Robot Assisted Endocrine Surgery: Thyroid and Adrenal

Nancy D. Perrier, MD, M.D. Anderson Cancer Center
Department of Surgical Oncology
Surgical Endocrinology

The Evolution of Modern Surgery

- The art of the surgical discipline
- The combination of science and technological advances
- The application of art and science towards healing

Major Revolution in Surgery

1987
Scarless Surgery: the Millenium Thyroidectomy

The Thyroidectomy Evolution

Thyroidectomy Options

**Approach**
- Open
- Endoscopic
  - Direct
  - Indirect
    - Transcervical
    - Transaxillary (30°/0°)
    - Anterior Chest Wall
    - Peri Areolar Breast
    - Trans-oral

**Techniques**
- Exposure
  - Insufflation vs Gasless
- Instrumentation
  - Robotic vs not
- Remote access

Transaxillary Approach

Transaxillary Pectoralis Exposure

Transaxillary Dissection

Space between the SCM branches

Sternal Head of SCM Elevation

Surgical Dissection
Korean Experience

- Multicenter study
- 1043 consecutive cases

Korean Experience

- Differences in outcome
- Prospective study
  - Preop, 1, 12 weeks post op
  - OR time longer
  - No difference in pain, LOS, voice
  - Less discomfort and swallowing disturbances than open
  - Cosmetic satisfaction higher in robot

Cadaveric Dissections

Lee, Han, Chung Surg Endo 2010
Port Placement- Axillary Space

Chung Retractor

8 mm Pro Grasp Retractor
8 mm Curved Harmonic Scalpel
5mm Maryland Dissector
12mm Dual Endoscope at 40° angle
Laparoscopic Suction

Foot
Head

Robotic Positioning

12mm 30° Dual Endoscope at 40° angle

5mm Maryland Dissector

Chung Retractor

Commercially Available 2010

Transaxillary Thyroidectomy

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean tumor size:</td>
<td>1.0 cm</td>
</tr>
<tr>
<td>Complications:</td>
<td></td>
</tr>
<tr>
<td>Major- 1%</td>
<td></td>
</tr>
<tr>
<td>Minor 6.3%</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. Clinical Characteristics of Patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td>40.3 ± 9.5 (range 16–69)</td>
</tr>
<tr>
<td>Gender ratio, male:female</td>
<td>1:1 (range 4:192)</td>
</tr>
<tr>
<td>Operation type</td>
<td></td>
</tr>
<tr>
<td>Total thyroidectomy with CCND</td>
<td>45</td>
</tr>
<tr>
<td>Less than total thyroidectomy</td>
<td></td>
</tr>
<tr>
<td>with CCND</td>
<td>155</td>
</tr>
<tr>
<td>Operation time, min</td>
<td>141.1 ± 38.8 (range 79–347)</td>
</tr>
<tr>
<td>Approaching time</td>
<td>26.7 ± 12.6 (range 6–72)</td>
</tr>
<tr>
<td>Docking time</td>
<td>6.8 ± 5.1 (range 3–23)</td>
</tr>
<tr>
<td>Console time</td>
<td></td>
</tr>
<tr>
<td>Postoperative complications, n (%)</td>
<td></td>
</tr>
<tr>
<td>Transient hypocalcemia</td>
<td>5 of 27 (36.7)</td>
</tr>
<tr>
<td>Transient voice change</td>
<td>8 of 27 (36.7)</td>
</tr>
<tr>
<td>Seroma</td>
<td>2 of 27 (0.5)</td>
</tr>
<tr>
<td>Permanent RLN paralysis</td>
<td>1 of 27 (0.5)</td>
</tr>
<tr>
<td>Postoperative hospital stay, d</td>
<td>3.2 ± 0.6 (range 2–6)</td>
</tr>
</tbody>
</table>

Unless otherwise indicated, data are expressed as mean ± SD. CCND, central compartment node dissection; RLN, recurrent laryngeal nerve.

Chung JACS 2009
Evidence Based Principles

– Define the question & problem
– Search for evidence
– Evaluate literature
– Apply results
– Audit outcome

Operative Times for RATS

Single Incision
Bilateral Transaxillary Thyroidectomy

Single Institution Cost of Robotic Thyroidectomy

s/p Thyroidectomy

Robotic Thyroidectomy Complications

- Massive emphysema and hypercarbia  
  (Gottlieb, Anes Analgesia 1997)
- Effect on intracranial pressure  
  (Rubino, Gagner Surgery 2000)
- Brachial Plexopathy
- Tracheal Injury
- Chest Wall Numbness

Why I have abandoned RATS

- Main benefit- translocation of the surgical incision to the axilla
- Requires 2X resources (personnel, sterilization, scheduling)
- Unable to justify the expense in a time of cost effectiveness and when demands outweigh resources
- Outcome not superior
- Not likely a bridge to telesurgery

Summary: Robotic Thyroidectomy

- More Expensive
  - Higher equipment depreciation costs
  - Substantially longer operating room time
  - Flat reimbursement schedule which is a disincentive to implementation
  - Cost prohibitive
- Niche Operation
Cushing's Syndrome

Robotic Technology

• Potential Benefits
  – Increased articulation of instruments: provides a flexible approach to dissection,
  – Magnified, 3 D optics: better visualization
  – Motion Scaling
  – Ergonomic advantages

• Disadvantages
  – Cost (non reusables, staff, maintenance, sterilization)
  – Time
  – Complexity

Patient Positioning

Retroperitoneoscopic Adrenalectomy

Laparoscopic Operative Technique
Robotic Docking

Left Sided Port Placement

- Robot Docked Here
- Prograsp Camera
- Harmonic Camera

- 8mm cannula
- 8mm cannula
- 12mm port balloon trocar
- 5mm trocar for suction, irrigation, clip applier

Left Sided Set Up

Ideal Instrument Articulation
Situations that Beckon Robotic Instrumentation

1. Cushing’s disease with prolonged preoperative medical (ketaconazole) therapy
2. Cortex preservation critical- may optimize the ability to maintain a vascularized remnant
3. Adrenal metastatic disease s/p neoadjuvant chemotherapy dense adherence to IVC
4. Adrenal vein anterior aspect of renal hilum
5. Morbid Obesity

Case 1

39 y/o F with C618S MEN IIa RET mutation
Biochemical evidence of pheochromocytoma
Bilateral lesions > 4 cm
Cortical preservation critical
4 of 4 young children + RET

Cortical-Sparing Strategy

• Preservation of adrenal vein
• Minimal peripheral dissection of spared remnant

Case 2

• 49 y/o F dx with small cell lung cancer
• Treated with XRT and whole brain radiation
• New isolated left adrenal metastasis
• Received systemic Cytoxan, Taxotere, Adriamycin
Systemic Treatment of Isolated Adrenal Metastasis

Case 3

41 y/o M with severe HTN
Right adrenal mass
Elevated aldosterone with right sided lateralization
Weight 152 Kg (334 lbs)

Robotic Adrenalectomy

- Robotic assistance is complimentary to PRA and may provide advantage in complex procedures
- Angled articulation appears to be beneficial in select PRA dissection
- The technology continues to evolve and further refinements are necessary
- Theoretic advantages should be rigorously validated in the clinical arena

Limitations

- Available Instruments
  - Robotic Clip Appliers
  - Articulating electrothermy instrumentation
- Hardware is bulky
- Access to robotic devices requires intermediate scheduling
- Requires experienced bedside assistant
- Dependent on multiple vendors
## Summary: Robotics in Endocrine Surgery

**Thyroid**
- Twice the time
- >Twice the expense
- Not superior
- Translocation of incision
- Different Complications

**Adrenal**
- Select cases
- Articulation and view beneficial
- Further instrument improvement
- Bulky hardware

## Principles of Safe Introduction of New Technology

- Broad diseased based knowledge
- Skill set for the operation; not technology
- Comprehensive educational experience
- Skill acquisition by a team rather than only a primary surgeon

---

**Endocrine Surgery: Robotics Implementation**

- Establish research aims
- Design data acquisition forms with definite endpoints
- Employ a consistent technique
- Develop and refine
- Objective review of outcomes

---

“...surgeons as fiduciaries must balance technologic advancement and ethical responsibilities, a subject rarely broached in our data-driven surgical publications.”

--James W. Jones, M.D.

---

Ethics of Rapid Surgical Technological Advances