

## **#1 - PERIPROCEDURAL COMPLICATION RATES ARE EQUIVALENT BETWEEN SYMPTOMATIC AND ASYMPTOMATIC PATIENTS UNDERGOING CAROTID ANGIOPLASTY AND STENTING**

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**Objectives:** Patients with neurologic symptoms who undergo carotid endarterectomy (CEA) have a higher incidence of stroke and death in the perioperative period than those with asymptomatic carotid disease. This study examines the outcomes of symptomatic and asymptomatic patients undergoing carotid stenting (CAS).

**Methods:** From 2003 and 2006, 201 CAS procedures were performed in 193 patients (117 men, mean age 73±10 years), of which 143 were for asymptomatic (AS) and 59 for symptomatic (S) disease. Preoperative neurologic symptoms included recent ipsilateral CVA (29%), TIA (50%), and amaurosis fugax (22%). 201 carotid stents were placed (107 Acculink, 43 Wallstent, 23 Precise, 21 NexStent, 3 Exponent, 3 Xact, 1 Herculink) and 198 protection devices were used (79 Accunet, 53 EPI Filterwire, 43 PercuSurge, 20 Angiogard, 3 EmboShield). Mean follow up was 31 weeks.

**Results:** The groups were matched in terms of demographics and comorbidities (CAD, HTN, hyperlipidemia, DM, PVD, smoking, and COPD). There was no significant difference in anatomic risk factors (neck irradiation (S-3%, AS-6%), prior CEA (S-14%, AS-14%), bovine arch (S-23%, AS-16%)), and the types of embolic protection devices and stents used were similar between groups. The mean percentages of pre-intervention carotid stenosis were equal (S- 88%, AS-88%), and the technical success rate was 99%. The incidence of CVA, MI, and death was equivalent between groups (Table).

**Conclusions:** CAS with cerebral protection can be performed safely in both symptomatic and asymptomatic patients. The presence of preoperative neurologic symptoms does not significantly increase the risk of adverse events in the perioperative period.

## **#2 - RESTENOSIS AFTER CAROTID STENTING REMAINS LOW EVEN IN PATIENTS WITH PRIOR NECK IRRADIATION OR ENDARTERECTOMY**

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### **BACKGROUND AND PURPOSE:**

Carotid angioplasty and stenting (CAS) is an appealing option for patients with prior neck irradiation/dissection or carotid endarterectomy (CEA). We compared restenosis in these patients to de novo lesions.

### **METHODS:**

Retrospective review, May 2001-July 2006. CAS was performed using cerebral embolic protection devices coupled with self-expanding nitinol stents. Restenosis was defined as a peak systolic velocity (PSV)  $\geq 170$  cm/s, end diastolic velocity (EDV)  $\geq 120$  cm/s, and 50% PSV increase over immediate post-operative values. Adjunctive imaging was obtained when restenosis was suspected.

### **RESULTS:**

We reviewed 263 patients (272 arteries) having CAS. Fifty-eight (64 arteries) had history of ipsilateral CEA, ipsilateral neck dissection, or neck irradiation ("hostile necks"). The 30-day event rate for the entire group was major stroke (1.5%), minor stroke (0.7%), and death (0.4%) – none in patients with "hostile necks". Restenosis for all 272 arteries was 2.2%. There was no significant difference between restenosis in de novo lesions (1.5%) and the "hostile neck" group (4.7%) ( $p=0.11$ ). 50% of the restenosed arteries (3/6) were "hostile neck" patients. Repeat angioplasty with or without stenting was completed on 4 of the restenosis patients, with no periprocedural stroke or death and no restenosis.

### **CONCLUSION:**

Patients with previous neck irradiation/dissection or CEA are not at increased risk for restenosis, periprocedural CVA, or death when compared to CAS patients without these risk factors. CAS is a safe and durable procedure for patients with a "hostile neck" and does not have a higher incidence of restenosis.

### #3 - NON-HEMORRHAGIC COMPLICATIONS OF PERCUTANEOUS FEMORAL ARTERIAL ACCESS

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**Background:** Femoral vascular closure devices have been adopted by many cardiac and peripheral interventionalists to decrease bleeding complications and to facilitate early ambulation, increase patient comfort, and optimize interventional suite efficiency. With the routine use of vascular closure devices, we and others have recognized a transition from minor bleeding complications to complex ischemic and inflammatory injuries of the femoral artery. In particular, we have observed a number of complications with delayed presentation, including disabling claudication, ischemic rest pain, and groin infections. We sought to describe our experience with non-hemorrhagic complications related to percutaneous femoral arterial access.

**Methods:** The operative registries of the attending vascular surgeons at one academic and two community hospitals were retrospectively reviewed to identify non-hemorrhagic complications of percutaneous femoral arterial access. Individual demographic and clinical data, including atherosclerotic risk factors, were collected. The clinical presentation, method of diagnosis, and technique of vascular reconstruction were analyzed. Details of the femoral catheterization, including indication, type of intervention, sheath size, and method of percutaneous femoral vascular closure were collected. The time from femoral catheterization to presentation as well as length of follow-up was calculated. Morbidity and mortality related to the corrective operation were determined.

**Results:** From January 2001 to August 2006, 23 patients with non-hemorrhagic percutaneous femoral arterial access complications were identified. The group included 7 male and 16 female patients and the mean age was 60 years (range 36-81 years). Comorbidities included hypertension, tobacco use, dyslipidemia, type 2 diabetes mellitus, and coronary artery disease. Peripheral arterial disease coexisted in 48% of patients. The most frequent indication for catheterization was diagnostic and therapeutic coronary intervention (n=20), followed by cerebral aneurysm embolization (n=2) and peripheral arterial intervention (n=1). Femoral vascular closure devices were utilized in 70% of cases. Clinical presentation included acute limb ischemia (n=10), chronic limb ischemia (n=11), and groin infection (n=2). Diagnostic modalities primarily included invasive and CT arteriography. The vast majority of patients (n=20) required thromboendarterectomy with patch angioplasty supplemented by open balloon angioplasty and stent implantation in 7 patients. Two patients required femoropopliteal bypass with vein graft. Each groin infection necessitated soft tissue and arterial debridement with patch angioplasty, one of which required a rotational sartorius muscle flap. Fourteen (61%) of the complications were associated with femoral vascular closure devices, of which 13 occurred in female patients. The median time to presentation following femoral catheterization was 3 days (range 1-271 days). Eight patients were referred greater than 3 weeks after the index catheterization. Mean follow-up was 3.5 months (range 1-30 months). Limb salvage was achieved in all patients. No mortalities occurred.

**Conclusions:** Non-hemorrhagic percutaneous femoral arterial access complications are an uncommon but increasingly important complication of femoral catheterization. A disproportionate number these complications are associated with femoral vascular closure devices, especially in women. Complex open and endovascular therapy is often required to correct the arterial injury.

#### **#4 - VERTEBRAL ANGIOPLASTY AND STENTING USING CEREBRAL PROTECTION IN SYMPTOMATIC PATIENTS.**

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**Purpose:** The optimal management of vertebral artery stenosis has received little attention, and is poorly understood with limited surgical treatment options. The union of the vertebral artery to a single vessel (basilar artery) before branching again to supply the brain can result in a major cerebro-vascular accidents in the event of embolic debris released during vertebral angioplasty and stenting (VAS). This may be responsible for the under diagnosis and treatment of cervical vertebral artery lesions. We report the use of cerebral protection devices during VAS as means to prevent intra-operative vertebro-basilar strokes.

**Methods:** Between 2003 and 2005, 10 patients with 11 stenoses of the extracranial vertebral artery that displayed a diameter reduction at least 80% underwent elective stenting. All patients had failed conservative medical management and had ischemic events clinically referable to the stenosis. Two of the 10 patients demonstrated computed tomogram evidence of vertebrobasilar infarcts. All patients had a pre-procedural Duplex exam and were evaluated by a neurologist. Follow-up consisted of a neurological exam and a Duplex scan at 6-month intervals.

**Results:** Stent deployment was technically successful and completion angiography confirmed elimination of the high-grade stenosis. One patient had tandem lesions requiring VAS at both locations. All patients had significant contralateral vertebral disease; aplasia in 7 and total occlusion in 3. None of the patients had associated treatable carotid artery disease; two had ipsilateral internal carotid artery occlusion. The Filter wire was used for cerebral protection in one patients, the Accunet in 3, and the Emboshield in 6 patients. Balloon mounted coronary platform stents were used in 6 (drug coated 2), nitinol stent in 4, and isolated angioplasty in 1. There were no adverse neurological events. Nine patients were discharged the following day and one patient on the 3rd post-op day due to severe nuchal pain at the site of the nitinol stent. All patients were symptomatically improved. During a mean follow-up interval of  $13.2 \pm 7$ -months recurrent neurological events were not observed and Duplex evidence of restenosis was noted in one patient.

**Conclusion:** The routine use of cerebral protection may be an important adjunct to VAS warranting further large scale clinical studies.

## #5 - MANAGEMENT OF SPONTANEOUS SUBCLAVIAN VEIN THROMBOSIS IN THE THROMBLYTIC ERA

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Introduction: Spontaneous subclavian vein thrombosis (also called "effort thrombosis" because of its frequent association with physical exertion) is usually related to extrinsic compression of the vein at the costoclavicular junction. Our experience with this entity over the past decade was reviewed with specific focus on the role of thrombolysis.

Methods: All patients treated for this problem at our institution over the past decade were identified and records retrospectively reviewed. The diagnosis was made either by venography or duplex ultrasound.

Results: From 1996 to June, 2006, a total of 34 patients were treated. Mean age was 33 (range 18 to 69) years; 86% presented with arm swelling and 69% with pain, and half gave a history of an inciting factor. Thrombolysis prior to planned surgery was performed in 26 patients, while surgery alone was performed in 8. Time since onset of symptoms was the major factor influencing this decision, being a mean of 18 days in the 26 referred for lysis but 3 months to many years in the 8 who underwent surgery alone. In patients undergoing lysis, flow was restored in 16 (62%), of whom 9 (35%) had a residual lesion. All but one of these patients then underwent thoracic outlet decompression (TOD) with or without angioplasty, and 62% underwent venous reconstruction. Patients not undergoing lysis were managed by TOD, with 38% undergoing venous reconstruction:

Anticoagulation only TOD±plasty V. Recon (% of total)

Successfully lysed (16) 0 6 10 63%

Unsuccessfully lysed (10) 1 3 6 60%

Lysis not attempted (8) 0 5 3 38%

Complications occurred in 31% of those undergoing lysis followed by surgery, and in 63% of those undergoing surgery only. At mean followup of 33 months, symptom resolution was almost universal. Primary patency at five years was 84 and 88% in the two groups, respectively.

Conclusions: The primary factor influencing treatment choice at our institution is time since onset of symptoms. Using this algorithm, 62% of patients presenting acutely were felt to require venous reconstruction after lysis whether lysis was successful or not, while only 38% of those who presented months to years after occlusion were felt to need (or to benefit from) reconstruction. While complications were not rare, those undergoing lysis followed by surgery actually had fewer problems than those undergoing surgery alone. These patients seem to be two different groups, and while optimal therapy cannot be defined based on this retrospective review, our algorithm results in excellent overall long-term patency and symptom relief.

## #6 - INTRAVENOUS HEPARIN INCREASES WOUND COMPLICATIONS IN LOWER EXTREMITY ARTERIAL REVASCULARIZATION

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**Objectives:** Sub-therapeutic intravenous (IV) heparin is used to prevent graft thrombosis, improve patency and avoid complications of full anticoagulation in the setting of disadvantaged bypass grafts. We evaluated the role of IV heparin on peri-operative outcomes, graft patency, and limb salvage.

**Methods:** We reviewed all lower extremity arterial revascularizations performed in the year 2000 for heparin use and outcomes. Statistical analysis was performed using chi-square, log rank, and Kaplan Meier analysis.

**Results:** A total of 318 lower extremity arterial revascularizations performed in 283 patients were categorized to those who received no IV heparin (Group 1; n=242), therapeutic IV heparin (Group 2; n=35), and sub-therapeutic low dose IV heparin (Group 3; n=41).

Baseline demographics were similar across groups. Post-operative MI and 30-day mortality rates were also similar. Peri-operative IV heparin use prolonged hospital stay. Therapeutic and sub-therapeutic heparin was associated with increased wound hematomas (Table 1). Sub-therapeutic heparin was associated with increased wound infection, wound dehiscence and increased blood transfusion requirements (Table 1). Therapeutic heparin was also associated with increased rates of hemorrhage. One year graft patency rates were 76.1% in Group 1 and 60.4% in group 3. Limb salvage was 88.4% in controls and 73.7% in the sub-therapeutic heparin group at one year. Sub-therapeutic heparin use was associated with significantly decreased long-term graft patency ( $p=0.04$ ) and limb salvage ( $p=0.003$ ).

**Conclusions:** Sub-therapeutic IV heparin is associated with increased wound complications, equal to or greater than therapeutic heparin, and may not improve graft patency and limb salvage in disadvantaged grafts.

HEPARIN:	GROUP 1 (%) NONE	GROUP 2 (%) THERAPEUTIC	GROUP 3 (%) SUB-THERAPEUTIC
Hematoma	6.2	48.4 ( $p<0.001$ )	28.9 ( $p<0.001$ )
Wound Infection	6.2	6.5 ( $p=NS$ )	31.1 ( $p<0.001$ )
Wound Dehiscence	0.8	3.2 ( $p=NS$ )	6.7 ( $p<0.007$ )
Median Length of Stay (days)	5	8	7
Hemorrhage	1.7	6.5 ( $p<0.007$ )	2.2 ( $p=NS$ )
Transfusion	50	61.3 ( $p=NS$ )	71.1 ( $p<0.008$ )
30 Day Graft Occlusion	1.7	3.2 ( $p=NS$ )	6.7 ( $p<0.046$ )
1 yr Patency	76.1 (SE 3.4)	62 (SE 18.9)	60.4 (SE 8.2)
1 yr. Limb Salvage	88.4 (SE 2.6)	68 (SE 11.5)	73.7 (SE 5.7)

Table 1

## #7 - ROUTINE DUPLEX SCANNING IN GRAFT SURVEILLANCE AND FACTORS PREDICTING FAILURE.

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### INTRODUCTION

The concept of graft surveillance aims to identify those grafts that are at risk of failure as intervention in a patent, but failing graft, results in improved long term patency and limb salvage rates compared to rescue of the occluded graft. The natural history of stenoses in such grafts has been studied but a consensus opinion has not been reached. Disagreement also exists as to which types of graft benefit the most from surveillance and whether patient factors such as diabetes and smoking status have an effect on graft survival. This is the first study to attempt to clarify the natural history of stenoses within lower limb bypass grafts.

### AIMS

Our aims were, primarily to clarify the natural history of intermediate graft failure as a consequence of myointimal hyperplasia. Secondly to identify which patients and grafts are at a higher risk of failure and at what time points this is most prevalent.

### METHODS

Serial vascular laboratory and clinical data of 212 infrainguinal lower limb grafts in 197 patients was analysed. Follow up within the surveillance programme was by focused examination with colour flow duplex ultrasound of grafts at 0, 1, 3, 6, 12 and 18 months with respect to surgery. Stenoses were graded according to the peak systolic velocity ratio (PSVR). Outcomes were correlated with retrospectively collected data regarding patient demographics, smoking status, concurrent medication, co-morbidity and operative factors such as distal target vessel and conduit.

### RESULTS

21.6% of grafts occluded during the programme. Overall 34 grafts underwent a salvage procedure and the majority of these were carried out at the six month time point. 56.6% of occlusions were preceded by a stenotic lesion. De novo occlusions accounted for 95.9% of occlusions in the prosthetic group and 66.5% among the femoro-distal grafts. As a group, vein grafts were more likely to develop a progressive stenosis prior to occlusion with 58.3% of occlusions in this group pre-dated by a stenotic lesion. Non-significant graft stenoses, were common and had a variable natural history with over 40% resolving or failing to progress. 56.2% of grafts remained lesion free throughout the study period. Stenoses were more common at the proximal anastomosis in the vein graft cohort. There were low rates of significant stenoses within the prosthetic group. These lesions were more likely to occur at the distal anastomosis but were poor predictors of occlusion. Extremes of age were a predictor of poor outcome. Statin use postoperatively was protective against the development of significant stenosis and occlusions, particular in the above knee grafts ( $P= 0.03$ ). Surprisingly, preoperative smoking status was neither predictive of occlusion nor the development of significant lesions. The presence of hypertension, hypercholesterolaemia or diabetes was not predictive of poor outcome.

### DISCUSSION

Our findings suggest that graft surveillance is a valid method for detecting the presence of significant lesions at high risk of failure without intervention yet despite the intensive follow up, the programme failed to detect lesions prior to occlusion in a large percentage of prosthetic and femoro-distal grafts and so perhaps this group are poorly served by graft surveillance.

## #8 - LATE FOLLOWUP AFTER EVAR: CAN WE FORGO CT SCANNING IN CERTAIN PATIENTS?

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Introduction: Current recommendations for followup following endovascular aneurysm repair (EVAR) include contrast CT at yearly intervals for an indeterminate period, with the disadvantages of cost and contrast administration. Based on our experience, we hypothesize that if a patient has a shrinking sac and no leak seen at one year, no problems will occur that cannot easily be identified by ultrasound, history, and physical examination □ i.e., CT is not needed after the first year in patients who meet these criteria. In addition, we sought to determine whether the type of device has an influence on this issue.

Methods: All patients undergoing EVAR at our institution since 1999 were identified, and charts reviewed with specific attention to AAA and sac size over time, endoleak, and the need for secondary intervention. Patients receiving grafts not currently commercially available (75), those that died, were lost to followup, or had followup less than 18 months (240), and those without testing performed at one year (7) were excluded as not relevant to this hypothesis.

Results: Of 415 EVARs performed during this period, 322 were excluded as above, leaving 93 patients who met all criteria. Cook Zenith, Medtronic AneuRx, and Gore Excluder were used in 63, 18, and 12 cases, respectively. 18 patients required secondary interventions, most commonly after AneuRx implantation:

Graft All sec. int. (18) Within one year (11) >1 year (7)

Zenith (63) 8 (13%) 6 2

AneuRx (18) 7 (39%) 3 4

Gore (12) 3 (25%) 2 1

Zenith v AneuRx  $P < .02$  Zenith v AneuRx  $P < 0.02$

At one year, 71 patients (76%) had shrinking sacs without endoleak. Only two of these patients had subsequent problems: One patient (AneuRx) developed a type I endoleak and enlarged to 7cm over 24 months (explanted), and the other (AneuRx) developed sudden limb occlusion at 13 months (revised). At last followup (mean 31 months), only 5 patients did not have shrinking sacs: 3 were without change but had no leak, 1 (Zenith) is 3mm larger at 18 months but has no leak and is being observed, and 1 (AneuRx) underwent a distal extension for leak at 3 years but is still enlarging at 48 months.

Conclusions: No patient at our institution with a commercially-available graft implanted since 1999 whose sac was shrinking AND had no endoleak one year after EVAR has had a subsequent problem that was not immediately recognizable by ultrasound or history and exam. In our experience the rate of secondary intervention is highest with the AneuRx device, and both patients with problems despite a reassuring one-year exam had AneuRx devices. CT scanning may not be needed in patients who are doing well after the first year, especially if repaired with Cook Zenith or second generation Gore Excluder grafts.



## #9 - REDO PEDAL BYPASS SURGERY AFTER PEDAL GRAFT FAILURE: GAIN OR GADGET?

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### Introduction:

Pedal bypass failure is not always associated with limb loss. Management of critical limb ischemia after failure is controversial. The aim of this study is to evaluate the results of redo bypass procedures to foot arteries in the absence of alternative tibial outflow arteries.

### Methods:

Data of patients undergoing pedal bypass within a 14-year period were reviewed. Outcomes after early (< 30 days) and late redo procedures (> 30 days) were examined. SVS reporting standards were applied.

### Results:

Out of 335 pedal bypass grafts, 22 pedal redo bypass procedures were identified in 20 patients after previous pedal graft failure (6.6%). 59% were male, median age: 64.8 yrs (range: 55 □ 80 yrs); diabetes: 90.9%, hypertension: 86.4%, coronary disease 40.9%;, renal disease: 31.8%. 7 patients were operated for early failure and 15 for late failure (median: 186 days). The primary graft conduit was ipsilateral greater saphenous vein (GSV) in 19 (86.4%), alternative vein in 2 (9.1%), one ePTFE. Redo graft conduits: ipsilateral GSV in 10 (45.5%), arm vein in 5 (22.7%), contralateral GSV in 3 (13.6%), lesser saphenous vein in 1 (4.5%), homologous artery in 3 (13.6%). The same target artery was used in 86.4%, at the initial site in 59.1%, more distally in 27.3%. Redo revascularization for early failure was successful only once (14.3%). Median follow up was 476 days after late redo. 8 grafts failed after a median of 102 days, requiring amputation in 5.

### Conclusions:

The availability of adequate autologous conduit is the limiting factor for redo procedures. Lack of alternative outflow sites add to the difficulty of target artery dissection. Redo for early failure should not be offered routinely. Acceptable patency and extension of limb salvage can be achieved with redo procedures for late pedal bypass failure.

## #10 - ANTIBIOTIC PROPHYLAXIS IN VARICOSE VEIN SURGERY: A DOUBLE BLIND RANDOMISED CONTROLLED CLINICAL TRIAL

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### INTRODUCTION

Wound infection rates of up to 13% have been reported following varicose vein surgery. The value of antibiotic prophylaxis in clean surgery is disputed. This double blind, randomised controlled clinical trial aimed to assess the value of antibiotic prophylaxis in patients undergoing saphenofemoral ligation +/- great saphenous vein (GSV) stripping and phlebectomy.

### METHODS

Patients undergoing groin saphenofemoral ligation with or without GSV stripping and phlebectomy were randomised to receive co-amoxiclav 1.2g intravenously (n = 277 limbs) or placebo (n = 275 limbs) on induction of anaesthesia. Patients completed a personal logbook over the initial 10-day postoperative period. Wound assessment was performed on days 3,5,7,9 and 10 using a modified ASEPSIS score. Patients were reviewed at 14 days, and GP attendance, further antibiotic requirement, surgical intervention and need for readmission was determined.

### RESULTS

Groups were matched for demographics and wound infections risk factors. Post operatively, patients receiving prophylaxis had

- significantly lower ASEPSIS scores on days 3, 5 and 7 ( $p < 0.05$ )
- lower global ASEPSIS scores ( $p < 0.05$  Chi Squared test)
- fewer GP attendances (14.8% vs. 30.6%;  $p = 0.0017$  Chi squared test)
- reduced requirement for antibiotics (3.61% vs. 9.49%  $p = 0.0088$ ).

Univariate and multivariate analyses demonstrated worse outcomes associated with

- not receiving prophylactic antibiotics
- higher BMI
- male sex

Age was associated with seeing a GP postoperatively, but not with a worse outcome.

### CONCLUSION

Intravenous antibiotic prophylaxis significantly reduces wound related problems following varicose vein surgery. Furthermore, it also reduces the burden placed upon primary care in the post-operative period.

## #11 - ARE BRANCHED PEDAL ARTERY BYPASSES A DURABLE OPTION FOR LIMB SALVAGE?

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**Purpose:** Patients with critical limb ischemia and tibial occlusive disease, who also lack a patent dorsalis pedis artery, are at high risk for limb loss. Autogenous venous bypasses to branched pedal arteries are an option to extend limb salvage. In this study we review our experience with bypasses to branched pedal arteries.

**Methods:** From 1978 to 2006, 7579 autogenous vein bypasses were performed. Of these (4696) were in situ, (2016) excised, and (867) spliced vein. Forty-seven bypasses were performed to branches of pedal arteries. These bypasses (non-DP group) were compared to dorsalis pedis artery bypasses (DP- group) performed during the same time period (801 cases). Both groups were analyzed for indications, clinical parameters, operative strategies and long term outcomes.

**Results:** There was no significant difference in demographics or comorbidities between the two groups. Operative indication for all bypasses was critical limb ischemia. Conduits for non-DP groups were excised vein (55%), in situ (33%), and spliced vein (12%). Operative mortality for the two groups respectively was (4.3% vs 4.2%). Early and late bypass failure was slightly higher in non-DP vs DP group (4.3% vs 2.2%). Early limb loss was (6.4% vs 1.6 %). Primary and secondary patency for non-DP group at 3 yrs was 75% and 75% and the DP group was 70% and 80% respectively. Limb salvage at 3 years was 82% and 93% for non-DP and DP groups respectively. Overall patient survival at 3 years was 78% and 69% respectively.

**Conclusions:** Autogenous vein bypasses to branched pedal arteries is a durable limb salvage procedure for patients who lack patent tibial or dorsalis pedis arteries.

## #12 - DEVELOPMENT OF A NOVEL VASCULAR SIMULATOR AND INJURY MODEL TO EVALUATE SMOOTH MUSCLE CELL RESPONSE FOLLOWING BALLOON ANGIOPLASTY

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**Introduction:** Following angioplasty, denudation of endothelial cells causes exposure of smooth muscle cells (SMC) to normally unseen shear forces from blood flow. In-vivo studies investigate the response to angioplasty injury, but limited studies have been performed using in-vitro systems. In order to study SMC response in-vitro, a concurrent shear and tensile forces simulator has been developed to provide clinically significant levels of strain and shear stresses. Mechanical force influence can be isolated from biochemical signals and act as a preliminary step in pharmaceutical research for reduction or prevention of SMC proliferation following endovascular procedures.

**Design:** This simulator consists of six independent channels for increased statistical applicability and multiple analysis techniques. Design parameters were considered to resemble in-vivo conditions with minimal compromises, including laminar flow, developed flow at the cells, negligible wall boundary effects, and shear stresses. Cells are grown on a flexible membrane which oscillates at 60 cycles/min (1 Hz). Oscillation effects are investigated using the Computational Fluid Dynamics software FLUENT.

**Methods:** SMC are seeded on Type I collagen coated silicone membranes. Three study groups are: (1) Static (S) group where cells are not subject to mechanical strain, (2) "Normal Function" (T) which are only subject to applied tensile stress and (3) an injury model referred to as Injury+Shear+Tensile (IST), representing SMC that have undergone angioplasty and then exposed to shear stress. Cells in groups T and IST are subject to preconditioning strain of 0-4% cyclic strain for 2 hours prior to injury at gradually increasing frequencies of 0.1 Hz (30 min), 0.5 Hz (30 min), and 1.0 Hz (60 min). The IST group is additionally subject to preconditioning shear rate of 350 ml/min. The "normal function" group (T) is then subject to 0-4% cyclic strain for 8 hours which represents the lower end of arterial physiologic strain of 5-10% due to pulsation. Following preconditioning, the IST group is subject to two 12% static radial stretches for 1.5 minutes each with a 30 second interval between stretches. Following angioplasties, shear flow is resumed at 350 ml/min and 0-4% cyclic strain levels for 8 hours. The flow rate of 350 mL/min provides low wall shear stress (0.25 dynes/cm<sup>2</sup>) which promotes cell proliferation.

**Results:** Acute studies (8 hours) using rat aortic SMC demonstrate significant cell proliferation following angioplasty injury and shear exposure (IST group) when compared to "normal function" tensile exposure (T). DAPI analysis indicated a 75% increase in the number of cells of the IST group compared to the T group ( $p=0.001$ ). Western blot analysis paired with densitometry support proliferation findings by indicating a significant decrease in SMC  $\alpha$ -actin expression of the IST group ( $p= 0.015$ ) compared to both S and T groups, supporting the hypothesis of a more synthetic phenotype in the injury model.

**Conclusion:** These findings demonstrate the efficacy of the developed model for in-vitro angioplasty and the simulated mechanical environment to the cells. This is the first in-vitro model to allow the concurrent study of shear and tensile stress effects on SMC response to injury.

### **#13 - REPAIR OF THORACIC ANEURYSMS AFTER INFRARENAL AORTIC RECONSTRUCTION: IMPROVED RESULTS WITH ENDOVASCULAR REPAIR**

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**Purpose:** Patients undergoing open thoracic aneurysm repair after infrarenal aortic reconstruction have been noted to have a paraplegia rate between 10% - 20% in many studies. In this study, we review our results in patients undergoing endovascular thoracic aneurysm repair after abdominal aortic aneurysm (AAA) reconstruction for aneurysmal disease.

**Methods:** Prospective data was retrieved from our vascular registry. Patients who had prior aortic reconstruction and subsequent thoracic aneurysm repair were analyzed for perioperative complications, especially paraplegia, bowel ischemia, death and other significant morbidities.

**Results:** Over the past two years, 101 endovascular thoracic aneurysm repairs have been performed for elective and ruptured cases. Patients undergoing elective thoracic repair after AAA had spinal drainage catheters. No patients had permanent neurologic deficits postoperatively in elective thoracic repair after infrarenal aneurysm. One patient had para-paresis in patients undergoing urgent thoracic aneurysm repair 1/24 (4%). One death occurred in elective thoracic after AAA in a gentleman with chronic aortic dissection whose aorta ruptured after completion of the thoracic repair. Another patient in this group had colon ischemia requiring a colectomy who survived. When compared to all patients undergoing just elective thoracic repair, mortality was similar.

**Conclusion:** Patients undergoing thoracic aneurysm repair who had prior infrarenal AAA repair can undergo these procedures with acceptable mortality and morbidity. The postoperative complication of paraplegia appears to be minimized in this small group when a spinal drainage catheter is used. It does not appear to offer significant increased risk in those patients who have had prior AAA repair.

## #14 - OPEN REPAIR OF AORTIC ANEURYSMS INVOLVING THE RENAL VESSELS

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**Background:** The application of aortic endografts to infrarenal aneurysmal disease has resulted in increased complexity of open aneurysm repairs. Future endograft designs will likely accommodate this more complex anatomy. With this in mind, we reviewed the perioperative outcomes of patients undergoing open repair of intact juxtarenal (JRAA) and suprarenal (SRAA) aortic aneurysms including those in association with renal artery revascularization (RRAA).

**Methods:** All patients undergoing non-emergent, open repair of JRAA, SRAA, and RRAA were identified through an IRB approved vascular surgery patient registry at our institution. Repairs for infrarenal, thoracoabdominal (including type IV), and ruptured aneurysms were excluded. Preoperative medical comorbidities and perioperative outcomes were recorded. Primary end points of interest are hospital mortality and significant perioperative morbidity (any condition leading to prolonged hospital stay, transfusion, or requiring operation). Associations between outcomes and clinical variables were examined using univariate and multivariate techniques where appropriate.

**Results:** Between January 1997 and June 2006 678 patients underwent open operative repair of aortic aneurysms, including 110 JRAA, 12 SRAA, and 65 RRAA repairs. Hospital mortality and significant morbidity for the entire group were 6.4% and 24.6% respectively. Perioperative clinical variables and outcomes are summarized in table 1.

**Conclusions:** These results demonstrate a perioperative morbidity and mortality in keeping with previous reports of open complex abdominal aortic aneurysm repair. Future implementation of branch and fenestrated aortic endografts to treat similar aneurysms should approximate these results prior to wide spread acceptance.

TABLE 1	JRAA/SRAA (n=122)	RRAA (n=65)	P-value
Age*	71.2	69.5	NS
Male	91 (75%)	50 (64%)	NS
Race: White	114 (93%)	71 (91%)	NS
African Am	4 (3%)	3 (4%)	NS
Weight (Kg)*	82.4	79.1	NS
Mortality	8 (6.5%)	4 (6.2%)	NS
Significant Morbidity	28 (23.0%)	18 (27.7%)	NS
Operative time (min)*	287	386	<0.01
LOS (days)*	13.3	11.8	NS
ICU (days)*	6.7	6.5	NS
Ventilator (days)*	3.8	3.1	NS
Aneurysm size (cm)*	6.0	5.1	<0.01
Preop Creatinine (mg/dL)*	1.2	1.7	<0.01
Postop Creatinine (mg/dL)*	1.2	1.6	0.02

\*Mean

## #15 - PREDICTORS OF DELAYED OUTCOME FOLLOWING KISSING-STENT RECONSTRUCTION OF THE AORTIC BIFURCATION

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**Purpose:** to identify variables influencing the long-term patency rates of kissing stent reconstruction of the aortic bifurcation, and to evaluate the effect of □Geometric Mismatch□ between the protruding segment of the stents and the distal aortic lumen.

**Methods:** retrospective review of single institution stent-reconstruction procedures of the aortoiliac bifurcation from 1/1998 through 12/2004. Impact of demographic variables, risk factors, aortic anatomy, disease location and characteristics, stent material and design, and stenting configuration was assessed using univariate and multivariate analysis.

**Results:** 96 limbs were treated with aorto-bi-iliac stenting in 52 patients. Complete occlusions were present in 32 limbs (20 patients). Technical Success was achieved in 100% of limbs. Self-expanding stents were used in 46 procedures and balloon expandable stents in 6, number of stents per limb  $1.7\pm 1.0$  (range: 1-5), maximum stent diameter  $10.0\pm 0.8$  (range: 8-12 mm), total stenosis length  $59\pm 32$  mm (range: 8-160), stented length  $83\pm 48$  mm (range: 20-180). Median combined followup was 56 months (range 3-88). Hemodynamically significant restenosis developed in 5 patients (8 limbs). Management was endovascular in 3 (successful in both), and open in 2. The mortality rate during followup was 32%, predominantly from cardiopulmonary causes. Survival table analysis of the surviving population showed primary and primary-assisted patency at 96 months of 76% and 98%, respectively. Univariate analysis showed geometric mismatch (aortic lumen dead space around the protruding segment of the stents), female gender, and a hemodynamically significant residual stenosis to be significant predictors of restenosis. Multivariate logistic regression analysis showed female gender and geometric mismatch to be the only significant determinants of restenosis.

**Conclusions:** Geometric variables related to individual aortic anatomy and disease pattern (patient dependent) and stenting configuration (operator dependent) may have an impact on long-term patency.

## **#16 - COMBINED CATHETER AND OPEN SEQUENTIAL GRAFTS FOR LIMB SALVAGE REVASCULARIZATION: A VIABLE OPTION**

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**Background:** Autogenous vein grafting remains the gold standard for the treatment of lower ischemia gangrene, but this becomes more problematic with inadequate conduit. While endovascular therapies are becoming increasingly more common, most patients with lower extremity gangrene have long segment tibioperoneal occlusion making exclusively endovascular options difficult. A combined endovascular and open approach may provide an acceptable alternative when autogenous conduit is limited, but outcomes are not well defined.

**Methods:** All patients undergoing combined sequential superficial femoral artery (SFA) angioplasty with stenting and open infrapopliteal bypass with limited available autogenous vein grafts were identified from a prospectively maintained vascular database. All catheter-directed angioplasties and stents were performed retrograde through the open arterial exposure site used for bypass. Postoperative patency was assessed using duplex ultrasound at three and six month intervals. Primary patency, primary assisted patency, and limb salvage rates were determined using life table analysis. Perioperative morbidity and mortality were also analyzed.

**Results:** Twenty-one patients underwent combined SFA angioplasty and stenting with open infrapopliteal bypass grafting from December 2003 to August 2006. The combined one-year primary, assisted primary, and limb salvage rates were 61%, 75%, and 87% respectively. There were no deaths in the 30 day perioperative period. Patency loss occurred at the SFA angioplasty and stent location in one patient (4.7%), this patient had a patent vein graft and was converted to a standard composite sequential graft using PTFE. Three patients lost primary patency in their vein grafts and were revised to assisted primary patency with vein patch angioplasty of in-graft stenosis. Two patients died during follow-up with patent grafts. Major amputation occurred in one patient (n=1) for graft occlusion and in two patients (n=2) for limb infection.

**Conclusion:** Combined sequential superficial femoral artery (SFA) angioplasty and stenting with open infrapopliteal bypass grafting for patients with limb-threatening gangrene is an acceptable alternative when autogenous vein conduit is limited.



## **#17 - TRANSPERITONEAL VERSUS RETROPERITONEAL SUPRARENAL CROSS-CLAMPING FOR REPAIR OF AAA WITH A HOSTILE INFRARENAL AORTIC NECK**

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### **Objectives:**

Infrarenal AAA's harboring a hostile infrarenal aortic neck is unsuitable for EVAR and may require open repair with suprarenal aortic cross-clamping. We compared the results of transperitoneal vs. retroperitoneal approaches for repair of infrarenal AAA requiring suprarenal cross-clamping and the relative frequency of such techniques after incorporating EVAR into our clinical practice.

### **Methods:**

From 1998 through 2005, 478 elective infrarenal aortic aneurysms were repaired. There were 160 (33%) open repairs (71% transperitoneal and 29% retroperitoneal) and 318 (67%) endovascular repairs. In 38 cases (24%) suprarenal cross-clamping was performed (47% transperitoneal and 53% retroperitoneal incisions) for a hostile infrarenal neck. A hostile aortic neck was defined as: severe angulation ( $>60^\circ$ ), short neck ( $<15$  mm), extensive calcification or circumferential thrombus. The median age was 70 years and 47% were men; 16% had diabetes mellitus, 29% pulmonary disease, 53% coronary artery disease, and 11% renal insufficiency. The median aneurysm size was 6.0 cm. A retrospective analysis was performed to compare 30 day postoperative outcomes between the trans- and retroperitoneal patient cohorts. The results were determined for two time periods to assess whether open repair with suprarenal cross-clamping was being performed more frequently as a result of increased utilization of EVAR in the contemporary period.

### **Results:**

After 2002, EVAR increased from 60% to 71% ( $P=0.04$ ) while open repair declined from 40% to 21%. The retroperitoneal approach doubled from 19% to 39% while the transperitoneal approach decreased from 81% to 61% ( $P=0.02$ ). Suprarenal cross-clamping increased by 11% after 2002. There was no significant difference in age, sex, aneurysm size, or co-morbidities in between the transperitoneal and the retroperitoneal groups with suprarenal cross-clamping. The 30-day mortality was 2/38 (5%) and occurred only in the transperitoneal group. The blood loss was significantly greater and the suprarenal cross-clamp time was longer in the transperitoneal group ( $P=0.03$ ), but there were no significant differences in postoperative outcomes.

### **Conclusions:**

In our experience, there has been a steady and significant increase in EVAR since 1998. This has been accompanied with greater utilization of the retroperitoneal approach for suprarenal aortic cross-clamping. Advantages of the retroperitoneal approach include less perioperative blood loss and shorter suprarenal cross-clamp time which may explain the trend towards better survival when compared to the transperitoneal approach.

## #18 - VARIABLE ANEURYSM SAC BEHAVIOR AND MIDTERM EFFECTIVENESS OF SECONDARY INTERVENTIONS FOR TYPE II ENDOLEAKS FOLLOWING EVAR

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**Background :** We sought to better define the relative risk posed by persistent type II / branch endoleaks occurring after infrarenal endovascular aneurysm repair (EVAR) and to determine if secondary interventions could provide durable obliteration of leaks and favorably influence AAA sac behavior.

**Methods :** Fifty-nine patients (56 men, 3 women, age range 58 - 89 yrs), representing 15% of our 397 infrarenal EVAR cases since 1999, had type II endoleaks persisting > 1 mo postoperatively and detected by biannual contrast-enhanced CT scans or duplex ultrasound surveillance imaging. During a mean follow-up of 27 + 18 mo (range 3 - 68 mo), 18 patients (31%) experienced AAA diameter growth > 5mm and underwent secondary interventions to obliterate the leak at an average of 12 + 7 mo following EVAR. Twenty-four total secondary interventions were performed (multiple procedures in 5 patients) including 6 transfemoral ilio-lumbar embolizations (done before 2002), 5 transfemoral inferior mesenteric (IMA) embolizations, 10 transaortic sac puncture embolizations (done after 2002), and 3 open surgical trans-sac ligations. Percutaneous trans-sac punctures were done under general anesthetic, prone positioning, and CT-guidance with involved lumbar or IMA vessels and sac embolized with various combinations of coils and bio-glues. Mean follow-up after secondary interventions was 19 + 15 mo (range 1 - 52 mo).

**Results :** Endovascular secondary interventions were successful in obliterating leaks and arresting further AAA expansion in 16 of 18 (89%) patients with the exception of transfemoral lumbar embolization failures in 67% (4 of 6) cases. After secondary interventions, 39% of patients had sac regression by > 5 mm while 56 % exhibited size stabilization. Sac behavior after intervention was similar (P=.3) to the distribution of diameter responses in patients avoiding treatment of type II leaks (5% with growth > 5mm, 49% unchanged size, 46% regression > 5mm). No ruptures, AAA-related deaths or late conversion/explants occurred in patients with type II endoleaks, although cumulative survival was 78% during the follow-up interval. Interestingly, presence of type II leak (P<.01) and especially the need for intervention (P<.01) was associated with later proximal attachment site instability. 46% (6 of 13) of patients with eventual type I leaks and/or migration had existing type II endoleaks and 4 of these 6 (67%) patients had required secondary interventions for earlier AAA growth associated with their type II leaks.

**Conclusions :** Type II endoleaks remain common after EVAR and are associated with continued sac pressurization and expansion in a significant fraction of patients. Current sac embolization techniques can effectively obliterate branch-related leaks and facilitate AAA size stabilization or regression. The potential deleterious effect of type II leak on infrarenal neck endograft fixation requires further investigation.

## **#19 - ULTRASOUND SURVEILLANCE OF ENDOVASCULAR ANEURYSM REPAIR (EVAR): A SAFE MODALITY VERSUS COMPUTED TOMOGRAPHY**

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**Objective:** Routine ultrasound surveillance is adequate and safe for monitoring endovascular aneurysm repairs (EVAR).

**Methods:** A retrospective chart review including 160 endograft patients was performed from August 2000 to September 2005. All ultrasound examinations (359) were performed by a board-certified vascular surgery group's accredited laboratory. Registered Vascular Technologists utilized the same equipment consisting of Siemens Antares high definition ultrasonography with Tissue Harmonics and Color Flow Doppler. Identical protocol was followed by each technologist: scan body and both limbs of the endograft and distal iliac vessels, measure anterior-posterior aneurysm sac size, and detect intrasac pulsatility and color flow.

**Results:** Forty-one endoleaks were discovered out of the 359 exams (11.4%). There were type I (7, 17%), type II (26, 63%), and combined (8, 20%) endoleaks. Correlation with computed tomography (CT) was obtained in 35 of these cases. CT discovered 3 endoleaks that were not seen with ultrasound. However, these particular ultrasound exams were inadequate studies due to additional factors (bowel gas, body habitus, hernia), which prompted CT investigation and hence endoleak discovery. Of the 41 endoleaks found on ultrasound, only 14 were seen on CT. Specifically, 26 type II endoleaks were seen with ultrasound versus only 8 during CT. Additional factors addressed included: comparison between ultrasound and CT of residual aneurysm sac measurements and conditions limiting ultrasound examination. Statistical analysis utilized Pearson's correlation coefficient and the paired t-test to analyze data.

**Conclusions:** Although criticized in the past, color flow ultrasonography is a safe and effective modality for surveillance of aortic endografts.

## **#20 - REGIONAL NERVE BLOCK ALLOWS FOR OPTIMIZATION OF PLANNING IN THE CREATION OF ARTERIO-VEIN ACCESS FOR HEMODIALYSIS BY IMPROVING SUPERFICIAL VEIN DILATATION.**

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**Introduction:** Durable vascular access for hemodialysis remains a critical issue in end stage renal disease patients. Creation of an autogenous arteriovenous fistula in the most distal location of the non dominant extremity is the preferred technique and provides superior patency over an AV graft. Others have shown that regional anesthesia in the form of axillary block results in the dilatation of the native veins and allows for their increased utilization in creating AV fistulae.

**Methods:** We report on 26 patients undergoing a creation of vascular access for hemodialysis. Regional anesthesia consisting of axillary nerve block was used in all cases. All surgical plans with regards to the site and type of the access were made based on the physical exam and ultrasound vein measurements taken prior to surgery. On the day of surgery patients were re-evaluated with venous ultrasound using tourniquet before and after the administration of the regional block. The previously determined operative plan either remained unchanged or was modified depending on the venous dilatation noted after administration of regional block.

**Results:** Among 26 patients, average vein diameter increased from 0.29cm to 0.34cm ( $p=0.008$ ). 21 of 26 patients had no modification in operative plan (group 1). 5 of 26 patients (20%) had some modification of the original operative plan (group 2): AV graft to a brachial vein transposition ( $n=2$ ), AV graft to a Cimino fistula ( $n=2$ ), and brachiocephalic to a Cimino ( $n=1$ ). The average followup for all patients was 82.6 days and did not differ between the groups. There was one failure in a patient from group 1 and there was no significant difference in the patency rate between study groups ( $p=0.29$ ).

**Conclusion:** Following regional nerve block, operative plans in patients undergoing AV access surgery were modified in 20% of patients undergoing a creation of arteriovenous access for hemodialysis; from either graft to fistula creation or from the proximal to more distal fistula site. The routine use of regional anesthesia as well as intra-operative ultrasound during AV access surgery can lead to improved site selection and increased opportunity for AV fistula creation.

## #21 - EARLY EXPERIENCE WITH PERCUTANEOUS RADIOFREQUENCY ABLATION FOR TREATMENT OF PERFORATING VEIN INCOMPETENCE: A SINGLE CENTER EXPERIENCE

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**Background:** Perforating vein incompetence (PVI) affects 50-65% of patients with chronic venous insufficiency and associated with debilitating medical, social, and economical consequences. Our objective was to evaluate the rates of successful perforator vein ablation using radiofrequency ablation (RFA). The safety profile of this modality was also studied.

**Methods:** Between June 2005 and August 2006, all patients presented to our clinic with evidence of chronic venous insufficiency, underwent ultrasound evaluation for deep venous thrombosis, valvular reflux, and presence of incompetent perforator veins. In the operating room, ultrasound guidance was used to access the perforator veins near the crossing point at the fascia. Rigid 6F Radiofrequency stylet (RFS) device (VNUS Medical Technologies, San Jose, CA) was used for venous access. Veins were treated for 2 minutes at 85 degrees centigrade. Post-operative compression was applied. Patient follow-up included clinical and duplex ultrasound evaluation at 1 and 3 weeks, 6 and 12 months. Concomitant venous procedures are also reported.

**Results:** Over the time period, RFA was performed on 49 perforator veins in 22 patients, 15M/7F, with average age 59 years old (38-84 years). All patients were CEAP class 4-6. Technical success was achieved in all patients. There were no incidents of deep vein thrombosis, concomitant parasthesia, arterial or skin injuries. Successful perforator ablation was achieved in most patients returning for follow up (Table 1). Concomitant procedures are shown in Table 2

**Conclusion:** Percutaneous RFA of incompetent perforating veins is technically feasible, safe and effective in the treatment of PVI. Further data collection and analysis is needed before establishing its exact role in treating venous pathology and improving rates of ulcer healing.

**Table 1: Rate of Perforator Ablation of Follow Up Ultrasound**

N= Total patients (number of veins treated)	1 week	3 week	6 months	12 months
N=22 (49)	N= 22 (49)	N= 17 (40)	N= 7 (8)	N= 2 (2)
Number of vein ablated (%)	47 (96)	38 (95)	7 (88)	2 (100)

**Table 2: Concomitant Procedure**

GSV ablation &/or stripping (%)	Pelvic venography &/or stenting (%)	Phlebectomy (%)
20 (91)	8 (36)	10 (45)

Tables 1 & 2

## #22 - MIDTERM PATENCY FOLLOWING AHERECTOMY FOR INFRAINGUINAL OCCLUSIVE DISEASE. A WORD OF CAUTION

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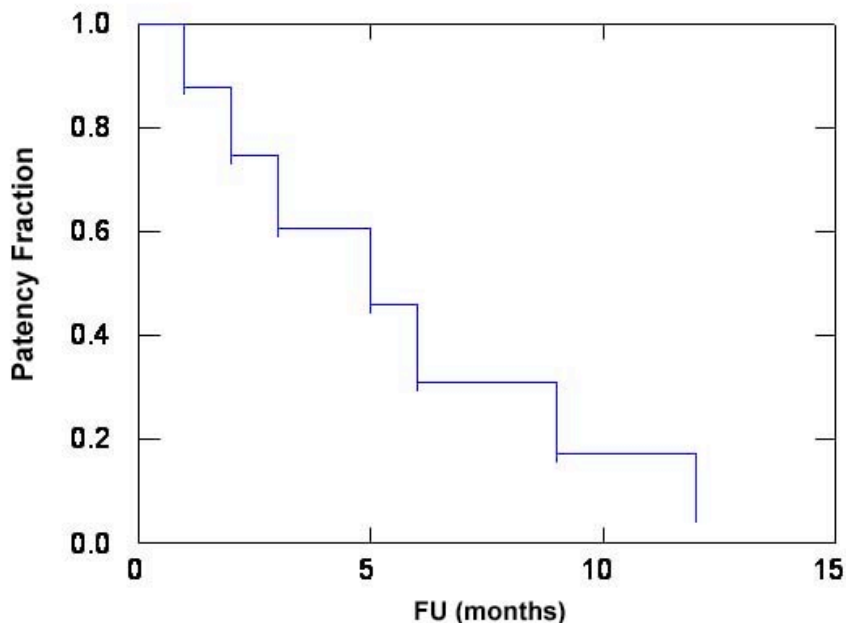
OBJECTIVES: There has been widespread initial enthusiasm in peripheral atherectomy using the SilverHawk device. We sought to evaluate our midterm patency following infrainguinal atherectomy.

OBJECTIVES: There has been widespread initial enthusiasm in peripheral atherectomy using the SilverHawk device. We sought to evaluate our midterm patency following infrainguinal atherectomy.

METHODS: 17 consecutive patients underwent 20 separate atherectomy procedures from 3/2005 through 2/2006 (7 males, 9 females, age  $66\pm 14$  yrs). Lesions were atherosclerotic in 15, restenoses in 3, and vein graft stenoses in 2. TASC classification was "A" in 1, "B" in 8 and "C" in 10. The median number of treated lesions per limb was 2 (range 1-4). Location of the most distal stenosis was SFA in 8, popliteal artery in 5, and crural artery in 5.

RESULTS: Atherectomy was successful in 18 procedures. Complications included 1 groin hematoma and 2 perforations treated with stenting in 1 and bypass grafting in 1. Preoperative ABI and PVR were  $0.51\pm 0.16$  and  $3.3\pm 0.8$ , respectively, which at 1-month improved to  $0.80\pm 0.16$  and  $2.4\pm 0.4$  ( $P<0.001$ ). Only one lesion remained patent at 12 months. Recurrence developed in 17 of 18 successful procedures. Mode of recurrence was restenosis in 12, and occlusion/thrombosis in 5. Secondary interventions included balloon angioplasty/stenting in 5, re-atherectomy in 3, bypass grafting in 4, major amputation in 3, and observation in 1. Life table analysis demonstrated a primary patency rate of 30% at 6 months and 5% at 12 months ( $p<0.02$ ).

CONCLUSIONS: Our experience suggests a poor midterm patency of directional cutting atherectomy using the SilverHawk device, although a 82% limb salvage rate was maintained through secondary interventions. Liberal use of this technology is associated with high cost and frequent requirement for reintervention.



*Survival analysis following atherectomy (per limb)*

## #23 - RISK OF HEPARIN INDUCED THROMBOCYTOPENIA FROM HEPARIN-BONDED VASCULAR PROSTHESES

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**Objective:** Heparin, an indirect thrombin inhibitor, can be bonded to vascular devices. Heparin-bonding is intended to improve patency of vascular devices. The purpose of this study was to determine if a clinically utilized heparin bonded Dacron® graft (HBG) places patients at risk for heparin-induced thrombocytopenia (HIT) and the complications of HIT.

**Methods:** A commercially available HBG (8 millimeter diameter) was divided into 1-centimeter long segments. Segments (n=3) were immersed in 5 cc of platelet poor plasma (PPP) for 24 hours at 37°C (n=3). Control segments of non-heparin bonded Dacron® graft were similarly treated. After immersion, aliquots of PPP were assayed for heparin content. Additional (n=3) 1 cm long segments of graft were immersed in PPP from HIT-positive patients to determine if the effluent from the HBG could lead to platelet activation as assayed by platelet aggregometry.

**Results:** Heparin was discharged from the HBG ( $1.82 \pm 0.08$  units/cc). The control group exhibited no heparin in the effluent PPP (0.00 units/cc,  $p < .05$ ). Platelet aggregation occurred in 85.7% of the plasma samples (after incubation with the HBG) with leached heparin when mixed with normal donor platelets and plasma containing heparin anti-platelet antibodies. None of the control grafts caused any type of aggregation.

**Conclusion:** Heparin was liberated from the HBG and caused platelet aggregation in susceptible plasma. Platelet aggregation due to HIT causes a prothrombotic state which counteracts the theoretic advantages of a HBG. In addition, released heparin from a HBG may contribute to the development of heparin anti-platelet antibodies that can lead to HIT in previously unaffected patients.

## **#24 - EXPERIENCE WITH FEMORO-POPLITEAL ARTERY BALLOON ANGIOPLASTY AND STENTING: CAN PATENCY BE PREDICTED?**

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**Objectives:** In this study we report our experience with Balloon angioplasty and stenting (BAS) of the femoropopliteal arteries with analysis of the factors contributing to patency.

**Methods:** All cases that underwent BAS in the period from January 2001 to June 2005 were analysed. Risk factors, symptoms, length of the lesions, outflow disease and the presence of occlusion or stenosis were analysed. Patency of the treated segment over a three year followup was evaluated. Patency was correlated with length of lesion, and outflow disease.

**Results:** 133 cases were reviewed with data available on 116 cases. The average age 68.3 (38-82) years. Risk factors include: hypertension (63%), CAD (46.6%), MI (18.8%), CABG (25.6%), DM (32.3%), hypercholesterolemia (50.4%) and Chronic renal failure (2.3%). The indication for intervention included claudication in 93 (69.9%) patients, rest pain in 13 (9.8%), ulcer in 13 (9.8%) and gangrene in 14 (10.5%) patients.

Occlusion of the involved segment was present in 78 (58.6%) and stenosis in 55 (41.4%) cases. Outflow disease was present in 63 (55.3%) cases. TASC classification was: A in 32%, B in 14.6%, C in 17.4% and D in 36%.

Overall primary patency : 6 months (71%), 1 year (58.6%), 2 years (47%) and 3 years (44.8%). 1 year patency in patients with three vessel outflow disease was 20%, two vessel disease 17.9% and one or no outflow vessel disease 72%. One year patencies for patients with lesion less than 40 mm , 41-100 mm, 101 -150 mm and more than 150 mm diseased segments were 58%, 41%, 50% and 57% respectively.

**Conclusion:** Femoropopliteal artery BAS is an acceptable option for intervention in arterial occlusive disease with outflow occlusive disease the only factor contributing to patency..