Surgical Management and Outcomes of Thyroid Cancer in Children

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OBJECTIVES

• Understand the surgical approach to pediatric thyroid nodules and well-differentiated cancer as recommended by the recent ATA guidelines

• Summarize clinical outcomes after surgical intervention and strategies for prevention of complications

• Review institutional outcomes of Thyroid Tumor Program
BACKGROUND

- Children’s neoplasms have unique pathophysiology, clinical presentation, long-term outcomes
- Recommended therapy for adults may not be appropriate for children
- Need for pediatric-specific management guidelines
ATA GUIDELINES ON PEDIATRIC THYROID CANCER

Management Guidelines for Children with Thyroid Nodules and Differentiated Thyroid Cancer

The American Thyroid Association Guidelines Task Force on Pediatric Thyroid Cancer


*Designates Chair (GLF) and Co-Chairs (AJB and SGW)
Guidelines Task Force in Alphabetical Order Following the Chairs

• Literature review (up to 2014)
• Restricted population ≤ 18 years
• Evidence graded by USPSTF modified schema
• Recommendations on aspects of surgical treatment
  – Preoperative staging
  – Surgical management
  – Postoperative complications and minimization of risks

Thyroid. 2015 Jul; 25 (7):716-59
Is there a role for surgery in children with benign and autonomous thyroid nodules?
BENIGN AND AUTONOMOUS THYROID NODULES

• Benign lesions are followed serially with US and FNA repeated if growth or suspicious features
• Lobectomy considered for compressive symptoms, cosmetic concerns, patient/parent preference
• Benign solid >4 cm nodule, significant growth, other clinical concern for malignancy
• Lobectomy for toxic adenoma (suppressed TSH, uptake on scintigraphy, clinically euthyroid or mild hyperthyroidism)
• In asymptomatic patient if surgery deferred, consider FNA if features concerning for PTC

Recommendation Rating: B, A
What is the optimal pre-operative evaluation for the child with newly diagnosed PTC?
PREOPERATIVE STAGING

• Comprehensive neck US
• FNA of suspicious lateral neck lymph nodes
• MRI or CT with contrast only if large or fixed thyroid masses, vocal cord paralysis, or bulky metastatic lymphadenopathy
• *Routine* chest CT is not recommended for patients with minimal neck disease
• No role for 18FDG-PET/CT

Recommendation Rating: A
What is the recommended surgical approach for a patient with PTC?
EXTENT OF SURGERY: LOBECTOMY vs. TOTAL THYROIDECTOMY

• Total thyroidectomy is recommended for the majority of children

• Increased incidence of bilateral and multifocal disease (30% and 65%, respectively)\(^1,2\)

• Bilateral lobar resection compared with lobectomy decreases the risk for persistent/recurrent disease\(^3\)

• Optimizes use of RAI for imaging and/or treatment, and Tg as a marker to detect persistent/recurrent disease

• Intracapsular dissection preserves blood supply of parathyroid glands


Recommendation Rating: A
Should central neck dissection be performed?
THERAPEUTIC vs. PROPHYLACTIC CENTRAL NECK DISSECTION

- *Therapeutic* CND is indicated in patients with preoperative evidence of central compartment metastasis
  - Malignant cytology, gross clinical extrathyroidal tumor extension and/or locoregional mets on preop staging or intraoperative findings
- Decrease need for second surgical procedures, increase in DFS
- Must balance the goal of achieving surgical remission with the increased risks of complications related to more aggressive surgical treatment
- CND if and when performed should be done by highly experienced surgeon

Recommendation Rating: B
The role of routine prophylactic CND is controversial.

Very limited data in children suggest 95% DFS at 5 and 10 years with TT and CND.

Predictors of locoregional metastases such as >4 cm tumor size may not apply in children:
- 36% tumors ≤4 cm have cervical LN metastasis
- Anecdotal reports of regional mets in primary tumors < 1 cm
- Smaller thyroid volume

Need prospective, long-term outcome data, reliable risk stratification to select patients who need more aggressive resection.

Prophylactic CND may be selectively considered based on tumor focality and size and surgeon experience.

Recommendation Rating: C
What are the indications for lateral neck dissection?
LATERAL NECK DISSECTION

• Pediatric patients with bulky disease to the lateral neck and suspicious lymph nodes on pre-operative US imaging
  – Increased size, rounded shape, loss of central hilum, cystic appearance, peripheral vascularity on Doppler, microcalcifications\textsuperscript{5}
• Lateral neck dissection should be performed on patients with cytologic evidence of metastases to the lateral neck
• Routine prophylactic lateral neck dissection (levels III, IV, anterior V, and II) is not recommended

\textsuperscript{5} Fish SA, et al. Endocrinol Metab Clin North Am 2008 37: 401-417, ix

Recommendation Rating: B
What are the possible complications of surgery and what should be done to minimize the risks of surgery?
Children < 10 years of age have increased risk of complications associated with the presence of extrathyroidal extension, lymph node dissection and repeat surgery.

<table>
<thead>
<tr>
<th>Complication</th>
<th>ATA Guidelines Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient or Permanent Hypoparathyroidism</td>
<td>5-15%</td>
</tr>
<tr>
<td>Permanent Hypoparathyroidism</td>
<td>&lt;2.5%</td>
</tr>
<tr>
<td>Nerve Injury (RLN, CN XI), Horner syndrome</td>
<td>1-6%</td>
</tr>
</tbody>
</table>

*Thyroid. 2015 Jul; 25 (7):716-59*
ENDOCRINE-SPECIFIC COMPLICATIONS

• Hypoparathyroidism correlates with extent of surgery
• Predicting increased risk of hypocalcemia:
  – Serial measurements of serum calcium
  – Perioperative iPTH level
• iPTH < 10-15 pg/ml correlates with an increased risk to develop clinically significant hypocalcemia

• Early incorporation of calcium and calcitriol in patients at high-risk for hypocalcemia may decrease the risks of symptomatic hypocalcemia

Recommendation Rating: B

STRATEGIES FOR RISK MINIMIZATION

• Pediatric thyroid surgery should be performed in a hospital with the full spectrum of pediatric specialty care
  – Endocrinology, Radiology, Nuclear medicine, Anesthesia, High-volume Thyroid Surgeon, Intensive Care
• Pediatric thyroid surgery should ideally be performed by high-volume surgeon (>30 cervical endocrine procedures/year)
• Associated with lower complications rates, decreased hospital stay and lower cost

7 Tuggle CT, et al. Surgery 2008 144: 869-877

Recommendation Rating: B
A dedicated multidisciplinary program focused on improving the care and treatment of children with thyroid disease

Endocrinology, Pediatric Surgery, ENT, Radiology and Interventional Radiology, Pathology, Hematology/Oncology, Outcomes and Impact Service

Individualized treatment plans based on standardized practice guidelines, monitor clinical outcomes, patient and family engagement
Thyroid Surgical Cases Since Inception of Thyroid Tumor Board

104
Thyroid Surgical Cases Quarterly Volume
Oct 2012-May 2016

Surgery Count

Surgery Count

y = 6.9333

YearQuarter

Texas Children's Hospital

Baylor College of Medicine
# Thyroidectomy Patient Demographics

<table>
<thead>
<tr>
<th></th>
<th>Oct 2012-May 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total operations</td>
<td>104</td>
</tr>
<tr>
<td>Total patients</td>
<td>99</td>
</tr>
<tr>
<td>Gender</td>
<td>Female =79 (80%)</td>
</tr>
<tr>
<td>Median age at operation</td>
<td>15 years (1-26)</td>
</tr>
</tbody>
</table>

This information is privileged and confidential pursuant to Texas Health and Safety Code sections 161.031-161.033 and Texas Occupations Code section 160.007 and/or T.R.C.P.192.5.
## Types of Cases

<table>
<thead>
<tr>
<th>Type of Case</th>
<th>Oct 2012-May 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cases</td>
<td>n=104</td>
</tr>
<tr>
<td>Total thyroidectomy</td>
<td>54 (52%)</td>
</tr>
<tr>
<td>Hemi thyroidectomy</td>
<td>44 (42%)</td>
</tr>
<tr>
<td>Completion thyroidectomy</td>
<td>5 (5%)</td>
</tr>
<tr>
<td>Excision of thyroid cyst</td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>

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# Indications for Thyroidectomy

**Oct 2012- May 2016**

<table>
<thead>
<tr>
<th>Indication per Case</th>
<th>n=104</th>
<th>Surgical Pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Graves’/Hyperthyroidism</strong></td>
<td>22 (21%)</td>
<td>5% (1/22)</td>
</tr>
<tr>
<td><strong>Nodule/Thyroid Cyst/Goiter</strong></td>
<td>64 (62%)</td>
<td>52% (33/64)</td>
</tr>
<tr>
<td><strong>Branchial Cleft Cyst</strong></td>
<td>13 (12%)</td>
<td>0% (0/5)</td>
</tr>
<tr>
<td><strong>Completion</strong></td>
<td>5 (5%)</td>
<td>0% (0/13)</td>
</tr>
</tbody>
</table>

This information is privileged and confidential pursuant to Texas Health and Safety Code sections 161.031-161.033 and Texas Occupations Code section 160.007 and/or T.R.C.P. 192.5.
Mortality and LOS

<table>
<thead>
<tr>
<th></th>
<th>Oct 2012-May 2016</th>
<th>n=104</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hospital mortality ≤ 30d</strong></td>
<td>0/104 (0%)</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital LOS in Days</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>1.3 day</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.5 day</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>0 - 5 days</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital LOS in Hours</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>32 hours</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>37 hours</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>4 – 127 hours</td>
<td></td>
</tr>
<tr>
<td><strong>Estimated Blood Loss</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td>10ml</td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>39ml</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>2-700ml</td>
<td></td>
</tr>
</tbody>
</table>
# OUTCOMES ≤ 30 days

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return to EC ≤ 30 days</td>
<td>7 (7%)</td>
</tr>
<tr>
<td>Readmission ≤ 30 days</td>
<td>5 (5%)</td>
</tr>
<tr>
<td>Reoperations ≤ 30 days</td>
<td>3 (3%)</td>
</tr>
</tbody>
</table>

Oct 2012-May 2016
n=104
Reoperations and EC Visits

Reoperations ≤ 30d
- Completion for PTC Follicular Variant
- Post-op Hematoma bedside I&D

Return to EC ≤ 30d
**Related** to Thyroid Surgery
- Poor oral intake, fever, drooling
- Thyroid bed and incisional pain
- Tingling and numbness POD # 5

**Unrelated** to Thyroid Surgery
- Contact Dermatitis from ETT
- Headache
- Buttock Cellulitis
- Viral Symptoms

Oct 2012-May 2016
n=104

<table>
<thead>
<tr>
<th></th>
<th>3 (3%)</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematoma</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-op</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Related to Thyroid Surgery</td>
<td>3 (3%)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Poor oral intake</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fever, drooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroid bed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incisional pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tingling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Numbness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrelated to Thyroid Surgery</td>
<td>4 (4%)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Contact Dermatitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ETT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Headache</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buttock Cellulitis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viral Symptoms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Readmission ≤ 30d</td>
<td>Oct 2012-May 2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------</td>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completion for PTC Follicular Variant</td>
<td>5/104 (5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buttock Cellulitis Abscess</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor oral intake, fever, drooling</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planned RAI</td>
<td></td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Occurrences</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Post-op Transient Hypocalcemia (Ca &lt; 8)</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>20 (37%)</td>
</tr>
<tr>
<td></td>
<td>20/54 total</td>
</tr>
<tr>
<td></td>
<td>1 (20%)</td>
</tr>
<tr>
<td></td>
<td>1/5 completion</td>
</tr>
</tbody>
</table>

| IV Calcium Required Post-Op                          | 7                 |
|                                                     | 6 Total (6/54) 11%|
|                                                     | 1 Hemi with lymphadenectomy (1/44) 2% |

| RLN injury/paralysis ≤ 30d                           | 2                 |
|                                                     | 1 Total thyroidectomy |
|                                                     | (voice weakness resolved at 2 months) |
|                                                     | 1 Hemi thyroidectomy w/ central node dissection extensive disease |
|                                                     | (right vocal cord paralysis via scope) |
Future Directions

• Outcomes on the website and provided in print materials for families

• Education, e.g. local, national and international conferences

• Research

• Regional partners

• National benchmarking via AAES Collaborative Endocrine Surgery Quality Improvement Project
CONCLUSIONS

• Surgery has an important role in the management of benign thyroid nodules and is the mainstay of treatment for well-differentiated pediatric thyroid cancer

• Complications of thyroidectomy include transient or permanent hypoparathyroidism and nerve injury

• Strategies for prevention of endocrine-specific complications include early calcium and calcitriol supplementation, use of iPTH to risk-stratify patients

• Programs with multidisciplinary expertise are essential in achieving best outcomes for pediatric patients with thyroid disease