Laparoscopic Adrenalectomy: technique step by step

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Steps for laparoscopic transperitoneal and retroperitoneal adrenalectomy

Trans or retro?

Adrenal Cortical Carcinoma? Contraindication

Partial adrenalectomy

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April 1992-March 1993, n=22 (25 adrenalectomies)

Mean tumor size 4.1 cm (1-15 cm);
R=12 vs. L=13
Functional tumors n=16
One open conversion
Transperitoneal adrenalectomy

- Instruments
- Position
- Port placement
- Reflection of Colon
- Identification of renal hilum, Identification, dissection and control of adrenal vein
- Mobilization of adrenal gland and control of arterial blood supply (inferior phrenic, renal, aortic)
- Entrapment and Extraction
• Laparoscope 2 mm, 5mm, or 10 mm?
• Laparoscope 0, 30 or 45-degrees ?
• Energy source- harmonic, monopolar, bipolar or ligasure?
Patient Positioning

- semi-lateral decubitus
- umbilical line over kidney rest
- neuro arm board
- axillary roll
- kidney rest down
- table flexed
Port Placement
Right adrenalectomy

- 2 mm
- 5 mm
- 10 mm
Port Placement
Left adrenalectomy

- 2 mm
- 5 mm
- 10 mm

Alternative camera/retraction port
Reflection of Colon

Right

Line of Toldt

Ascending colon

Liver

Left
Adrenal Anatomy

Extraction sites

- Small specimen
- Large specimen

1
Laparoscopic Retroperitoneal Radical Nephrectomy

- Patient position and Retroperitoneal access
- Identification of landmarks (psoas, lateral border of IVC/Aorta), and identification, dissection and control of hilum
- Mobilization of specimen, Entrapment and extraction
Patient Position

Full Flank

Break in the table
Retroperitoneal Access

Peritoneal Cavity

800 cc
Port Placement

Primary Port

Secondary Ports

Origin (R) - Blunt Tip Port Balloon Cuff
Oncology: Adrenal/Renal/Upper Tract/Bladder

PROSPECTIVE, RANDOMIZED COMPARISON OF TRANSPERITONEAL VERSUS RETROPERITONEAL LAPAROSCOPIC ADRENALECTOMY

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ABSTRACT

Purpose: We report a prospective, randomized comparison of transperitoneal laparoscopic adrenalectomy (TLA) vs retroperitoneal laparoscopic adrenalectomy (RLA) for adrenal lesions with long-term followup.

Materials and Methods: Between December 1997 and November 1999, 57 consecutive eligible patients with surgical adrenal disease were prospectively randomized to undergo TLA (25) or RLA (32). Study exclusion criteria were patient age greater than 80 years, body mass index greater than 40, bilateral adrenalectomy and significant prior abdominal surgery in the quadrant of interest. Mean followup was 5.96 years in the 2 groups.

Results: The groups were matched in regard to patient age (p = 0.84), body mass index (p = 0.43), American Society of Anesthesiologists class (p = 0.81) and laterality (p = 0.12). Median adrenal mass size was 2.7 cm (range 1 to 9) in the TLA group and 2.6 cm (range 0.5 to 6) in the RLA group (p = 0.83). TLA was comparable to RLA in terms of operative time (130 vs 126.5 minutes, p = 0.64), estimated blood loss (p = 0.92), specimen weight (p = 0.81), analgesic requirements (p = 0.25), hospital stay (p = 0.56) and the complication rate (p = 0.58). One case per group was electively converted to open surgery. Pathology data on the intact extracted specimens were similar between the groups. Averaged convalescence was 4.7 weeks in the TLA group and 2.3 weeks in the RLA group (p = 0.02). During a mean followup of 6 years 2 patients in the TLA group had a late complication (port site hernia). Mortality occurred in 5 patients, including 1 with TLA and 4 with RLA, during the 6-year followup.

Conclusions: For most benign adrenal lesions requiring surgery laparoscopic adrenalectomy can be performed safely and effectively by the transperitoneal or the retroperitoneal approach.
<table>
<thead>
<tr>
<th></th>
<th>Group 1</th>
<th>Group 2</th>
<th>p Value</th>
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<tbody>
<tr>
<td>No. pts</td>
<td>25</td>
<td>32</td>
<td></td>
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<tr>
<td>Intraop data</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Median mins operative time (Q1, Q3)</td>
<td>130 (111, 187)</td>
<td>126.5 (90, 180)</td>
<td>0.640</td>
</tr>
<tr>
<td>Median ml estimated blood loss (Q1, Q3)</td>
<td>50 (25, 100)</td>
<td>50 (25, 100)</td>
<td>0.922</td>
</tr>
<tr>
<td>Median gm specimen wt (Q1, Q3)</td>
<td>24 (13, 43)</td>
<td>29 (11.8, 48.5)</td>
<td>0.809</td>
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<tr>
<td>No. open conversion (%)</td>
<td>1 (4)</td>
<td>1 (3.1)</td>
<td>0.859</td>
</tr>
<tr>
<td>Postop data</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median mg analgesic Toradol® requirement (Q1, Q3)</td>
<td>60 (30, 60)</td>
<td>42.5 (11.25, 60)</td>
<td>0.246</td>
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<tr>
<td>Median days to oral intake (Q1, Q3)</td>
<td>1 (1, 1)</td>
<td>1 (1, 1)</td>
<td>0.860</td>
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<td>Median days to ambulation (Q1, Q3)</td>
<td>1 (1, 1)</td>
<td>1 (1, 1)</td>
<td>0.860</td>
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<tr>
<td>Median days hospital stay (Q1, Q3)</td>
<td>1 (1, 2)</td>
<td>1 (1, 1)</td>
<td>0.560</td>
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<td>No. no postop complications (%)</td>
<td>23 (92)</td>
<td>31 (96.8)</td>
<td>0.576</td>
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<td>No. urinary retention (%)</td>
<td>0 (4)</td>
<td>1 (3.2)</td>
<td></td>
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<tr>
<td>No. fever (%)</td>
<td>1 (4)</td>
<td>0 (3.2)</td>
<td></td>
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<tr>
<td>No. hematoma (%)</td>
<td>1 (4)</td>
<td>0 (3.2)</td>
<td></td>
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<tr>
<td>Median convalescence (wks)</td>
<td>4.7</td>
<td>2.3</td>
<td>0.02</td>
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</table>
Trans or Retro

- **Transperitoneal**
  - More working area
  - Easier to learn
  - Larger tumors
  - Prior retroperitoneal surgery

- **Retroperitoneal**
  - Less working area
  - One functional hand
  - Smaller tumors
  - Rapid access to adrenal vein
  - Prior abdominal surgery
Other routes?

THORACOSCOPIC TRANSDIAPHRAGMATIC ADRENALECTOMY: THE INITIAL EXPERIENCE

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ABSTRACT

Purpose: We introduce the technique of thoracoscopic transdiaphragmatic adrenalectomy.

Materials and Methods: Initially in 4 human cadavers bilateral thoracoscopic nephrectomy was performed to develop the technique of diaphragmatic incision, retroperitoneal control of renal artery and vein, circumferential mobilization of the kidney and adrenal gland, and suture repair of the diaphragm. Subsequently, 3 select patients underwent thoracoscopic transdiaphragmatic adrenalectomy (2 right side and 1 left side). All 3 patients had significant prior abdominal scarring after either partial or total radical nephrectomy, thereby precluding efficient transabdominal laparoscopic access to the adrenal gland. After double lumen endotracheal intubation, a 4 port transthoracic approach without pneumo-insufflation was performed with the patient in the prone position. The diaphragm was incised under real-time laparoscopic ultrasound guidance. The adrenal gland was visualized high in the retroperitoneum, the vasculature controlled, and the specimen entrapped and extracted intact through a thoracic port site. The diaphragm was suture repaired with freehand laparoscopic suturing and intracorporeal knot tying. A chest tube was inserted in the initial 2 patients.

Results: There were no intraoperative or postoperative complications. Operating time was 4.5, 6.5 and 2.5 hours, and blood loss was 150, 500 and 50 cc, respectively. Mean narcotic analgesic requirement was 27 mg. morphine sulfate equivalent. Hospital stay was 2 days for all 3 patients. Pathology revealed metastatic renal cell carcinoma in 2 patients and myelolipoma in 1.

Conclusions: In select patients with significant concomitant intraperitoneal and retroperitoneal scarring from prior major abdominal or renal surgery laparoscopic adrenalectomy can be safely performed with the transthoracic transdiaphragmatic approach. We present our initial experience.
Is laparoscopy CONTRAINDICATED in the presence of adrenal cancer?
- 6/33 ACC; 1/33 malignant pheochromocytoma
- Local recurrence 2/6 with ACC
- Mortality: 6/7 dead in median time of 17 mos (range, 9 to 52 mos).
1994-2000 lap adrenalectomy experience, n=216 patients

> 6cm tumors n=19

6 with adrenal cortical carcinoma

1/6 with liver metastasis at f/u; 5/6 NED 8-83 mos.

N=23 with malignant tumors
5/23 with ACC; 1/23 undifferentiated tumor
Local recurrence 2/6, LN metastasis 1/6

ACC: Laparoscopy

- Laparoscopic adrenalectomy for ACC
- 5 case reports of recurrence (Carcinomatosis) following laparoscopic adrenalectomy for ACC


Adrenal Cortical Carcinoma

- Surgery is the mainstay in achieving cure.
- Laparoscopy is associated with the potential for peritoneal seeding/recurrence in the event of incomplete resection or specimen fracture.
What about Partial Adrenalectomy?

**Why?**
- In order to preserve adrenal function.

**When?**
- Suitability for partial adrenalectomy
  - Benign functional tumor.
  - Presence of residual adrenal tissue.
  - Bilateral disease, solitary adrenals
1995-2004 (n=33, 8 open, 25 lap)

Partial performed if normal tissue could be identified on preop or intraoperative imaging.

All patients tumor free at mean follow up 36 mos (range, 3-102 mos).

10 bilateral, 8 solitary with steroid replacement needed in 4 (temporary in 3).
# Table 1: Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of Patients</th>
<th>Number of Articles</th>
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<tbody>
<tr>
<td>Total Patients</td>
<td>455</td>
<td>24</td>
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<tr>
<td>Clinical Diagnosis</td>
<td>426</td>
<td>24</td>
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<tr>
<td>Pheochromocytoma</td>
<td>205</td>
<td>15</td>
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<tr>
<td>Conn’s Syndrome / Aldosterone Producing Adenoma</td>
<td>172</td>
<td>13</td>
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<tr>
<td>Cushing’s Syndrome / Cortisol Producing Adenoma</td>
<td>15</td>
<td>3</td>
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<tr>
<td>Benign Lesion</td>
<td>34</td>
<td>6</td>
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<tr>
<td>Mean tumor size, cm (range)</td>
<td>2.7 (0.8-4.0)</td>
<td>16</td>
</tr>
<tr>
<td>Mean age, years (range)</td>
<td>44.8 (27-60)</td>
<td>19</td>
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<td>Patients with description of surgical approach</td>
<td>411</td>
<td>22</td>
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<tr>
<td>Patients treated laparoscopically</td>
<td>299</td>
<td>22</td>
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<tr>
<td>Patients treated via open approach</td>
<td>112</td>
<td>22</td>
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<tr>
<td>Patients with perioperative complications</td>
<td>21 out of 275</td>
<td>11</td>
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<tr>
<td>Mean follow up time, months (range)</td>
<td>55.3 (24-138)</td>
<td>14</td>
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<tr>
<td>Recurrence</td>
<td>17 out of 272</td>
<td>17</td>
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<tr>
<td>Mean time to recurrence, months (range)</td>
<td>119 (72-206)</td>
<td>3</td>
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<tr>
<td>Patients needing post-operative cortisol replacement</td>
<td>21 out of 113</td>
<td>7</td>
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</table>
Total Adrenalectomy (n=77) for Conn’s disease (n=28) or pheochromocytoma (n=49)

- Multifocality
  - Conn’s 7/28 (25%)
  - Pheochromocytoma 3/49 (6%)
    - Sporadic pheochromocytoma 1/41
    - Familial pheochromocytoma 2/8 (25%)
Conclusions

- Both transperitoneal and retroperitoneal laparoscopic adrenalectomy can be learnt and performed expeditiously.
- Laparoscopic Adrenalectomy should be the standard of care except in patients with large tumors.
- Presence of adrenal cancer is a relative contraindication to laparoscopy.
- Partial Adrenalectomy is an attractive option in patients in whom conservation of adrenal tissue is of importance.
Thank you
ACC: Presentation

SYNDROME FREQUENCY

- Virilization and Cushing's syndrome 50%
- Virilization 25%
- Cushing's syndrome 20%
- Feminization <5%
- Precocious puberty <5%
- Hypokalemia alkalosis <5%
- Hypoglycemia <5%
Port Placement
left adrenalectomy

Alternative camera/retraction port
Laparoscopic Retroperitoneal Radical Nephrectomy

Patient position and retroperitoneal access

Origin (R) - Blunt Tip Port
Balloon Cuff

Origin (R) - Retroperitoneal Balloon Dilator
ACC: Diagnostic tests

- Aldosterone hypersecretion:
  - BP, serum K (sodium restriction minimizes hypokalemia)
  - upright PRA and PAC

- Cushing’s:
  - Diurnal variation
  - Overnight 1.0 mg dex suppression test. (Low dose dex suppression: Img PO at 11 pm, plasma cortisol, ACTH and plasma dex levels are drawn at 8 am. Cortisol should fall to <5 mcg/dl.)

- Virilizing
  - Serum dehydroepiandrosterone sulfate

- Feminizing
  - DHEAS, serum estradiol
5.0 cm cutoff resulted in 93% sensitivity and 64% specificity. (PPV 28%, NPV 98%).


- 6 cm malignant unless proven otherwise postoperatively.

- <1.5 cm incidence of ACC 1:4000.
MRI (ACC)

- Sensitivity 81 to 84%
- Specificity 100%

<table>
<thead>
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<th><strong>No. pts</strong></th>
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<tr>
<td><strong>No. gender:</strong></td>
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<tr>
<td>Male</td>
<td>19</td>
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<tr>
<td>Female</td>
<td>12</td>
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<tr>
<td><strong>No. side:</strong></td>
<td></td>
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<tr>
<td>Lt</td>
<td>15</td>
</tr>
<tr>
<td>Rt</td>
<td>14</td>
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<td>Bilat</td>
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<td><strong>No. approach:</strong></td>
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<td>Transperitoneal</td>
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<td>Transthoracic</td>
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<tr>
<td><strong>Mean cm mass size on CT (range)</strong></td>
<td>5 (1.8–10)</td>
</tr>
<tr>
<td><strong>Mean gm specimen wt (range)</strong></td>
<td>116 (10–678)</td>
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<tr>
<td><strong>Mean estimated blood loss (ml)</strong></td>
<td>258</td>
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<tr>
<td><strong>Mean operative time (mins)</strong></td>
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<tr>
<td><strong>Hospital stay (days)</strong></td>
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<td>Renal cell Ca metastasis</td>
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<td>Colonic metastasis</td>
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<td>Ushiyama et al&lt;sup&gt;1&lt;/sup&gt;</td>
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<td>Sex</td>
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<td>Tumor size (cm)</td>
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<td>History</td>
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<td>Pathological findings:</td>
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<td>Initial specimen</td>
<td>Benign adenoma</td>
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<td></td>
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<td>Final reoperation</td>
<td>ACC</td>
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LAPAROSCOPIC PARTIAL VERSUS TOTAL ADRENALECTOMY FOR ALDOSTERONE PRODUCING ADENOMA

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ABSTRACT

Purpose: Laparoscopic surgery has become a standard method for adrenal treatment. Primary hyperaldosteronism is known to be frequently characterized by multiple adrenal lesions. The indication of laparoscopic partial or total adrenalectomy in patients with aldosterone producing adenoma (APA) remains controversial. We performed the 2 procedures and compared the outcomes of these 2 operations retrospectively.

Materials and Methods: A total of 92 patients with primary hyperaldosteronism were laparoscopically treated at our institution from 1995 to 2004. A total of 29 patients underwent partial adrenalectomy or enucleation, while unilateral total adrenalectomy was performed in 63. A single pathologist examined the number and histopathological characteristics of APAs. Postoperative median followup was 60.3 and 29.3 months, respectively.

Results: Laparoscopic adrenalectomies were successfully performed in each group, although the partial type had fewer ports and shorter operative time. All 63 patients with total adrenalectomy showed recovery from hypertension, suppressed plasma renin activity and high plasma aldosterone. Two of 29 patients with partial adrenalectomy or enucleation still experienced hypertension with high plasma aldosterone. Of the 63 extirpated specimens 17 adrenals (27.0%) demonstrated multiple space occupying lesions along with the main APA.

Conclusions: Primary hyperaldosteronism is highly associated with multiple adrenal space occupying lesions. The risk-to-benefit ratio must be carefully weighed against the potential advantage of partial adrenalectomy. We chose total laparoscopic adrenalectomy in patients with unilateral APA and primary hyperaldosteronism.
LAPAROSCOPIC RADICAL ADRENALECTOMY FOR MALIGNANCY IN 31 PATIENTS

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From the Section of Laparoscopic and Robotic Surgery, Glickman Urological Institute, Cleveland Clinic Foundation, Cleveland, Ohio

ABSTRACT

Purpose: Laparoscopic adrenalectomy for malignancy is controversial. We analyzed our experience with laparoscopic radical adrenalectomy for cancer with an emphasis on predictors of surgical outcome and oncological followup data.

Materials and Methods: Since July 1997, 31 patients have undergone a total of 33 laparoscopic adrenalectomies for malignancy. Mean adrenal tumor size was 5 cm (range 1.8 to 9). The laparoscopic approach was transperitoneal in 17 cases, retroperitoneal in 15 and transthoracic in 1. Data were obtained from patient charts, radiographic reports and direct telephone calls to patient families.

Results: Associated organ resection (radical nephrectomy) was performed in 3 patients. One case was electively converted to open surgery. There was no operative mortality. The pathological diagnoses were metastatic cancer in 26 cases and primary adrenal malignancy in 7. Current median followup, available on 30 patients, was 26 months (range 1 to 69). Overall 15 patients (48%) died and 16 (52%) were alive, of whom 13 (42%) showed no evidence of disease. Cancer specific survival at a median followup of 42 months was 53% and 5-year actuarial survival was 40%. Local recurrence was noted in 7 patients (23%). There were no port site metastases. Survival was similar in patients with tumors less than 5 cm vs 5 cm or greater. Survival was not associated with patient age, tumor size, operative time or surgical approach. Survival was compromised in patients with local recurrence (p = 0.016).

Conclusions: Laparoscopic radical adrenalectomy can be performed with acceptable outcomes in the carefully selected patient with a small, organ confined, solitary adrenal metastasis or primary adrenal carcinoma. To our knowledge the largest series in the literature to date is presented.
ACC: Laparoscopy

- 5 case reports of recurrence following laparoscopic adrenalectomy for ACC
  - Cushing’s n=2
  - Hyperaldo n=2
  - Virilizing tumor n=1
- 4/5 benign on initial pathology
- 1/5 partial adrenalectomy
- 2/5 converted to open