patients (24.4%) at some point during routine surveillance, including, Type I (n = 56, 23.0%), Type II (n = 166, 68.3%), Type III (n = 11, 4.5%), Type IV (n = 2, 0.8%), and Type V (n = 8, 3.3%). One hundred and seven secondary interventions were performed in 85 patients (9.2%) for EVAR related problems, and included placement of an iliac extender (n = 36, 33.7%), proximal cuff placement (n = 20, 18.7%), embolization of a branch vessel (n = 24, 22.4%), stent graft relining (n = 15, 14.0%), ligation of a branch vessel (n = 4, 3.7%) fem-fem bypass grafts (n = 3, 2.8%), ilio-femoral thrombectomy (n = 3, 2.8%), and hypogastric artery stent placement (n = 2, 1.9%). Sixteen endografts (1.7%) required explantation after primary failure (10) or failed secondary intervention (6). Indications for explant included expanding size or persistent endoleak (n = 12), infection (n = 2), and rupture (2). Three instances of rupture following EVAR were noted.

Conclusions: Secondary aneurysm related procedures after EVAR were required in <10% of this population with most requiring minimally invasive catheter based procedures. Long-term surveillance remains important to provide optimal vascular outcomes for these patients.

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SS5.

A Comparison of Indirect Radiation Dose Estimates With Directly Measured Radiation Dose for Patients and Operators During Complex Endovascular Procedures

Giuseppe Panuccio, Roy K. Greenberg, Kevin Wunderle, Tara Mastracchi, Matthew J. Eagleton, William Davros. Vascular Surgery, Cleveland Clinic Foundation, Cleveland, OH

Objectives: To assess the accuracy of indirect estimated radiation doses during endovascular thoracoabdominal aneurysm repair (cTAAA).

Methods: Patients undergoing cTAAA had imaging system generated indirect radiation parameters recorded concurrently with direct measurements of radiation exposure patterns using radiochromatic film. Operator dose was determined by electronic dosimeters. Observed radiation exposure patterns were reproduced in phantoms allowing for effective radiation dose calculations. Continuous variables were assessed with scatter plots and Pearson coefficients.

Results: No patients had evidence of radiation induced skin injury. Cumulative air kerma (CAK) exceeded 15Gy in 3 patients, however, direct measurements were below 15Gy in all patients. Peak skin dose (PSD), quantified using gafchromic film, correlated weakly with fluoroscopy time (FT) but better with CAK and kerma air product (KAP). The formula “PSD = 0.677 + 0.257CAK” provides the best estimate of actual PSD. The average effective dose was 119.68mSv (for type II or III cTAAA) and 76.46mSv (type IV cTAAA). Mean operator effective dose was 0.17mSv/case, and correlated best with KAP (r = 0.82, p < 0.0001).

Conclusions: FT, CAK and KAP represent poor markers of PSD, and directly measured PSD did not correlate with clinical events. The effective radiation dose of cTAAA is equivalent to 2 preoperative CT scans. An operator could perform up to 294 cTAAA annually before reaching the maximum recommended operator dose.

Indirect calculations and direct measurements of dose

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Total Group (n = 47)</th>
<th>Type II and III (n = 18)</th>
<th>Type IV (n = 29)</th>
<th>Correlation with measured PSD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct FT (min)</td>
<td>104.42</td>
<td>140.67</td>
<td>81.92</td>
<td>r = 0.55</td>
</tr>
<tr>
<td>Direct CAK (Gy)</td>
<td>7.45</td>
<td>9.64</td>
<td>6.09</td>
<td>p = 0.0001</td>
</tr>
<tr>
<td>Direct KAP (Gy cm²)</td>
<td>781.62</td>
<td>1005.73</td>
<td>642.81</td>
<td>0.76</td>
</tr>
<tr>
<td>Direct Measured PSD (Gy)</td>
<td>2.59</td>
<td>3.16</td>
<td>2.24</td>
<td>0.80</td>
</tr>
<tr>
<td>Direct 95% Isodose area (cm²)</td>
<td>4.03</td>
<td>4.86</td>
<td>3.51</td>
<td>0.90</td>
</tr>
<tr>
<td>Direct Patient effective dose (mSv)</td>
<td>0.17</td>
<td>0.23</td>
<td>0.13</td>
<td>0.90</td>
</tr>
<tr>
<td>Direct Procedure</td>
<td>87.3</td>
<td>112.3</td>
<td>71.8</td>
<td>0.90</td>
</tr>
<tr>
<td>Direct Diagnostic CT</td>
<td>34.59</td>
<td>34.31</td>
<td>34.76</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Author Disclosures: W. Davros: Nothing to disclose; M. J. Eagleton: Nothing to disclose; R. K. Greenberg: Cook Inc, WL Gore, Terarecon, Research Grants Cook Inc., Consulting fees or other remuneration (payment) Cook Inc., Stock Options or Bond Holdings; T. MastracCI: Cook Inc., Consulting fees or other remuneration (payment); G. Panuccio: Nothing to disclose; K. Wunderle: Nothing to disclose.

SS6.

Venous Specific Eph-B4 Regulates Vein Graft Thickening via Caveolin-1

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Objectives: Successful vein graft adaptation to the arterial environment is critical to maintain long-term vascular graft patency. However, the mechanism of vein graft adaptation remains unclear. Since Eph-B4, an embryonic determinant of venous identity, expression is reduced during vein graft adaptation, we determined whether Eph-B4, and the shear stress-sensing caveolin-1 (cav-1), play mechanistic roles to limit wall thickening during vein graft adaptation.

Methods: Full length mouse Eph-B4 cDNA was inserted into the pShuttle-IRE5-hrGFP2 vector and the cav-1 binding domain (CBD) was mutated at w804. Intrathoracic inferior vena cava was harvested from wild-type (WT) or cav-1 knockout (cav-1-KO) mice and placed as an
interposition aortic graft in WT mice. In some mice Eph-B4 was stimulated with Ephrin-B2/Fc injected IP every other day until harvest; other vein grafts were locally treated with WT or mutated Eph-B4 coding adenovirus (1.0x10⁹ pfu). Vein grafts were harvested and analyzed after 3-4 weeks.

Results: Stimulation of Eph-B4 with Ephrin-B2/Fc limited wall thickness (0.03 ± 0.01 mm vs 0.06 ± 0.01 mm, n = 5-7). Eph-B4 colocalized with cav-1 in sucrrose gradient separation and co-immunoprecipitation. Vein grafts derived from cav-1-KO mice had increased wall thickness (0.09 ± 0.01 mm, n = 3-5). Unlike WT grafts, Ephrin-B2/Fc treated Cav-1 KO vein grafts did not have reduced wall thickness (0.09 ± 0.01 mm, n = 4). CBD mutated Eph-B4 was unable to phosphorylate tyrosine in vitro; adenovirus incorporating the CBD mutated Eph-B4 did not limit vein graft wall thickness compared to reduced wall thickness with WT Eph-B4 adenovirus (0.09 ± 0.01 mm vs 0.06 ± 0.01 mm, n = 6).

Conclusions: Eph-B4 is functional in adult veins and actively limits vein graft wall thickening during adaptation to the arterial environment. Caveolin-1 may act as the shear stress sensor for Eph-B4, suggesting that the Eph-B4-caveolin-1 pathway may be a therapeutic target to improve vein graft patency.

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S2: SVS Plenary Session II

SS7.

Asymptomatic Internal Carotid Artery Stenosis and Cerebrovascular Risk Stratification

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Objectives: To determine the cerebrovascular risk stratification potential of degree of stenosis, clinical features and ultrasonic plaque characteristics in patients with asymptomatic internal carotid artery (ICA) stenosis.

Methods: In this prospective, multicentre, cohort study, 1121 patients with 50-99% asymptomatic ICA stenosis in relation to the bulb (ECST) undergoing medical intervention were followed-up for 6-98 (mean 48) months. Hazard ratios for ICA stenosis, clinical features and ultrasonic plaque texture features associated with ipsilateral cerebrovascular or retinal ischemic (CORI) events were calculated using univariate analysis and Cox proportional hazard models.

Results: During follow-up, a total of 130 CORI events including 59 strokes occurred. Severity of stenosis, smoking history of more than 10 pack-years, systolic blood pressure, history of contralateral TIA or stroke, low gray scale median (GSM), increased plaque area, plaque types 1, 2 and 3, and presence of discrete white areas without acoustic shadowing (DWA) were associated with increased risk. The area under the curve in ROC curves for stenosis, stenosis combined with clinical features and stenosis combined with clinical features and plaque features was 0.59, 0.66 and 0.82 respectively. In a Cox proportional hazard model, stenosis, history of contralateral TIA or stroke, GSM, plaque area and DWA were independent predictors of stroke. Of the 923 patients with ≥ 70% stenosis (≥ 50% NASCET) 5-year stroke rates less than 5% were predicted in 524, 5-9% in 149, 10-19% in 176, 20-29% in 40 and rates equal or greater than 30% in 34 patients.

Conclusions: Cerebrovascular risk stratification is possible using a combination of clinical and ultrasonic plaque features. These findings can be used to refine the indications for carotid endarterectomy. However, they need to be validated in additional prospective studies or the medical arm of future randomized controlled trials of medical vs surgical or endovascular therapy.

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SS8.

Effects of Statins on Early and Late Results of Carotid Stenting

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Objectives: Increasing data are suggesting that statins can significantly decrease cardiovascular and cerebrovascular events due to a plaque stabilization effect. However, the benefit of statins in patients undergoing carotid angioplasty and stenting (CAS) for carotid stenosis is not well defined. Aim of this study was to investigate whether statins use was associated with decreased perioperative and late risks of stroke, mortality and restenosis in patients undergoing CAS.