Minimally invasive parathyroidectomy

Jessica E. Gosnell MD
Assistant Professor of Surgery

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Minimally invasive parathyroidectomy

1. What?
2. When?
3. How?
4. Convert?
5. What adjuncts?
Primary hyperparathyroidism

- The incidence of primary hyperparathyroidism is 25-30 cases per 100,000 people in the US
- In people ages 15-65 years old, the incidence increases to 70-150 cases per 100,000
- Surgery is the only effective treatment, with numerous physiologic benefits to the patient

Parathyroidectomy

- Bilateral exploration is the gold standard- durable, 95% cure rates
- 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

“The best localizing test is a good parathyroid surgeon”
Quoted in “The History of Parathyroid Surgery, 1850-1996” JACS vol 191 2000, by Dr. Claude H. Organ
85% of patients with primary hyperparathyroidism have a single hyperfunctioning gland

Incidence of multiglandular disease:
* 15-20% in earlier series (bilateral exploration)

Improved imaging

Sestamibi scan

High resolution ultrasound
Alternatives to bilateral exploration

- **Unilateral exploration:** one enlarged parathyroid gland and one ipsilateral normal gland
  

- **Endoscopic parathyroidectomy:** Gagner 1996
  
  Letter to the editor, British Journal of Surgery

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**Intraoperative PTH: Miami criteria**

Intraoperative confirmation of complete excision of all hypersecreting parathyroids using four rapid assays

![Graph showing changes in PTH levels over time](image)

- % drop PTH
- 50
- Suspected parathyroid excision
- 76%
- preincision
- preexc
- 5'
- 10'

Time of plasma samples

(Irven et al, Am J Surgery 2007)
Minimally invasive parathyroidectomy

What is it??

- Laparoscopic, endoscopic
- Open
- Small incision
- Radio-guided
- Limited exploration (focused, unilateral)
- Regional anesthesia

**Definition:**

*Minimally invasive parathyroidectomy is a focused, image-directed resection of a single enlarged parathyroid gland*
Minimally invasive parathyroidectomy

- Focused = 1 gland
- Unilateral = 2 gland
- Bilateral = 4 gland

First: Confirm diagnosis of primary hyperparathyroidism

- Increased blood calcium and PTH without hypocalciuria
- Consider extremely rare ectopic tumor secreting PTH
- Does patient have sporadic or familial disease?

Patients with hypercalcemia and an increased PTH for more than 6 months have primary hyperparathyroidism
Second: Does the patient need surgery?

- 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)

Third: Which patients are appropriate for minimally invasive parathyroidectomy?

Patients with single-gland disease
Minimally invasive parathyroidectomy: predicting single-gland disease

- 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

Minimally invasive parathyroidectomy: predicting single-gland disease

- Neck ultrasound
- Tc-sestamibi

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"

(Arici et al, Surgery 2001;129:720)
What surgical adjuncts should I use?

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

(Arici et al 2001;129:720)

Minimally invasive parathyroidectomy? Which patient?

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 sestambibi

Score >3
100% PPV for single-gland disease

(Kebebew et al, Arch Surg 2006;141:777)
Minimally invasive parathyroidectomy
Predicting single gland disease

Case 1: 46yo woman found to have elevated serum calcium levels to 11.1 mg/dL on routine testing. PTH levels 170. The patient also has Depression, bony pain and global fatigue. No family history.

IOPTH: pre-excision 237
post-excision 29

2.4 x 0.5 x 0.8 cm oblong hypoechoic vascular nodule

Oblong persistent uptake medial to thyroid

Parathyroidectomy

- 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
Parathyroidectomy?

- **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)

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
- ID of normal PTH
- +/- IOPTH, frozen section
- ID/preserve RLN

Concordant US/Mibi

Non-concordant US/Mibi
What surgical adjuncts should I use?

- **Intra operative PTH**
  - "works best when its needed least" (Dr. 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 (Miami Criteria)

(Gauger et al Surgery 2001;130:1005)
(Haciyanli et al JACS 2003;197:739)

What surgical adjuncts should I use?

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

![Parathyroid adenoma, with a rim of normal parathyroid tissue](image)
Avoiding failed parathyroidectomy

Are my operative findings satisfactory?

1-gland exploration

Adenoma

Normal PTH gland ("slightly enlarged")

Resect adenoma

IOPTH

IOPTH >50% drop

IOPTH <50% drop

Stop

Stop

Keep looking
Consider conversion

No PTH glands found

Keep looking
Consider conversion

Normal PTH gland

Resect adenoma

2-gland exploration

Adenoma

2 normal glands

Resect adenoma

Explore other side

IOPTH >50% drop

IOPTH <50% drop

Stop

Stop

Explore other side

Consider repeat IOPTH vs

<2 glands

Explore other side

<2 glands

Explore other side
Are my operative findings satisfactory?

Have a low threshold for converting to 4-gland exploration!

1. Usual locations
2. Ectopic locations
3. Tracheoesophageal groove
4. Retroesophageal
5. Retropharyngeal
6. Thyrothymic ligament
7. Bilateral exploration
8. Supernumerary glands  
   • 15-25% of failed cases (Henry JF World J Surg 1990;14:303)
9. Intrathyroidal
10. Mediastinal  
   • 5-11% of failed cases (Conn JM Am Surgeon 1991;57:62)