Mortality and Unrecognized Readmissions Following Abdominal Aortic Aneurysm Repair: Conclusions from a National Analysis

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Disclosures

• The study authors have no actual or potential conflict of interests to disclose
Background

• Postoperative Readmissions
  – Associated with increased morbidity, mortality, and cost to all stakeholders in the U.S. health system
  – Medicare imposes significant penalties on hospitals for all-cause readmissions
    • Estimated $528 million in 2017¹
• Increasingly used by payers as a quality metric to determine provider and system reimbursement

Background

- **Vascular surgery** patients have higher rates of unplanned readmissions compared to other surgical populations
  - 9-10% of patients are readmitted, compared to 5.5% average of non-vascular surgical patients
- Variation is accounted for by increased risk of these patients and procedures
  - Vulnerable population with significant medical comorbidities (CHF, CAD, CKD, etc.)
  - Manipulation of vessels supplying major organs

<table>
<thead>
<tr>
<th>Readmission status</th>
<th>Vascular surgery patients (n = 86,403), No. (%)</th>
<th>All other surgery patients (n = 1,078,018), No. (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>No readmission</td>
<td>77,526 (89.8)</td>
<td>1,019,185 (94.5)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>All readmissions</td>
<td>8827 (10.2)</td>
<td>58,833 (5.5)</td>
<td></td>
</tr>
<tr>
<td>Planned readmission</td>
<td>773 (8.8)</td>
<td>3148 (5.4)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Unplanned readmission</td>
<td>8054 (91.2)</td>
<td>55,685 (94.6)</td>
<td></td>
</tr>
<tr>
<td>Related to principal procedure</td>
<td>4951 (61)</td>
<td>41,169 (74)</td>
<td></td>
</tr>
</tbody>
</table>

Background

- Single-state study (Maryland, n = 115)
  - Patients undergoing thoracic and thoracoabdominal aortic aneurysm repair
  - Patients readmitted in early post-discharge period (≤30 days) often present to hospitals other than the site of initial intervention
    - Defined Non-Index Hospital (NIH) Readmission

- Medicare Claims Database - *Lancet* (n = 9,440,503)
  - Major surgical procedures (CABG, pancreatectomy)
  - Patients returning to their index hospital for readmission have improved survival compared to those who seek care elsewhere

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Objectives

• **Characterize** the burden of NIH readmission
  – Are patients **missed by single-institution** metrics?
  – What are **risk factors** for NIH readmission?
  – Is there a **mortality difference** for patients readmitted to a NIH?
  – Are previously identified trends consistent with **national, multi-payer** data?

• **Hypothesis**
  – Patients **readmitted to NIH** will have higher mortality
    • Body of literature suggests **fragmented postoperative care** impacts outcomes
Methods

- Nationwide Readmissions Database (NRD)
  - Produced by subgroup of the Department of Health and Human Services
  - Collects comprehensive data through public-industry partnerships
    - All 50 states, public and private hospitals, and all payer types (including private insurance)
- Queried for years 2013-2014 (January 2013-December 2014)
- All endovascular (EVAR) and open (OAR) abdominal aortic aneurysm repairs (AAAR)

- Outcomes of interest:
  - 30 and 365 day readmission rates
  - 30 and 365 day readmission rates to a non-index hospital (NIH)
  - Mortality during initial admission and within 365-days
- Identified risk factors for:
  - Mortality
  - Readmission
  - NIH Readmission
- Identified most common readmission diagnosis
- Tabulated cost associated with initial admission and readmission
Results

- **53,417** patients underwent AAAR from 2013-2014
  - EVAR: 88.8%, Open Repair (OAR): 11.2%
- **6.9%** of patients were readmitted in 30 Days (3,694)
  - EVAR: 6.8%, OAR: 8.2% (p <0.001)
Results

• **19.7%** of patients readmitted in **30 days** presented to a different hospital
  – EVAR: 22.11%, OAR: 23.98 (p <0.001)

• **32.1%** of patients readmitted in **365 days** presented to a different hospital
  – EVAR: 32.2.9%, OAR: 31.24% (p <0.001)
Risk Factors for Readmission

Odds Ratio for 30 Day RA (Any Hospital)  Odds Ratio for 30 Day RA (NIH)

Risk factor
- Female
- LOS ≥30
- CCI 4-8
- CCI >8
- DC to Short-Term Care
- DC to Skilled Nursing Facility
- DC to Home health care
- Left Against medical advice
## Readmission Diagnoses

- Patients largely readmitted for **heart failure**, **sepsis/infection**, and **renal failure**

### Frequency of Diagnostic Related Groups (DRGs) on Readmission

<table>
<thead>
<tr>
<th>DRG on Readmission</th>
<th>n</th>
<th>%</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Failure</td>
<td>526</td>
<td>6.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Septicemia &amp; Disseminated Infections</td>
<td>455</td>
<td>5.4</td>
<td>11.6</td>
</tr>
<tr>
<td>Post-Operative, Post-Traumatic, Other Device Infections</td>
<td>380</td>
<td>4.5</td>
<td>16.1</td>
</tr>
<tr>
<td>Renal Failure</td>
<td>367</td>
<td>4.3</td>
<td>20.4</td>
</tr>
<tr>
<td>Other Vascular Procedures</td>
<td>341</td>
<td>4.0</td>
<td>24.4</td>
</tr>
</tbody>
</table>

### Frequency of Readmission Diagnoses

<table>
<thead>
<tr>
<th>Diagnosis Group on Readmission</th>
<th>n</th>
<th>%</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unspecified septicemia</td>
<td>356</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Other postoperative infection</td>
<td>333</td>
<td>4.0</td>
<td>8.2</td>
</tr>
<tr>
<td>Acute kidney failure, unspecified</td>
<td>325</td>
<td>3.9</td>
<td>12.1</td>
</tr>
<tr>
<td>Pneumonia, organism unspecified</td>
<td>256</td>
<td>3.0</td>
<td>15.1</td>
</tr>
<tr>
<td>Obstructive chronic bronchitis with (acute) exacerbation</td>
<td>226</td>
<td>2.7</td>
<td>17.8</td>
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</tbody>
</table>
Cost

- Index admission most costly, minimal variation between readmission groups

<table>
<thead>
<tr>
<th></th>
<th>Index Admission Cost (mean)</th>
<th>Readmission Cost (mean)</th>
<th>NIH Readmission Cost (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EVAR</strong></td>
<td>$28,839.73</td>
<td>$12,669.61</td>
<td>$12,571.57</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td></td>
</tr>
<tr>
<td><strong>OAR</strong></td>
<td>$34,161.34</td>
<td>$15,716.89</td>
<td>$14,223.40</td>
</tr>
<tr>
<td><strong>CCI 0-3</strong></td>
<td>$28,777.07</td>
<td>$12,699.18</td>
<td>$12,367.84</td>
</tr>
<tr>
<td></td>
<td>p&lt;0.001</td>
<td>p&lt;0.001</td>
<td></td>
</tr>
<tr>
<td><strong>CCI 4-8</strong></td>
<td>$33,136.33</td>
<td>$13,531.01</td>
<td>$13,844.04</td>
</tr>
<tr>
<td><strong>CCI &gt;8</strong></td>
<td>$34,049.51</td>
<td>$47,432.17</td>
<td>$20,038.25</td>
</tr>
</tbody>
</table>
Conclusions

• **One in five** patients present to a **non-index hospital** for readmission following aortic aneurysm repair
  – 20% of patients excluded from single-center metrics; potential to skew hospital data on surgical outcomes
  – Demonstrates impact of fragmented post-operative care

• Overall 365-day readmissions are associated with **increased mortality**
  – NIH readmission was not a risk factor for increased mortality
    • Contrast to readmissions data from other vascular procedures (i.e. PVD)
  – Readmission diagnoses are largely comprised of heart failure, infections, and renal failure
Conclusions

• Risk factors can identify patients to prevent readmission and decrease mortality
  – Target high comorbidity burden and long initial admissions
  – Guide health systems to improve quality of care
• Sex-based differences
  – Female sex: risk factor for readmission AND mortality
  – Consistent with previous literature on sex disparities in vascular disease
    • Despite 4:1 male-to-female AAA predominance, women have higher rupture risk and worse postoperative morbidity

Thank you!