Risk Factors for Postoperative Complications Following Ruptured Aneurysm Repair

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Disclosures

• None
Introduction

Background:
- Each year, 30,000 people suffer from a ruptured intracranial aneurysm (RIA) in the United States.
- Roughly 40% of these cases are initially fatal, 66% of those who survive the initial rupture suffer a permanent neurological deficit, and another 25% die within six months.
- Open surgery for RIA is a common recommendation within current practice guidelines, but to date no research has evaluated postoperative complications following open surgery for RIA within the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP).

Objective:
- To identify risk factors associated with complications following open surgery for RIA from the ACS-NSQIP.
Methods

• Patients who underwent open surgery for intracranial aneurysm repair (CPT codes: 61697-8, 61700, 61702) were extracted from the 2005-2015 ACS-NSQIP

• Rupture status was determined using ICD-9/10 codes

• Prevalence of postoperative complications was determined

• Multivariable logistic regression was used to identify demographic, comorbid, and perioperative characteristics associated with any morbidity, major (Clavien IV) complications, and mortality
Results

- A total of 417 cases were identified
- Of these, there were 245 (58.6%) patients with any morbidity, 97 (23.3%) patients with major complications, and 56 (13.4%) cases of mortality
- The most common complications were:
  - Reoperation: 21.1%
  - Prolonged ventilation >48 hrs: 19.1%
  - Transfusion: 18.0%
  - Pneumonia: 15.6%
  - Mortality: 13.4%
  - Urinary tract infection: 11.8%
  - Unplanned intubation: 10.8%
  - Sepsis: 10.0%
- Factors associated with postoperative complications included: aneurysm type (simple, complex, other), age, diabetes, functional status, preoperative ventilator dependence, COPD, bleeding disorder, ASA classification, emergency surgery, serum sodium, and hematocrit
Results

- N=417
- Aneurysm type:
  - Simple: 2.8%
  - Complex: 89.7%
  - Other: 7.5%
- Age: 54.23 ± 13.51 yrs
- Male: 31.2%
- White race: 52.5%
- BMI: 28.53 ± 6.88 kg/m²
- Tobacco use: 60.4%
- Emergency surgery: 58.8%
- Duration of surgery: 4.52 ± 1.85 hrs
- Total dependence: 86.6%
- Hypertension: 46.3%
- ASA Class IV/V: 57.3%
Prevalence of Postoperative Complications

- Reoperation
- Transfusion
- Pneumonia
- Mortality
- Urinary Tract Infection
- Unplanned Intubation
- Sepsis
- CVA/Stroke
- Septic Shock
- Pulmonary Embolism
- Cardiac Arrest
- Organ Space SSI
- Superficial incisional SSI
- Deep Incisional SSI
- Myocardial Infarction
- Acute Renal Failure
- Renal Insufficiency
- Wound Dehiscence

Prevalence (%)

Reoperation >24 hours
## Results

### Significant predictors for any morbidity:
- Age > 65
- Total dependency
- Ventilator dependence
- ASA Class IV/V
- Emergency surgery

### Significant predictors for major complications:
- Age > 65
- Non-insulin treated diabetes
- Total dependency
- Ventilator dependence
- COPD
- Bleeding disorder
- ASA Class IV/V
- Sodium ≥ 135
- Hematocrit < 36.0

### Significant predictors for mortality:
- Aneurysm type
- ASA Class IV/V

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<table>
<thead>
<tr>
<th>Variable</th>
<th>Any Morbidity</th>
<th>Major Complications</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aneurysm Type</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Simple (CPT 61700, 61702)</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
</tr>
<tr>
<td>Complex (CPT 61697, 61698)</td>
<td>0.341 (0.054-2.14)</td>
<td>1.29 (0.19-8.70)</td>
<td>43.52 (2.64-716.225)***</td>
</tr>
<tr>
<td>Other</td>
<td>0.931 (0.343-2.53)</td>
<td>1.41 (0.49-4.06)</td>
<td>13.12 (1.56-110.14)*</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 45</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
</tr>
<tr>
<td>&gt; 65</td>
<td>5.29 (2.31-12.09)***</td>
<td>3.28 (1.5-7.508)***</td>
<td>2.77 (0.865-8.92)</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td></td>
<td></td>
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<tr>
<td>Non-Insulin Therapy</td>
<td>2.2 (0.47-10.19)</td>
<td>12.23 (3.23-46.257)***</td>
<td>1.70 (2.88-10.09)</td>
</tr>
<tr>
<td><strong>Functional Status</strong></td>
<td></td>
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</tr>
<tr>
<td>Totally Dependent</td>
<td>6.01 (1.62-22.19)***</td>
<td>3.37 (1.07-10.56)*</td>
<td>2.96 (0.628-13.93)</td>
</tr>
<tr>
<td>Ventilator Dependent</td>
<td>3.2 (1.61-6.39)***</td>
<td>0.4895 (0.237-1.01)***</td>
<td>3.86 (1.61-9.24)</td>
</tr>
<tr>
<td>COPD</td>
<td>1.0 (0.217-4.68)</td>
<td>0.96 (0.204-4.509)*</td>
<td>9.425 (1.39-63.81)</td>
</tr>
<tr>
<td>Bleeding Disorder</td>
<td>1.2 (0.16-9.09)</td>
<td>8.19 (1.26-53.11)*</td>
<td>5.74 (0.577-57.18)</td>
</tr>
<tr>
<td><strong>ASA Classification</strong></td>
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<tr>
<td>I/II/III</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
</tr>
<tr>
<td>IV/V</td>
<td>1.88 (1.09 - 3.22)*</td>
<td>2.61 (1.37-4.95)**</td>
<td>7.09 (2.3-21.82)***</td>
</tr>
<tr>
<td>Emergency Surgery</td>
<td>2.09 (1.21-3.60)**</td>
<td>1.44 (0.78-2.67)</td>
<td>1.13 (0.452-2.828)</td>
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<tr>
<td><strong>Sodium</strong></td>
<td></td>
<td></td>
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<tr>
<td>&lt; 135</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
</tr>
<tr>
<td>≥ 135</td>
<td>0.86 (0.284-6.34)</td>
<td>0.35 (0.13-0.936)*</td>
<td>1.84 (0.654-5.21)</td>
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<td><strong>Hematocrit</strong></td>
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<tr>
<td>&lt; 36</td>
<td>1.29 (0.730-2.29)</td>
<td>0.476 (0.236-0.957)*</td>
<td>0.828 (0.33-2.03)</td>
</tr>
<tr>
<td>≥ 36</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
<td>1.00 (Ref.)</td>
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* = p<0.05, ** = p<0.10, *** = p<0.001
Discussion

• More than half of patients experienced morbidity following open surgery for RIA and roughly one in four patients had a complication that would require intermediate and/or intensive care level management

• There were multiple risk factors for non-fatal postoperative complications and only two significant predictors for mortality

• The high mortality of RIA, coupled with the inherent risk of complications following open surgery, suggests a need for risk stratification when determining the benefits of open surgery versus endovascular interventions
Summary Points

- The prevalence of any morbidity, major complications, and mortality following open surgery for ruptured intracranial aneurysms was 58.6%, 23.3%, and 13.4%, respectively.
- The most common complications were:
  - Reoperation: 21.1%
  - Prolonged ventilation >48 hrs: 19.1%
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