Improving Length of Stay After Carotid Endarterectomy

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No disclosures
100,000 CEA procedures performed in the USA/year

Extended LOS: increased cost in cardiac, trauma, orthopedics and endocrine surgeries

Additional day in the hospital: 8% increase in total cost
Factors that determine the length of stay after CEA represent opportunities to avoid financial losses

JVS, 2014

- Vascular Study Group of New England (23 centers) ‘03-11

- Predictors of a postoperative LOS >1 day

- Logistic regression analysis and Knaus-Wagner chi-pie analysis
Factors that determine the length of stay after CEA represent opportunities to avoid financial losses
JVS, 2014

- Average LOS: 1.4 days
- 1244 (17%) stayed > 1 day postoperatively
Factors that determine the length of stay after CEA represent opportunities to avoid financial losses

JVS, 2014

• MAEs were more common among those who had a LOS >1 day

• LOS > 1 day more likely to receive an IV medication to treat hypotension or hypertension postoperatively
Factors that determine the length of stay after CEA represent opportunities to avoid financial losses

JVS, 2014

**Multivariable analysis:**

- Female, positive stress test, CHF, COPD, increasing age
- Preoperative stroke
- Low-volume surgeons (< 15 cases/year), general anesthesia, CEA performed on Fridays
Factors that determine the length of stay after CEA represent opportunities to avoid financial losses

JVS, 2014

Financial loss for patients who stay >1 postoperative day, with a longer stay corresponding to a greater loss
Contemporary predictors of extended postoperative hospital length of stay after CEA


Retrospective review, 2001-2011. n=840
Extended postoperative LOS (ELOS)= > 2 days

• 11.4% pre-admitted
• Median postoperative LOS 1 day
• > 2 days: 46.2%
• ELOS less likely to be discharged home (11.9% vs 1.5% P=0.01) and associated with increased hospital readmission

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adjusted OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-admit</td>
<td>3.3</td>
<td>1.9-5.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CHF</td>
<td>2.1</td>
<td>1.1-4.2</td>
<td>0.03</td>
</tr>
<tr>
<td>Female gender</td>
<td>1.9</td>
<td>1.4-2.6</td>
<td>0.001</td>
</tr>
<tr>
<td>COPD</td>
<td>1.7</td>
<td>1.0-2.9</td>
<td>0.04</td>
</tr>
<tr>
<td>Electroencephalography change</td>
<td>1.9</td>
<td>1.2-3.2</td>
<td>0.009</td>
</tr>
<tr>
<td>Operating room start time after 12.00 pm</td>
<td>1.7</td>
<td>1.2-2.4</td>
<td>0.002</td>
</tr>
<tr>
<td>Total operating room time</td>
<td>1.5</td>
<td>1.2-1.9</td>
<td>0.004</td>
</tr>
<tr>
<td>Postoperative ICU</td>
<td>5.4</td>
<td>3.1-9.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number of in-hospital complications</td>
<td>3.7</td>
<td>2.2-6.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Foley catheter</td>
<td>2.1</td>
<td>1.3-3.4</td>
<td>0.002</td>
</tr>
</tbody>
</table>
Discharge on the first postoperative day after elective CEA


- Prospectively evaluated social and medical feasibility of patient discharge on day 1
- N=57
- Discharge day 1: 74%
- Discharge day 2: 26%
  - Absence of a relative (n=12)
  - Medical reasons (n=3)
Vascular Quality Initiative

Since 2011, 33% of elective CEA in VQI centers had LOS > 1 day
Vascular Quality Initiative

Emory Hospital high outlier in postoperative LOS after elective CEA

<table>
<thead>
<tr>
<th>CEA LOS &gt; 1 day</th>
<th>Your center</th>
<th>Your region</th>
<th>VQI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observed (N)</td>
<td>Expected (p-value)</td>
<td>Observed (N)</td>
</tr>
<tr>
<td>CEA LOS &gt; 1 day</td>
<td>40% (N=10)</td>
<td>27% (p=0.066)</td>
<td>36% (N=1248)</td>
</tr>
</tbody>
</table>

Carotid Endarterectomy: Percentage of Patients with Length of Stay > 1 Day (excludes urgent, emergent cases during all years through June, 2014)

Percent CEA LOS > 1 day Change over Time.
Vascular Quality Initiative

Emory: high outlier in postoperative LOS after elective CEA within the region

Regional variation of CEA LOS > 1 day
Aims

• Reduce the % of elective CEA patients with LOS > 1 day postsurgery

• Determine factors associated with LOS > 1 day

• Describe LOS before and after implementation of quality strategies to shorten LOS
Phase 1. Baseline

![Graph showing data trend over quarters from 2010 to 2014. The graph includes a line graph with data points marked by black circles. The x-axis represents quarters (1-4) for each year from 2010 to 2014. The y-axis represents a percentage scale ranging from 0.0 to 1.0. The graph shows fluctuations in data points across the years. A horizontal dashed line is drawn at the average percentage level marked as Avg% = 469.}
Phase 2. Design

• Understanding the current process and looking for opportunities

• Establish what changes need to be made to the system

• Define quality improvement initiatives aimed at reducing LOS >1 day after CEA and therefore preventing financial losses.
Phase 2. Cause-and-effect diagram

**Patient**
- Unaware of expectation
- No transportation ready

**Surgery**
- Use of Foleys
- Use of drains
- General anesthesia
- Friday surgeries
- Late surgeries

**PACU**
- Use of IV medications to treat hypertension/hypotension

**Floor**
- Bed not available
- Wait for physical therapy (not needed)
- Drain removal
- Delayed Foley removal
- Late recognition of urinary retention
- Ambulation order not written
- ICU patient
Phase 2. High level process map

Steps

Clinic/scheduling

Preoperative testing

Admission/Surgery

PACU

Floor

Scheduler: early cases, details of transportation

Demographics, risk factors

Type of anesthesia

Blood pressure management

Early ambulation

Expectations of discharge

Need for further testing

Use of drains, Foley catheters

Urinary retention

Early discharge

2-4hrs

2hrs

24hrs
## Phase 3. Implementation of quality strategies

<table>
<thead>
<tr>
<th>Target</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case timing (early/mid week)</td>
<td>Scheduler education</td>
</tr>
<tr>
<td>Patient transportation</td>
<td>Scheduler, discussion with patient in clinic</td>
</tr>
<tr>
<td>Patient expectation of discharge day 1</td>
<td>Discussion in clinic, preop testing, nurse education</td>
</tr>
<tr>
<td>Type of anesthesia</td>
<td>Discussion in preop testing and day of surgery</td>
</tr>
<tr>
<td>Limit use of Foleys</td>
<td>Track and report, education</td>
</tr>
<tr>
<td>Remove Foleys at midnight</td>
<td>Foley removal added to Powerplan, education</td>
</tr>
<tr>
<td>Hypo/hypertension in PACU</td>
<td>Limit pressors- education to fellows, ICU. Track, reports</td>
</tr>
<tr>
<td>Drain removal day 1 morning</td>
<td>Vascular team education</td>
</tr>
<tr>
<td>Early ambulation after surgery</td>
<td>Patient education in preop, team education (fellows, residents, nurses, technicians)</td>
</tr>
</tbody>
</table>
Preliminary results

- Improved from 46% to 11% of patients having LOS>1 Day
- Amounts to Savings of: $8,700
  - Assuming:
    - 1 extra day of LOS costs the hospital $1,000
Preliminary results

Improved rate of CEA LOS > 1 day at Emory since implementing quality strategies
Preliminary results

Improved rate of CEA LOS > 1 day at Emory compared to other centers in the region

![Graph showing CEA LOS >1 Day by Center in Your Region]

YC=Your Center; * Rate significantly different than expected.

![Graph showing Percent CEA LOS > 1 day Center Variation Within Your Region]

Observed (Red) vs Expected (Blue) based on Risk-Adjustment
Preliminary results

CEA LOS > 1 day by region
Future steps

• Review of elective CEAs from 2010-2016

• Define the institutional variation in LOS and determine the factors associated with increased LOS within the region

• Implementation of quality strategies to decrease LOS in elective CEA
Conclusion

LOS > 1 day in carotid endarterectomy associated with higher hospital cost and readmission

Implementation of quality strategies in CEA patients reduce hospital stay and cost

Identification of factors associated with longer LOS can be used to guide quality improvement efforts designed to reduce LOS after elective CEA
Thank you