Avoiding failed parathyroidectomy

How to avoid a failed parathyroidectomy

1. Does the patient have the disease?
2. Does the patient need an operation?
3. What imaging is needed?
4. What is the best operation for this patient?
5. Where do I find the diseased glands?
6. Are my operative findings satisfactory?
7. What adjuncts (IOPTH, frozen sx) should I use?

Edward D. Churchill, 1931

“the success of parathyroid surgery must lie in the ability of the surgeon to know a parathyroid gland when he sees it, to know the distribution of the glands, where they hide, and also to be delicate enough in technique to be able to make use of this knowledge”
Does the patient have the disease?
First things first: establish a biochemical diagnosis

- Serum Ca >10.1 mg/dL
- Serum intact PTH >65 ng/L
- Urinary Ca excretion > 400 mg
- Serum phosphorous low or low-normal
- Serum chloride/phos ratio >33
- Elevated serum alkaline phosphatase, uric acid
- Serum Creatinine

Exclude familial disease, BFHH (benign familial hypocalciuric hypercalcemia) urinary Ca<100mg/24hrs

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Does the patient need an operation?

- 2002 NIH guidelines for parathyroid surgery in asymptomatic primary hyperparathyroidism
  - Serum Ca (above upper limit normal) 1.0 mg/d
  - 24-h urinary Ca >400 mg
  - Creatinine clearance by 30%
  - BMD t-score < -2.5
  - Age <50 yrs

(Bilezikian et al, JCEM 2002;87:5353)

What is the best operation?

- Bilateral approach
  - Explores all 4 glands
  - “gold standard”
  - Indicated for pts at high risk for multi-gland disease
    - Familial syndromes
    - Negative localization studies
  - Over 95% successful

(Paloyan E and Lawrence A, Endocrine Surgery: Operative Surgery, 1976)

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What is the best operation?

- Unilateral approach
  - Explores 2 glands
  - Only one RLN, 2 PTH glands at risk
  - Useful for patients with discordant studies, w/ US or Mibi suggesting disease on one side
  - Over 90% success rate

(Randomized trial: Westerdahl et al, Ann Surg 2007;246:976
Mibi and IOPTH guided surgery)

(Gosnell et al ANZ J Surg 2004;74:330)
What is the best operation?

- Minimally invasive (1 gland)
  - Explores 1 gland
  - Midline or lateral incision
  - Only one RLN at risk
  - Indicated in patients with high probability of single-gland disease
    - US & MIBI concordant
    - 95% success rate

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Causes of primary HPT

- 15-20% in earlier series (bilateral exploration)
- 5% in newer series (unilateral, focused exploration)

Likely selection bias for patients with single-gland disease, and likely some missed multiglandular disease

What imaging is needed?

- Ultrasound
- Tc-sestamibi
- CT/MRI
- FNA (intrathyroidal PTH adenoma, thyroid nodules)
- Selective venous sampling

- Review the images yourself!
- Suspicious thyroid nodules should be biopsied first

What imaging is needed?

- + Sestamibi alone 90% success rate
- + Ultrasound alone 85% success rate
- + Sestamibi and US 96% success rate

(Arici et al 2001:129:720)
Is it single-gland disease?

In patients with primary hyperparathyroidism, when both the ultrasonography and sestamibi scans identified the same, solitary parathyroid tumor in patients with sporadic primary hyperparathyroidism, this was the only abnormal parathyroid gland in 96% of the patients. A focused parathyroidectomy could therefore be performed in such patients with an acceptable (95%) success rate.

(Serci et al, Surgery 2001;129:720)

CaPTHUS (Kebebew) scoring model for predicting single-gland disease

- Serum Ca > 12 mg/dL
- Serum int PTH > 2x normal upper limit
- US+ for single enlarged gland
- Sestamibi scan + for single enlarged gland
- Concordant US and sestamibi

Score > 3

100% PPV for single-gland disease

(Kebebew et al, Arch Surg 2006;141:777)

Where do I find the diseased glands?

- **Superior parathyroids**
  - 4th brachial pouch
  - Associated with lateral thyroid, C-cells
  - Most are located in the cricothyroid area
  - 2cm area, intersection of the inferior thyroid artery and the RLN
  - Tend to be more posterior

(Paloyan E and Lawrence A, Endocrine Surgery: Operative Surgery, 1976)

- **Inferior parathyroids**
  - 3rd brachial pouch
  - Associated with thymus
  - Tend to be anterior
  - More variable in position
  - Lower pole of thyroid, below and anterior to the intersection of inferior thyroid artery and the RLN, thyrothymic ligament

(Paloyan E and Lawrence A, Endocrine Surgery: Operative Surgery, 1976)
Where do I find the diseased glands?

- **Enlarged parathyroids**
  - Tend to become displaced into pathways of least resistance
    - Superior PTH
      - Tracheosophageal groove
      - Retroesophageal
      - Superior posterior mediastinum
    - Inferior PTH
      - Ant/Post mediastinum

(Paloyan E and Lawrence A, Endocrine Surgery: Operative Surgery, 1976)

What are the critical technical aspects?

- Bloodless field
- Meticulous dissection
- Lighting, exposure, judgement

Ectopic parathyroid adenomas

Sites of 104 missing parathyroid tumors
(From Wang CA, Ann Surg 1977;186:142)

What are the critical technical aspects?

- Bloodless field
- Meticulous dissection
- Lighting, exposure, judgement

1-gland
- midline (lower) or lateral (upper)
- resection of adenoma
- +/- IOPTH, frozen section
- ID/preserve RLN

2-gland
- midline or lateral
- resection of adenoma
- +/- IOPTH, frozen section
- ID/preserve RLN

4-gland
- midline cervical
- ligate/divide middle thyroid veins
- ID of 4 PTH glands
- resection of enlarged PTH gland(s)
- +/- IOPTH, frozen section
- ID/preserve RLN
### What are the critical technical aspects?
- Bloodless field
- Meticulous dissection
- Lighting, exposure, judgement

<table>
<thead>
<tr>
<th>1-gland</th>
<th>2-gland</th>
<th>4-gland</th>
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<tr>
<td>-midline (lower) or lateral (upper) resection of adenoma</td>
<td>-midline or lateral resection of adenoma</td>
<td>-midline cervical -ligate/divide middle thyroid veins</td>
</tr>
<tr>
<td>-ID of normal PTH</td>
<td>-ID of normal PTH</td>
<td>-ID of 4 PTH glands</td>
</tr>
<tr>
<td>+/- IOPTH, frozen section</td>
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### Avoiding failed parathyroidectomy

A surgical adjunct can help preserve normal tissue and identify abnormal tissue.

- **Intraoperative PTH**
  - “works best when its needed least” (QY Duh)
  - Excellent results in 85% pts with solitary adenoma
  - Only helpful in 50% of pts with double adenomas
  - >50% drop associated with successful resection (vs return to normal PTH levels)

- **Frozen section**
  - Use sparingly, esp for normal glands
  - Can confirm PTH tissue
  - Cannot distinguish b/ adenoma and hyperplasia
  - Cannot distinguish b/ PT and Hurthle cell
  - Useful as confirmation in pts with concordant imaging but no IOPTH

(Gauger et al Surgery 2001;130:1005)  
(Haciyanli et al JACS 2003;197:739)
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Are my operative findings satisfactory?

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Usual locations
- tracheoesophageal groove
- retroesophageal
- retropharyngeal
- thyrothymic ligament
- carotid sheath
- intrathyroidal

Ectopic locations
- mediastinal 5-11% of failed cases (Conn JM Am Surgeon 1991;57:62)

Supernumerary glands 15-25% of failed cases (Henry JF World J Surg 1996;14:303)
Thank you