Abstracts from the 2012 New England Society for Vascular Surgery Annual Meeting

Shared Quality Data Results in Increased Protamine Use and Reduced Bleeding Complications After Carotid Endarterectomy in the Vascular Study Group of New England

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Introduction and objectives: The study goal was to evaluate whether protamine usage after carotid endarterectomy (CEA) increased within the Vascular Study Group of New England (VSGNE) in response to the VSGNE presentation (April 2009), the Society for Vascular Surgery presentation (June 2009), and *Journal of Vascular Surgery* publication (March 2010) "Protamine reduces bleeding complications associated with carotid endarterectomy without increasing the risk of stroke."

Methods: We reviewed protamine usage during 9882 CEAs excluding concomitant coronary bypass within the VSGNE from January 2003 to June 2011. Protamine usage was evaluated biannually using statistical process control charting. Trends in surgeon use before (n = 67) and after 2009 (n = 113) were categorized as rare, selective, or routine. End points included postoperative myocardial infarction (POMI), stroke, death, and reoperation for bleeding.

Results: Protamine was administered during 54% of procedures, increasing from 46% before 2009 to 61% after 2009 ($P < .001$). The increase in protamine use surpassed the upper control limit of three standard deviations in 2009 coincident with presentation and publication of the VSGNE study (Fig). Surgeon usage shifted from rare, selective, and routine over time from 45%, 18%, and 37% to 24%, 35% and 42%, respectively. Reoperation for bleeding decreased (0.5% vs 1.4%, $P < .001$) with similar rates of POMI (1.0% vs 1.2%, $P = .52$), stroke, or death (1.1% vs 1.1%, $P = .796$) in protamine treated vs untreated patients, respectively. Reoperation for bleeding decreased significantly from 1.2% before 2009 to 0.6% after 2009 ($P = .003$).

Conclusions: Protamine use increased by VSGNE surgeons coincident with presentation of VSGNE-derived data showing the benefit of protamine. Improvements in the process of care can be achieved in regional quality groups by sharing safety and efficacy data.

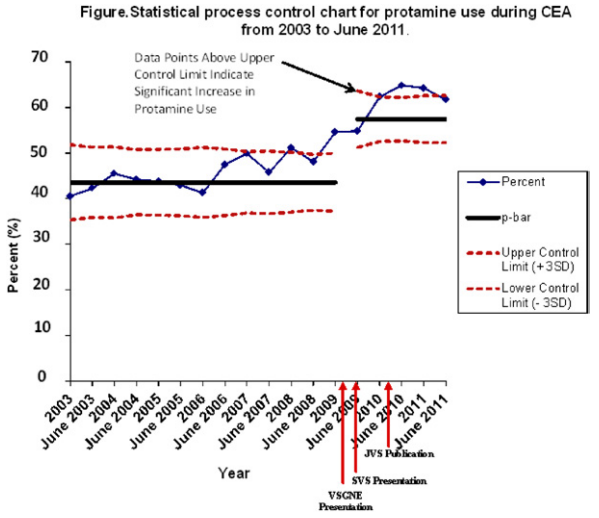

Fig.

Timing of Perioperative Events Following Carotid Endarterectomy: In-Hospital vs Post-Discharge Adverse Events

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Introduction and objectives: Most studies based on state and nationwide registries evaluating perioperative outcome after carotid endarterectomy (CEA) rely on hospital discharge data. Therefore, true 30-day complication risk after carotid revascularization may be underestimated.

Methods: We used the National Surgical Quality Improvement Program database 2005-2010 to assess the in-hospital and postdischarge rate of any stroke and stroke/death at 30 days after CEA and identified predictors for the timing of these events. Univariate analysis including demographics and preoperative variables served as a base (threshold $P = .2$) for multivariable analysis to identify predictors associated with outcome.

Results: A total of 35,916 patients (asymptomatic and symptomatic; 59% men, median age, 72 years) underwent CEA during 2005 to 2010. The 30-day stroke rate was 1.6% (n = 591) and the combined stroke/death rate was 2.2% (n = 792), and 31.2% of strokes (0.5%) and 40.9% of combined events (0.9%) took place after hospital discharge (median days to stroke, 8 [interquartile range, 11]). Women were more likely to have postdischarge events than men (stroke, 38.1% vs 29.0%, $P = .005$; stroke/death, 42.8% vs 40.0%, $P = .009$). Renal failure was also predictive for postdischarge stroke (odds ratio, 3.16; 95% confidence interval, 1.54-6.47), whereas those undergoing emergency procedures and redo-CEA were more likely to have in-hospital events.

Conclusions: One in three perioperative strokes and deaths after CEA are missed when only hospital admission data are analyzed. This emphasizes the need for reporting and comparing 30-day outcomes. Selected subgroups at increased risk for either in-hospital or postdischarge events merit further investigation and may benefit from changes in management. Particularly in woman and those with renal failure, we need to be alert to the ongoing risk of adverse events after hospital discharge.

The Effect of Postoperative Stroke and Myocardial Infarction on Long-Term Survival After Carotid Revascularization

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Introduction and objectives: The largest randomized controlled trial comparing the efficacy of carotid endarterectomy (CEA) vs carotid artery stenting (CAS) showed equivalent outcomes for the composite end point of postoperative stroke, myocardial infarction (MI), or death. However, CAS had a higher risk of postoperative stroke, and CEA had a higher risk of MI. This analysis of long-term survival after carotid revascularization tested the hypothesis that postoperative stroke reduced long-term survival more than postoperative MI.

Methods: The Vascular Study Group of New England was used to identify all CEA and CAS procedures from 2003 to 2011. Patients were stratified according to whether they experienced a minor or major postoperative stroke, MI (troponin elevation, electrocardiographic changes and/or clinical symptoms), or neither. Primary study end points were 1- and 5-year survival. Multivariable Cox proportional hazards models compared the magnitude of effect of stroke and MI on survival.

Results: Of 8315 patients, 81 (1.0%) experienced postoperative MI and 63 (0.8%) experienced stroke (37% major, 64% minor). Survival significantly differed at 1 year: MI, 84%; stroke, 77%, neither, 96% (log-rank, $P < .0001$). After adjusting for confounders, stroke was an independent predictor of death at 1 year (hazard ratio [HR], 6.6; 95% confidence interval [CI], 3.7-12; $P < .0001$), as was MI (HR, 3.6; 95% CI, 2-6.8; $P < .0001$). At 5 years, on multivariable modeling, stroke was again an independent predictor of death (HR, 2.7; 95% CI, 1.7-4.3; $P < .0001$), with a magnitude of effect similar to that of MI (HR, 2.8; 95% CI, 1.8-4.3; $P < .0001$).

Conclusions: Postoperative stroke conferred a sixfold increased hazard of death at 1 year, which was nearly twice that associated with postoperative MI. By 5 years, survival curves converged and the disadvantage conferred by stroke was similar to that by MI. This study demonstrates that stroke portends a significantly worse survival prognosis than MI within the first year after carotid revascularization.

Race As a Predictor of Morbidity and Mortality After Carotid Endarterectomy

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Introduction and objectives: Racial disparities in the outcomes of patients undergoing carotid endarterectomy (CEA) have been reported. We sought to examine the contemporary relationship between race and outcomes, as well as to report postdischarge events after CEA.

Methods: American College of Surgeons-National Surgical Quality Improvement Program data were reviewed to identify all CEAs performed from 2005 to 2010. The influence of race on outcomes was examined. Multivariate analysis was performed using variables found to be significant on bivariate analysis. The primary outcomes were stroke and mortality. Secondary outcomes were other 30-day complications, including postdischarge events.

Results: CEA was performed on 29,114 white patients (95.7%) and 1316 black patients (4.3%). The overall stroke and mortality rates were 1.65% and 0.7%, respectively. The stroke rate was 1.6% for whites and 2.5% for blacks ($P = .0009$). The 30-day mortality rate was 0.7% for white

patients, and 1.4% for blacks ($P = .0002$). There was a longer operating time ($P < .001$) and total length of stay ($P < .001$), more postoperative pneumonias ($P = .0049$), unplanned intubations ($P < .001$), ventilator dependence ($P < .001$), cardiac arrests ($P < .001$), bleeding requiring transfusions ($P = .0024$), and returns to the operating room ($P = .0021$) among black patients. Multivariate logistic regression identified black race as an independent risk factor for 30-day mortality (relative risk, 1.9; $P = .0007$). Black patients also had more in-hospital deaths than white patients (73.7% vs 43.1%, $P = .001$). The rate of postdischarge strokes did not differ between the groups: 36.4% of all strokes occurred after discharge at a mean of 8.3 days and 54.3% of deaths occurred after discharge at a mean of 11 days.

Conclusions: Black race is identified as an independent risk factor for 30-day mortality after CEA. A significant proportion of strokes and deaths occur after discharge in both racial groups evaluated.

Progression of Asymptomatic Carotid Stenosis Despite Optimal Medical Therapy

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Introduction and objectives: Despite level 1 evidence in support of carotid endarterectomy (CEA) vs medical therapy in selected asymptomatic patients, an alternative posture is that optimal medical therapy (OMT) has not been adequately studied and that such OMT has reduced stroke risk to levels wherein CEA is no longer justified. The goal of this study was to determine the natural history of patients with asymptomatic moderate (50%-69%) carotid stenosis (AMCS) in a contemporary cohort as a function of their associated medical therapy.

Methods: Patients with AMCS determined by duplex ultrasound (DUS) imaging from 2005 to 2006 were identified in our hospital database. Patients were included in the cohort if they had at least one additional DUS during the 6-year follow-up interval. Patient characteristics, including medication history and lipid levels, were collected. Patients were considered to have OMT if they were on aspirin and a statin with a low-density lipoprotein (LDL) level <100 mg/dL. Study end points included progression of carotid disease by DUS (70%-100%), development of ipsilateral neurologic symptoms (stroke/transient ischemic attack), and death.

Results: There were 906 carotids in 801 patients in the study cohort. The average age was 72.5 years, 77.3% had hypertension, 59.7% had coronary artery disease (CAD), and 84% were on a statin. The LDL cholesterol level was always normal (<100) in 56.4%, and 29.4% had OMT. The 5-year actuarial outcomes are detailed in the Table. Ipsilateral symptoms developed in 97 patients during follow-up (58% of these were strokes). Multivariate predictors of disease progression were chronic kidney disease (hazard ratio [HR], 2.14; confidence interval [CI], 1.22-3.76; $P = .0008$), and statin use (HR, 1.59; CI, 1.0-2.53; $P = .0049$). The multivariate models of symptom development and survival showed that statin use was protective for both (symptoms: HR, .046; CI, .026-0.79; $P = .0005$; survival: HR, .050; CI, .034-0.73; $P = .00004$).

Conclusions: OMT failed to prevent disease progression or development of ipsilateral symptoms in patients with AMCS.

Table. Five-year outcomes

Variable	*Cohort, % (n = 906)*	*OMT, %*		P
		Yes (n = 266)	*No (n = 640)*	
Survival	75.4	75.4	75.4	.86
Freedom from disease progression	61.5	60.6	61.7	.37
Freedom from symptoms	87	85	87.9	.17
Freedom from ipsilateral CEA/CAS	71.7	67.5	73.6	.10

Outcomes of Endovascular Interventions for Salvage of Renal Transplant Allografts

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Introduction and objectives: As renal transplantation has been performed with increased frequency, interventions to preserve graft function and integrity have been steadily increasing. This study examines the outcomes of endovascular therapy based on indication for renal allograft salvage.

Methods: A prospective transplant registry was queried for all patients undergoing endovascular interventions for transplant allograft salvage from 2002 to 2011. Demographics, perioperative data, and transplant function outcomes were extracted and analyzed.

Results: Among 34 renal transplant recipients who underwent endovascular interventions for graft salvage, the mean age was 48.2 years (18-74 years), and 62% were men. The indications for intervention included worsening serum creatinine (n = 15), renovascular hypertension (n = 11), and structural abnormalities identified on noninvasive imaging (n = 8). Transluminal angioplasty, with or without stenting, was done in 26 patients: 14 (41.2%) with significant transplant stenosis, 11 (32.4%) with peripheral arterial disease (PAD) in proximal iliac vessels, and one with iliac dissection. Five arteriovenous fistulae and two pseudoaneurysms required embolization. One patient had deep venous thrombosis causing obstruction of allograft outflow requiring lysis. There were no periprocedural deaths, and 30-day morbidity was 17.6%. Of patients with worsening renal function, 67% had improvement or stabilization of their renal function. Interestingly, only 36% of patients with renovascular hypertension showed improvement. Mean follow-up was 4.2 years. There were no significant differences in transplant allograft survival over the duration of follow-up based on indication for endovascular intervention (Fig; log-rank test, $P = .03$).

Conclusions: Endovascular salvage of renal allograft transplants can be safely done for various indications, although patients with renovascular hypertension were less likely to improve. Despite differences in symptomatic outcome, the indication for initial intervention does not significantly influence the long-term transplant graft survival.

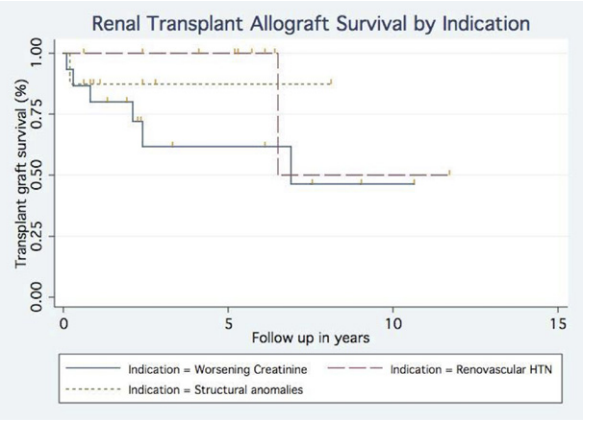

Fig.

Clinical Effectiveness of Secondary Interventions for Restenosis Following Renal Artery Angioplasty and Stenting: Does it Help, Hurt or Even Make a Difference?

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Introduction and objectives: Secondary interventions for restenosis after renal artery angioplasty and stenting are commonly performed, despite limited data on their effectiveness. This study was designed to evaluate whether successful outcomes are achieved in patients after endovascular treatment of recurrent renal artery stenosis (RAS).

Methods: We conducted a retrospective review of all patients who underwent renal artery angioplasty or stenting, or both, for renovascular hypertension between 2001 and 2011 at Dartmouth-Hitchcock Medical Center. We compared the clinical effectiveness of secondary vs primary interventions. Nonparametric models were used to identify factors associated with successful outcomes, as measured by changes in blood pressure, estimated glomerular filtration rate (eGFR), and number of antihypertensive medications.

Results: Thirty-nine patients (54 renal arteries) underwent secondary interventions for recurrent RAS, and 180 patients (180 arteries) underwent primary intervention. There were no significant differences between patients undergoing primary vs secondary interventions with respect to preoperative medication usage (including antihypertensive, antiplatelet or statin medications), comorbid conditions, or blood pressure. Primary and secondary interventions were both completed using a similar proportion of bare-metal stents (90%), with no difference in procedural complications or technical success. At a mean follow-up of 23 months (range, 1-128 months), similar improvements in renal function were found between patients undergoing primary and secondary interventions (Fig). There were no differences in number of antihypertensive medications, overall blood pressure management, or overall survival.