Minimally Invasive Parathyroid and Thyroid Surgery

Wave of the Future

University of Colorado
Department of Surgery Grand Rounds

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Adam Lackey, PGY-4
How to make a wave

- Define the procedure and expected benefits
- Standardize the technique
- Prove the safety
- Prove the benefits
- Marketing
Minimally invasive neck surgery

- Endoscopic
  - Central
  - Lateral
  - “Other” (transaxillary, transpectoral)
- Minimally invasive
  - MIVAT
  - Minimally invasive parathyroid (multiple)
Expected benefits

- Better visualization of structures
- Less risk of damage to RLN, parathyroids
- Better cosmesis
- Less patient distress/pain
Define the procedure

- Patient supine
- Neck in normal position
- Midline incision
Define the procedure

- Dissect through platysma and straps
- Bloodless field essential
Laparoscope introduced, external retraction
Needlescopic spatula used to dissect towards superior pole.
- Upper pole isolated
Superior laryngeal nerve identified
Upper pole divided with Harmonic scalpel or clipped
Inferior pole isolated
Inf pole retracted cranially
Dissection down toward RLN
Note position of parathyroid and RLN
• RLN identified and dissected off thyroid
Upper lobe extracted through incision
Final capsular vessels ligated
Inferior lobe delivered through incision
Ligament of Berry divided
Thyroid dissected off trachea
- Parynchema divided
- Incision closed
Comparison between minimally invasive video-assisted thyroidectomy and conventional thyroidectomy: A prospective randomized study

Paolo Miccoli, MD, Piero Berti, MD, Marco Raffaelli, MD, Gabriele Materazzi, MD, Silvia Baldacci, BS, and Giuseppe Rossi, PhD, Pisa, Italy

- 2001 Surgery article
- RCT of 49 patients, randomized to MIVAT or CT
- Nodules < 35mm, (-) thyroiditis, thyroid volume <20ML
Miccoli et al.  Surgery 2001

- Patients evaluated for post op pain
- DL for vocal cord mobility
- Serum Ca+
- Operative times
Complications were one transient RLN palsy and one transient hypoparathyroidism in the MIVAT group, 2 transient RLN palsy's in the open group.
Conclusions:

- Similar safety profile
- Patients much happier with post op pain and cosmesis at 1 mo
- Steep learning curve
- More investigation needed
Video-Assisted vs Conventional Thyroid Lobectomy

A Randomized Trial

Rocco Bellantone, MD; Celestino Pio Lombardi, MD; Maurizio Bossola, MD; Mauro Boscherini, MD; Carmela De Crea, MD; Pier Francesco Alesina, MD; Emanuela Traini, MD

- 2002 Archives of Surgery
- RCT of 62 patients randomized to VAS or COS
- Outcomes were postop pain, complications, hospital stay
Bellantone et al. 2002 Arch Surg

At 12 and 24 weeks:
- 100% VAS patients thought outcome was excellent or good.
- > 90% VAS patients very satisfied with scar
- 100% VAS patients would recommend same operation

Table 2. Participant Ratings of Outcomes 12 and 24 Weeks After Conventional or Video-Assisted Thyroid Lobectomy

<table>
<thead>
<tr>
<th>Time Postoperation, wk</th>
<th>COS (n = 31)</th>
<th>VAS (n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Outcome of operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent</td>
<td>14 (45)†</td>
<td>14 (45)†</td>
</tr>
<tr>
<td>Good</td>
<td>12 (39)‡</td>
<td>13 (42)‡</td>
</tr>
<tr>
<td>Fair or worse</td>
<td>5 (16)</td>
<td>4 (13)</td>
</tr>
<tr>
<td>Satisfaction with scar</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very</td>
<td>12 (39)†</td>
<td>14 (45)†</td>
</tr>
<tr>
<td>Moderately</td>
<td>13 (42)‡</td>
<td>12 (39)‡</td>
</tr>
<tr>
<td>Barely or worse</td>
<td>6 (19)§</td>
<td>5 (16)</td>
</tr>
<tr>
<td>Recommend same operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>25 (81)§</td>
<td>25 (81)§</td>
</tr>
<tr>
<td>N</td>
<td>6 (19)</td>
<td>6 (19)</td>
</tr>
</tbody>
</table>
Bellantone et al. 2002 Arch Surg

- No patient in either group had hypoparathyroidism, post op bleeding, RLN injury, wound infection.
- 9 patients in COS and 10 patients in VAS groups had malignancy dx’d after the operation:
  - At 22 mo postop, no recurrences in either group
  - No detectable thyroglobulin in either group
Bellantone et al. 2002 Arch Surg

- **Conclusions:**
  - No difference in safety profile
  - No difference in oncologic result
  - Less pain in VAS group
  - Much more patient satisfaction with scar in VAS group
  - VAS group overall happier with operation
Minimally Invasive Video-Assisted Thyroidectomy: Five Years of Experience

Paolo Miccoli, MD, Piero Berti, MD, Gabriele Materazzi, MD, Michele Minuto, MD, Leonardo Barellini, MD

- 2004 longitudinal study in JACS
- 579 patients enrolled and underwent MIVAT, 312 total thyroidectomies and 267 lobectomies
- Selection criteria: nodule <35mm, thyroid volume <20, no thyroiditis, no neck surgery
Wide variety of indications, both malignant and benign

<table>
<thead>
<tr>
<th>Table 1. Preoperative Diagnoses</th>
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<tbody>
<tr>
<td>Diagnosis</td>
</tr>
<tr>
<td>Follicular adenoma</td>
</tr>
<tr>
<td>Papillary carcinoma (low risk)</td>
</tr>
<tr>
<td>Multinodular goiter</td>
</tr>
<tr>
<td>Hurtle adenoma</td>
</tr>
<tr>
<td>Graves’ disease</td>
</tr>
<tr>
<td>Toxic adenoma</td>
</tr>
<tr>
<td>Toxic goiter</td>
</tr>
<tr>
<td>Completion thyroidectomy</td>
</tr>
<tr>
<td>RET gene</td>
</tr>
<tr>
<td>Thyroglossal duct carcinoma</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
Complications were comparable to the open procedure, with a notably low hypoparathyroidism rate.

<table>
<thead>
<tr>
<th>Complication</th>
<th>n</th>
<th>%</th>
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<tbody>
<tr>
<td>Transitory laryngeal nerve palsy</td>
<td>10</td>
<td>1.7</td>
</tr>
<tr>
<td>Definitive laryngeal nerve palsy</td>
<td>8</td>
<td>1.3</td>
</tr>
<tr>
<td>Transitory hypoparathyroidism</td>
<td>10</td>
<td>1.7</td>
</tr>
<tr>
<td>Definitive hypoparathyroidism</td>
<td>2</td>
<td>0.2</td>
</tr>
<tr>
<td>Bleeding</td>
<td>1</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Patients had
- Less pain (17.0 +/- 21 vs 33.6 +/- 22.2, p=0.003)
- Better cosmetic result (3.7 +/- 0.3 vs 3.2 +/- 0.9, p=0.003 on a visual scale)

Of note, 3 patients had the RET oncogene, central neck dissection were undertaken in these patients
- Post op thyroglobulin levels undetectable
- Mean LN harvest = 10
Minimally invasive video-assisted thyroidectomy for papillary carcinoma: A prospective study of its completeness

Paolo Miccoli, MD, Rossella Elisei, MD, Gabriele Materazzi, MD, Marco Capezzone, MD, David Galleri, MD, Furio Pacini, MD, Piero Berti, MD, and Aldo Pinchera, MD, Pisa, Italy

- 2002 Surgery study of 33 patients with Bx proven papillary cancer
- Near total thyroidectomy by MIVAT (n=16) vs conventional operation (n=17)
- Postop assays for bed uptake and serum thyroglobulin
Miccoli et al.  Surgery 2002

No difference in preop characteristics

No difference in postop I-131 uptake in thyroid bed

No difference in serum Tg levels

**Table.** Comparison of mean tumor size, mean serum Tg levels, and mean 131-I bed uptake, 1 month after operation in groups A and B.

<table>
<thead>
<tr>
<th></th>
<th>Group A (MIVAT)</th>
<th>Group B (CT)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>16</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>13 f</td>
<td>17 f</td>
<td>NS</td>
</tr>
<tr>
<td>Age</td>
<td>3 m</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (range, 29-60 yr)</td>
<td>41.7 ± 9.1 yr</td>
<td>46.1 ± 7.8 yr</td>
<td>NS</td>
</tr>
<tr>
<td>Mean size thyroid tumor</td>
<td>1.3 ± 0.4 cm</td>
<td>2.1 ± 1.9 cm</td>
<td>NS</td>
</tr>
<tr>
<td>Mean 131-I uptake</td>
<td>5.1 ± 4.9%</td>
<td>4.6 ± 6.7%</td>
<td>NS</td>
</tr>
<tr>
<td>Mean serum Tg</td>
<td>5.3 ± 5.8 ng/mL</td>
<td>7.6 ± 21.7 ng/mL</td>
<td>NS</td>
</tr>
</tbody>
</table>

*CT, conventional treatment; NS, not significant.*
Miccoli et al. Surgery 2002

- Complications: one permanent hypoparathyroid patient in the MIVAT group, 3 transient RLN palsies

- Conclusion: no significant difference in the completeness of total thyroidectomy between MIVAT and open procedure
Minimally Invasive Video-assisted Thyroidectomy: Multiinstitutional Experience

Paolo Miccoli, M.D.,¹ Rocco Bellantone, M.D.,² Michel Mourad, M.D.,³ Martin Walz, M.D.,⁴ Marco Raffaelli, M.D.,¹ Piero Berti, M.D.¹

- 2002 World Journal of Surgery multiinstitutional study of 336 patients
- Inclusion criteria thyroid volume <15ml, (-) thyroiditis, nodules < 3.5cm
- Designed to confirm safety and effectiveness of MIVAT over multiple institutions/surgeons
Miccoli et al.  World J Surg 2002

Table 1. MIVAT operative complications.

<table>
<thead>
<tr>
<th>Complication</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhage</td>
<td>3 (0.9%)</td>
</tr>
<tr>
<td>Wound sepsis</td>
<td>1 (0.3%)</td>
</tr>
<tr>
<td>Recurrent nerve palsy</td>
<td></td>
</tr>
<tr>
<td>Transitory</td>
<td>7 (2.1%)</td>
</tr>
<tr>
<td>Permanent</td>
<td>1 (0.3%)</td>
</tr>
<tr>
<td>Transient hypocalcemia</td>
<td>9 (2.67%)</td>
</tr>
<tr>
<td>Permanent hypoparathyroidism</td>
<td>2 (0.6%)</td>
</tr>
</tbody>
</table>

MIVAT: minimally invasive video-assisted thyroidectomy.

- Complication rates essentially the same as open procedure.
Operative time still longer than open procedure across all 4 institutions

- 69.4 min +/- 30.6 for lobectomy
- 87.4 min +/- 43.5 for total thyroidectomy

However, the procedure exhibited a marked reduction in time, with the last 100 operations having a mean time of 40 min.
2008 article in Head and Neck

Patients receiving MIVAT for a variety of indications

Designed to show that MIVAT is safe and effective in patients not fitting the ‘classic criteria’

- Benign nodules 1.0-5.0cm
- Malignant lesions 0.5-5.9cm
- Largest lobe 6.5X4.5X4.0cm
- 4 patients with thyroiditis
- 3 patients with previous neck surgery
- 6 patients with central neck compartment LN dissection

**Safety**
- 1 temp RLN palsy
- No permanent hypoparathyroidism, 2 temporary
- No wound infections, hypertrophic scars

**Results**
- Surgical margin negative in all cases
- 16 patients with malignant disease, post op thyroglobulin undetectable in all cases
Conclusions - MIVAT

- **MIVAT**
  - Is as safe as conventional procedure
  - Has similar oncologic results as open procedure
  - Can be applied to lobectomy, thyroidectomy, central neck dissection
  - Better surgical exposure of critical structures
  - Longer operative times, but significant dropoff as experience gained
  - Patients much happier with cosmesis and postop pain
  - Not a ‘niche surgery’
Endoscopic Parathyroidectomy

- Technology has made traditional 4 gland exploration obsolete in patients with focal adenomas
  - Preop U/S and Sestamibi scanning
  - Intraop QPTH assays
- “Why expose the whole neck if you know where the problem is?”
- Used in patients with focal adenoma, not appropriate for multiple gland hyperplasia patients
Multiple approaches

- Videoendoscopic – gas insufflation
- Videoendoscopic – gasless
- Video-assisted (MIVAP)
- Radioguided/gamma probe (MIRP)
- Focused central mini-incision (2.5 cm = 1 in)
- Focused lateral mini-incision (1.5-2.0 cm = 0.6 to 0.8 in)
Endoscopic parathyroidectomy: Report of an initial experience

Paolo Miccoli, MD, Cino Bendinelli, MD, Edda Vignali, MD, Salvatore Mazzeo, MD, Gian Matteo Cecchini, MD, Aldo Pinchera, MD, and Claudio Marcocci, MD, *Pisa, Italy*

- 1998 Surgery article
- 39 consecutive patients with pHPT
- Minimally invasive videoassisted parathyroidectomy
Miccoli et al. Surgery 1998

- All patients had preop U/S showing single adenoma, no previous neck operations, no goiter.
- 39 adenomas from 39 patients
- In all patients intraop PTH measured, in all patients it decreased by >50% w/in 10 min
- Serum PTH and calcium levels normal in all patients (mean f/u 7 mo)
Miccoli et al.  Surgery 1998

- Patients asked to rate pain on 10 pt scale
  - 2.6 +/- 1.7 in MIP
  - 4.1 +/- 2.0 in conventional parathyroidectomy

- “The cosmetic result was always considered excellent by both the patient and the surgeon.”
2002 Annals of Surgery study of 100 consecutive hyperparathyroid patients

Inclusion criteria: primary hyperparathyroidism, confirmed single focus on imaging, intraop PTH assay

- 89% outpatient, 10% d/c’d next day.
- All patients had normal calcium level at 7d f/u.
- 99 patients had normal calcium at mean of 8 mo f/u.
- One RLN temporary palsy and one seizure.
- Mean hospital charge for conventionally operated patients was 2.5X that for MIP patients.
Conclusions – Endoscopic Parathyroidectomy

- Has the same risk profile as the corresponding open procedure
- Endocrine outcome is excellent
- Cosmetic outcome is superior to open procedure
- Patient satisfaction is superior to open procedure
Final conclusions

- MIVAT and MIVAP yield equivalent endocrine results as open procedure
- Oncologic result is equivalent in selected patients
- Equivalent safety profile as open procedures
- Postop pain is decreased
- Patient satisfaction with procedure and cosmetic result is significantly increased
The new era of health care delivery:

Effective, safe procedure + clear patient preference=