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Feasibility and safety of laparoscopic adrenalectomy for large tumours

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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 $\geqslant 5$ 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

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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.

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 preoperative imaging: < 5 and $\geqslant 5$ 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 (α_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)	–	

case). Complications (excluding mortality) during the hospital stay and at ⩽30 days postoperatively related to LA occurred in six (13.3%) patients without any subsequent readmission after discharge. Three patients in the small-tumour group had a Clavien–Dindo classification stage of ⩾IIIA. One patient had acute bleeding that needed transfusion and re-operation, the second had a postoperative pneumothorax resolved by chest tube drainage under local anaesthesia, and the third had a pulmonary embolism that resolved under supportive measures in the intensive care unit. The three other complications were lymphangitis, in two patients in the small-tumour group and one in the large-tumour group. One patient died of an air embolism during surgery in the small-tumour group that occurred whilst the operator was trying to control haemorrhage from the adrenal vein in a right adrenalectomy. Monitoring showed a mismatching of respiration, perturbation of cardiac rhythm and dysfunction in the right heart (whilst there was a high central venous pressure and a total control of the bleeding), followed by a fatal cardiac arrest.

The two groups of patients were statistically comparable except for the indication and ASA score. There were more phaeochromocytoma in the large-tumour group (73%, $P = 0.03$) (Table 1). Comparing perioperative and postoperative outcomes, we found that the median operative time was longer in the large-tumour group, at a mean (SD) of 247 (71) vs 155 (60) min ($P < 0.001$). There were no statistical differences between the groups for conversion rate (3.7% vs 11.7%, $P = 0.32$), postoperative complications (14% vs 12%, $P = 0.4$), mortality (3.7% vs 0%, $P = 0.99$) or median postoperative hospital stay (5 vs 6 days, $P = 0.43$) (Table 2).

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

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	
Mean (SD) operative time, min	155 (60)	247 (71)	0.001
Conversion, *n* (%)	1 (3.7)	2 (11.7)	0.32
Postoperative complications,* *n* (%)	4 (14)	2 (12)	0.4
Complications ⩾ IIIA Clavien–Dindo,* *n* (%)	3 (11)	0	0.3
Complications ⩾ IIIA Clavien–Dindo, *n* (%)	4 (14)	0	0.34
Median (range) postoperative stay, days	5 (4–7)	6 (5–8)	0.43
Mortality, *n* (%)	1 (3.5)	0	0.99

* Excluding mortality.

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 [14,16,13]. A Spanish national study showed that good results concerning morbidity and hospital stay are related to high-volume centres and surgeons experience [18]. 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 [19]. 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 [20], 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.

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