Feasibility and safety of laparoscopic adrenalectomy for large tumours

Badr Serji a,d,*, Amine Souadka a, Amine Benkabbou a, Hajar Hachim a, Lamin Jaiteh a, Raouf Mohsine a, Lahcen Ifrine a, Abdelkader Belkouchi a, Hadj Omar El Malki a,b,c

a Surgery Department ‘A’, Ibn Sina Hospital, Medical School, Mohammed V University in Rabat, Morocco
b Medical Centre of Clinical Trials and Epidemiological Study and Biostatistical, Clinical Research and Epidemiological Laboratory, Medical School, Mohammed V University in Rabat, Morocco
c Abulcasis International University of Health Sciences, Abulcasis Medical School, Rabat, Morocco
d Medical School, Mohammed the First University, Oujda, Morocco

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KEYWORDS
Adrenalectomy; Laparoscopy; Large tumour
ABBREVIATIONS
ASA, American Society of Anesthesiology; HCC, hepatocellular carcinoma;

Abstract Objective: To verify the feasibility and safety of laparoscopic adrenalectomy for large tumours, as since it was described, the laparoscopic approach for adrenalectomy has become the ‘gold standard’ for small tumours and for large and non-malignant adrenal tumours many studies have reported acceptable results.

Patients and methods: This is a retrospective study from a general surgery department from January 2006 to December 2013 including 45 patients (56 laparoscopic adrenalectomies). We divided patients into two groups according to tumour size: < 5 or ≥ 5 cm, we compared demographic data and peri- and postoperative outcomes.

Results: There was no statistical difference between the two groups for conversion rate (3.7% vs 11.7% P = 0.32), postoperative complications (14% vs 12%, P = 0.4), postoperative length of hospital stay (5 vs 6 days P = 0.43) or mortality.
LA, laparoscopic adrenalectomy

(3.5% vs 0% $P = 0.99$). The only statistical difference was the operating time, at a mean (SD) 155 (60) vs 247 (71) min ($P < 0.001$).

**Conclusion:** Laparoscopic adrenalectomy for large tumours needs more time but appears to be safe and feasible when performed by experienced surgeons.

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**Introduction**

Described for the first time by Gagner et al. [1], the laparoscopic approach has become the ‘gold standard’ procedure for adrenal surgery [2–4], and especially with the development of materials for dissection and coagulation (Ligasure, ultrasonic scalpel). However, laparoscopic adrenalectomy still has some limits concerning size and malignancy. Recently published studies have shown that size is not a limitation [5,6]. The aim of the present study was to verify the feasibility and safety of laparoscopic adrenalectomy (LA) for large tumours in our context.

**Patients and methods**

This is a retrospective study from January 2006 to December 2013, including all consecutive LAs performed in our surgical department. Our policy in the department is to exclude adrenal tumours that are potentially malignant (locally invasive on imaging or presence of suspicious deep lymph nodes) or metastatic adrenal tumours for laparoscopic resection. We reviewed data on age, gender, American Society of Anaesthesiology (ASA) score, preoperative diagnosis, tumour size, operating time (excluding repositioning time for bilateral resection), conversion to open surgery, morbidity, and mortality. We used the Clavien–Dindo score to classify postoperative complications. We divided patients into two groups according to the size of the tumour using pre-operative imaging: $< 5$ and $\geq 5$ cm, which was considered as the definition of large adrenal tumours. All data concerning pre-, peri- and postoperative outcomes were compared and analysed using adequate statistical tests (with SPSS 13). Results are expressed as mean (SD) or median (range). Continuous data were compared between two groups using the Student’s $t$-test. When data were not normally distributed, univariable analysis was carried out using non-parametric tests. Categorical data were compared using the chi-squared test or Fisher’s exact test, as appropriate. We considered a $P < 0.05$ to indicate statistical significance.

Patients were operated upon in a general surgery department by four surgeons. For every patient with an adrenal secreting tumour, medical preparation is given according to the diagnosis ($\alpha_1$ inhibitor for phaeochromocytoma and cortisol antagonist for Cushing’s disease). Once in the operating room and after general anaesthesia, invasive blood pressure monitoring and a central venous line catheter are used if necessary. We perform LA in the lateral position using a transperitoneal approach, with four ports for a unilateral lesion and seven ports for bilateral adrenal tumours with the same epigastric port. Pneumoperitoneum is maintained at 12 mm Hg. For dissection we use a monopolar or bipolar scalpel, occasionally ultracision (Ethicon Endo-Surgery Inc, Cincinnati, OH, USA) or Ligasure (Covidien, Boulder, CO, USA) when available. For the right side, we begin by mobilising the liver, which is retracted via the epigastric port. We continue the incision of the peritoneum in the inferior part of the liver to the right border of the inferior vein cava to expose the adrenal vein, which is first clipped using two clips on the patient side or sometimes ligated. The adrenal gland is then dissected from the rest of the adjacent structures, artery and an eventual accessory adrenal vein is ligated as we advance in dissection. On the left side, we start by the incision of the splenic flexure, and then the spleno-renal ligament is opened until the greater curvature of the stomach is seen. We look for the adrenal vein on the superior border of the left renal vein, which is dissected on the renal hilum. It is then clipped using two clips on the patient side. The rest of adrenal tumour is dissected from the surrounding structures and other additional adrenal branches are coagulated or clipped from inferior phrenic vessels. The specimen is extracted by an incision joining two ports, in a retrieval bag. A drain is placed using the lateral port.

**Results**

In all, 56 consecutive LAs were performed on 45 patients. The mean (SD; range) age was 38 (14; 17–67) years, with a male to female ratio of 0.23. The mean (SD; range) adrenal tumour size was 6 (2.4; 3.3–14) cm. We performed 16 right LAs, 18 left, and 11 bilateral. There were 20 patients with phaeochromocytoma, 16 cases of functional and non-functional adenomas, two cases of Cushing’s disease (pituitary adenoma after failure of surgical, medical and radiotherapy approach), and one case of hepatocellular carcinoma (HCC) adrenal metastasis. The mean (SD) operative time was 184 (81) min. Three (6.7%) patients underwent conversion to laparotomy (difficulties regarding dissection in two patients and uncontrollable haemorrhage in the other
Table 1 Demographic data of the two groups.

| Variables               | Small tumour < 5 cm | Large tumour ≥5 cm | P     |
|-------------------------|---------------------|--------------------|-------|
| Number of patients      | 28                  | 17                 |       |
| Mean (SD) age, years    | 41 (13)             | 34 (15)            | 0.13  |
| Male, n (%)             | 4 (14.8)            | 3 (16.6)           | 0.9   |
| ASA score, n (%)        |                     |                    |       |
| 1                       | 11 (40)             | 2 (12)             | 0.03  |
| 2                       | 6 (21)              | 10 (59)            |       |
| 3                       | 10 (35)             | 5 (30)             |       |
| Median tumour size, cm  | 0.30                | 0.70               | 0.1   |
| Localisation, n (%)     |                     |                    |       |
| Left                    | 15 (54)             | 3 (18)             | 0.09  |
| Right                   | 10 (35)             | 6 (35)             |       |
| Bilateral               | 3 (11)              | 8 (47)             |       |
| Indication, n (%)       |                     |                    |       |
| Phaeochromocytoma       | 9 (32)              | 11 (65)            | 0.03  |
| Adenoma-Cushing’s       | 18 (64)             | 6 (35)             |       |
| HCC metastasis          | 1 (4)               | –                  |       |

Table 2 Results of statistical comparison of operative time and postoperative outcomes between the two groups.

| Variables               | Small tumour < 5 cm | Large tumour ≥5 cm | P   |
|-------------------------|---------------------|--------------------|-----|
| Number of patients      | 28                  | 17                 | 0.001|
| Mean (SD) operative time, min | 155 (60) | 247 (71) | 0.32 |
| Conversion, n (%)       | 1 (3.7)             | 2 (11.7)           |     |
| Postoperative complications, n (%) | 4 (14) | 2 (12) | 0.4  |
| Complications ≥ IIIA, n (%) | 3 (11) | 0 | 0.3  |
| Clavien–Dindo, n (%)    | 4 (14)              | 0                  | 0.34 |
| Median (range)          | 5 (4–7)             | 6 (5–8)            | 0.43 |
| Mortality, n (%)        | 1 (3.5)             | 0                  | 0.99 |

Discussion

LA for large tumours in our context is feasible and safe but it takes more time. In our present study, we considered tumours of ≥5 cm as large. Defining ‘large’ adrenal tumours is subject to controversy. Some recent authors suggest 6 or 8 cm as thresholds [5,6], but most authors support the size of 5 cm as large because of the risk of malignancy in larger tumours [7,8]. As a general surgery department, we feel comfortable with a transperitoneal approach and recent studies suggest that there is no difference between a transperitoneal and a retroperitoneal approach in terms of perioperative complications and immediate outcomes [9]. Tumour size may increase operative time [10,11], first by disturbing the surrounding anatomy of the adrenal gland and secondly because the surface of dissection is also increased. The learning curve also influences mean operative time [12], especially when it concerns many surgeons. The present cohort contained our first 17 LAs for large tumours performed by four different surgeons. The mean operative time can be improved with experience (learning curve). Conversion rates range from 3.9% to 16% in different studies [12–14]. A retrospective study of 456 LAs found that predictive factors for conversion are phaeochromocytoma, high body mass index, and tumour size of > 5 cm [15]. Apart from the limited number of patients in the present large-tumour group, those factors may explain the conversion rate of 11.7% in our present study in the large-tumour group, first because it was our initial experience (learning curve) and secondly because we had more phaeochromocytoma in this group (Table 1, P = 0.03). However, the difference in the conversion rate was not statistically significant. Contrary to operative time and conversion rate, size does not seem to influence immediate outcomes of LA. The morbidity rate ranges from 6% to 16% and these are mostly minor complications [14,16,17]. In our present study, no major complications
occurred in patients with large tumours, probably because they were operated towards the latter period of our experience and we think that the surgeons were more careful regarding the size of the lesion. There was no difference in postoperative hospital stay between the two groups. Patients with large adrenal tumours can benefit from a short postoperative hospital stay. A Spanish national study showed that good results concerning morbidity and hospital stay are related to high-volume centres and surgeons experience. We report one death due to an air embolism during surgery in the small-tumour group. This is a specific complication of laparoscopic surgery with variable incidence. In our patient it was concomitant with a venous haemorrhage. We support that LA for large tumours should be adopted for adrenal lesions with no suspicion of malignancy, and can be performed by general surgeons with laparoscopic experience even in developing countries.

Conclusion

LA for large tumour takes more time but is feasible and safe.

Conflicts of interest

Authors have no conflicts of interest to declare.

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None.

References

[1] Gagner M, Lacroix A, Bolté E. Laparoscopic adrenalectomy in Cushing’s syndrome and pheochromocytoma. N Engl J Med 1992;327:1033.
[2] Prinz RA. A comparison of laparoscopic and open adrenalectomies. Arch Surg 1995;130:489–92.
[3] Jacobs JK, Goldstein RE, Geer RJ. Laparoscopic adrenalectomy. A new standard of care. Ann Surg 2004;239:495–502.
[4] Smith CD, Weber CJ, Amerson JR. Laparoscopic adrenalectomy: new gold standard. World J Surg 1999;23:389–96.
[5] Carter YM, Mazeh H, Sippel RS, Chen H. Safety and feasibility of laparoscopic resection for large (≥ 6CM) pheochromocytomas without suspected malignancy. Endocr Pract 2012;18:720–6.
[6] Zografos GN, Farfaras A, Vasilias G, Pappa T, Aegili C, Vassilatou E, et al. Laparoscopic resection of large adrenal tumors. JSLS 2010;14:364–8.
[7] Sharma R, Ganpule A, Veeramani M, Sabnis RB, Desai M. Laparoscopic management of adrenal lesions larger than 5 cm in diameter. Urol J 2009;6:254–9.
[8] Dalvi AN, Thapar PM, Thapar VB, Rege SA, Deshpande AA. Laparoscopic adrenalectomy for large tumours: single team experience. J Minim Access Surg 2012;8:125–8.
[9] Nigri G, Rosman AS, Petrucciani N, Fancellu A, Pisano M, Zorcolo L, et al. Meta-analysis of trials comparing laparoscopic transperitoneal and retroperitoneal adrenalectomy. Surgery 2013;153:111–9.
[10] Ito T, Kurita Y, Shinbo H, Nagata M, Takayama T, Furuse H, et al. A clinical study of laparoscopic adrenalectomy for pheochromocytoma – analysis of clinical parameters influencing operative time and intraoperative systolic blood pressure. Nihon Hinyokika Gakkai Zasshi 2012;103:655–9.
[11] Kazaryan AM, Mala T, Edwin B. Does tumor size influence the outcome of laparoscopic adrenalectomy? J Laparoendosc Adv Surg Tech A 2001;11:1–4.
[12] Ali JM, Liu SS, Gunning K, Jah A, Huguet EL, Praseedom RK, et al. Laparoscopic adrenalectomy: auditing the 10 year experience of a single centre. Surgeon 2012;10:267–72.
[13] Boylu U, Oomen M, Lee BR, Thomas R. Laparoscopic adrenalectomy for large adrenal masses: pushing the envelope. J Endoural 2009;23:971–7.
[14] Ramacciato G, Mercantini P, La Torre M, Di Benedetto F, Ercolani G, Ravaoli M, et al. Is laparoscopic adrenalectomy safe and effective for adrenal masses larger than 7 cm? Surg Endosc 2008;22:516–21.
[15] Shen ZJ, Chen SW. Predictive factors for open conversion of laparoscopic adrenalectomy: a 13-year review of 456 cases. J Endoural 2007;21:1333–7.
[16] Hara I, Kawabata G, Hara S, Yamada Y, Tanaka K, Fujisawa M. Clinical outcomes of laparoscopic adrenalectomy according to tumor size. Int J Urol 2005;12:1022–7.
[17] Wilhelm SM, Prinz RA, Barbu AM, Onders RP, Solorzano CC. Analysis of large versus small pheochromocytomas: operative approaches and patient outcomes. Surgery 2006;140:553–60.
[18] Villar JM, Moreno P, Ortega J, Bollo E, Ramirez CP, Muñoz N, et al. Results of adrenal surgery. Data of a Spanish National Survey. Langenbecks Arch Surg 2010;395:837–43.
[19] Park EY, Kwon JY, Kim KJ. Carbon dioxide embolism during laparoscopic surgery. Yonsei Med J 2012;53:49–66.
[20] Al-Zahrani HM. Laparoscopic adrenalectomy: an update. Arab J Urol 2012;10:56–65.