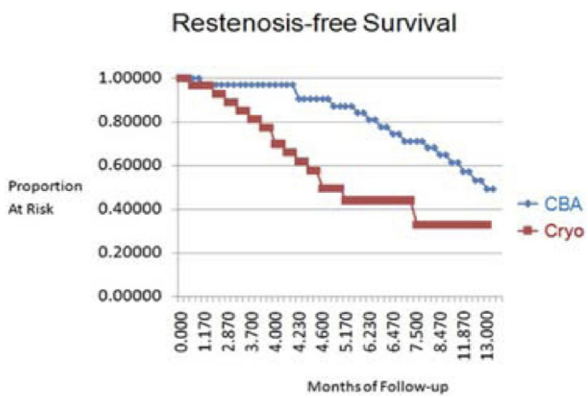

Anatomic Patterns of Failure After Infrainguinal Percutaneous Revascularization

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Objective: Percutaneous revascularization (PTA) of infrainguinal occlusive disease is associated with a significant recurrence rate, with a 15% to 25% reintervention rate to maintain secondary patency. Other studies have focused on clinical predictors of such failure, but little is known of the anatomy of such failures, which is the goal of this study.

Methods: Of 1100 limbs that underwent infrainguinal PTA from 2002-2007, 40% failed based on worsening ABIs, clinical symptoms, amputation, or reintervention. A total of 150 limbs underwent femoral-popliteal PTA and had follow-up arteriograms for evaluation. Lesions were stratified into proximal, middle (adductor canal), and distal (popliteal). Angiographic findings from the initial PTA were compared with the follow-up study.

Results: Of the 150 limbs in the cohorts, 38% underwent initial PTA for critical limb ischemia, with 10% limb loss. The mean length of time to recurrence was 13.2 months, with 70% of patients recurring by that time point. The distribution of disease was not different between the initial PTA and the follow-up angiography (70% vs 64% [$P = .2$] proximal, 79% vs 78% [$P = .1$] middle, and 28% vs 30% [$P = .8$] distal femoral-popliteal). There was no change in multilevel disease from initial PTA either (64% vs 58% $P = .3$). Significantly more middle femoral-popliteal segments were initially occluded (25% proximal, 33% middle, and 12% distal; $P < .001$). An initially occluded segment did not increase the likelihood of new or worsening disease on repeat angiography. Tibial runoff deteriorated in 11% of patients but did not correlate with amputation, initial lesion location, or severity. Initially, 40% of the limbs treated underwent stenting in at least one segment; this did not predict worsening disease. In 68% of the limbs treated, the site of recurrence was the same as the initial PTA site, and in 16%, the disease was immediately adjacent to the initial PTA site.

Conclusions: Recurrent lesions after infrainguinal PTA tend to occur within the first year and most occur at or immediately adjacent to the site of initial treatment. There was no difference in the location of the recurrent disease when compared with primary PTA site. Presence of an occlusion was not predictive of worsening disease within the femoral-popliteal artery or the location of the recurrence.

Scientific Session II

Role of IVUS Versus Venograms in Assessment of Iliac-Femoral Vein Stenosis

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Objective: Lower extremity venous stasis disease could be related to outflow obstruction in the iliac-femoral vein segments due to stenosis or extrinsic compression. Conventional methods to assess these vein segments include transcutaneous ultrasonography and ascending venography. The transcutaneous approach has a low sensitivity, and venography can miss significant lesions as the assessment is undertaken in a single view. We assessed the role of intravenous ultrasound (IVUS) imaging in detecting the location as well as the degree of stenosis in the iliac-femoral vein segments.

Methods: IVUS and ascending venography were used to evaluate outflow obstruction/stenosis in 104 patients with chronic lower extremity venous stasis disease. The location and degree of any stenosis were noted. A significant stenosis was defined as a 50% reduction in the diameter of the vein relative to the adjacent vein segments. Patients with significant stenosis underwent venous stenting to restore outflow. The results of venography and IVUS were compared.

Results: Forty-six (44.2%) patients had no evidence of stenosis on venography or IVUS and hence received no stents, but 58 (55.8%) had significant stenotic lesions on IVUS. Among those, 10 (17.2%) had no detectable lesion on venogram and would have been missed. In 24 patients (41.4%), venography failed to identify all stenotic lesions or resulted in inaccurate localization of the lesion. Only 24 patients (41.4%) had stenotic lesions on venogram that conformed anatomically to the lesions detected on IVUS.

Conclusions: In assessing patients with lower extremity venous stasis disease for iliac-femoral vein stenosis/obstruction, venography alone can result in poor localization (50% specificity) and can even miss significant stenotic lesions (82.8% sensitivity). IVUS is a more sensitive and accurate method and should be included in all such evaluations.

Venous Ablation Can Be Performed Safely on High-Risk Patients

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Introduction: Patients with a previous history of deep vein thrombosis (DVT) or a family history of DVT are considered at high risk for thrombotic complications (DVT) after endovenous ablation (EVA). In this study, we examine our outcomes on patients presenting for "high-risk" EVA.

Methods: We reviewed our vascular registry for all patients undergoing EVA from 2006-2008. All patients were evaluated with venous ultrasonography and initially treated with a minimum of 3 months of compression stockings. EVA candidates were treated with laser ablation or radiofrequency ablation using a standardized technique. All patients who were identified as potential high risk for DVT had hematology consultation and were prescribed periprocedural anticoagulation prophylactically. Postprocedural ultrasonography was performed at 1 week, 1 month, 3 months, and every 6 months thereafter for 2 years.

Results: A total of 685 EVA were performed (480 laser, 205 radiofrequency), most in the great saphenous veins. A subgroup of 15 patients (2.1%) was identified to be high risk for DVT. Mean age was 44 years. CEAP classifications ranged from 2 to 6, with ankle edema being the most common diagnosis. The immediate technical success rate was 99.6%. Access failure occurred in three patients (0.4%). The most common postprocedural complications included bruising in 203 (29%), phlebitis in branch varicosities in 28 (4%), and heat induced thrombus formation in 13 (1.9%). There was no significant difference between laser and radiofrequency groups. None of the presumed hypercongealable patients developed thrombotic complications. There were no deaths in this series. Mean follow-up was 6 months (range, 1-27 months). Ancillary procedures were performed in 19%, including stab phlebectomy, sclerotherapy, and perforator injection or ablations. All patients remain successfully ablated to date.

Conclusions: In our experience, EVA can be safely performed in appropriate candidates with excellent clinical outcomes and minimal morbidity and mortality. Preliminary data suggests that patients with hypercoagulable conditions or strong family history of thrombosis can be considered for EVA with periprocedural anticoagulation.

Clinical Outcomes With Covered Stent Placement for Central Venous Occlusive Disease in Hemodialysis Patients

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Objectives: The use of covered stents (CSs) has been proposed as a new treatment option for central venous occlusive disease (CVOD) in hemodialysis patients. Among its advantages include the mechanical support of bare-metal stents while providing an inert and stable intravascular matrix for endothelialization. The aim of this study is to evaluate the efficacy and durability of CSs in treating central venous stenosis while preserving hemodialysis access patency.

Methods: A retrospective review was performed in all patients with symptomatic CVOD manifested with venous hypertension or access malfunction and treated by means of CS from April 2007 to March 2010. The Gore Viabahn Endoprosthesis stent graft was implanted in all cases. Patients' demographics, stenotic lesions location, stent graft, and patency were determined; complications, reintervention, and factors influencing their outcomes were examined.

Results: Twenty patients (60% men) with a mean age of 56 years (range, 28 to 86) primarily underwent CS placement for CVOD. Of the 20, 18 (90%) had history of arterial hypertension, 13 (65%) were diabetic, and 4 (20%) had peripheral arterial disease. All patients had a history of multiple central catheter placements. The indications for the CS placement were access malfunction with angioplasty-resistant lesions in 12 patients (60%)

and symptomatic venous hypertension in the remaining 8 (40%). Technical success and resolution of the symptoms was achieved in all cases. Locations CS placements are summarized in the Table. The mean follow-up was 8.4 months, 3 cases (15%) of thrombosis occurred within the first 3 months of stent placement requiring percutaneous thrombectomy and percutaneous transluminal angioplasty (PTA). Three patients required PTA for restenosis. The overall primary patency, assisted primary patency, and secondary patency were 66%, 94%, and 100% at 12 months, respectively.

Conclusion: Endovascular therapy with CS for CVOD is safe and effective in hemodialysis patients. In the present series, we demonstrated promising results with higher primary and secondary patency than angioplasty and bare-metal stents. CS placement should be considered in recalcitrant lesions; however, further prospective and randomized studies are necessary to determine whether CSs provide superior long-term results to those achieved with PTA and bare-metal stents.

Location of covered stent placements

Location	*Subclavian vein*	*Innominate vein*	*Both veins*
Right	1	5	5
Left	4	5	0

Placement Issues for Hemodialysis Catheters With Pre-existing Central Lines and Catheters

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Background: It has been a widely accepted practice that a previously placed pacemaker was a contraindication to placing a hemodialysis catheter in the ipsilateral internal jugular vein. Fear of dislodging pacing wires, tunneling close to the battery site, or causing venous obstruction has been a concern for surgeons and interventionalists alike. We suggest that this phobia is unfounded.

Methods: This is a retrospective review of 600 hemodialysis catheters placed between 1999 and 2009. For each hemodialysis catheter that was placed, the perioperative chest x-ray image was examined to evaluate for pre-existing pacemakers and central catheters.

Results: We found 20 pacemakers and 19 central catheters on the same side of the neck as the hemodialysis catheter that was placed in the ipsilateral jugular vein. Subclavian central catheters were also left in place for these procedures. The mean age of the patients was 73.6 ± 12 years (median, 76 years). No patient exhibited malfunction or dislodgment of the central catheter, the pacemaker, or automated implantable cardioverter-defibrillator (AICD), or evidence of upper extremity venous obstruction based on signs symptoms or duplex examinations.

Conclusions: Since the updated Disease Outcomes Quality Initiative (DOQI) guidelines call for placement of the arteriovenous fistula opposite the side of the hemodialysis catheter, pacemakers and AICDs, we suggest the policy of placing the hemodialysis catheter in the ipsilateral internal jugular vein is safe and spares the contralateral limb for arteriovenous fistula creation.

Scientific Session II

Cervical Ribs—A Rare Entity but Clinically Significant

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Objectives: Owing to their unique presentation, we reviewed our operative experience in patients with large, clinically significant cervical ribs.

Methods: This was a retrospective review of a prospectively acquired database.

Results: Between January 2006-December 2009, 19 patients (16 women) with cervical ribs underwent first rib resection and cervical rib resection. Patients were an average age of 35 years (range, 16-51 years). Fourteen patients had sustained arterial compromise as a result of their cervical ribs. Six patients presented with arterial thrombosis, and two also had a venous thrombosis at presentation. Five patients had undergone thrombolysis, one had received angioplasty, and thrombectomy procedures had been attempted in two. Three patients had visible and palpable pulsatile masses: one was painful, and one had embolized. One patient had had a previous partial cervical rib resection. Three patients underwent contralateral prophylactic operations due to the presence of a cervical rib. The remaining five patients had neurogenic symptoms as the indication for their operation. A transaxillary approach was used in 20 of the 22 operations to remove both the first rib and the cervical rib. The cervical rib was fused to the first rib in 17 of 22 cases (77%).) A supraclavicular approach was used in two patients to resect the axillosubclavian aneurysm and place an interposition graft. All patients did well but required postoperative physical therapy to gain strength and range of motion.

Conclusions: Significant cervical ribs are large and frequently are fused to the first rib, which results in arterial compression or aneurysm formation. Thrombosis and embolization can occur and causes arterial ischemia. In these patients, both the cervical rib and the first rib must be removed to relieve the arterial compromise and can be done safely through a transaxillary approach. Only those patients with aneurysms who need to have the artery resected and replaced should undergo a supraclavicular approach.

Scientific Session III

Clinical Outcomes for Hostile Versus Favorable Aortic Neck Anatomy in Endovascular Aortic Aneurysm Repair Using Modular Devices

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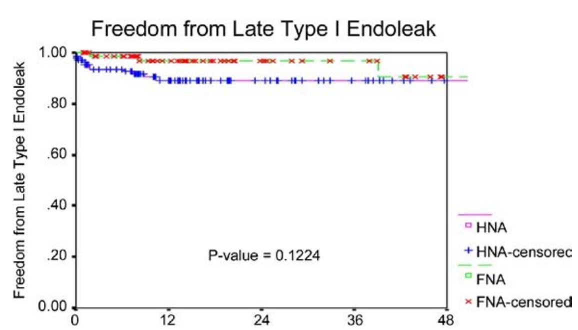
Objective: This study analyzed the clinical implications of various clinical features of proximal aortic neck anatomy in EVAR using modular devices.

Methods: A total of 258 EVAR patients were divided into favorable (FNA) or hostile neck anatomy (HNA). HNA was defined as having one or more of the following features: length of <10 mm, angle of >60°, diameter of >28 mm, ≥50% circumferential thrombus, ≥50% calcified neck, and reverse taper.

Results: Thirty-seven percent of patients had FNA and 63% had HNA. The HNA group included 46 angulated, 20 short, 19 dilated (>28 mm), 16 calcified, 93 thrombus lined, and 51 reverse tapered. The technical success was 99%. The mean follow-up was 22 months (range, 1-78 months). The perioperative complication and death rates for FNA were 3% and 0% vs 16% and 3% for HNA (P = .0027). Operative blood loss, contrast volume, and operative time were similar for both groups. Proximal type I early endoleaks occurred in 9% of FNA vs 23% for HNA (P = .0068). Intraoperative proximal aortic cuffs were used to seal endoleaks in 8% for FNA vs 22% for HNA (P = .0044). AAA expansion was noted in 6% for FNA vs 7% for HNA (P = .8509). Rates of freedom from late type I endoleaks at 1, 2, 3, and 4 years were 97%, 97%, 97%, and 90% for FNA vs 89%, 89%, 89%, and 89% for HNA (P = .1224; Fig 1). Graft patency rates at 1, 2, and 3 years were 99%, 99%, and 99% for FNA vs 97%, 92%, and 90% for HNA (P = .0925; Fig 2). The rates for late interventions were 95%, 90%, 90%, and 90% for FNA vs 95%, 93%, 91%, and 85% for HNA (P = .6902; Fig. 3). The survival rates were 93%, 84%, 76%, and 76% for FNA vs 88%, 82%, 74%, and 66% for HNA (P = .2631; Fig. 4). Multivariate logistic regression analysis revealed that reverse taper was a significant predictor for early type I endoleak (OR, 5.25, P < .0001), reverse taper (OR, 5.95, P < .0001), and neck length (OR, 4.15, P = .0146) were predictors for aortic cuff use and circumferential thrombus (OR, 2.44, P = .0448) and neck angle (OR, 3.38, P = .009) were predictors for perioperative complications.

Conclusions: Patients with HNA can be treated with EVAR, but with higher rates of early type I endoleak and intervention. However, the mid-term outcomes were similar to FNA.



All Risk	FNA	83	46	24	17	8
	HNA	135	70	40	29	16
Percent	FNA	100%	97%	97%	97%	90%
	HNA	100%	89%	89%	89%	89%
SE	FNA		2.2%	2.2%	2.2%	6.6%
	HNA		3.0%	3.0%	3.0%	3.0%