Thyroid and Parathyroid Surgery: Achieving Optimal Outcomes

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Thyroid
Greek word *thyreos-* shield shaped
Histology of normal thyroid

colloid
Characteristics of Malignant Thyroid Nodules

- solitary nodule
- hard, fixed
- rapidly enlarging
- ipsilateral adenopathy
- hoarseness with vocal chord paralysis
- development of nodule at age less than 14 or greater than 65 years
- history of low dose ionizing radiation
Evaluation of Solitary or Dominant Thyroid Nodules

Hx X-ray Therapy

no

yes

FNA

Total Thyroidectomy

Colloid Nodule

"Benign"

Observe

Follicular Neoplasm

"Suspicious"

Lobectomy

Papillary Cancer

"Cancer"

Total Thyroidectomy

Inadequate Specimen

"Benign"

"Suspicious"

"Cancer"

Inadequate Specimen
Radioiodine scans
Thyroid sono in 35yo man

Thyroid

Left jugular noncompressed

Left jugular compressed
Sono guided needle placement
Equipment for FNA
3cm incision marked
Specimen and incision
Location of parathyroids
De-Evolution of disease severity in Hyperparathyroidism

- Classically patients presented with $\text{Ca}^{++} > 12$ and significant symptoms
- Routine chem panels detected “asymptomatic” patients with mildly elevated calciums
- Use of $\text{Ca}^{++}$ and PTH screening in patients with osteoporosis and kidney stones is detecting disease with high normal or minimally elevated calciums
Nice big parathyroid adenoma
Parathyroid disease in 2009
Difficulties in diagnosis of mild hyperparathyroidism

- 1° HP vs 2° HP vs normal
- Use of ionized Ca, albumin, Vit D levels
- 24h urinary Ca to exclude BFHH
- Pts on bisphosphonates
- May need serial studies to establish diagnosis
2002 NIH Criteria for Surgery

- Blood calcium level more than 1.0 mg/dL above normal
- 24-hour urinary calcium excretion greater than 400 mg/day
- Kidney function reduced by 30% below normal
- Bone mineral density reduced by 2.5 standard deviations below young, healthy controls
- Age less than 50
Strongest evidence (High likelihood of benefit)
- Improved bone health
- Improved sense of well being and quality of life
- Reduction in risk of kidney stones

Intermediate evidence (Possible benefit)
- Improvement in muscular and skeletal complaints
- Improvement in abdominal complaints

Weakest evidence (Benefit uncertain)
- Improved blood pressure
- Reduced risk of diabetes
- Reduced risk of early death from cardiovascular disease
Fracture-free survival of 1569 patients with primary hyperparathyroidism

Risk of kidney stone events after parathyroid surgery

Fold risk above normal

Time

- Before surgery
- <1 year after surgery
- 1-4 years after surgery
- 5-9 years after surgery
- >10 years after surgery
Most common symptoms in primary hyperparathyroidism

- Fatigue or exhaustion
- Muscle and bone pain
- Back pain
- Weakness
- Excessive thirst
- Frequent urination
- Constipation
- Depression
- Memory loss
- Nausea
- Itching
Symptoms improve after parathyroid surgery

- Fatigue or exhaustion
- Muscle and bone pain
- Back pain
- Weakness
- Excessive thirst
- Frequent urination
- Constipation
- Depression
- Memory loss
- Nausea
- Itching

[Graph showing improvements in symptoms after parathyroid surgery]
Minimally Invasive Parathyroid Surgery = MIPS

• This is a marketing term used to make patients think one approach to parathyroid surgery has significantly better outcomes than another.

• Surgeons should define their operations in technical terms:
  • Single gland exploration through 2cm incision
  • 4 gland exploration through a 2.5cm incision
  • Single gland exploration using videoscopic instrumentation
Extent of Parathyroid Exploration

- Bilateral exploration - look for all 4 glands
- Unilateral exploration - look for 2 glands on one side
- Focal exploration - look for single abnormal gland
  - Select cases based on localizing studies
  - End procedure based on rapid intraop PTH
Key to the success of focal exploration:

- What is the incidence of multiple gland disease?
- How good are localizing studies in predicting single gland disease?
- How good is intraop PTH measurement in determining that all pathology has been removed?
- How good is the long term follow-up?
- What is an acceptable failure rate balanced by the proposed benefits?
Incidence of multiple gland disease

- Retrospective review at 2 endocrine surgery centers: Emory and CCF
- 828 patients with 1º hyperparathyroidism
- Bilateral neck exploration
- Disease patterns:
  - single adenomas 71%
  - double adenomas 15%
  - hyperplasia 13%
Distribution of Double Adenomas

% DA Patients

- Both Superior
- Both Inferior
- Both Right
- Both Left
- Right Superior
- Left Inferior
- Right Inferior
- Left Superior

*P < .001
Sestamibi iodine subtraction scan with SPECT imaging
Surgeon Preformed Parathyroid Ultrasound

- 7.5 MHz or higher transducer
- Curved or small footprint linear
- Patient positioned supine with neck hyperextended
Experience and Outcomes

- Importance of experience is intuitive
- Many published reports confirm this
  - Clinician volume
  - Hospital volume
- What about thyroid/parathyroid surgery?
  - Stavrakis et al, Surgery 2007
  - Pieracci et al, World J. of Surgery 2008
Re-operative Surgery

- Significant percentage of our practice
- Some unavoidable
- Many felt to be avoidable
- Can re-operations be reliably classified as avoidable or unavoidable?
Aims

1. Create a set of criteria for classifying re-operations as avoidable or unavoidable
2. Determine the incidence of avoidable re-operations in thyroid and parathyroid surgery
3. Determine whether clinical volume affects the incidence of avoidable re-operations
Methods

- All patients undergoing re-operative thyroid and parathyroid surgery 1999-2007

Pre-op imaging
Intra-op findings
Histopathology

+ Objective criteria

Avoidable or Unavoidable?
Methods

- Hospital volume obtained using inpatient & outpatient data
- < 20 cases/year = low-volume center
- ≥ 20 cases/year = high-volume center
- Each re-operation treated as separate case
Criteria for Avoidable vs Unavoidable Operations

- **Example for Thyroid Cases**
  - **Unavoidable** → Completion thyroidectomy after lobectomy for follicular neoplasm on FNA
  - **Avoidable** → Selective LN excision ("berry picking") with recurrence in same compartment

- **Example for Parathyroid Cases**
  - **Unavoidable** → Persistent 1° HPT due to ectopic gland inaccessible through standard incision
  - **Avoidable** → Persistent 1° HPT due to missed gland in normal anatomic location
280 patients underwent re-operative surgery

- 227 single re-operations
- 53 multiple re-operations

395 total re-operations

335 cases with initial hospital data available
## Case Distribution

<table>
<thead>
<tr>
<th>Type of Re-operation</th>
<th>Number of Cases</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyroid</td>
<td>189</td>
<td>56%</td>
</tr>
<tr>
<td>Parathyroid</td>
<td>146</td>
<td>44%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hospital Volume</th>
<th>Number of Cases</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>High-Volume Center</td>
<td>167</td>
<td>50%</td>
</tr>
<tr>
<td>Low Volume Center</td>
<td>168</td>
<td>50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Re-operation Classification</th>
<th>Number of Cases</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoidable</td>
<td>134</td>
<td>40%</td>
</tr>
<tr>
<td>Unavoidable</td>
<td>201</td>
<td>60%</td>
</tr>
</tbody>
</table>
Incidence of Avoidable Re-operations: Thyroid vs. Parathyroid Surgery

Thyroid Re-operations
189 cases
- 70% Unavoidable
- 30% Avoidable

Parathyroid Re-operations
146 cases
- 47% Unavoidable
- 53% Avoidable
Thyroid Cases:
Low vs. High-Volume Centers

Low-Volume Centers
86 cases

High-Volume Centers
103 cases

- 54% CCF
- 46%

Volume Centers
Avoidable Thyroid Re-operations

Low-Volume Centers
86 cases

43% Unavoidable
57%* Avoidable

High-Volume Centers
103 cases

15%* Avoidable
85% Unavoidable

*p < 0.001
Thyroid Cancer Cases

Low-Volume Centers
- 62 cases
  - 45% Unavoidable
  - 55%* Avoidable

High-Volume Centers
- 72 cases
  - 12%* Avoidable
  - 88% Unavoidable

* p < 0.001
Benign Thyroid Cases

Low-Volume Centers
- 24 cases
- 67% Unavoidable
- 33% Avoidable

High-Volume Centers
- 31 cases
- 81% Unavoidable
- 19% Avoidable

*p = NS
Hospital Volume and Incidence of Avoidable Thyroid Re-operations

% Avoidable Referrals

Low-Volume Centers

High-Volume Centers

Annual Number of Thyroid Cases
Parathyroid Cases: 
Low vs. High-Volume Centers

Low-Volume Centers
- 82 cases

High-Volume Centers
- 64 cases

- 56%
- 44%

CCF
Avoidable Parathyroid Re-operations

Low-Volume Centers
82 cases
- 78% Avoidable
- 22% Unavoidable

High-Volume Centers
64 cases
- 22%* Avoidable
- 78% Unavoidable

* p < 0.001
Persistent 1º HPT Cases

Low-Volume Centers
- 34 cases
  - 95%* Avoidable
  - 5% Unavoidable

High-Volume Centers
- 62 cases
  - 59% Avoidable
  - 41%* Unavoidable

* p < 0.001
Persistent 1º HPT Cases: Impact of Initial Sestamibi Scan

- Low-Volume Center:
  - % Correct Imaging: 70%
  - % Avoidable: 36%

- High-Volume Center:
  - % Correct Imaging: 100%
  - % Avoidable: 17%

* p < 0.001
Hospital Volume and Incidence of Avoidable Parathyroid Re-operations

Annual Number of Parathyroid Cases
RLN Injury after Initial Operation: High vs. Low-Volume Center

Complication Rates in Our Practice: Initial vs. Re-operative Surgery

% RLN Injury

High-Volume Center: 3%
Low-Volume Center: 9%

Complications

Initial Operations: 1%
Re-operations: 4%

p < 0.05

p < 0.001
Conclusions

- Re-operative thyroid & parathyroid surgery can be reliably classified as avoidable or unavoidable
- A significant number of re-operative thyroid and parathyroid surgeries are avoidable
- Most avoidable re-operations originate from low-volume centers → Persistent 1° HPT, Thyroid Cancer
- Provides further evidence for concentrating the treatment of thyroid & parathyroid disease to high-volume centers
Keys to successful high volume Endocrine Surgery program

- 4 surgeons - group practice model
- Dedicated RNs & NP
- “One stop shopping”
  - Pre visit record review
  - Lab studies
  - Consult
  - Ultrasound
  - Needle biopsy

Cleveland Clinic
Challenging Parathyroid Localization