Presentation Number:	34
Publishing Title:	Age at Revascularization Does Not Predict Need for Reintervention in Patients with Femoropopliteal Occlusive Disease

Author Block: **Daniel J. Torrent, MD**, Jill N. Zink, MD, William M. Bogey, Jr., MD, Charles S. Powell, MD, Frank M. Parker, DO, Dean J. Yamaguchi, MD, Nishika S. Patel, Avery G. Colomb, Aseem G. Kaul, Michael C. Stoner, MD.
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Abstract Body:

OBJECTIVES: Conventional wisdom holds that patients with need for intervention at a younger age have more aggressive disease, although there is a paucity of supportive literature. The purpose of this study is to evaluate this assumption.

METHODS: A retrospective cohort of patients undergoing endovascular or open revascularization for femoropopliteal occlusive disease (FPOD) over a four year period was assembled. Demographic information, comorbidities, disease characteristics, and time to last follow up, or death were recorded. Time to major revascularization or amputation, major adverse limb event (MALE), was also recorded. The patients were stratified by age into three groups: the youngest quartile, the oldest quartile, and the middle two quartiles. Univariate and multivariate methods were used to analyze the data.

RESULTS: There were 229 patients in the cohort representing a total of 206,925 days of follow up. The mean age was 64.5±0.85. The overall mean time to MALE or death was 1216.8±85.9 days. The younger group was 54 years old and younger (n=57), the middle group was 55 to 74 years old (n=111), and the older group was 75 years old and older (n=61). Significant findings on univariate analysis (table) included more severe disease at presentation in the older age group and a higher proportion of secondary revascularization and amputation in the younger group. A Kaplan-Meier curve to MALE or death approached significance (p=0.06) with median time to event for the younger, middle and older groups at 253, 1083, and 865 days respectively. A Cox regression model was constructed and age group was not significantly correlated with time to MALE or death (p=0.57) when controlling for confounders.

CONCLUSIONS: These data refute the common assumption that younger patients in need of intervention for FPOD have more aggressive disease. It is the older population that has more severe disease before intervention, and although on univariate analysis they have a lower proportion of amputation and secondary revascularization this is confounded by a higher rate of death in this population. The younger cohort has a longer life expectancy, and as such a longer timer period during which re-intervention may be required.

Differences in disease severity, significant comorbidities, and outcomes on univariate analysis				
Variable	<55 (n=57)	55-74 (n=111)	>74, (n=61)	P
Rutherford Class 5	21.8%	25.5%	41.8%	0.05
Critical Limb Ischemia	48.2%	49.5%	71.7%	0.009
Open Procedure	66.7%	78.4%	60.7%	0.04
History of Smoking	69.2%	72.3%	43.4%	0.002
Quit Smoking	15.4%	34.1%	24.5%	0.04
Secondary Revascularization	43.9%	37.7%	18.0%	0.004
Amputation	28.1%	10.8%	21.7%	0.02

Presentation Number:	MP39

Publishing Title:

Defining Utility and Predicting Outcome of Cadaveric Lower Extremity Bypass Grafts

Author Block: **Catherine K. Chang, MD**, Salvatore T. Scali, MD, Robert J. Feezor, MD, Adam W. Beck, MD, Alyson L. Waterman, MD, Thomas S. Huber, MD, Scott A. Berceli, MD.
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Abstract Body:

INTRODUCTION: Acceptable limb salvage rates have been reported with infrainguinal cryopreserved vein bypass (CVB) for various indications despite poor long-term patency. The utility of CVB in patients with critical limb ischemia (CLI) remains undefined. Our purpose was to determine the role of CVB in CLI patients and identify predictors of successful outcomes.

METHODS: A retrospective review was performed of all lower extremity bypass(LEB) procedures at a single institution. CVB patients CVB were further analyzed. The primary-end point was amputation-free survival(AFS). Secondary end-points included primary patency and limb salvage. Life tables were used to estimate occurrence of endpoints and cox regression analysis used to determine predictors of major amputation.

RESULTS: From 2000-2012, 112 of 1059 patients undergoing LEB underwent CVB[mean age±standard deviation:66±10; male 53%(N=60); diabetes 47%(N=53); hemodialysis dependence 9%(N=10)]. A majority (65%, N=73) had a history of failed ipsilateral LEB. None had sufficient autogenous conduit for even a composite vein bypass. CVB to an infrainguinal target (infrapopliteal-90%, N=102) was completed for a variety of indications including: acute limb ischemia 13%(N=15), graft infection 23%(N=26), and ischemic rest pain/tissue loss 63%(N=71). Intraoperative adjuncts (e.g. profundaplasty, proximal stent/bypass) were used in 59%(N=66) of cases. Complications occurred in 45.9%(N=50) with 30-day and in-hospital mortality of 7.1%(N=8) and 9.9%(N=11), respectively.

Median follow-up time for CLI patients was 11.8(interquartile range:0.4-28.4) months with corresponding 1 and 3 year actuarial estimated survival of 84±4% and 62±6%. Primary patency (±standard error mean) of CVB for CLI was 36±6% and 19±6% at 1 and 3 years, respectively. One and 3-year AFS was significantly greater for ischemic rest pain (59±9%, 36±10%) compared to tissue loss (31±7%, 14±7%, log-rank P=.04). Freedom from major amputation after CVB for CLI was 58±5% and 47±6% at 1 and 3 years, respectively.

Multivariable predictors for successful limb salvage included: postoperative coumadin(HR 0.3, 95% CI:0.1-0.7), dyslipidemia(HR 0.4;0.2-9), and rest pain(HR 0.4;0.2-0.9). Predictors of major amputation included graft infection(HR 3.1;1.1-9.0).

CONCLUSIONS: The role for CVB appears limited, even in CLI patients with no autologous options and prior failed infrainguinal bypass. Outcomes are better in patients with rest pain and without graft infection but other studies suggest that there are more cost effective alternatives for these patients with equivalent outcomes. Graft or wound infection without autologous conduit may be one important indication for CVB.

Presentation Number:	MP40

Publishing Title: Increasing Costs of Inpatient Care of Diabetic Foot Ulcers are Associated with Limb Salvage in Sicker Patients

Author Block: Caitlin W. Hicks, MD, MS, Shalini Selvarajah, MD, MPH, Nestoras Mathioudakis, MD, Bruce A. Perler, MD, Julie A. Freischlag, MD, James H. Black, III, MD, **Christopher J. Abularrage, MD**.
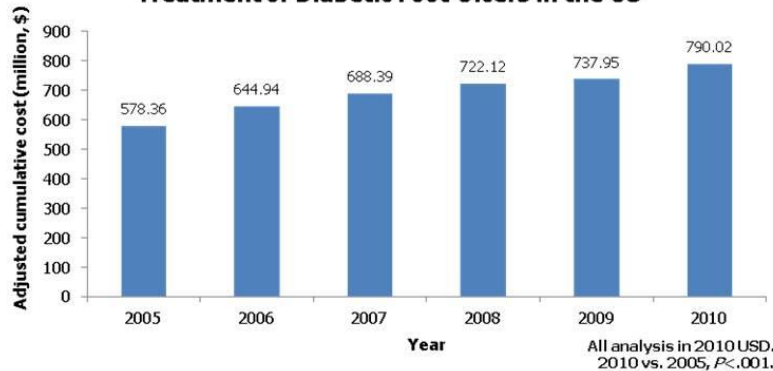The Johns Hopkins Hospital, Baltimore, MD

OBJECTIVES: The cost of care for diabetic foot ulcers is estimated to be more than $1.5 billion annually. The aim of this study was to analyze inpatient diabetic foot ulcer cost changes over time and to identify factors associated with these costs.

METHODS: The Nationwide Inpatient Sample (2005-2010) was queried using ICD-9 codes for a primary diagnosis of foot or ankle ulceration. The primary outcomes were changes in adjusted total hospital charges over time. Multivariable analysis was performed to assess relative increases (RI) in hospital charges per patient between 2005 vs. 2010 adjusting for demographics, income, comorbidities (Charlson Index$\geq$3), insurance type, hospital characteristics, diagnostic imaging, revascularization, amputation, and length of stay.

RESULTS: Overall, 336,641 patients were admitted with diabetic foot ulcers (mean age 62.9$\pm$0.1 years, 59% male, 61% white race). The annual cumulative cost for inpatient treatment of diabetic foot ulcers rose significantly from 2005 to 2010 ($578,364,261 vs. $790,017,704; Figure; P<0.001). More patients were hospitalized (128.6 vs. 152.8 per 100,000 hospitalizations; P<0.001), and the mean adjusted cost per patient hospitalization increased significantly over time ($11,483 vs. $13,258; P<0.001). The proportion of non-elective admissions remained stable (25% vs. 23%; P=0.32) and there were no differences in mean hospital length of stay (7.0$\pm$0.1 vs. 6.8$\pm$0.1; P=0.22). Minor (17.9% vs. 20.6%, P<0.001), but not major amputations (3.9% vs. 4.2%, P=0.27) increased over time. Based on multivariable analysis, the main factors contributing to the escalating cost per patient hospitalization included increased patient comorbidities (unadj. mean difference 2005 vs. 2010 $3,303 [RI:1.08] vs. adj. $15,220 [RI:1.35]), diagnostic angiography (unadj. $18,635 [RI:1.36] vs. adj. $29,079 [RI:1.46]), open revascularization (unadj. $15,145 [RI:1.25] vs. adj. $30,759 [RI:1.37]), endovascular revascularization (unadj. $17,662 [RI:1.29] vs. adj. $28.937 [RI:1.38]), and minor amputations (unadj. $9,918 [RI:1.24] vs. adj. $18,084 [RI:1.33])(P<0.001, all).

Abstract Body:

Risk-adjusted Annual Cumulative Cost for Inpatient Treatment of Diabetic Foot Ulcers in the US

All analysis in 2010 USD.
2010 vs. 2005, *P*<.001.

CONCLUSIONS: Hospital charges related to diabetic foot ulcers have increased significantly over time despite stable hospital length of stay and proportion of emergency admissions. Risk-adjusted analyses suggest that this change may be reflective of a progressively sicker patient population, and increasing charges associated with diagnostic angiography and revascularization aimed at limb salvage. Despite this, overall major amputation rates remained stable.

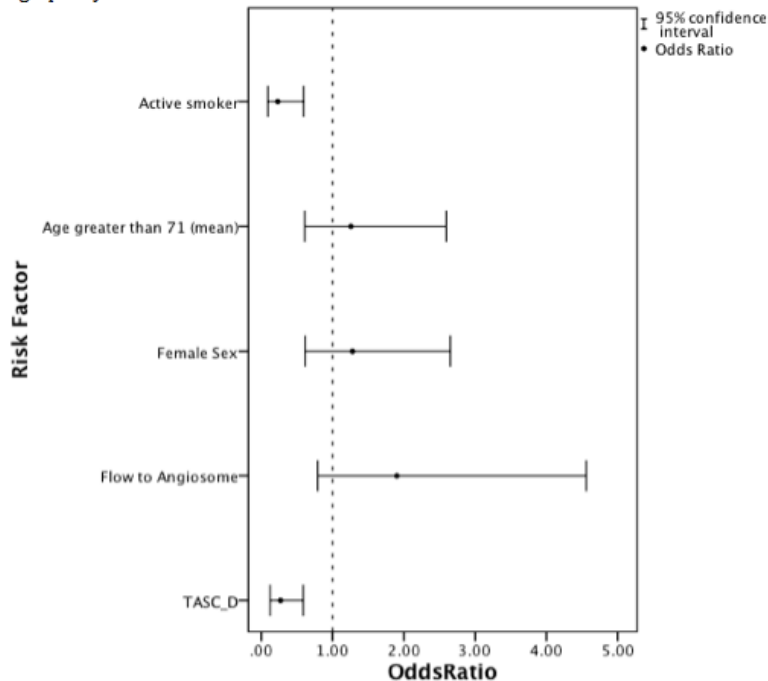| Presentation Number: | MP41 |
| Publishing Title: | Flow Restoration to Arteries Feeding Angiosomes of Foot Wounds Does Not Predict Better Wound Healing After Infrapopliteal Angioplasty |

Author Block: **John C. McCallum, MD**, Eduardo S. Cabral, Thomas Curran, MD, Jeremy D. Darling, BA, Dominique B. Buck, MD, Elliot L. Chaikof, MD, PhD, Mark C. Wyers, MD, Allen D. Hamdan, MD, Raul J. Guzman, MD, Marc L. Schermerhorn, MD.
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Abstract Body:

OBJECTIVES: It has been suggested that in patients with tissue loss, percutaneous transluminal angioplasty (PTA) which targets arteries mapped to wounds in idealized regions of the foot called "angiosomes" optimizes wound healing. We report our institutional rate of wound healing after PTA in patients in whom flow was restored to the angiosome of the wound, and those in whom it was not.

METHODS: 459 consecutive patients who underwent tibial angioplasty from 2004-2011 were identified retrospectively. Patients with an indication for intervention other than tissue loss were excluded. Flow was classified as having been restored to the angiosome corresponding to the wound if the intervention was performed on a vessel corresponding to the angiosome. Outcomes were analyzed via bivariate and multivariable logistic regression.

RESULTS: 363 patients underwent analysis of flow restoration. Flow was restored to the vessels feeding the angiosome in 234 (75%, n=312), and not in 78 (25%). There were no differences in comorbidities or infrapopliteal TransAtlantic Intersociety Consensus (TASC I) class among patients in whom flow was or was not restored to the angiosome. At 12 months, 86 patients (47%, n=181) had completely healed their wounds, and 95 (52%) had not. Bivariate analysis revealed anterior tibial artery intervention, active smoking and TASC-D class as predictive of failure to completely heal wounds (P=0.03, <0.01 and <0.01, respectively). Neither multi-vessel intervention nor restoration of flow in vessels mapped to the angiosome predicted healing (P=0.19 and 0.20, respectively). On multivariable analysis, multi-vessel intervention and flow restoration to the angiosome similarly did not predict healing (Odds ratio (OR) 1.17, 95%Confidence Interval (CI) 0.59-2.33 and OR 1.89, 95%CI 0.86-4.13 respectively). Active smoking was predictive of failure to completely heal wound (OR 0.23, 95% CI 0.09 -0.59) as was TASC D classification (OR 0.27, 95% CI 0.12-0.59) (Figure 1).

Figure 1. Multivariable regression model of complete wound healing after tibial angioplasty for tissue loss

CONCLUSIONS: Our approach is to treat the vessel or vessels seen on angiogram to provide best flow to the area of the wound, and we found that restoring flow to the predefined vessels mapped to the angiosome of the wound was no better.

| Author Block: | **Karan Garg, MD**, Rameen Moridzadeh, BS, Patrick A. Kaszubski, BS, Caron B. Rockman, MD, Mark A. Adelman, MD, Frank J. Veith, MD, Firas F. Mussa, MD.
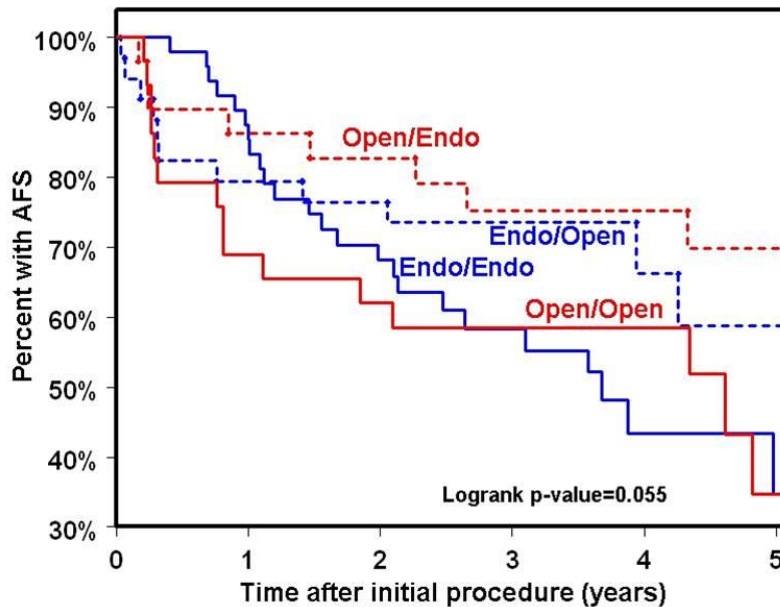NYU Langone Medical Center, New York, NY |

Abstract Body:

OBJECTIVES: Patients with critical limb ischemia (CLI) remain at risk of significant limb loss despite timely intervention and reintervention. This study reports the fate of failed primary revascularization attempts and their rescued approaches.
METHODS: A cohort of 302 patients with CLI was identified between March 2007 and December 2010. Endovascular-first was selected if: 1) the patient had short (5-7cm occlusions or stenoses in crural vessels) 2) the disease in superficial femoral artery was limited to TASC II A, B or C and 3) no impending limb loss. Failures were defined as recurrent clinical signs and symptoms. Criteria for reintervention were the same as for primary intervention.
RESULTS: Endo-first was performed in 187 (62%) and open-first in 105 patients (35%). Secondary procedures (endo or open) were more common after open-first (68% vs. 55%; p= 0.029). Patients with above knee open-first intervention were less likely to undergo secondary interventions than those who underwent endo-first at same location, 58% versus 40% (p=0.003). Patients treated with rest pain were more like to undergo secondary interventions than those with ulcers, 29% versus 54% (p<0.0001). At five-years, mortality rates were higher among those without secondary interventions, 53% versus 39% (p=0.0096). However, amputation rates were higher in patients undergoing secondary interventions, 22% versus 5%, (p=0.0016). There was no difference in amputation free survival (AFS) based on need for secondary interventions, 49% versus 47%, (p=0.165) (Figure 1). Patients with an initial open intervention followed by endovascular reintervention had a trend towards the best outcome with 70% five-year AFS.
CONCLUSIONS: At 5 years, selective revascularization strategy led to frequent reinterventions, higher in those treated with an open-first approach. While amputation rates were higher in those undergoing secondary interventions, mortality was higher among those without secondary interventions. Amputation free survival was not different in the two cohorts with a trend towards improved outcomes in those undergoing an open-first followed by endovascular reintervention.

Publishing Title: **Impact of Femoropopliteal Endovascular Interventions on Subsequent Open Bypass**

Author Block: **Shaun M. Gifford, MD**, Bernardo C. Mendes, MD, Mark D. Fleming, MD, Randall R. De Martino, MD, Audra A. Duncan, MD, Manju Kalra, MBBS, Gustavo S. Oderich, MD, Peter Gloviczki, MD, Thomas C. Bower, MD
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Abstract Body:

OBJECTIVE: Endovascular first approach has been widely adopted as an alternative to surgical bypass in patients who need lower extremity revascularization for diffuse femoropopliteal artery disease. The purpose of this study was to evaluate anatomical changes in extent of bypass and outcomes due to failed endovascular interventions.

METHODS: We reviewed all consecutive patients treated by endovascular femoropopliteal revascularization from 2002 to 2012. Patients who required open bypass following a failed endovascular intervention were analyzed. Pre-intervention angiography was reviewed by blinded investigators with respect to anatomical characteristics and run-off scores. Location of the intended distal anastomosis was compared to the open procedure and mid-term results analyzed.

RESULTS: 566 patients underwent endovascular femoropopliteal revascularization of 665 limbs. Mean follow-up was 20 months. 123 (22%) required 171 re-interventions due to restenosis/occlusion. 30 patients required open bypass at an average of 15 months to treat failed angioplasty or stenting. The indication for revascularization was critical limb ischemia in 33% of patients at the time of the index endovascular procedure. Mean run-off score was 4.4 and included concomitant tibial intervention in 8% of those progressing to bypass. Open bypass consisted of 6 above-knee (AK), 14 below-knee (BK), and 10 tibial level interventions with vein and prosthetic used equally. The location of the distal anastomosis changed to a more distal target in 13 limbs (4 BK and 9 tibial; 43%). Mean follow up was 27 months and patency was maintained in 47% (n=14) without intervention. 5 underwent graft salvage with patch angioplasty (3) and angioplasty (2) for assisted primary patency of 63%, while 3 required redo bypass and one underwent thrombolysis for limb salvage. 7 progressed to amputation (23%).

CONCLUSIONS: When endovascular interventions on SFA lesions fail, open revascularization may be required. In our cohort, only 4.5% (30/665) of SFA interventions resulted in conversion to surgical bypass. Of these, 13 required a more distal target. In patients requiring subsequent bypass after transcatheter intervention, the patency and amputation rates were worse than historic primary bypass results. An endovascular first approach to treating claudication and CLI is safe and resulted in a low rate of progression to open bypass.