

# Clipless Laparoscopic Adrenalectomy in Children and Young Patients: A Single Center Experience with 12 Cases

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**Purpose:** Laparoscopy is the gold standard approach for management of some adrenal masses in adult cases. Still there have not been many findings in case of children. We present our experience with clipless laparoscopic adrenalectomy in pediatric cases for the first time.

**Materials and Methods:** From January 2007 to January 2011, thirteen laparoscopic adrenalectomy were performed in patients 5-18 years old. The first port (10 mm) was inserted using open approach above the umbilicus and three 5 mm trocars were inserted under direct vision. On the left side, the colon was mobilized medially, then the renal vein exposed. Adrenal vein was coagulated using bipolar cautery after separating from renal vein. No endoscopic clips were used.

**Results:** Eight girls and five boys with the mean age of 14.4 years old (ranging from 5 to 18 years old) underwent laparoscopic adrenalectomy. The mean operative time was  $151 \pm 47$  (80-240) minutes. The mean size of adrenal lesions in greatest diameter was  $6.9 \pm 2.4$  cm (3.5 to 10). The mean hospital stay was 3.7 days (2-5) and average follow-up time was 21 months (6-27).

**Conclusion:** Laparoscopic adrenalectomy in children and young adults is effective and safe if the cases are selected appropriately. Clipless laparoscopic approach by an expert surgeon has acceptable outcomes.

**Keywords:** adrenalectomy; laparoscopy; child; postoperative complications; treatment outcome.

## INTRODUCTION

The early experiences of laparoscopic adrenalectomy were reported in 1992.<sup>(1,2)</sup> Nowadays, it is widely performed in adult patients and is accepted as a gold standard surgery for adrenal tumor up to 8-11 cm.<sup>(3,4)</sup> The advantages of laparoscopic adrenalectomy compared to open surgery are, less post-operative pain and discomfort, shorter hospital stay and better cosmetic results.

Only a few percent of pediatric adrenal lesions are benign. The most common pediatric adrenal tumor is neuroblastoma; this type of adrenal tumor is the most common extra cranial solid tumor in children. Saad and colleagues and Iwanaka and colleagues have described the effectiveness of laparoscopic biopsy and excision of abdominal neuroblastoma even in children with advanced neuroblastoma.<sup>(5,6)</sup>

Some previous reports with different number of cases (from 8 to 140 patients) about laparoscopic adrenalectomy in children have revealed that this approach should be considered in the majority of adrenal lesions in children.<sup>(7-10)</sup> Few studies have been published about clipless laparoscopic adrenalectomy in adult cases where adrenal vessels were controlled by different modalities including LigaSure vessel-sealing system<sup>(11,13)</sup> and bipolar coagulator, but we found no reports of clipless laparoscopic adrenalectomy in paediatric patients. The present study describes our experiences of thirteen laparoscopic clipless adrenalectomy cases in children and young adolescents with adrenal tumors during their four-year treatment.

## MATERIALS AND METHODS

From January 2007 to January 2011, thirteen cases of laparoscopic adrenalectomy were performed in patients 5-18 years old. Preoperative evaluation of patients included metabolic and hormonal assessment, plus imaging studies such as computed tomography (CT), magnetic resonance imaging (MRI) and metaiodobenzylguanidine (MIBG) scan according to the circumstances of each case. Selected patients who were suspicious of pheochromocytoma were treated with phenoxybenzamine for a period of one week before operation.

General anesthesia was used in all patients. Each patient was positioned in a 45 degree lateral decubitus. First 10 French urethral catheter was fixed and then transperitoneal approach

was carried out in all cases. The first port (10 mm) was fixed using open access technique above the umbilicus and three 5 mm trocars (and additional trocar in the right-sided adrenal tumor for retracting the liver) were inserted under direct vision. On the left side, the colon was mobilized medially and the renal vein was exposed. Adrenal vein was coagulated using only bipolar cautery.

No endoscopic clips or other energy sources such as ultrasonic or vessels sealing system were used. Also, no other energy sources were used for controlling the vessels such as harmonic scalpels. On the right side, duodenum was mobilized medially, then adrenal vein was coagulated using bipolar cautery and finally the adrenal was freed from the surrounding tissues. The specimen was extracted from abdominal cavity using Endobag and depending its size, it was brought out via the umbilical port or using a Pfannenstiel incision.

## RESULTS

Thirteen laparoscopic adrenalectomies were performed. Eight girls and five boys with the mean age of 14.4 years old (ranging from 5 to 18 years old) were included in this study. Only one patient underwent two sessions of laparoscopic surgery.

The mean operation time was  $151 \pm 47$  (80-240) minutes. Perioperative blood loss was negligible for all patients except a 17-year-old patient who had 10 cm retro-peritoneal mass with some adhesions to the surrounding tissues that received one unit packed red blood cell after operation. The mean size of adrenal lesions in greatest diameter was  $6.9 \pm 2.4$  cm (3.5 to 10). The mean hospital stay was 3.7 days (2-5 days). Average follow-up time was 21 months (6-27 months). There were no intra-operative complications and no conversion to open was required.

Final pathology of these tumors were ganglioneuroma (n = 2), adrenocortical hyperplasia (n = 5), adrenal adenomas (n = 2), pheochromocytoma (n = 1), adrenocortical carcinoma (n = 2), and Cushing syndrome (n = 1) (Table).

The youngest patient was a 5-year-old girl presented with hirsutism, clitoromegaly and hyperandrogenemia. She had an equivocal pathology, adrenocortical tumor with undetermined clinical behavior. Capsular and intra-tumoral vascular

**Table .** Pathology and side of the adrenal tumors in study subjects.

Pathology of adrenal tumor	Number	Left	Right
Ganglioneuroma	2	1	1
Adrenal adenoma	2	1	1
Adrenocortical hyperplasia	5	3	2
Pheochromocytoma	1	0	1
Adrenocortical carcinoma	2	1	1
Cushing	1	0	1

invasion were in favor of carcinomatous change of this neoplasm but lack of pleomorphism and necrosis were against it. Her operative time was 140 minutes and she revealed complete resolution during the follow up.

In another case, a 12-year-old girl underwent two sessions of laparoscopic surgery for bilateral adrenalectomy. She had adrenal hyperplasia (refractory to medical management). No significant improvement of symptoms happened after one side laparoscopic adrenalectomy; hence she underwent laparoscopic adrenalectomy in the other side and follow-up visit revealed noticeable symptom improvement.

Final pathology of adrenal mass in a 15-year-old girl, who underwent complete laparoscopic en bloc tumor resection, was adrenocortical carcinoma. She was symptom free and no recurrences were detected during a 16 months follow up.

Lastly, a 17-year-old girl with right adrenal mass and retro-peritoneal mass underwent laparoscopic tumorectomy. The pathology of adrenal and retro-peritoneal mass was ganglioneuroma and benign nerve sheath tumor, respectively and short-term follow-up imaging revealed no residual tumors. 10 months later, she was readmitted with relapsing of hypertension after temporary resolution of her signs and symptoms. She had no abnormal laboratory test results. Considering local recurrence, she underwent open surgery and the pathology of lesion at the location of right adrenal was adrenocortical adenoma consistent with Cushing and the pathology of para-vertebral and para-caval mass was ganglioneuroma.

## DISCUSSION

Laparoscopic adrenalectomy is the standard treatment of benign adult adrenal tumors.<sup>(3)</sup> However, it is less common for pediatric adrenal lesions. Some surgeons believe that pediatric adrenal tumors do not require laparoscopic surgery because most of them are malignant and malignant tumors trend to grow and become huge, invading the other organs. Thus, learning curve is an important subject in laparoscopic adrenalectomy in children.<sup>(14)</sup>

There are some controversies about the maximum size of the adrenal lesions in children which can be treated by a laparoscopic approach. MacGillivray and colleagues have recommended an upper size limit of 12 cm for laparoscopic adrenalectomy in adult adrenal lesions.<sup>(15)</sup> Still, there is no obvious limitation for the tumor size in children and it should be decided individually according to the ratio of the tumor size to the body size. Heloury and colleagues have considered the laparoscopic approach for removing small adrenal masses in children.<sup>(14)</sup> However, it seems that there is no limitation in respect to tumor size and patient age for expert surgeons. In our experience, the maximum diameter of adrenal mass was 10 cm.

A multicenter experience of laparoscopic adrenalectomy in 140 pediatric cases from 10 institutions during 10 years has revealed noticeable findings about this issue in children. The mean operation time was  $130.2 \pm 63.5$  (43-406) minutes in this study. They had a 9.9% conversion to open (the most

common reason was adhesion of the tumor to the surrounding tissues) and there was only one local recurrence in a patient with pheochromocytoma. This report had emphasized that tumor size is not a risk factor for open conversion.<sup>(9)</sup>

Some previous reports have assessed the efficacy and safety of laparoscopic adrenalectomy in children and young patients with different number of cases, follow-up periods and tumor sizes. To our knowledge, no report of clipless laparoscopic adrenalectomy using bipolar cautery in children and young patients has been published.

In one report, 10 patients with adrenal tumor in adult cases (mean size of 6.2 cm) underwent laparoscopic adrenalectomy using LigaSure vessel-sealing device instead of clip and suture. The authors demonstrate that using this modality is concomitant with shorter operation time, less blood-loss, and lower conversion rates.<sup>(12)</sup> In another study, Chueh and colleagues performed laparoscopic adrenalectomy in 12 adult cases using bipolar coagulation cautery for vessels control and found acceptable results.<sup>(13)</sup>

This study introduced the first experience of clipless laparoscopic adrenalectomy in 12 cases of pediatric and young patients in this study. It seems that using bipolar instead of clip has comparable results and is applicable even in large adrenal masses (i.e. 10 cm). Displacement of clips by instrument manipulation or spontaneously is an issue of concern, so there will be no fear of clip displacement by using bipolar cautery. The authors accept that larger group of cases and longer follow-up time is necessary to evaluate this approach more properly in pediatric patients.

## CONCLUSION

Laparoscopic adrenalectomy in children and young adults is effective and safe if the cases are selected appropriately. Taking a clipless laparoscopic approach by an expert surgeon is preferred to open surgery and has acceptable outcomes.

## CONFLICT OF INTEREST

None declared.

## References

- Gagner M, Lacroix A, Bolté E. Laparoscopic adrenalectomy in Cushing's syndrome and pheochromocytoma. *N Engl J Med.* 1992;327:1033.
- Higashihara E, Tanaka Y, Horie S, et al. A case report of laparoscopic adrenalectomy. *Nihon Hinyokika Gakkai Zasshi.* 1992;83:1130-3.
- Ramacciato G, Nigri G, Di Santo V, et al. Minimally invasive adrenalectomy: transperitoneal vs. retroperitoneal approach. *Chir Ital.* 2008;60:15-22.
- Goitein D, Mintz Y, Gross D, Reissman P. Laparoscopic adrenalectomy: ascending the learning curve. *Surg Endosc.* 2004;18:771-3.
- Saad DF, Gow KW, Milas Z, Wulkan ML. Laparoscopic adrenalectomy for neuroblastoma in children: a report of 6 cases. *J Pediatr Surg.* 2005;40:1948-50.
- Iwanaka T, Arai M, Ito M, et al. Surgical treatment for abdominal neuroblastoma in the laparoscopic era. *Surg Endosc.* 2001;15:751-4.
- Laje P, Mattei PA. Laparoscopic adrenalectomy for adrenal tumors in children: a case series. *J Laparoendosc Adv Surg Tech A.* 2009;19 Suppl 1:S27-9.
- Nerli RB, Reddy MN, Guntaka A, Patil S, Hiremath M. Laparoscopic adrenalectomy for adrenal masses in children. *J Pediatr Urol.* 2011;7:182-6.
- St Peter SD, Valusek PA, Hill S, et al. Laparoscopic adrenalectomy in children: a multicenter experience. *J Laparoendosc Adv Surg Tech A.* 2011;21:647-9.
- Castilho LN, Castillo OA, Dénes FT, Mitre AI, Arap S. Laparoscopic adrenal surgery in children. *J Urol* 2002;168:221-4.
- Surgit O. Clipless and sutureless laparoscopic adrenalectomy carried out with the LigaSure device in 32 patients. *Surg Laparosc Endosc Percutan Tech.* 2010;20:109-13.
- Misra MC, Aggarwal S, Guleria S, Seenu V, Bhalla AP. Clipless and sutureless laparoscopic surgery for adrenal and extra-adrenal tumours. *JLS.* 2008;12:252-5.
- Chueh SC, Chen J, Chen SC, Liao CH, Lai MK. Clipless laparoscopic adrenalectomy with needlescopic instruments. *Chueh SCJ Urol.* 2002;167:39-42.
- Heloury Y, Muthucumar M, Panabokke G, Cheng W, Kimber C, Leclair MD. Minimally invasive adrenalectomy in children. *J Pediatr Surg.* 2012;47:415-21.
- MacGillivray DC, Whalen GF, Malchoff CD, Oppenheim DS, Shichman SJ. Laparoscopic resection of large adrenal tumours. *Ann Surg Oncol.* 2002;9:480-5.