Medical Resource Utilization and Costs for Total Hip Arthroplasty – Benchmarking the Anterior Approach in the Medicare Population

Study Rationale

- Clinical studies indicate that the anterior approach (AA) to total hip arthroplasty (THA) allows for faster recovery when compared to other surgical approaches to THA.¹ ²
- However, no studies have characterized the impact of a pre-specified AA technique on costs or resource utilization over the 90-day period relevant to the Centers for Medicare and Medicaid Services Comprehensive Care for Joint Replacement Program (CJR).
- No billing codes are available to discriminate approaches to THA, thus a unique method was required for retrospective identification of AA patients.

Study Objectives

- To assess 90-day medical resource utilization and costs for a cohort of AA patients, including:
  - Proportion of patients discharged to home (primary endpoint),
  - Post acute care costs (primary endpoint),
  - Hospital length of stay,
  - Days/costs of SNF care,
  - Days/costs of home health care, and
  - Days/costs of hospital outpatient care
- To benchmark this performance against that for similar THA patients receiving care at similar institutions

Data Source

- The Centers for Medicare and Medicaid Services (CMS) 100% Standard Analytic File was used to quantify episode costs:
  - Part A claims (Inpatient, home health, skilled nursing, hospital outpatient) for patients who received elective (non-fracture), primary total hip arthroplasty (THA) between Q1 2012 and Q3 2014.
  - All claims were wage-adjusted prior to analysis.
- All Medicare Part A (facility) payments from hospitalization through 90-days after the day of discharge were eligible for inclusion:
  - Hospitalization for chronic conditions, as stipulated by CMS under the Comprehensive Care for Joint Replacement (CJR) program, were excluded
- All cell counts <11 are hidden, per CMS requirements

Study Methods

- Six surgeons agreed to participate in this analysis, all of whom used the AA approach between 2012-2014.
  - All surgeons indicated that they used the AA technique as described by Dr. Joel Matta.³
- The CORAIL® Hip System and PINNACLE® Acetabular Cup System were the most commonly used implants for these procedures; other systems were used in a minority of cases.
- A two-stage analytical approach (matching and regression) sought to maximize similarity between patients/hospitals/surgeons in the AA cohort and those in the control group.
  - After patient matching was completed, regression analysis with generalized estimating equations (GEE) was applied to control for remaining imbalances and clustering of outcomes within hospitals.

Regression Analysis

- Multivariate regression using the GEE technique was used to compare AA versus the control cohort on the following primary outcomes:
  - Wage-adjusted Medicare payments from index discharge through 90-days post-discharge, and
  - The proportion of patients discharged to home or home health agency versus other settings (e.g., skilled nursing facility [SNF]).
- This model sought to account for patient clustering within hospitals and to control for all baseline patient characteristics.*
- Predicted adjusted means and 95% confidence intervals (marginal outcomes) were estimated based on GEE model results using the method of recycled predictions.

*Age category, sex, race, year of surgery, Charlton Comorbidity Index (CCI), obesity, morbid obesity, diabetes, OA, RA, osteoporosis, dual-eligible (Medicare + Medicaid), physician hip arthroplasty volume, hospital resident-to-bed ratio (teaching status), disproportionate share percentage (DSH), hospital volume, number of hospital beds.

Demographics for Matched Cohorts

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Cohort</th>
<th>AA Cohort</th>
<th>p-value</th>
<th>Standardized difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-match/pre-match counts</td>
<td>897087.916</td>
<td>897923</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Age</td>
<td>72.11 (7.86)</td>
<td>72.12 (8.46)</td>
<td>0.968</td>
<td>0.002</td>
</tr>
<tr>
<td>Sex</td>
<td>% %</td>
<td>% %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>59.5 59.4</td>
<td>59.5 59.4</td>
<td>0.962</td>
<td>-0.002</td>
</tr>
<tr>
<td>Race</td>
<td>% %</td>
<td>% %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>94.7 94.8</td>
<td>94.7 94.8</td>
<td>0.699</td>
<td>0.082</td>
</tr>
<tr>
<td>Black</td>
<td>3.5 2.9</td>
<td>3.5 2.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.8 2.3</td>
<td>1.8 2.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual Eligible Status</td>
<td>7.8 8.5</td>
<td>7.8 8.5</td>
<td>0.604</td>
<td>0.025</td>
</tr>
<tr>
<td>Year of Surgery</td>
<td>% %</td>
<td>% %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>25.5 26.4</td>
<td>25.5 26.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>37.1 37.4</td>
<td>37.1 37.4</td>
<td>0.863</td>
<td>0.026</td>
</tr>
<tr>
<td>2014</td>
<td>37.4 36.2</td>
<td>37.4 36.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Provider & Surgeon Characteristics for Matched Cohorts

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Cohort %</th>
<th>AA Cohort %</th>
<th>p-value</th>
<th>Standardized difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching Hospital (Yes)</td>
<td>27.0</td>
<td>20.0</td>
<td>0.0004</td>
<td>-0.166</td>
</tr>
<tr>
<td>Large Urban</td>
<td>52.6</td>
<td>40.6</td>
<td>&lt;0.0001</td>
<td>0.292</td>
</tr>
<tr>
<td>Other Urban</td>
<td>46.4</td>
<td>59.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD) Surgeon THA volume (2012-2014)</td>
<td>172.44 (198.08)</td>
<td>273.90 (145.69)</td>
<td>&lt;0.0001</td>
<td>0.584</td>
</tr>
</tbody>
</table>
Results

Proportion of Patients Discharged Home*

Discharged home or home health agency after index surgery

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Adjusted Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA cohort</td>
<td>897</td>
<td>87.3%</td>
<td>85.0-89.6%</td>
</tr>
<tr>
<td>Control cohort</td>
<td>897</td>
<td>68.7%</td>
<td>65.5-71.8%</td>
</tr>
</tbody>
</table>

*Adjusted (marginal) proportions obtained from method of recycled predictions from GEE multivariate model

Post-Acute Total Claim Payments*

Total 90-day wage-adjusted payments

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Adjusted Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA cohort</td>
<td>897</td>
<td>$4,139</td>
<td>$3,294-$4,985</td>
</tr>
<tr>
<td>Control cohort</td>
<td>897</td>
<td>$7,465</td>
<td>$6,356-$8,573</td>
</tr>
</tbody>
</table>

*Adjusted (marginal) means obtained from method of recycled predictions from GEE multivariate model

Hospital Length of Stay

Days in Hospital

- Patients who received AA from the participating surgeons had lower in-hospital length of stay than those in the control cohort (2.07 vs. 2.98 days);
- Patients who received AA from the participating surgeons were significantly more likely than those in the control arm to be discharged home (87% vs. 69%); and
- Patients incurred nearly 50% lower post-acute costs: ($4,139 vs. $7,465, for per-patient 90-day savings of $3,326).

These differences represent a large proportion of post-acute care resource use after THA, and are highly relevant for the transition to value-based care.

Limitations

- This is not a purely comparative study, given mixed surgical approaches within control cohort.
- The participating surgeons were not a random, independent sample, and may not be representative of the broader population of surgeons who use the AA technique.
- In particular, all surgeons were highly experienced with the AA technique prior to the observation period.
- All limitations and biases inherent to analysis of retrospective administrative data apply; principally, relationships cannot be considered causal.

Conclusions

- After control for variables spanning multiple patient and provider domains:
  - Patients who received AA from the participating surgeons had lower in-hospital length of stay than those in the control cohort (2.07 vs. 2.98 days);
  - Patients who received AA from the participating surgeons were significantly more likely than those in the control arm to be discharged home (87% vs. 69%); and
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REFERENCES:

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