CHALLENGES & PEARLS IN PARATHYROID SURGERY
UCSF Head & Neck Endocrine Surgery Course

Maisie Shindo, M.D., F.A.C.S.
Professor
Department of Otolaryngology – Head & Neck Surgery
Oregon Health & Science University

Indications for Parathyroid Surgery

Multidisciplinary NIH Consensus Panel, 1990

- Symptomatic or developed complications
- If asymptomatic,
  - Ca^{2+} consistently > 1 mg/dL above normal range
  - Episode of hypercalcemic crisis (> 12.5 mg/dL)
  - Reduced creatinine clearance
  - Nephrolithiasis on x-ray
  - 24-hr urine Ca^{2+} > 400
  - Reduction in bone density: T score < -2.5
- < 50 years of age
- Unsuitable for medical management of co-existing illness complicates medical management
- Patient requests surgery
Primary Hyperparathyroidism

- High calcium
- Elevated PTH
- Low phosphate

Diagnostic Challenges

- 55 y/o, Calcium 11.2; PTH 46
  - Primary hyperparathyroidism
    - Inappropriately normal PTH for the elevated calcium

Familial hypocalciuric hypercalcemia (FHH)
- Autosomal dominant
- Familial history
- 24 hr Ca/Cr clearance ratio < 0.01
  \[
  \frac{\text{Urine Ca}^{2+}}{\text{Serum Ca}^{2+}} \times \frac{\text{Serum Cr}}{\text{Urine Cr}}
  \]
- Mutation in CASR gene \(\rightarrow\) impairs Ca\(^{2+}\) sensing
- Mild hypermagnesemia

Non-hyperparathyroid causes
- Sarcoidosis
- Multiple myeloma
- Malignancy (PTH like hormone)

PTH levels are generally low
**Diagnostic Challenges**

- Calcium – 9.8, PTH - 140
- Differential diagnosis
  - Total Ca$^{2+}$ not representative of free Ca$^{2+}$
  - Secondary hyperparathyroidism
    - Vitamin D deficiency
    - Renal leak (elevated 24 hr urine calcium)

**Diagnostic Challenges**

- Calcium – 9.8, PTH - 140
- Differential diagnosis
  - Normocalcemic primary hyperparathyroidism
    - May account for about 27% of pHPT
  - PTH resistance
    - Lower bone turnover
    - Lower RT reabsorption of Ca$^{2+}$

**Diagnostic Challenges**

- Normocalcemic hyperparathyroidism
  - Diagnosis –
    - Confirmation of adenoma on imaging
    - Calcium load challenge
    - Hydrochlorothiazide challenge

**Normocalcemic Hyperparathyroidism**

<table>
<thead>
<tr>
<th>Bone loss (BMD) over time by site (N-37)</th>
<th>&gt;5% decline</th>
<th>&gt;10% decline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any site</td>
<td>7/30 (23%)</td>
<td>6/30 (20%)</td>
</tr>
<tr>
<td>Lumbar spine</td>
<td>3/27 (11%)</td>
<td>1/27 (4%)</td>
</tr>
<tr>
<td>Femoral neck</td>
<td>5/29 (17%)</td>
<td>3/29 (10%)</td>
</tr>
<tr>
<td>Distal radius</td>
<td>4/24 (17%)</td>
<td>3/24 (13%)</td>
</tr>
</tbody>
</table>

_Lowe et al., J Clin Endocrinol Metab, August 2007, 92(8):3001–3005_
Normocalcemic Hyperparathyroidism

Clinical course of untreated patients (N=37)
- Hypercalcemia 7
- Kidney stone 1
- Fracture 1
- New osteoporosis 4
- Greater than 10% decline in BMD 6
- Urinary calcium > than 400 mg/24 hr 2

Lowe et al., J Clin Endocrinol Metab, August 2007, 92(8):3001–3005

Diagnostic Pearls

Preop Ultrasound and MIBI scan
- Multiple foci on MIBI
  - Multiple adenomas or concurrent thyroid pathology
  - No suspicious foci: Hyperplasia or a small retroesophageal adenoma
  - Repeat MIBI with SPECT or perform other localization studies (CT + contrast, MRI)
**Beware – the illusive inferior gland**

**Diagnostic Pearls**

**Ultrasound and MIBI scan**
- No suspicious foci → Hyperplasia or a small retroesophageal adenoma
  - Repeat MIBI with SPECT or perform other localization studies (CT + contrast, MRI)
  - Plan for bilateral exploration (Consent for forearm reimplantation and possible thyroidectomy)
- Consider MEN

**Surgical Pearls - Bilateral Exploration**
- Systematically look for all 4 glands
- Do not completely excise any glands until all 4 are identified
  - Multiple adenomas – leave normal gland(s)
  - 4 gland hyperplasia
    - subtotal excision
    - leave ½ of most viable gland

**Superior Parathyroid Glands**
Inferior Parathyroid Glands

Right inferior adenoma

Parathyroidectomy – Bilateral Exploration

ECTOPIC Locations for inferior parathyroid

- Carotid sheath
- Thymus
- Superior mediastinum

ECTOPIC Locations for superior parathyroid

- Retro/para-esophageal

Final consideration for the “missing gland”

- Intra-thyroid parathyroid
  - Hemithyroidectomy on side of “missing gland”
  - Intraoperative ultrasound
**SURGICAL PEARLS** - Minimally Invasive Parathyroidectomy

Anterior approach     Lateral Approach

**Surgical Pearls**

*Focused Lateral Approach*
A more direct approach to deep, posteriorly located glands

**Minimally Invasive Parathyroidectomy**

*Focused Lateral Approach – Surgical Technique*

- 2-3cm incision from midline to anterior border SCM
- Extend contralaterally if bilateral exploration
Focused Lateral Approach – Surgical Technique

Endoscopic Video Assisted Dissection
**When NOT to Use Focused Lateral Approach**

Inferior, superficially located adenomas

---

**SURGICAL PEARLS**

**MIP Under Local Anesthesia**

- Prerequisite - Localization study
  - Tc$^{99}$ sestamibi scan (MIBI) with single-photon emission CT (SPECT)
  - Ultrasound
- Targeted approaches
  - Anterior
  - Lateral

---

**MIP Under Local With IV Sedation (MAC)**

- 186 MIP under local sedation (No block)
  - FLA - 84 cases; FAA - 102 cases
  - (95%) successfully completed under MAC
- Complications
  - 1 transient vocal cord paresis
  - 2 pneumothorax – one required chest tube
  - 1 small hematoma -resolved

Shindo et al, Otolaryngol HNS, 2008

---

**MIP: Local + Sedation is not appropriate for:**

- Suspected multiple gland pathology
- Suspected parathyroid carcinoma
- Concomitant thyroid pathology requiring surgery
- Moderate to severe sleep apnea
- Severe GERD
- Extremely anxious patients
- Children
- Patient preference for GETA

Shindo et al, Otolaryngol HNS, 2008
**SURGICAL PEARLS**

**Intraop Rapid PTH Assay**

- (A) Pre-excision PTH level
- (B) 5 minute post-excision level
- Criteria for success*: B ≤ 50% of A

---


---

**SURGICAL PEARLS**

**Intraop Rapid PTH Assay - Pitfalls**

- False positives – MGD
  - Example
    - PTH: pre=120; 5min post=55
    - Presence other enlarged gland(s)
      - Theory
        - Other enlarged glands may not be secreting

---

**SURGICAL PEARLS**

**Intraop Rapid PTH Assay - Pitfalls**

- False negatives
  - Successful surgical excision, single gland disease but 5-min iPTH > 50%
  - Example
    - PTH: pre=180, 5 minute post=100
      - Only one adenoma
  - Possible mechanisms
    - Post-manipulation surge in PTH
    - Slower kinetics

---

**SURGICAL PEARLS**

**Intraop Rapid PTH Assay**

**Suggested Approach**

- 10-minute iPTH
  - < 50% baseline
  - within normal range
- If 10-minute criteria not met, send a second post-excision level
- If second level doesn’t meet above criteria, examine other gland(s)