SAFETY, EFFICACY AND COST SAVINGS OF SINGLE PARATHYROID HORMONE MEASUREMENT FOR RISK STRATIFICATION AFTER TOTAL THYROIDECTOMY

Meghan McCullough BA, Collin Weber MD, Jyotirmir Shaarma MD
Emory University School of Medicine, Department of Surgery

Background

- Hypocalcemia is the most common complication following total thyroidectomy. The reported incidence varies from 14% to 16% high as 54%. Most series report an incidence around 20-30%, with symptoms ranging from mild paresthesia to severe stranges, tetany, and convulsions.

- Hypocalcemia following total thyroidectomy can be a cause of significant distress and anxiety for caregivers and patients alike. In addition, postoperative hypocalcemia and its management is generally the most significant contributor to length of hospital stay and cost after thyroid surgery.

- V A few strategies for diagnosing and managing post thyroidectomy hypocalcemia have been used. The traditional approach of repeat clinical assessment and monitoring of serum calcium levels is still used by many institutions. Even though close monitoring of serum calcium levels is the standard of care for the patient who undergoes thyroidectomy, it has limitations as an early predictor of postoperative hypocalcemia, because the lowest concentration of serum calcium is usually not reached until 48 hours after surgery.

- M ore recently the measurement of parathyroid hormone postoperatively has been utilized to try to predict those patients at risk of developing hypocalcemia. However, this practice has not been widely adopted, nor has it been incorporated into a standardized system of care.

- W ith increasing trend toward shortening hospitalization, the ability to stage patients with thyrocalcemia and counsel them about their predicted length of hospital stay based on a single test has significant appeal for caregivers, patients and hospital administrators alike.

Methods

- Pre operative based parathyroid hormone (PTH) measurement, defined as either in the post operative care unit (PACU), within 8 hours postoperatively or with the next set of labs, and routine calcium supplementation, defined as Calcium/Vitamin D 500-200 mg TID (Ca+V D 500-200 mg), was instituted in 2010. A prospective database was queried between January 2010 and June 2012 with patients who had undergone total thyroidectomy (TT) identified.

- A ll surgeries were performed by a single surgeon at a single institution. All patients underwent either total or near total thyroidectomies. Patient demographics, pre-operative diagnosis, central neck dissection, postoperative laboratory values and cost (PTH and calcium) and PTH calcium supplementation regimen, post-operative complications including both transient hypocalcemia (TH) and permanent hypocalcemia (PH); necessity of intravenous (IV) calcium; number of parathyroid autografts and length of stay (LOS) were collected from the database for patients with PTH<10 pg/mL and PTH>10 pg/mL and analyzed for significance using a Fisher exact test with an alpha error set at 0.05.

- A cost analysis was conducted examining the actual cost difference between the two groups in terms of laboratory costs and length of stay and total costs. The cost of specific laboratory tests were based on published Medicare reimbursement rates and the cost of the operation and overnight stay were based on published national rates. Additionally, a theoretic cost analysis assuming implementation of the protocol was conducted using the same cost data sources.

Results

- Table 1: Comparison of PTH<10 pg/mL and PTH>10 pg/mL for LOS, Lab draws and Cost

<table>
<thead>
<tr>
<th>PTH&lt;10 pg/mL</th>
<th>% of Total</th>
<th>LOS (days)</th>
<th>Calcium draws</th>
<th>PTH draws</th>
<th>Total Average Cost (per pt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTH&lt;10 pg/mL</td>
<td>74.5%</td>
<td>1.3</td>
<td>18.8</td>
<td>1.0</td>
<td>$40.03</td>
</tr>
<tr>
<td>PTH&gt;10 pg/mL</td>
<td>25.5%</td>
<td>4.7</td>
<td>34.7</td>
<td>2.0</td>
<td>$139.32</td>
</tr>
</tbody>
</table>

| PTH<10 pg/mL | 63.1%      | $186.15    | $554.14       | $282.00   | $554.14                    |
| PTH>10 pg/mL | 36.9%      | $356.05    | $554.14       | $282.00   | $736.15                    |

- Figure 1: Distribution of Preoperative Diagnoses

- Figure 2: Cost Savings Model

- Table 2: Cost of Total Thyroidectomy

<table>
<thead>
<tr>
<th>PTH&lt;10 pg/mL</th>
<th>PTH&gt;10 pg/mL</th>
<th>Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>$186.15</td>
<td>$356.05</td>
<td>$542.20</td>
</tr>
</tbody>
</table>

- Figure 3: Cost Savings Model

- Table 3: Actual Cost Savings between PTH<10 pg/mL and PTH>10 pg/mL

<table>
<thead>
<tr>
<th>PTH</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 pg/mL</td>
<td>$186.15</td>
</tr>
<tr>
<td>&gt;10 pg/mL</td>
<td>$356.05</td>
</tr>
</tbody>
</table>

Cost Analysis

- Table 3: Actual Cost Savings between PTH<10 pg/mL and PTH>10 pg/mL

<table>
<thead>
<tr>
<th>PTH</th>
<th>Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10 pg/mL</td>
<td>$186.15</td>
</tr>
<tr>
<td>&gt;10 pg/mL</td>
<td>$356.05</td>
</tr>
</tbody>
</table>

Discussion

- Our proposed algorithm for a single PTH measurement postoperatively had extremely high sensitivity with 100% of hypocalcemic complications, even those mild and self-limited, identified. While the specificity of the algorithm was somewhat lower, 76.7%, the protocol was still extremely effective at risk stratification.

- Many studies have addressed the feasibility of same day surgery after total thyroidectomy, however ours is the first to directly compare the current average hospital stay to the expedient hospital stay with institution of the protocol. Use of our algorithm would allow for a significant reduction in LOS.

- Our study is also unique in its detailed examination of laboratory testing. We analyzed the average number of blood draws and associated costs, both in the group as a whole and in specific subgroups based on PTH risk stratification, and found concerning that with the use of PTH both the number of blood draws and the overall cost of laboratory testing could be significantly reduced.

- Our cost analysis is also more extensive than others in the literature in that it evaluates actual cost savings in terms of the two groups, PTH<10 pg/mL and PTH>10 pg/mL, and estimates theoretical cost savings with implementation of our proposed algorithm. In terms of total cost savings we estimated a total savings of $108,235.67 and $1,356.93 per patient, which translates to a 4.7% reduction with the implementation of our algorithm.

- The advantages of the use of our algorithmic approach for risk stratification are multiple:
  - A protocol will be more comfortable in the early postoperative period as a result of fewer blood tests: moreover, middle of the night testing interrupting sleep may be completely avoided.
  - In selected patients, same-day discharge may be reality and these patients could be able to spend the first postoperative night in the comfort of their home.
  - E ven if patients remain in the hospital overnight to any combination of patient socio-demographic factors or physician preference, lower blood test turns into cost as a result of reduction in laboratory expenditures and decreased work-load for the nursing staff, physicians and nurses.
  - In the case of patients requiring IV calcium supplementation, intervention can begin sooner: potentially averting more severe effects of hypocalcemia and/or avoiding delayed readmissions for IV supplementation.
  - If patients are discharged in accordance the algorithm, hospital savings resulting from reduced length of stay would be significant.

- References