The 5-hour parathyroidectomy: How is this possible?

David J. Terris, M.D.
Disclosures

- No dualities of interest
- Royalties from endocrine books
2 ways to ponder this:

- Inexperienced surgeon (maybe shouldn’t undertake this operation?)
- Experienced surgeon who encounters series of unanticipated findings
Volume-outcome relationship

- 10,000 hours to achieve mastery (baseball, violinist, surgeon)

Parathyroidectomy in Maryland: Effects of an endocrine center
Herbert Chen, MD, Martha A. Zeiger, MD, Toby A. Gordon, ScD, and Robert Udelsman, MD, Baltimore, Md.

The Importance of Surgeon Experience for Clinical and Economic Outcomes From Thyroidectomy
Julie Ann Sosa; Helen M. Bowman; James M. Tielsch; Neil R. Powe; Toby A. Gordon; Robert Udelsman
Volume-outcome relationship

Who performs endocrine operations in the United States?

Brian D. Saunders, MD, Reid M. Wainess, BS, Justin B. Dimick, MD, Gerard M. Doherty, MD, Gilbert R. Upchurch, MD, and Paul G. Gauger, MD, Ann Arbor, Mich

- 6100 surgeons – 14,323 operations
- 80% of operations by surgeons doing ≤3 per year

Saunders et al, Surgery, 2003
10,000 hours

- Outliers - Gladwell
- Saunders – low-volume PTH surgeons
- An operation more than any other where volume and cumulative experience matter
- Learning curves/inflection points - still improving after 1200 cases
5 most common pitfalls:

Nuances in parathyroid evaluation and management

David J. Terris, MD, FACS, FACE,a,b William S. Duke, MD, FACSa,b

From the aDepartment of Otolaryngology—Head and Neck Surgery, Augusta University, Augusta, Georgia; and the bDepartment of Endocrinology, Augusta University, Augusta, Georgia
1. Misdiagnosis

*It’s not surgical*

- Vitamin D deficiency (elevated PTH)
- FHH (rare); 24-hour calcium may be spuriously low
- Non-pth mediated hypercalcemia

*It is surgical*

- “Normal” PTH
1. Misdiagnosis

- In presence of hypercalcemia, PTH should be zero (or close to it)
- If PTH is not low, at least one of the 4 glands is “non-suppressed”
- The “normal” PTH level is not normal relative to the calcium
1. Misdiagnosis

*It’s not surgical*

- Vitamin D deficiency (elevated PTH)
- FHH (rare); 24-hour calcium may be spuriously low
- Non-pth mediated hypercalcemia

*It is surgical*

- “Normal” PTH
- True normocalcemic hyperparathyroidism
2. Imaging misinterpretations

15 minutes

2 hours
Rapid washout

Outside sestamibi negative

15 min

3 hr
Sestamibi repeated at AU
Read your own scans

A novel technique to improve the diagnostic yield of negative sestamibi scans

Sapna Nagar, MD, a David D. Walker, MD, b Omran Embia, MD, a Edwin L. Kaplan, MD, a Raymon H. Grogan, MD, a and Peter Angelos, MD, PhD, a Chicago, IL

Nagar et al, Surgery, 2014
Volume-outcome relationship

Among 18 outside negative scans

- 5 = read as positive
- 13 = study repeated at AU
- All 13 patients (100\%) localized

_Singer et al, Laryngoscope, 2012_
Limitations of Sestamibi

False Positives
Surgeon-performed ultrasound
Ultrasound pearls

- Turn the probe to demonstrate orientation of the adenoma (distinguish from lymph node)
Ultrasound pearls

• Turn the probe to demonstrate orientation of the adenoma (distinguish from lymph node)

• Explore for pedicle with Doppler

• If adenoma not seen on US, suspect deep gland
Ultrasound pearls

- Turn the probe to demonstrate orientation of the adenoma (distinguish from lymph node)
- Explore for pedicle with Doppler
- If adenoma not seen on US, suspect deep gland
- Immediate preop US on the table
Interpreting reports

- If the US report says “normal thyroid” except for “posterior hypoechoic thyroid nodule”

  That’s the parathyroid adenoma

- If the US report says “normal thyroid” except for “posterior hypoechoic thyroid nodule”, and then an FNA is done showing follicular cells, favor follicular neoplasm

  That’s STILL the parathyroid adenoma
3. Overly descended superior gland

- Most common cause for needing reoperative surgery
- Etiology – planar imaging reveals “lower pole adenoma”, presumed to be inferior gland
3. Overly descended superior gland

15 minutes

2 hours
Beware of planar imaging

- Overly descended superior adenoma is most common reoperative surgery
- Etiology – planar imaging reveals “lower pole adenoma”, presumed to be inferior gland
- Dissection insufficiently deep; paraesophageal
CT-Mibi
Overly-descended superior

- If inferior gland looks normal do not remove it
- Dissect dorsal to the RLN, expose the esophagus

Reoperative Parathyroidectomy: Overly Descended Superior Adenoma

William S. Duke, MD, Hampton M. Vernon, and David J. Terris, MD

Duke et al, Otolaryngol HNS, 2016
4. Inappropriate (inadequate) access

- Lateral incision (“inhibitory” to bilateral exploration)
- Remote access (eliminates bilateral)
- Insufficient opening (in proper location)
5. Other technical issues

- Bloodless, magnified dissection (color surgery)
- LN (especially Hashimoto’s); thymus; thyroid nodules (tubercle); muscle
- Look for the fat
- Low threshold to identify RLN
- Monitoring: guard against bilateral paralysis
- Use ballotment to reveal adenoma
- Low threshold for taking the upper pedicle (especially if superior gland is elusive)
- Avoid removing normal parathyroid glands
What about the high-volume (high-experience) surgeon?

- Do the math
- Lab-based “rapid” iopth assay = 35 minutes; POC = 8 minutes

Turbo PTH

Future Diagnostics
What about the high-volume (high-experience) surgeon?

- 15 minutes to find and remove

Augusta Algorithm
What about the high-volume (high-experience) surgeon?

- 15 minutes to find and remove
- Won’t even know double adenoma for 38 minutes (1 hour 5 minutes)
- An additional 38 (or 65) minutes for each additional abnormal gland (assuming 15 minutes to find each one)
- What about 4-gland hyperplasia
Case 1: 59 y.o. primary HPT

- Imaging co-localized to left superior; explored and 1.1 gm left superior adenoma removed
59 y.o. primary HPT

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Case 1:

- Straightforward double adenoma
- With POC pth, still took 1½ hours . . . (with the Turbo pth – 2½ hours)
Case 2:

- C.N. – 66 y.o. male with calcium 11.4, pth 147; kidney stones
- Imaging: solitary parathyroid adenoma inferior lateral to the inferior margin lower pole left thyroid lobe in the same coronal plane
Case 2:

- Intraoperatively: 4 normal eutopic glands identified

**Final Pathologic Diagnosis**

A) LEFT SUPERIOR PARATHYROID (BIOPSY):
   - Normocellular parathyroid tissue.

B) LEFT INFERIOR PARATHYROID (BIOPSY):
   - Normocellular parathyroid tissue.

C) RIGHT SUPERIOR PARATHYROID (BIOPSY):
   - Normocellular parathyroid tissue.

D) RIGHT INFERIOR PARATHYROID (BIOPSY):
   - Normocellular parathyroid tissue.

**Now what??**
Physiologic adjuncts

- Bilateral jugular venous PTH levels exploring for differential to lateralize
  - Preoperatively (10% difference)
    *Carneiro-Pla, AAES 2009*
  - Intraoperatively – Chen (5% difference)
    *Ito F and Chen H, Ann Surg 2007*
  - “poor man’s” selective venous sampling
### Final Pathologic Diagnosis

**A)** LEFT SUPERIOR PARATHYROID (BIPSY):
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- Normocellular parathyroid tissue.

**E)** LEFT THYROID (HEMITHYROIDECTOMY):
- Thyroid negative for significant pathologic change.
- Negative for parathyroid tissue.

**F)** LEFT THYMUS (THYMECTOMY):
- Atrophic thymic tissue with benign thymic cyst, 0.5 cm.
- Negative for parathyroid tissue.

- Bilateral IJ: right = 160.1; left = 174.9
- Further exploration on left; thyroid lobe removed, thymus removed, esophagus skeletonized, submandibular triangle explored
Case 2:

- Just prior to raising the white flag, carotid sheath opened (further):
Case 2:

Final Pathologic Diagnosis

A) LEFT SUPERIOR PARATHYROID (BIOPSY):
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B) LEFT INFERIOR PARATHYROID (BIOPSY):
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D) RIGHT INFERIOR PARATHYROID (BIOPSY):
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E) LEFT THYROID (HEALTHY THYROIDectomy):
   - Thyroid negative for significant pathologic change.
   - Negative for parathyroid tissue.

F) LEFT THYMUS (THYMECTOMY):
   - Atrophic thymic tissue with benign thymic cyst, 0.5 cm.
   - Negative for parathyroid tissue.

G) PARATHYROID ADENOMA, LEFT CAROTID SHEATH (THYMECTOMY):
   - Parathyroid adenoma, 0.45 g.

- 2 hours, 50 minutes (with Turbo pth, >5 hours)
A need for speed

- Doing an operation fast does not necessarily correlate with success (as a well-known colleague discovered)
MIRP is “retired”

Abandoning Unilateral Parathyroidectomy: Why We Reversed Our Position after 15,000 Parathyroid Operations

James Norman, MD, FACS, FACE, Jose Lopez, MD, FACS, Douglas Politz, MD, FACS, FACE

- 6% recurrence rate
- Now 4-gland exploration (and biopsy) in 97%
- Still call it a MIRP

Norman et al, JACS, 2012
Reason for 6% recurrence rate

- Reliance on flawed logic of a “20% rule”
- Stubborn arrogance in refusing to utilize intraoperative assay (at least in the OR)
- Obsession with doing operation fast
- Puts both nerves and all 4 glands at risk resulting in unnecessary disasters
MI Parathyroidectomy

Many definitions have been proposed:

- Local anesthesia
- Endoscopic
- Mini-incision
- Remote access
- Radioguided
MI Parathyroidectomy

**Critical elements**

- ***Single-gland surgery***
- Image-guided
- Confirmation of cure (PTH)
- Outpatient
- $\frac{1}{2}$ to $\frac{3}{4}$ inch incision
- Endoscopically-assisted
Persistent Eucalcemic HPT

- In up to 40% of patients who undergo curative parathyroidectomy, PTH remains elevated for up to 12 months after surgery
- Vitamin D deficiency; renal dysfunction; normal glands finding new “set-point”

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Persistently Elevated Parathyroid Hormone After Successful Parathyroid Surgery

William S. Duke, MD; Anna Song Kim, BS; Jennifer L. Waller, PhD; David J. Terris, MD
Persistently elevated pth

- 314 parathyroidectomies, 187 pHPT and single gland disease, 119 met criteria
- 25.2% with eucalcemic HPT

Jon van Heerden

• “for the missing superior gland look inferior to the inferior gland; for the missing inferior gland, look superior to the superior gland”
Final surgical thoughts

- Find the fat
- Pass nothing off
- Let the ioPTH tell its story
- Biopsy as needed (and especially if failing)
- Mediastinal usually thymic
- Know the common hiding places
Conclusions

5-hour parathyroidectomy
ok, as long as . . .

- Normal pth glands preserved
- Recurrent laryngeal nerves are preserved
- And especially if the adenoma was removed
- It happens rarely