Defining a “High Volume” Radical Cystectomy Hospital: Where Do We Draw the Line?

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Defining a “High Volume” Radical Cystectomy Hospital: Where Do We Draw the Line?

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What we already know

• Radical cystectomy
  • One of the most technically complex procedures in urology,
  • Standard of care for muscle-invasive and recurrent high-risk non–muscle-invasive bladder cancer.
  • **Up to two-thirds** of patients undergoing RC experience postoperative morbidity,
    • Including a high rate of potentially life-threatening complications such as hemorrhage, bowel leakage, and sepsis

• Increased hospital volume = better outcomes

• Debate on restricting this procedure to ”High volume” hospitals
Is it the right policy? What is “High” volume?

• Example of Bariatric surgery
• Access to care vs complication rate
• Previous analyses
  • Assumption of linearity of volume-outcome relationship
  • Quartile/Quintile/Tertile Based analysis
  • “high volume” hospital has been arbitrarily defined in the literature from as low as eight to as high as 33.5 cases/yr
• Other procedures – No linear association
• Need to systematically evaluate this cutoff
• Too high cutoff? – Decreased access to care
• Too low cutoff? – Low quality of care
Data source and patient cohort

- United States HCUP – NIS
- largest publicly available, all-payer, inpatient care database in the United States.
- 20% stratified sample of hospital discharges from all US community hospitals.
- 2008-2011
- 31,793,174 records within the NIS
- Population estimate of 156,919,107 discharges.
Definitions

• Hospital volume
  • Calculated as the number of procedures performed by the hospital in the specific year as described previously by Budaus, et al.

• Outcomes:
  • Outcome 1 - Any Inpatient complications
  • Outcome 2 - Major Inpatient complications
    • At least one complication and a length of stay greater than the 75th percentile for the procedure
Finding the cutoff

• Hospital volume modeled as continuous variable
• Without prior assumption of the form of association
• Multivariable logistic regression with restricted cubic splines
  • age, race, gender, primary payer status, location, Charlson comorbidity, and median zip-code income quartiles) and hospital teaching status
  • Generalized estimating equation framework (to account for nesting effect)
• “Range” of inflection point determined by visual inspection of RCS plot
  • Did not use Bayesian analysis for a discrete point due to limitations of doing the same.
Results

• Median hospital volume 24 cases/yr
• Any inpatient complications 4769/6790 (70.2%)
• Major inpatient complications 1572/6790 (23.2%)
### Table 2 – Perioperative outcomes for 6790 radical cystectomy procedures from the National Inpatient Sample from 2008 to 2011 stratified by hospital volume quartile.

<table>
<thead>
<tr>
<th></th>
<th>Entire cohort</th>
<th>Q1 (very low)</th>
<th>Q2 (low)</th>
<th>Q3 (intermediate)</th>
<th>Q4 (high)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patients (n)</strong></td>
<td>6790</td>
<td>1849</td>
<td>1625</td>
<td>1774</td>
<td>1542</td>
<td></td>
</tr>
<tr>
<td><strong>In-hospital death, n (%)</strong></td>
<td>108 (1.59)</td>
<td>50 (2.7)</td>
<td>29 (1.8)</td>
<td>14 (0.8)</td>
<td>15 (1.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Any inpatient complication, n (%)</strong></td>
<td>4769 (70.4)</td>
<td>1406 (75.9)</td>
<td>1199 (73.9)</td>
<td>1164 (66.0)</td>
<td>1000 (65.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Major inpatient complication, n (%)</strong></td>
<td>1572 (24.6)</td>
<td>490 (26.5)</td>
<td>402 (24.8)</td>
<td>352 (19.8)</td>
<td>328 (21.1)</td>
<td>0.002</td>
</tr>
<tr>
<td><strong>Specific complication, n (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>1147 (17.9)</td>
<td>379 (20.5)</td>
<td>303 (18.7)</td>
<td>240 (13.7)</td>
<td>225 (14.8)</td>
<td>0.020</td>
</tr>
<tr>
<td>Urinary</td>
<td>1114 (17.6)</td>
<td>317 (17.1)</td>
<td>273 (16.9)</td>
<td>286 (16.1)</td>
<td>238 (15.5)</td>
<td>0.781</td>
</tr>
<tr>
<td>Cardiac</td>
<td>557 (8.2)</td>
<td>166 (9.0)</td>
<td>149 (8.4)</td>
<td>133 (7.4)</td>
<td>109 (7.1)</td>
<td>0.702</td>
</tr>
<tr>
<td>Vascular</td>
<td>243 (3.6)</td>
<td>69 (3.8)</td>
<td>56 (3.5)</td>
<td>66 (3.8)</td>
<td>52 (3.4)</td>
<td>0.924</td>
</tr>
<tr>
<td>Wound</td>
<td>548 (8.1)</td>
<td>159 (8.6)</td>
<td>151 (9.3)</td>
<td>135 (7.6)</td>
<td>103 (6.8)</td>
<td>0.042</td>
</tr>
<tr>
<td>Miscellaneous medical</td>
<td>2485 (36.7)</td>
<td>813 (44.0)</td>
<td>668 (41.2)</td>
<td>585 (33.4)</td>
<td>419 (27.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Miscellaneous surgical</td>
<td>615 (9.1)</td>
<td>173 (9.5)</td>
<td>164 (10.1)</td>
<td>135 (7.6)</td>
<td>143 (9.2)</td>
<td>0.150</td>
</tr>
<tr>
<td>Median eLOS, d (IQR)</td>
<td>7.5 (5.9–10.6)</td>
<td>7.8 (6.0–11.4)</td>
<td>7.7 (6.1–10.9)</td>
<td>7.1 (5.7–9.7)</td>
<td>7.2 (5.7–10.1)</td>
<td>0.001</td>
</tr>
<tr>
<td>Use of parenteral nutrition, n (%)</td>
<td>691 (10.2)</td>
<td>221 (12.0)</td>
<td>170 (10.4)</td>
<td>163 (9.1)</td>
<td>137 (9.0)</td>
<td>0.406</td>
</tr>
<tr>
<td>Use of blood transfusion, n (%)</td>
<td>2334 (34.3)</td>
<td>689 (37.0)</td>
<td>521 (31.9)</td>
<td>598 (34.1)</td>
<td>526 (33.9)</td>
<td>0.751</td>
</tr>
<tr>
<td>Median total inflation-adjusted cost, $ (IQR)a</td>
<td>26714</td>
<td>25 173</td>
<td>24 949</td>
<td>26 394</td>
<td>31 240</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

IQR = interquartile range; eLOS = estimated length of stay.

a Normalized to 2014 US dollars.
Fig. 2 – Smooth restricted cubic spline plot of hospital volume (annual number of RCs performed) modeled as a nonlinear continuous variable against the adjusted log odds ratio of (A) any inpatient complication and (B) a major inpatient complication, using a reference value of 5 cases/yr for hospital volume. Solid lines represent the main restricted cubic spline, while dashed lines represent the 95% CLs. Dots on the solid line denote the location of knots used in the model. The model was adjusted for patient characteristics (age, race, gender, primary payer status, location, Charlson comorbidity, and median zip-code income quartiles) and hospital teaching status. The p values are for a nonlinear association. RC = radical cystectomy; CL = confidence limit.
Limitations

• Limitations of secondary analysis of administrative datasets
  • Retrospective and observational
  • Coding errors/problems
• No tumor characteristics, no BMI
• No post discharge events
• Selection bias – Higher hospital volume select more complex cases
Conclusion

• The relationship between hospital volume and RC morbidity is nonlinear.

• A plateau for the complication rate is seen at 50–55 cases/yr.

• This extends beyond the thresholds previously reported in the literature.

• Restricting RC to centers with such a high threshold for the annual caseload would restrict access to care for most patients.

• There is a need to share and publish best practices from high-volume centers in quality improvement initiatives (eg: MUSIC) to improve morbidity at low-volume centers.
• Won best poster prize at EAU, Barcelona