Laparoscopic Adrenalectomy

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Laparoscopic Adrenalectomy

**Benign Conditions:**
- Non-functioning mass
- Functioning mass
  - Cushing’s syndrome
  - Pheochromocytoma

**Malignant Conditions:**
- Carcinoma
- Neuroblastoma
Three Most Common Presentations

• Patient is found to have an asymptomatic mass on a CT scan.  
  Should I remove it - laparoscopically?

• Patient has signs/symptoms and is found to have an adrenal mass.  
  What is it?

• Infant has neuroblastoma.
Asymptomatic Adrenal Mass
On CT Scan

- Is it functional?
  - Probably not

- How big is it?

- Is it a discrete mass? Are the margins distinct or indistinct?

- Is it benign or malignant?
  - Does it matter?
Asymptomatic Adrenal Mass On CT Scan

- Good physical exam
  - Cushing’s features – cortical tumor
  - Hirsutism – cortical tumor
  - Hypertension - pheo

- Serum/urine studies - ?
Should I Remove an Incidentally Discovered Adrenal Mass

- 1990 – 2002 - Toronto Sick Kids
- 26 patients - (mean age, 4.6 yrs)

<table>
<thead>
<tr>
<th>IAM Histopathology</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Benign (n = 18)</td>
<td></td>
</tr>
<tr>
<td>Ganglioneuroma</td>
<td>6</td>
</tr>
<tr>
<td>Cortical adenoma</td>
<td>4</td>
</tr>
<tr>
<td>Cortical hyperplasia</td>
<td>1</td>
</tr>
<tr>
<td>Cyst/pseudocyst</td>
<td>3</td>
</tr>
<tr>
<td>Teratoma</td>
<td>1</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>3</td>
</tr>
<tr>
<td>Malignant (n = 8)</td>
<td></td>
</tr>
<tr>
<td>Neuroblastoma</td>
<td>7</td>
</tr>
<tr>
<td>Ganglioneuroblastoma</td>
<td>1</td>
</tr>
</tbody>
</table>

Recommend: Due to high proportion of malignant lesions (31%), should remove all IAMs.

BUT

- Mean age for malignant lesions (1.3 ± 0.6 yrs) was significantly less than for benign lesions (6.5 ± 6.2 yrs) – p = 0.03

- No difference in tumor size b/w benign and malignant lesion (p = 0.57)
Asymptomatic Mass On CT Scan

- CMH Endo – No further w/u if no signs of function
- Remove laparoscopically if > 3cm and discrete
- Evaluate more thoroughly if > 3 cm and indistinct margins, then remove open or laparoscopically
- Unclear best approach if < 3 cm – I’d remove it laparoscopically
Pheochromocytoma

- Elevated plasma catecholamines
- Elevated plasma/urine metanephrines
- Inpatient alpha blockade (phenoxybenzamine)
- Outpatient f/u q week x 2
- Admit pre-op IV hydration
- Arterial line/central line
- Urinary catheter
Adrenal Cortical Tumors

- Relatively rare in children
- Virilization – 80%
  - Elevated DHEA & DHEA-S
- Can be malignant in significant # cases (? 50%)
- Favorable findings: age <4, virilization alone, small tumor (< 5cm)
Adrenal Cortical Tumors
Adrenal Cortical Tumors

- Cushingoid features
- Elevated 24 hr urine free cortisol
- 2° amenorrhea in a non-obese girl
Adrenal Cortical Tumors
Should I Remove It Laparoscopically?

- Size
- Benign vs malignant
- Experience
- Invasion/adherence other structures
Neuroblastoma

- Most common adrenal mass
- Malignant
- Usually young infant
- Usually large and invasive
- Usually not amenable to the laparoscopic approach for resection
Neuroblastoma

However, laparoscopic approach might be very reasonable for a small, localized tumor and low risk of incomplete resection.
Experience With Laparoscopic Adrenalectomy in Pediatric Patients

By K.A. Miller, C. Albanese, M. Harrison, D. Farmer, D.J. Ostlie, G. Gittes, and G.W. Holcomb III
Kansas City, Missouri and San Francisco, California

Background: Laparoscopic adrenalectomy (LA) is now being recognized as the standard in the management of benign adrenal pathology in adult patients. Few reports have described the use of this technique in pediatric patients. This study combines experience from 2 institutions with lateral transperitoneal LA in children to analyze our results and the clinical and biochemical response to laparoscopic adrenalectomy in patients with hormonally active adrenal tumors.

Methods: A bi-institutional retrospective review of all patients undergoing LA between January 1997 and January 2001 was performed. Clinical and biochemical data were obtained during routine follow-up.

Results: Seventeen laparoscopic adrenalectomies were performed during this period. The average operating time was 120 minutes, mean estimated blood loss was 25 mL, the mean size of the adrenal lesion was 4.8 cm, and the mean length of hospitalization was 35 hours. Resolution of clinical and biochemical parameters of adrenal hyperfunction was accomplished in all patients with adrenocortical hyperplasia and pheochromocytoma in postoperative follow-up.

Conclusions: Laparoscopic adrenalectomy can be performed safely and effectively with a short hospital stay, minimal blood loss, and excellent functional outcome in this age group. The authors believe laparoscopic adrenalectomy is an excellent approach for the management of benign pediatric adrenal pathology.

INDEX WORDS: Adrenalectomy, laparoscopic.

LAPAROSCOPIC ADRENALECTOMY (LA) was first performed in 1991. As proficiency in laparoscopic skills grew, laparoscopic adrenalectomy rapidly replaced open adrenalectomy as standard management of
Laparoscopic Adrenalectomy

Children’s Mercy - UCSF
1997 - 2000

16 pts

- Lateral transperitoneal approach
- Diagnosis:
  - Ganglioneuroma - 6
  - NonFx adenoma - 5
  - Cushing’s disease - 2
  - Pheochromocytoma - 2
  - Adrenal Ca - 1

11 Left 5 Right

Laparoscopic Adrenalectomy

Children’s Mercy - UCSF
1997 - 2000

- OR time: 110 min., mean
- Discharge: 35 hrs., mean
- Conversions: 1 - (L) renal vein tumor thrombectomy in Ca pt
- Results: No complications
  28 mos., mean f/u
  Post-op endocrine studies normal

Literature Review 2000 - 2010

- No RCTs in children due to rarity of disease – (Level 1)

- Low morbidity from LA (and OA) (0 – 10%) – (Level 4)
  Werli, Al-Shanafey, Skarsgard. Romano, Leclair “Bias: Selection of patients with small tumors”

- No reports of port site recurrences in children with malignant tumors

- Advantages of LA (Level 4): Reduced discomfort, reduced hospitalization, cosmesis, reduced incidence SBO (Molinaro)
Conclusion of Literature Review 2000 - 2010

- LA is probably superior than OA for discrete benign tumors (Level 4 evidence)

- LA probably appropriate for small malignant tumors (Level 4 evidence)
Which Approach is Better?

- LTA – Lateral Transperitoneal Adrenalectomy
- PRA - Prone Retroperitoneal Adrenalectomy
- LRA - Lateral Retroperitoneal Adrenalectomy
- Robotic Approach
- SSULS - Single Site Umbilical Laparoscopic Surgery
LTA

90° Decubitus Position
LTA

Port Positions
Laparoscopic Adrenalectomy Technique

**Left**

- Divide spleno-renal peritoneum
- Dissect inferior aspect mass
- Ligate vein early, esp. pheo
- Dissect perimeter of mass (cautery, harmonic scalpel)
- Extract mass in bag
Laparoscopic Adrenalectomy Technique

Right

- Divide R. triangular ligament
- Incise posterior peritoneum
- Dissect perimeter of mass (cautery, harmonic scalpel)
- Ligate R. adrenal vein as last step
- Extract mass in bag
Laparoscopic Right Adrenalectomy Video
Laparoscopic Adrenalectomy in Children: A Multicenter Experience

Shawn D. St. Peter, MD,1 Patricia A. Valusek, MD,1 Sarah Hill, MD,2 Mark L. Wulkan, MD,2 Sohail S. Shah, MD,3 Marcello Martinez Ferro, MD,4 Pablo Laje, MD,5 Peter A. Mattei, MD,5 Kathleen D. Graziano, MD,6 Oliver J. Muensterer, MD,7 Elizabeth M. Pontarelli, MD,8 Nam X. Nguyen, MD,8 Timothy D. Kane, MD,9 Faisal G. Qureshi, MD,9 Casey M. Calkins, MD,10 Charles M. Leys, MD,11 Joanne E. Baerg, MD,12 and George W. Holcomb III, MD1

Abstract

Introduction: Laparoscopic adrenalectomy is now being recognized as the standard approach for adrenalectomy for benign lesions in adults. The published experience in children and adolescents has been limited to sporadic small case series. Therefore, we conducted a large multicenter review of children who have undergone laparoscopic adrenalectomy.
Multi-Center Report

- 11 U.S. and 1 international hospitals
- 2000 – 2010
- 140 patients (50 surgeons)
  - 76 left (54%)
  - 59 right (42%)
  - 5 bilateral (4%)
- Mean age – 8.8 ± 6.3 yrs (0 – 25 yrs)
- Mean operative time – 130 ± 63 minutes (43 – 406 min)

JLAST 21:647-649, 2011
## Multi-Center Report
### 140 Patients

<table>
<thead>
<tr>
<th>Pathology</th>
<th># Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroblastoma</td>
<td>39 (28%)</td>
</tr>
<tr>
<td>Pre-op chemo</td>
<td>23 (59%)</td>
</tr>
<tr>
<td>Pheochromocytoma</td>
<td>30 (21%)</td>
</tr>
<tr>
<td>Ganglioneuroma</td>
<td>22 (16%)</td>
</tr>
<tr>
<td>Adenoma</td>
<td>20 (14%)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>27</td>
</tr>
</tbody>
</table>

JLAST 21:647-649, 2011
Multi-Center Report
140 Patients
Morbidity

• 13 conversions (9.9%)
  • Most due to adherence/invasion other organs
  • Tumor size not different in converted cases
    \[ P = 0.97 \]

• 2 blood tx (BL: 125 cc, 900 cc)

• 1 renal infarction

• 1 local recurrence - pheo

JLAST 21:647-649, 2011
## Multi-Center Report

### Size of Mass

<table>
<thead>
<tr>
<th>Size</th>
<th>Op Time</th>
<th>Conversion</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6 cm</td>
<td>123 min</td>
<td>7.7%</td>
</tr>
<tr>
<td>≥ 6 cm</td>
<td>172 min</td>
<td>17.4%</td>
</tr>
<tr>
<td>$P$ Value</td>
<td>0.003</td>
<td>0.23</td>
</tr>
</tbody>
</table>

JLAST 21:647-649, 2011
1. Reasonable to approach large lesions (> 6 cm) laparoscopically if lesion is circumscribed and not infiltrating other structures
Conclusions

2. Small, non-infiltrating NB lesions are well suited for the laparoscopic approach.

3. Post-chemotx NB lesions with good response to tx can be approached laparoscopically – 23 cases, 12% conversion rate

4. Large or infiltrating NB lesions are probably best approached via laparotomy

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Adult Reports


