flow volume. The average was 52.7 ml/min. In severe cases, that was 64.5 ml/min. About blood gas analysis, legs inflammatory venous pO2 were higher than arms significantly ($P = 0.0016$).

About operations, we performed laser ablation with branch ablation. We used collecting suture along tortuous vein and crossing puncture was used for grouped aneurysms. And we focused on the foot and below knee as operation site, because of microAVC distribution.

Almost 90% patients could be free from preoperative symptoms. Postoperative CTA imaged no more early venous return. Circumference of calf and ankle was improved significantly (calf $p = 0.0307$, ankle $p = 0.0470$)

Conclusion: Several kinds of stress may induce microAVC dilatation and vessel wall hyper permeability. If this situation will be chronic, vein wall sclerosis may progress and reflux may be chronic and stronger. Pulsatile phlebitis and varicose vein may be related pathology due to microAVC. We should pay more attention to venous flow situation, skin inflammation and edema location, not only Reflux.

Author Disclosure: T Murayama: Nothing to disclose

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Enhancing Performance of Repeat Studies Following Incomplete Lower Extremity Venous Duplex Ultrasound (LEVDUS) Examinations: A Needed but Difficult to Achieve Objective

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Objective: Lower extremity Venous Duplex Ultrasound (LEVDUS) is a standard diagnostic test to evaluate patients for lower extremity deep vein thrombosis (DVT). However, some of these studies are incomplete for a variety of reasons including pain, edema, or large leg circumference, or the presence of obstructing bandages or orthopedic equipment. We previously determined rates of DVT in initially complete studies and compared them to DVT rates in complete studies following an initial incomplete LEVDUS and found they were similar. We therefore initiated a quality improvement intervention at our institution to improve the rates of repeat LEVDUS following incomplete studies to minimize chances of missing a potentially detectable DVT.

Methods: As part of a quality improvement mission, a recommendation to order a repeat LEVDUS after an incomplete study was included in the accompanying official results and report starting in September of 2018. From September 2018 to February 2019 (follow-up phase), incomplete LEVDUS were prospectively identified in patients who did not otherwise have an indication for anticoagulation and compared to a historical cohort of patients in 2017 (initial phase). We compared the frequency of repeat studies performed within 4 weeks following incomplete LEVDUS and DVT rates of the repeat LEVDUS following an incomplete LEVDUS before and after this quality improvement intervention.

Results: In the follow-up phase, subjects were 49.4% female with the average age of 51 ± 17 years. There were 197 and 89 incomplete LEVDUS examinations in the initial phase and follow-up phases respectively. 27.9% (55 of 197) and 34.8% (31 of 89) of incomplete studies were followed by repeat duplex US examinations in phase 1 and 2, respectively. This difference was not statistically significant (Chi-Squared, P=0.24) indicating that the quality improvement intervention was not successful in increasing the number of repeat LEDUS performed following the incomplete examinations. The rate of thrombi detected with a follow-up examination following an initial incomplete study was not statistically significant between the initial phase (9.1%) and follow-up phase (17%), Chi-Squared analysis, P=0.26).

Conclusion: The rate of detected DVT in a complete LEVDUS examination following an initially incomplete LEVDUS examination is similar to the rate of DVT detected in initially complete studies. Despite a written recommendation for a follow-up study in LEVDUS reports of incomplete LEVDUS examinations, the rate of repeat LEVDUS after an initial incomplete examination was unchanged with the result being missing potentially detectable DVT. Additional interventions beyond a written recommendation in the final report are needed to ensure repeat studies are performed following incomplete LEVDUS.

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Clinical Conditions Associated With Ultra-high (>5,000 ng/ml) Levels of D-dimer

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Objective: D-dimer is a fibrin degradation product. It is a small fragment present in the blood after blood clot breakdown (fibrinolysis). It is a blood test that is often used clinical to rule out blood clots. However, sometimes ultra-high d-dimers are encountered in other conditions and they are not always related to blood clots. We explored the causes of ultra-high d-dimers.

Methods: This is a retrospective longitudinal study of patients who had ultra-high d-dimer values (> 5,000 ng/ml) during their hospital stay. Patients hospitalized to one of the three metropolitan area hospitals of a large health care system for any reason over the last the last four years were included in this study. All patients were followed up for at least 60 days from their discharge from the hospital. Clinical, laboratory and imaging information was reviewed in order to identify any pathology that is associated with elevated levels of d-dimer along with other clinical diagnoses.

Results: A total of 671 patients (357 female, age 66.9+/-17.9 years) were included in the study. D-dimer levels ranged from 5,000 to 67,000 ng/ml. Venous thromboembolism (DVT or PE) was the most common pathology associated with elevated d-dimer. Cancer, sepsis, pneumonia, infection, and traumatic injury were commonly encountered as well. 61.6% of patients had more than of the listed conditions. Overall, though 11.3% of patients had no clear cause found for their elevated d-dimer, which was similar across the d-dimer ranges. Of those with no clear cause found in the 5-10K d-dimer range, about 20% had a co-morbidity develop in 60 days and 24% died. Of those with no clear cause found in the >15K d-dimer range, no further co-morbidities were found and 75% died.

Conclusion: Ultra-high d-dimer levels are often seen in the setting of thrombosis, cancer, sepsis, pneumonia, infection, and traumatic injury. If one of these causes is not found, then further causes should be investigated. However, one of these causes is not found in only about 10-11% of cases. The mortality rate is high for those with d-dimer >15K when no clear cause is found.

Author Disclosure: D Oostra: Nothing to disclose; **T Russell**: Nothing to disclose; **J Fish**: Nothing to disclose; **E Wolff**: Nothing to disclose; **F Lurie**: Nothing to disclose

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Multidisciplinary Approach to Lower Extremity Hospital Acquired Tissue Injury Can Identify Vascular Etiologies

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Objective: Hospital acquired pressure injury (HAPI) can occur during hospitalization complicating the care of the patient. HAPI are commonly identified by nursing wound care specialists. The purpose of this study was to examine the effect of a multidisciplinary team including vascular specialists has on the identification of HAPI versus vascular disease in the patients with lower extremity tissue injury.

Methods: A retrospective review of data was collected from 2006 through 2019 of lower extremity HAPI reported at a single centered academic institution. Data was collected by a dedicated wound care team that initially consisted of nursing specialists from 2006 to 2012. During 2013, the team was expanded to include vascular surgeons, podiatrists, physical therapists, and advanced care practitioners. This multidisciplinary team conducted bedside rounds of identified HAPI patients. Diagnosis and identification of HAPI and wounds of vascular etiology was differentiated.

Results: Between 2006 and 2017, 3475 HAPI were reported. Prior to educational intervention, 553 pressure injuries occurred on the lower extremity. 34% were Stage I, 36% Stage 2, 2% Stage 3, 0.9% Stage 4 and 27% were deep tissue pressure injuries/unstageable. 438 (79%) of these HAPI were localized to the foot or heel and 66 (12%) involved the leg, knee, and/or thigh. The average number of lower extremity HAPI cases from 2006 through 2012 was 72. Post-intervention (2013-2017), 62 lower extremity HAPIs were reported consisting of 6% Stage I, 13% Stage II, 0% Stage III, 0% Stage IV, and 82% deep tissue injury/unstageable ulcers. 60 (97%) of the HAPI involved the foot/heel.

Conclusion: A multidisciplinary team consisting of a vascular specialist can help identify patients of vascular etiology versus hospital acquired pressure injury. Rates of HAPI decreased due to proper classification of tissue injury. The immediate and beneficial impact of the correct identification of tissue injury could lead to an improved patient care outcome and more accurate reporting.

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Initial Experience with the INARI ClotTriever Mechanical Venous Thrombectomy Device for Iliofemoral Deep Venous Thrombosis

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Objective: Iliofemoral deep venous thrombosis(DVT) has been traditionally treated with anticoagulation; however, thrombolysis has been shown to reduce the risk of development and/or severity of the post-thrombotic syndrome, but with the added potential risk of bleeding. The Inari ClotTriever (Inari Medical, Irvine, CA) was recently approved and offers the advantages of thrombolysis in the form of thrombus removal without the associated bleeding risks. Here we review our initial experience with the INARI ClotTriever device for the treatment of iliofemoral DVT.

Methods: All patients presenting to our institution and undergoing mechanical venous thrombectomy with the Inari ClotTriever device for iliofemoral DVT were included for analysis. Outcomes evaluated included technical success, major adverse events, thrombolytic drug administration, intensive care unit(ICU) admission and symptomatic improvement. Technical success is defined as successful thrombus removal with angiographic evidence of improvement. Financial analysis was also performed in terms of inpatient versus outpatient reimbursement rates.

Results: During the study period, 8 patients presented with iliofemoral DVT and underwent mechanical venous thrombectomy with the Inari ClotTriever device. The cohort had an average age of 66±15.6 years(range:46-91 years), with 75%(6/8) male. Average procedure length was 79±19 minutes (range:41-101 minutes). There was 100% technical success, no thrombolytic drug used, no ICU admission, and all patients (8/8[100%]) experienced improvement in swelling and symptoms in the treated lower extremity at the time of discharge. There were no complications or major adverse events including no postoperative bleeding events at any anatomic location. Overall the post-procedural length of stay(LOS) was short with 6/8 patients discharged on POD1, however with 2 outliers staying 8 and 9 days postoperatively, which was not procedure related.

The short post-operative LOS presents an issue in terms of reimbursement given that the patients are not meeting criteria for inpatient admission by the CMS Two-Midnight rule leading the hospital to be reimbursed based on an outpatient rather than inpatient code. The ClotTriever kit costs roughly $9000 in our system with the proposed inpatient reimbursement being based on the inpatient DRG 270-272 paying between $15,985 and $30,904 (2019 dollars). However, when patients fail to meet inpatient criteria the procedure is billed utilizing an outpatient code, 37187, which reimburses $4678.53 (2019 dollars), representing a more than $4000 loss on the procedure for the hospital.

Conclusion: Our initial experience with the INARI ClotTriever device for treatment of iliofemoral DVT is promising with: 100% technical success, no major adverse events, zero thrombolytic agents used, no ICU utilization and a short post-procedural LOS. However,

financial reasons may preclude from widespread inpatient adoption of this procedure despite its potential clinical advantages.

Author Disclosure: H Ray: Nothing to disclose; **K Charlton-Ouw**: Nothing to disclose; **N Saqib**: Nothing to disclose; **S Harlin**: Nothing to disclose

Poster 30

Ascending Lumbar Vein Angioplasty and Stenting to Improve Lower Extremity Venous Drainage in the Setting of Ipsilateral Common Iliac Vein Occlusion

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Objective: Iliofemoral deep venous thrombosis(DVT) can result in development of the post-thrombotic syndrome(PTS) with catheter directed thrombolysis(CDT) aiming to reduce the development and/or severity of the PTS. After reduction of thrombus burden with thrombolysis any underlying anatomic venous abnormalities should be addressed.

Methods: Here we present two cases of iliofemoral DVT treated with CDT and found to have uncrossable common iliac vein occlusion with large ascending lumbar vein collaterals draining via the hemiazygos system necessitating venous stent placement resulting in symptomatic improvement.

Results: The first patient is a 40-year-old male truck driver with acute left iliofemoral DVT who was taken for pharmacomechanical thrombolysis with the Angiojet device(Boston Scientific, Marlborough, Mass) with CDT overnight. The following day the patient was taken for repeat venography revealing occlusion of the left common iliac vein, but a large yet stenotic ascending lumbar vein emptying the leg via the hemiazygos system. Attempts to cross the occluded common iliac vein were unsuccessful and thus attention was turned to the stenotic ascending lumbar vein which was then cannulated and stented. Following stent deployment brisk emptying of the leg via the ascending lumbar vein was noted with symptomatic improvement prior to discharge.

The second patient is a 39-year-old male with a recent international flight and a history of medically managed left lower extremity DVT 10 years prior who presented with new acute left iliofemoral DVT. He was taken for pharmacomechanical thrombolysis using the Angiojet with CDT continued overnight. Venography the following day demonstrated continued common iliac vein occlusion with large thrombus laden ascending lumbar vein noted to be draining the leg, thus a lysis catheter introduced into this vessel with CDT reinitiated. The following day repeated venography demonstrated a stenosis of the ascending lumbar vein with balloon angioplasty performed with improvement of venous flow noted. Two days postoperatively recurrence of DVT was noted after transition to apixaban, taken for CDT overnight with reduction in thrombus burden noted and with venous drainage of the lower extremity again noted to be via a stenotic ascending lumbar vein. At this time a stent was placed with notable improvement in venous drainage noted. At follow-up his leg symptoms have resolved without DVT recurrence.

Conclusion: In the setting of uncrossable common iliac vein occlusion and drainage via the ascending lumbar vein into collateral venous pathways diameter augmentation with angioplasty and stent placement appears to be safe and to afford symptomatic improvement in the short term.

Author Disclosure: H Ray: Nothing to disclose; **S Harlin**: Nothing to disclose

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Percutaneous Mechanical Thrombectomy with the ClotTriever Device for the Treatment of Ilio-femoral Deep Vein Thrombosis: Initial Experience and Short Term Outcomes

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Objective: The purpose of this study is to describe our initial experience with the ClotTriever system (Inari, Irvine, CA), a novel percutaneous device for the treatment of ilio-femoral deep vein thrombosis. The device utilizes a self-expanding nitinol mesh cage that is deployed and retrieved via a dedicated percutaneous sheath (13F).

Methods: A retrospective review was performed of our initial experience utilizing the ClotTriever device. We identified all patients that underwent percutaneous thrombectomy with ClotTriever from January 2019 through August 2019. All patients treated were included irrespective of thrombus location, chronicity, and/or if this was a frontline or secondary thrombectomy. Primary end points were technical success of the thrombectomy, procedural success, and symptom improvement at short term follow up.

Results: We identified 10 patients where ClotTriever was used as frontline or secondary thrombectomy. The mean age was 56 years (range: 35-83), and men were the most common sex in 7/10. Thrombus was located at the left limb in 6/10 and right limb in 4/10. Iliac Ithrombus was present in 9/10 patients, femoral and popliteal extension was present in 8/10 patients. Inferior vena cava extension in 2 patients. One patient had isolated fem-popliteal DVT without Iliac involvement. Overall, the mean time from symptom onset to ClotTriever thrombectomy was 12 days (range: 2-22). Five patients were treated with ClotTriever as frontline therapy, and 5 patients were treated as secondary therapy after a failure of pharmacologic or pharmaco-mechanical thrombectomy. Two patients were treated for iliac vein stent thrombosis. Mean operative time was 71 minutes (30-138 minutes). Extracted thrombus quality was acute, acute on chronic, and chronic in 2/10, 5/10, and 3/10, respectively. Adjuvant maneuvers included balloon angioplasty in 6/10 and stenting in one patient. Two patients received intraoperative TPA in conjunction with ClotTriever. Thrombus was successfully extracted in 10/10 patients. 9/10 patients had satisfactory thrombectomy and 1/10 required the utilization of a secondary thrombectomy device for incomplete thrombectomy. Inline flow was established in all patients. There were no access related complications. Mean time to discharge post procedure was 2.7 days. At a mean follow-up time of 59 days (range, 29-132 days) there were no re-interventions. Swelling was improved in 8/9 patients and pain was improved in 9/9 patients.

Conclusion: In our experience, the ClotTriever system is safe and effective for the treatment of acute and subacute DVT. We had a high technical and procedural success rate in frontline and secondary thrombectomy. Our early experience demonstrates a promising future for the ClotTriever as a percutaneous mechanical thrombectomy device.

Author Disclosure: L Rodriguez: Nothing to disclose; **A McChesney**: Nothing to disclose; **H Chen**: Nothing to disclose; **A Rathore**: Nothing to disclose; **J Panneton**: Nothing to disclose; **D Dexter**: Nothing to disclose

Poster 32

The Use of Adhesive Venous Closure for CEAP C6 Venous Disease Following Radiofrequency Ablation

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Objective: Venous ulcers represent a significant morbidity to patients and the care of them a substantial financial burden on the United States and foreign healthcare systems. The aim of this study was to identify if adhesive venous closure (Venaseal) in patients with persistent or enlarging venous ulcers following radiofrequency ablation might speed recovery or heal them completely.

Methods: This was a retrospective chart review of a single physician's experience in treating lower extremity venous ulcers associated with superficial venous reflux with adhesive venous closure following inadequate or failed radiofrequency ablation. 6 patients were identified who met these criteria. Additional data collected included age, sex, comorbidities, BMI, smoking history, and history of previous deep venous thrombosis. Postprocedural data was pulled, including the change in ulcer square area, healing time in days, and overall follow up in days.

Results: All 6 patients had prior radiofrequency ablation followed by adhesive venous closure in an attempt to heal their ulcers. All patients treated were CEAP class 6. Mean BMI was 38.03. 5/6 patients had a history of hypertension. Only 1 patient was otherwise healthy. 5/6 patients were never smokers. 1/6 patients had a history of deep venous thrombosis. A total of 9 vein segments were treated. 3/6 patients had more than 1 segment treated. 3/6 patients were treated in the identical vein segments which were treated previously. The patient's lower extremity ulcers were on average 51.24 sq cm in area. 2 patients experienced a 100% reduction in ulcer size with 5/6 experiencing 50% or greater reduction in size. The average reduction in size was 71% with a mean duration of 40.67 days, as seen in table 1. The mean total follow up, defined as time from procedure to most recent visit, was 83 days. There was a 96.18% inverse correlation between BMI and percent reduction in ulcer square area, however there was no statistically significant association between any of the preoperative factors and the duration of healing or ulcer square area reduction. There were no complications following the procedures.

Conclusion: This small series represents an early attempt to identify the utility of adhesive closure in patients who do not or do not completely respond to radiofrequency ablation. Previous studies have demonstrated similar efficacy of the two techniques when compared directly. While there was a clear benefit to the usage of adhesive closure in healing these ulcers following prior RFA, it remains to be determined in which patients it can be utilized in the future.

Patient	Age	Sex	BMI	Segment Treated	Ulcer Size Reduction	Duration of Healing (days)	Total Follow Up (days)
1	57	F	30.2	SSV	100%	18	93
2	35	M	55.6	GSV	22.02%	26	28
3	69	F	34.3	Perforator	80%	58	107
4	76	F	31.2	AASV, perforator	75%	72	79
5	62	M	46.5	AASV, perforator	49.89%	63	93
6	77	M	30.4	AASV, perforator	100%	7	98

Preprocedural Data and Postprocedural Outcomes for Venaseal

Author Disclosure: S Safir: Nothing to disclose; **S Kim**: Nothing to disclose; **R Tadros**: Nothing to disclose; **W Ting**: Nothing to disclose; **M Marin**: Nothing to disclose; **A Rao**: Nothing to disclose; **P Faries**: Nothing to disclose

Poster 33

Diagnostic Yield of Intravascular Ultrasound in Patients with Clinical Signs and Symptoms of Lower Extremity Venous Disease

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Objective: Intravascular ultrasound (IVUS) has a higher sensitivity compared to venography in the assessment of obstructive venous disease. However, in most practices, both modalities continue to be utilized concomitantly. This study evaluated the diagnostic clinical yield of IVUS as a singular intra-operative investigative modality in patients in whom clinical signs and symptoms of venous disease were severe enough to merit such an examination and in whom venogram was not performed simultaneously.

Methods: From January, 2013 to December, 2018, there were 31 limbs (29 patients) who only had IVUS planimetry without venogram. Clinical parameters such as pain, swelling and Venous Clinical Severity Score (VCSS) were measured preoperatively and postoperatively. Degree of stenosis noted on intraoperative IVUS was compared to the preoperative duplex. Incidence of complications, technical success and clinical yield of IVUS were noted.

Results: Etiology of venous lesion was post-thrombotic in the majority of patients (74%). All patients (100%) were either in CEAP class C3 or higher. Duplex appeared to underestimate degree of stenosis in the common femoral vein (CFV) compared to intra-operative IVUS. In all patients (100%) taken to the operating room, IVUS identified stenosis in at least one of the following three veins: common iliac vein, external iliac vein and common femoral vein. Intervention was in the form of venous stenting with or without additional procedures such as endovenous ablation of refluxing great saphenous vein. There was significant improvement in pain, swelling and VCSS post-intervention.

Conclusion: IVUS is an effective diagnostic tool that displays high quality, real-time cross sectional anatomy during venous interventions. When used as the sole intra-operative diagnostic modality, it appears to have a high clinical yield in patients in whom signs and symptoms of venous disease are severe enough to merit intervention.

Author Disclosure: T Saleem: Nothing to disclose; **A Knight**: Nothing to disclose; **S Raju**: Veniti Inc, IVUS diagnostics, Iliac vein stent design

Poster 34

Effect of Iliofemoral-caval Venous Intervention on Lower Extremity Compartment Pressures in Patients with Chronic Venous Insufficiency

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Objective: Chronic compartment syndrome (CCS) secondary to venous hypertension from chronic venous insufficiency is an uncommonly described entity. The measurement of high resting compartment pressures is helpful in establishing the diagnosis of CCS. However, only a few reports have described the effect of deep venous intervention on compartment pressures in patients with chronic venous insufficiency. This study evaluated a subset of patients with signs and symptoms of venous disease in whom intervention (hyperdilation or new stent placement) was performed on the iliofemoral caval venous system. The effect of the specific intervention was objectively measured by documenting preoperative and postoperative compartment pressures in the posterior superficial compartment of the calf.

Methods: From January, 2018 to January, 2019, 80 patients underwent either a hyperdilation (n=34) or new endovenous stent placement (n=46). All these patients had measurement of their compartment pressures before and after intervention with a simple needle manometer system. Values of 15 or higher were considered indicative of chronic compartment syndrome in the appropriate clinical context. Clinical parameters such as pain, swelling and Venous Clinical Severity Score (VCSS) were measured preoperatively and postoperatively.

Results: Venous intervention in the form of hyperdilation or endovenous stent placement was significantly associated with the reduction in the compartment pressure of the extremity undergoing the intervention. There was also a significant improvement in pain, swelling and VCSS post-intervention. In patients undergoing hyperdilation, there was a significant improvement in the ejection fraction of the calf pump post-intervention. There was no significant difference between the change in compartment pressure pre-intervention and post-intervention when comparing patients with and without lymphedema.

Conclusion: Deep venous intervention in the form of hyperdilation or endovenous stent placement results in the reduction of compartment pressure of the extremity undergoing intervention. It is also associated with an improvement of clinical parameters in patients with chronic compartment syndrome secondary to chronic venous insufficiency.

Author Disclosure: T Saleem: Nothing to disclose; **A Knight**: Nothing to disclose; **S Raju**: Veniti, IVUS diagnostics, Iliac vein stent design

Poster 35

The global prevalence of Chronic Venous Disease (CVD)

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Objective: Chronic Venous Disease (CVD) is an important cause of patient morbidity however estimates of the global burden of CVD can be heterogenous. This review aims to provide an updated estimate of the global prevalence of CVD.

Methods: A systematic review through Ovid MEDLINE identified 2534 articles. Full text articles, available in English, reporting the point prevalence of CVD in general populations, were included. The year each population was studied ranged from 1987-2015. Statistical analysis was performed through MetaXL.

Results: Twenty six articles were identified reporting the prevalence of CVD across 4 continents (Europe, Asia, North America, South America). Twelve utilised community surveys, eleven identified patients in primary care and three utilised electronic medical records. Sixteen articles reported prevalence across CEAP scale, others reported specific venous pathology e.g. varicose veins or ulceration. Average patient age ranged from 37.6 – 79.9 years. Overall pooled prevalence for each CEAP stage was: C0 (32.12%), C1 (27.93%), C2 (21.42%), C3 (17.74%), C4 (8.03%), C5 (1.41%), C6 (0.40%). The overall pooled prevalence of all CVD was 45.18% across all studies.

Conclusion: CVD affects a significant proportion of the population globally however estimates are heterogeneous due to different study designs. The global burden of CVD must be better characterised to optimise service provision and permit workforce planning for patients with different stages of CVD.

Author Disclosure: S Salim: Nothing to disclose; **S Onida**: Nothing to disclose; **A Davies**: Nothing to disclose

Poster 36

Water-jet Assisted Liposuction (WAL): Awake, Comfortable and Relaxed.

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Objective: Lymph Sparing Liposuction (LSL), like WAL, is the only available treatment for patients with symptomatic Lipedema who failed conservative treatments. The pain associated with WAL can be controlled by general, regional or "twilight" anesthesia but local anesthesia (LA) has also been frequently used. We WAL under LA using a method that evolved over the years. We aim to share it today.

Methods: We perform WALs in the office, with no IV anxiolytics or IV analgesics. Two parts in WAL: *Initial Spray* of '_Caines' for numbing, and *Irrigation* of fat, done by 'water-jet' (*CAREStream America*) infusion of Lactated Ringer (LR). We use a mixture of two '_Caines': *Mepivacaine* - for quick onset and *Ropivacaine* – for long anesthetic effect. WAL of trunk lasts 2.76hours, arms 3.71hours and legs 4.32hours.

Our first WAL was done in 2/2015 and until 8/2018 (102 procedures) the two '_Caines' were added to both, the *Initial spray* and to the *Irrigation* solutions. *Mepivacaine* 370mg+35.0mg and Ropivacaine 185+15.1mg per procedure were used. Total LR 12.5+0.50 liters.

Since 8/2018 (76 WAL procedures), we added the '-Caines' only to the *Initial Spray* solution and eliminated from the *Irrigation* solution. The average '_Caines' in this group: *Mepivacaine* 222+17.0mg ($p< 0.01$), *Ropivacaine* 111+8.5 per procedure ($p< 0.01$). At the same time, *Nitrous-Oxide* (N2O, ProNox^{TM}) was made available at patient's request: 50% N2O mixed with 50% Oxygen inhaled in rounds of 4-5 consecutive inhalations per round, at >5mins intervals. All patients used N2O, at average of 28.6+13.4 inhalations (range 4-102) per procedure delivered in 6.16+ 2.82 rounds (range 1-19). Similar amount of LR was used in the late group – 12.75+ 1.06 liters.

Results: In comparison to the early group, despite decreasing the dose of 'Caines' by 40%, and adding N2O, the late group

1. Requirements for oral anxiolytics and oral analgesics during WAL decreased significantly - suggesting same or better levels of pain and discomfort during WAL.
2. In-office recovery time has been significantly shorter
3. Orthostatic hemodynamic changes upon standing-up at the end of WAL - seldom occurs
4. Nausea, a common earlier complaint, has not been experienced. (data will be presented).

Conclusion: 1. Even with a reduced amount of local anesthetics and adding N2O inhalation, WAL can be done while patients are fully awake, comfortable and relaxed.

2. Staying awake enables patients to move, change position by herself, drink, snack and being entertained.
3. LA makes the procedure safer; patient can alert the surgeon about pain or discomfort that commonly indicates that the suctioning cannula is off the right plane and avoiding injury, muscle bruising or bleeding.

Author Disclosure: N Shapira: Nothing to disclose; **S McLane**: Nothing to disclose

Poster 37

Statewide Outcomes of Outpatient Venous Interventions

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Objective: Outpatient venous interventional procedures are performed by physicians of multiple specialties and with variable training and experience. Although reported outcomes from individual centers have been excellent, we sought to evaluate the safety and complications of outpatient venous interventions (sclerotherapy, ablation, phlebectomy and ligation) on a statewide basis.

Methods: Data was obtained from the state Ambulatory Surgery and Services Database (SASD) which encompassed all procedures performed regardless of payer, including those covered by private insurance, Medicare, Medicaid, and the uninsured. CPT (Current Procedural Terminology) and PCS (Procedure Classification System) procedural codes were used to identify patients who underwent these interventions. ICD-10 diagnosis codes identified procedure-related adverse events. The primary endpoints were death, admission to the hospital and adverse events that included myocardial infarction, venous thromboembolism, superficial thrombophlebitis, hematoma, paresthesia, pain, and leg swelling.

Results: A total of 3,393 venous interventions were identified during the year 2016, the latest year with data available. Mean patient age was 57±14 years and 69% were females, with no differences between the treatment groups. Endovenous ablation was performed in 2,511 (74%), phlebectomy in 896 (26%), sclerotherapy in 603 (18%), and ligation with or without stripping in 151 (5%); 752 (22%) patients had more than one procedure performed.

There were no deaths with any of the procedures. Only three patients (0.1%) were sent to the hospital after the procedure. Post-procedural complications developed in 72 patients (2.1%). The most common complications were pain (37 cases, 1.1%), leg swelling (16 cases, 0.5%), superficial thrombophlebitis (12 cases, 0.4%), and infection (5 cases, 0.1%). One patient suffered from venous thromboembolism (0.03%) and another developed paresthesia. There were no bleeding complications or major cardiac events.

The average charge per treatment was $8,391 ± 5,081. Mean charges were significantly higher for more invasive procedures, such as ligation/stripping ($12,673 ± 5,076) and phlebectomy ($10,364 ± 5,771), followed by minimally invasive endovenous ablation procedures ($9,497 ± 4,108), and sclerotherapy ($4,006 ± 5,471) [P<.0001].

Conclusion: Outpatient venous interventional procedures are performed with negligible mortality on a statewide basis and hospital admissions after these procedures are rare. Although under-reporting is possible, there is minimal morbidity, with overall complications rates of about 2%. Charges vary among procedures and likely reflect associated procedural expenses.

Author Disclosure: M Shaydakov: Nothing to disclose; **D Zikos**: Nothing to disclose; **J Blebea**: Nothing to disclose

Poster 38

Reflux volume is determined mainly by the ejection volume from the calf reservoir

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Objective: Previous studies has shown the reflux volume is associated with lower legs venous reservoir size. The mechanisms of this relationship remain to be unclear. Since the volume of blood in the venous segment immediately proximal to a valve at the onset of reflux is mainly determined by the volume ejected from the venous reservoir by the action of muscle pump, it is likely that reflux volume is closely related to ejection volume.
The aim of the study was to investigate the relationship between ejection volume and reflux volume measured by duplex ultrasound.

Methods: This was a prospective experimental multicenter study. Inclusion criteria were C1-6, Ep, As, Pr 2,3 (CEAP classification.) With the patients standing, the cross-section area (S) of the great saphenous and common femoral veins were measured. Automatic pneumatic cuff inflation-deflation was used a s the reflux provoking maneuver. The antegrade flow and reflux parameters were measured with the cuff pressure of 60, 90, and 120 mm Hg.

Results: Reflux volume is related to both parameters the ejection volume ($r^2 = 0.366$, $p < .0001$) and the reflux flow rate (Q_{reflux}, $r^2 = 0.647$, $p < .0001$) and was not associated with the body weight, BMI, and the reflux time (RT) regardless of pressure settings. Both Q_{reflux} and $TAMEAN_{reflux}$ did not have a statistically significant difference in different pressure settings. RV and EV values had statistically significantly difference between 60 vs 90 ($P < .0001$), and 60 vs 120 ($P < .0001$) pressure settings (Table I). The pressure settings had a statistically significant impacting on both the EV and RV (ANOVA, $p < 0.0001$.) The average Reflux index (RI) defined as the ratio of reflux volume over ejection volume had almost identical values in different pressure settings (0.425 ± 0.23; 0.426 ± 0.20; 0.418 ± 0.19 in 60, 90, and 120 mmHg respectively). There was statistically significant difference between CEAP stages (C_2, C_{3-5}) by IPR (ANOVA, Tukey HSD, $p = 0.009$)

Conclusion: The reflux volume is primarily determined by the ejection volume. Reflux index is larger in more advanced clinical classes of the disease.

Table I. Reflux parameters in different pressure settings

Parameters	60 mm Hg	90 mm Hg	120 mm Hg	*ANOVA*	*Tukey HSD* (60 vs 90)	*Tukey HSD* (90 vs 120)
EV (ml)	42.13 ± 19.2	68.63 ± 31.45	67.1 ± 28.26	<0.0001*	<0.0001*	0.958
RV (ml)	16.61 ± 9.21	28.06 ± 16.66	27.6 ± 16.15	<0.0001*	<0.0001*	0.987
Q_{reflux} (ml/sec)	4.26 ± 3.36	4.51 ± 2.98	4.66 ± 3.27	0.824	0.922	0.971
$TAMEAN_{reflux}$ (cm/sec)	13.98 ± 5.21	15.22 ± 5.21	15.33 ± 6.06	0.39	0.491	0.995

Note: data are presented as a mean and standard deviation; *p* value for ANOVA and Tukey HSD tests; * - statistical significance was defined as $p < 0.05$; EV = ejection volume; RV = reflux volume; Q_{reflux} = reflux volume flow rate; $TAMEAN_{reflux}$ = reflux time average linear velocity

Reflux parameters in different pressure settings

Author Disclosure: R Tauraginskii: Nothing to disclose; **R Tauraginskii**: Nothing to disclose; **K Zhdanov**: Nothing to disclose; **S Simakov**: Nothing to disclose; **D Borsuk**: Nothing to disclose; **K Mazayshvili**: Nothing to disclose; **F Lurie**: Nothing to disclose; **F Lurie**: Nothing to disclose

Poster 39

Combined Approach to Treating Thoracic Outlet Obstruction: Robotic Rib Resection with Completion Venogram

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Objective: Thoracic Outlet Syndrome encompasses a collection of pathologies that present with symptoms secondary to compression of nervous, venous or arterial structures. Traditionally, treatment has been surgical rib resection via a supraclavicular, transaxillary or infraclavicular approach. We examine a series of three patients, showcasing with intraoperative video, the combined approach of robotic transthoracic first rib resection with completion venogram and intervention as indicated.

Methods: From 2018-2019, five patients underwent Robotic First Rib Resection for Arterial or Venous Thoracic Outlet Syndrome. The video and venographic images were reviewed and representative cases selected. Intraoperative video and fluoroscopic images were exported for presentation.

Results: Three of the five patients underwent venogram at time of resection. One shows stenosis, another occlusion, and finally an example of normal vein anatomy.

Patient 1 is a 20-year-old female with right upper extremity swelling; work up demonstrated a deep vein thrombosis in the right subclavian vein and she was started on anticoagulation. Magnetic Resonance venography, with the right arm at rest and abducted, revealed lack of flow in the stress position. Post rib resection Venogram showed high-grade stenosis distal to the axillo-subclavian junction with significant collateralization; balloon angioplasty was performed with good results.

Patient 2 is a 24-year-old male with three year history of heaviness of the right arm, associated with increased varicosities along his right chest wall, with Venogram showing chronic subclavian vein disease with complete occlusion of the axillary vein with extensive collateralization. Magnetic Resonance venography showed decreased venous flow with arm abduction. Post rib resection Venogram showed complete occlusion centrally from axillary vein into the SVC; balloon angioplasty was performed with good results.

Patient 3 is a 50-year-old female with vague neurological symptoms and pallor with left arm abduction; cerebral angiogram with complete occlusion of the left subclavian artery during left arm abduction, without reversal in flow to suggest a subclavian steal syndrome. Post rib resection diagnostic Venogram showed no stenosis of the left subclavian vein.

Conclusion: These cases demonstrate that the benefit of a completion venogram, which allows for endovascular intervention to treat any residual stenosis after decompression via first rib resection, at the time of initial intervention. Repeat venogram, to be completed at 6 months, is expected to demonstrate the long-term impact of this approach.

Author Disclosure: A Thomas: Nothing to disclose; **J Sesti**: Nothing to disclose; **M Addis**: Nothing to disclose; **C Milici**: Nothing to disclose; **J Crawford**: Nothing to disclose

Poster 40

BODY DYSMORPHIC DISORDER IN PATIENTS WITH TELANGIECTASIAS

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Objective: Chronic venous insufficiency patients can debut with a spectrum from telangiectasias to ulcer, thrombosis or varicorragia. Some patients have a minimal degree of telangiectasias and almost non-visible for the physician; even though, these patients, in spite of being already treated successfully, consider that the treatment should continue, focusing excessive attention in supouselly persistent telangiectasias. Here we can be facing a possible body dysmorphic disorder (BDD).

Methods: This is a multicentric study performed in patients with telangiectasias seeking treatment, the "Body Dysmorphic Disease Questionnaire" (BDDQ) was self applied to all cases. Furthermore, each questionnaire was evaluated within the DSM-IV criteria for BDD.

Results: From a sample of 223 patients, 38 patients had criteria for BDD indicating that the prevalence of BDD in patients with telangiectasias is 17.04% according to the DSM-IV criteria.

Conclusion: Telangiectasias can be a stress trigger that changes the way that this patients see introspectively their physical appearance. BDD patients tend to focus their attention and create a dysfunctional interpretation around these type of veins. These patients also tend to demand an unnecessary treatment for a minimal telangiectasia as a mechanism of avoiding the corporal dysfunction interpreted by themselves.

Body dysmorphic disorder occurs in vascular patients in a considerable proportion and they should be evaluated by psychiatry. Patients with BDD should not undergo treatment because without psychiatric consultation first.

Author Disclosure: J Ulloa: Nothing to disclose; **J Bravo**: Nothing to disclose; **A Pedrazzoli**: Nothing to disclose; **C Simkin**: Nothing to disclose; **J Javier**: Nothing to disclose; **F Santiago**: Nothing to disclose

Poster 41

Reporting outcomes of EVLA of GSV

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Objective:

The heterogeneity of reporting outcomes of EVLA is alarming
There is a lack of adherence to international bibliography

Methods:

Type of study: prospective, nonrandomized,case series,observational
Technique: percutaneous, under ultrasound guidance, in outpatients with local anesthetic and sedation
Period:24 months
Population:406 GSV
Physical parameters: LEED: 30 J/cm
Materials
Laser type: diode 1470nm
Fiber:linear emission
Compression treatment: GIC protocol

Results:

Target vein
The EVLA results of GSV and SSV must be reported separately
Report of initial severity of the clinical cases
Distribution according to C of the CEAP
The highest percentage was C3 56%
Baseline characteristics
Olderage ,male sex and higher BMI are related to severe pathology
Age:53.72
Sex: female78%
Average BMI: 27.9
Target vein characteristics
Degree of reflux:severe89%
Follow-up time:2 years
Loss of follow-up
24 months:37ptes 9.11%
A- Primary results
Degree of severity
Clinical improvement
Improvement of CEAP: the static measurements are not recommended for longitudinal studies
Venous Disease Severity Score VSS is the best tool
pre-processing score:7.3
seven days:4.9

first month:4.2
third month:3.9
2 - Quality of life Qol: CIVIQ-20
Improvement of the scores of all the domains
pre-processing score:37.7
third months:17.5
The improvement of the average global score: 53.8%
3- Evaluation of recurrences
They are based on a pre and post procedure report of presence or absence of reflux in other sectors of the venous systems through VSDS
To evaluate the results of treatment: REVATA
4- Evaluation of the aesthetic results
They are assessed by the disappearance or reduction in the size and visibility of varicose veins by photograph of the treated areas
5- Cost benefit relation
Questionnaire of acceptance of the procedure by the patient
Lickert scales.
B- Secondary result by DUS
Efficacy
Anatomical success/ obliteration
7 days:99.51%
One month:98.51%
Three months:96.25%
Six months:95.13%
Twelve months:93.84%
Twenty four months:93.15 %
Repermeabilization
7 days:0.49 %
One month:1.49 %
Three months:3.75%
Six months: 4.87%
Twelve months:6.16%
Twenty four months:6.85%
All were: partial: less than 50% failure and more than 5 cm of length
Segurity/complications
Pain rate
Mid:90.14%
Moderate:9.86%
Severe: were not detected
Bruising scores
mild:87.19%
moderate:12.81%
Induration:100%
Superficial thrombophlebitis:1,72%

EHIT
Type 1:99.51%
Type 2:0,49%
Type 3 and 4: not detected
Paresthesias:3,67%

Conclusion:

It has been demonstrated biases in the design of clinical trials and significant variations in the report of outcomes measures
It is necessary to achieve greater adherence to the reporting standards of results
This will allow greater objectivity in the evaluation of the new technologies.
A combined report of primary and secondary results is recommended
It has not been proven that primary results correlate with secondary results

Author Disclosure: R Vellettaz: Nothing to disclose

Poster 42

Villalta Scores in Patients Without a History of Post Thrombotic Syndrome (PTS)

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Objective: The Villalta scale is a scoring system tool designed to assess the severity of the post- thrombotic syndrome (PTS); however questions have been raised regarding its validity and specificity, with potentially elevated scores reported in patients with primary venous disease and no history of deep venous thrombosis. Validated tools such as Clinical Etiological Anatomical Pathophysiological (CEAP), the Venous clinical Severity Score (VCSS), Aberdeen Varicose Vein Questionnaire (AVVQ) and the VEINES-QOL/Sym have all been used to globally assess patient's with chronic venous disease. The aim of this study was to assess the relationship between the Vilallta score and the other severity/quality of life tools mentioned above and determine the degree of association.

Methods:

110 patients with clinical and sonographic evidence of superficial venous disease and no background of deep vein thrombosis were recruited from a single centre. All patients were asked to complete the AVVQ and VEINES-QOL/Sym and a clinician examined each patient and scored the patient according to the CEAP, VCSS and Villalta tools. Spearman's correlation (non-parametric, inordinate) was performed to assess for any association between the clinical scale and the QoL score. Analysis was performed on SPSS® v25 (IBM, Armonk, USA).

Results:

110 patients (67 female) were recruited, with a median age of 59 (range 21 - 96).

View table

(very weak: R= 0 to 0.2, weak: R= 0.2 to 0.4, moderate: R= 0.4 to 0.7, strong: R=0.7 to 1)
Our results demonstrate a moderate correlation between Villalta and all clinical severity/QOL tools (except Veines-Qol).

Conclusion:

Our results demonstrate that Villalta is similar to CEAP, VCSS, Veines Sym and AVVQ in measuring chronic venous disease severity. These results have potential implications in the assessment of patients with post thrombotic syndrome.

	CEAP	VILLALTA	VCSS	VEINES SYM	VEINES QOL	AVVQ
CEAP		R= 0.525	R= 0.560	R= 0.007	R= -0.080	R= 0.346
VILLALTA	R= 0.525		R= 0.655	R= -0.457	R= -0.012	R= 0.526
VCSS	R= 0.560	R= 0.655		R= -0.156	R= -0.289	R= 0.505
VEINES SYM	R= 0.007	R= -0.457	R= -0.156		R= 0.842	R=-0.633
VEINES QOL	R= -0.080	R= -0.012	R= -0.289	R=0.842		
AVVQ	R= 0.346	R= 0.526	R= 0.505	R=-0.633	R= -0.633	

Correlation between clinical severity scores/QOL tools

Author Disclosure: K Kemal: Nothing to disclose; **S Onida**: Nothing to disclose; **T Lane**: Nothing to disclose; **A Davies**: Nothing to disclose

Poster 43

Deep Vein Stent Patency Outcomes After Eight Years of Surveillance

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Objective: Deep venous stenting has become more popular over the past few years with the advent of dedicated deep venous stents. Stenting is now commonly used in the treatment of May Thurner syndrome in the acute setting following an ilio-femoral DVT or in non thrombotic symptomatic May Thurner syndrome. It is also used in the treatment of post thrombotic syndrome (PTS) with the aim of alleviating venous obstruction. Re-intervention rates for stent thrombosis or stenosis can be high and are a big concern with regards to this treatment. The aim of this study was to assess stent patency and re-intervention rates in patients who had undergone lower limb deep venous stenting in a vascular tertiary unit. In addition, a comparative analysis of stent patency for acute and chronic occlusions was performed as well as between stents inserted for PTS and those for chronic non thrombotic symptoms.

Methods: This was a retrospective single centre study of prospectively collected data. All patients who underwent stenting for acute and chronic deep venous disease between November 2011 and February 2019 were included in the study. Duplex ultrasound was used to assess stent patency during patient follow up at regular intervals.

Results: Eight six deep venous stents were inserted between November 2011 and April 2019. The median age was 47 (range 13-84), forty-three of the procedures were acute (following deep vein thrombosis) and forty-three for chronic occlusions. Twenty four limbs required re-intervention (28%) (lysis, venoplasty and/or stent insertion). No statistical difference was found in the primary assisted or secondary patency of stents placed to treat post thrombotic and chronic non thrombotic lesions but a statistical difference (P 0.04) was found in the primary patency between these groups. No difference in stent patency was identified between acute and chronic lesion stenting.

see table

Conclusion: These results demonstrate a very good overall secondary patency outcomes in patients who have had deep venous stents inserted. To maintain this degree of secondary patency a surveillance programme is essential as demonstrated by our 28% re-intervention rate.

Time (months)	3	6	12	18	24	36	48	60	66	85
Primary patency	97%	83%	79%	72%	71%	64%	46%	36%	36%	36%
Primary Assisted patency	98%	93%	90%	88%	87%	81%	72%	64%	52%	51%
Secondary patency	99%	96%	91%	89%	89%	85%	85%	75%	75%	75%

Patency rates over a 85 month period:

Author Disclosure: K Kemal: Nothing to disclose; **T Lane**: Nothing to disclose; **S Onida**: Nothing to disclose; **m hifny**: Nothing to disclose; **N Burfitt**: Nothing to disclose; **A Davies**: Nothing to disclose