



Original research

Laparoscopic adrenalectomy for large adrenal masses: Single team experience



A. Agrusa*, G. Romano, G. Frazzetta, D. Chianetta, V. Sorce, G. Di Buono, G. Gulotta

Department of General Surgery, Urgency and Organ Transplantation, University of Palermo, Via L. Giuffrè 5, 90127 Palermo, Italy

ARTICLE INFO

Article history:

Received 23 March 2014

Accepted 3 May 2014

Available online 23 May 2014

Keywords:

Laparoscopic adrenalectomy

Large adrenal tumors

Laparoscopy

Laparoscopic surgery

ABSTRACT

Introduction: Laparoscopic adrenalectomy is today considered the standard treatment for benign small adrenal tumors. An open question is the use of laparoscopy for large adrenal masses because of technical limitations and increased risk of malignancy. In this study we report our experience in laparoscopic adrenalectomy for adrenal masses larger than 6 cm.

Methods: Between January 2010 and December 2013 we performed 41 laparoscopic adrenalectomy. Fourteen of 41 patients (34.1%) were submitted to laparoscopic adrenalectomy for lesion >6 cm in size. All patients were submitted routinely to radiological and hormonal tests to identify tumors characteristics.

Results: The patients treated were 9 male and 5 female, the mean age was 55.6 years (range 38–74). The mean tumor size was 8.2 cm (range 6–14 cm) and the lesion were localized on right side in 8 patients and on the left side in 6 patients. The mean operative time was 181 min (range 145–240 min). Mean blood loss was 90 ml. No conversion to open surgery was required.

Conclusion: Laparoscopic adrenalectomy offers better surgical outcomes than open adrenalectomy. Size criteria are, at the moment, the main subject discussed for the laparoscopic approach to adrenal tumors. In fact, size is an important variable in predicting malignancy. This experience and the results of literature suggest that laparoscopic approach is safe and feasible for adrenal masses larger than 6 cm with a longer operative time. In presence of local invasion or vascular infiltration laparoscopy is contraindicated.

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1. Introduction

Laparoscopic Adrenalectomy (LA) is today considered the standard treatment for benign small adrenal tumors. Since the initial description in 1992 by Gagner et al. [1] retrospective comparison studies have shown the decrease of the perioperative morbidity, lower complication rates, less operative blood loss, less post-operative pain and shorter hospital stay compared with open adrenalectomy (OA) [2]. An open question instead is the use of laparoscopy in case of large adrenal masses because of technical limitations, longer operative time and increased blood loss [3]. Furthermore, tumor size is usually considered an indicator or malignancy [4] and it is uncertain if the laparoscopic resection of large potentially malignant adrenal tumors is appropriate due to concern over incomplete resection, capsular disruption and local recurrence [5]. In literature different authors considered adrenal masses larger

than 5, 6 or 7 cm [6,7]. In this study we report our experience in LA for adrenal masses larger than 6 cm.

2. Methods

In our Department of General and Emergency Surgery at the University Hospital Policlinico “P. Giaccone” of Palermo between January 2010 and December 2013 we performed a total of 41 LA. In this study we review surgical outcome of 14 patients submitted to LA for adrenal masses larger than 6 cm.

2.1. Preoperative evaluation

Before surgery all patients were submitted routinely to Computed tomography (CT) scan to study the characteristics and size of the lesion. Abdominal magnetic resonance imaging (MRI) was performed for selected patients. A diagnosis of possible adrenal carcinoma was based on the patients history and radiologic findings. Radiological characteristics of malignancy included local infiltration, irregular margins or tumor heterogeneity, venous

* Corresponding author.

E-mail address: antonino.agrusa@unipa.it (A. Agrusa).

invasion. The only size of lesion was not considered a signal of malignant lesion [8]. Complete hormonal tests were performed preoperatively to identify functioning tumors. Indication for adrenalectomy included: hormone secreting tumors (Cushing's lesion, aldosteronoma, pheochromocytomas) and all non-functioning tumors > 4 cm [9]. We excluded from this study this patients with preoperative radiologic feature of tumor infiltration of the surrounding structures, venous invasion or systemic metastasis. In these cases we performed OA [10].

2.2. Surgical technique

Laparoscopic adrenalectomies were performed by a transperitoneal flank approach in the lateral decubitus position with an inclination of 50–60° relative to the operating table which is broken to extend the space between the last rib and the iliac crest [11]. We used Veress needle to induce pneumoperitoneum. For right adrenalectomy we used four trocars in the right subcostal region. The right lobe of the liver is mobilized by division of triangular ligament. Then the peritoneum overlying the right adrenal gland, in Albarran–Chatelin space, is dissected using harmonic scalpel. Tissue dissection along the lateral border of the inferior vena cava allowed the identification of the short adrenal vein which was clipped and divide. Then, by dissecting from medial to lateral and from inferior to superior the gland was mobilized until it was completely free. For left-side resection we positioned three trocars in the left subcostal region. We divided splenicocolic and splenophrenic ligament. The spleen and pancreatic tail were rotated medially. The peritoneal dissection was performed until the left renal vein is reached. We used also diaphragmatic vein like landmarks for adrenal vein which was clipped and divided. The resection then proceeded as previously described for the right adrenal gland. On the left side we used always Tisseel® for repositioning splenic-pancreatic block. Drainage was used routinely. At the end of the procedure the large tumors were positioning in endo-bag and removed with a sovrapubic mini-laparotomy. Nor fragmentation of the gland nor capsular disruption was recorded. All patients received prophylaxis for deep vein thrombosis [12].

3. Results

Fourteen of 41 patients (34.1%) were submitted to LA for a lesion >6 cm in size. The mean age of these patients was 55.6 years (range 38–74). The patients treated were 9 male and 5 female. Four of these 14 patients underwent previous abdominal surgery: two appendectomies, one hysterectomy and one open cholecystectomy (in this case the tumor was localized in left adrenal gland). The mean symptom evaluated was abdominal pain, in other two patients we observed blood hypertension too, in three case hyperglycaemia and typical Cushing presentation. The mean tumor size was 8.2 cm (range 6–14 cm) and the lesion were localized on right side in 8 patients and on the left side in 6 patients. We didn't observe bilateral adrenal masses. The mean operative time was 181 min (range 145–240 min) versus 120 min for adrenal masses smaller than 6 cm. The right and left adrenalectomy mean operative time was 179 min and 190 min respectively. Mean blood loss was 90 ml versus 80 ml of LA for small adrenal masses with not significative difference. Only in one case of left adrenalectomy for an 8 cm large non-functioning adenoma we registered intra-operative complication with bleeding from spleen injury (blood loss was 230 ml). In this case hemostasis was obtained with use of hemostatic matrix (FloSeal®) and blood transfusion was not necessary. In another recent case of a patients with Cushing's disease due to a right 12 cm adrenal mass we observed a discrete diffuse bleeding from peri-renal tissue solved by positioning of Hemopatch®. No

blood transfusion were required. Hemodynamic change with labil intra-operative blood pressure occurred in one patient with pheochromocytoma despite adequate preoperative pharmacological therapy [13,14]. No conversion to open surgery was necessary. All 14 patients had their tumor excised via en bloc resection, there was no capsular disruption during dissection or postoperative mortality. Mean postoperative hospital stay was 4.2 days (range 3–6 days). Preoperative hormonal tests and the final histological examinations for the 14 adrenal lesions revealed one case of malignant pheochromocytoma, two case of aldosteronoma, three case of Cushing's disease, two myelolipoma, five non-functioning adenoma. In a young female patient with clinical and hormonal presentation of Cushing's disease and pre-operative radiologic features of adenoma the histological examination revealed an adrenal cortical cancer. So, two of 14 patients (14.3%) treated had malignant tumors (Table 1). Both patients with malignant pheochromocytoma and incidental adrenal cortical cancer were still alive respectively after 15 and 36 months of follow-up. No local recurrence and port-side metastasis was noted.

4. Discussion

Since 1992 LA has become the first-choice treatment in patients with small adrenal masses [1]. When comparing with open technique, LA offers better clinical outcomes, lower less perioperative morbidity and mortality, shorten hospitalization and better cosmetic results [2]. Size criteria are, at the moment, the main subject discussed for the laparoscopic approach ti adrenal lesion. In fact, size is an important variable in predicting malignancy. Tumor larger than 6 cm are likely to be malignant, however many adrenal adenomas are larger than 6 cm. On the bases of the NIH consensus statement the incidental of adrenal cortical carcinoma is 2% for lesion <4 cm, 6% for tumors of 41–60 mm in size and 25% for tumors larger than 6 cm [15]. So, if size is the only criterion to choose the better surgical approach many patients with adrenal benign masses will have an unnecessary open adrenalectomy. Furthermore, some author suggest that also the patients with benign adrenal lesions larger than 5–6 cm should not be treated with LA because of longer operative time and the elevated risk of bleeding [16]. Recent records on the other hand, demonstrate that LA for large adrenal tumors is technically safe and feasible [17–19]. Really, these limitations for laparoscopic approach to large adrenal masses depend on the surgeon's experience and skill and the size cannot be considered as an absolute contraindication to laparoscopy. In our experience with adrenal lesions larger than 6 cm the operative time is longer than small lesions, but complication rate and bleeding are similar. Therefore, no patients required conversion to open procedures. So, the only real risk in treating by laparoscopy this large tumors is the possibility to treat an unknown adrenal cortical cancer [20]. A diagnosis of adrenal cortical cancer is based on patients history and radiological findings. CT scan and abdominal MRI can demonstrate signs of malignancy like irregular tumors margin, local invasion or periadrenal tissue infiltration. In these cases laparoscopic approach is contraindicated [21]. The intra-operative features indicative of malignant nature of an adrenal lesion include local fixity, invasion of the pancreas, spleen or upper renal pole, venous thrombosis or infiltration and it is recommended to convert to open technique [22]. Some authors suggest that the main limitation during laparoscopic dissection for large and potentially malign adrenal tumors is incomplete resection and capsular disruption with increased risk of local recurrence and intra-abdominal neoplastic dissemination [23]. But these intra-operative complication are also observed during open surgery. So, what is most important is the ability of the surgeon to perform a safe and complete resection.

Table 1

Characteristic of 14 patients with adrenal masses >6 cm. NF: non-functioning; Pheo: pheochromocytoma; ACC: Adrenal cortical carcinoma.

Gender	Age (years)	Histology	Tumor size (cm)	Side	Operative time (min)	Complication	Conversion
M	48	Aldosteronoma	9	R	145	–	–
F	65	Cushing's disease	6.5	R	240	Bleeding from peri-renal tissue	–
M	60	Myelolipoma	11	R	180	–	–
F	50	Adenoma, NF	7	R	165	–	–
M	38	Adenoma, NF	6.3	L	195	–	–
F	38	ACC	12	L	210	–	–
M	66	Cushing's disease	8	L	175	–	–
F	50	Adenoma, NF	8	L	180	Spleen bleeding	–
M	62	Adenoma, NF	6.5	R	165	–	–
F	74	Malign Pheo.	6.7	L	185	–	–
M	53	Aldosteronoma	8.3	L	155	–	–
M	65	Cushing's disease	7.6	R	195	–	–
M	58	Myelolipoma	14	R	185	–	–
M	52	Adenoma, NF	6.8	R	170	–	–

5. Conclusion

The literature demonstrates that LA shows better surgical outcomes when compared with open adrenalectomy. Is still debated if this technique is safe and feasible for large adrenal masses because of increased risk of malignant lesion. This experience and the results of literature suggest that LA is safe and feasible for adrenal masses larger than 6 cm, but in presence of local invasion or vascular infiltration, that are predictive signs of malignancy, LA should be converted to the open technique.

Ethical approval

None.

Author contribution

Agrusa Antonino: study design and writing.
 Romano Giorgio: study design and writing.
 Frazzetta Giuseppe: data collections and data analysis.
 Chianetta Daniela: data collections and data analysis.
 Sorce Vincenzo: data collections and data analysis.
 Di Buono Giuseppe: data collections, data analysis and writing.
 Gulotta Gaspare: study design.

Funding

Agrusa Antonino and other co-authors have no study sponsor.

Conflicts of interest

Agrusa Antonino and other co-authors have no conflict of interest.

References

- [1] M. Gagner, A. Lacroix, E. Bolte, Laparoscopic adrenalectomy in Cushing's syndrome and pheochromocytoma, *N Engl. J. Med.* 327 (1992) 1033.
- [2] D. Hazzan, E. Shiloni, D. Golijanin, O. Jurim, D. Gross, P. Reissman, Laparoscopic vs open adrenalectomy for benign adrenal neoplasm, *Surg. Endosc.* 15 (2001) 1356–1358.
- [3] M.G. Hobart, I.S. Gill, D. Schweizer, et al., Laparoscopic adrenalectomy for large-volume (> or = 5 cm) adrenal masses, *J. Endourol.* 14 (2000) 149–154.
- [4] C.H. Liao, S.C. Chueh, M.K. Lai, P.J. Hsiao, J. Chen, Laparoscopic adrenalectomy for potentially malignant adrenal tumors greater than 5 centimeters, *J. Clin. Endocrinol. Metab.* 91 (2006) 3080–3083.
- [5] P.S. Soon, M.W. Yeh, L.W. Delbridge, C.P. Bambach, M.S. Sywak, B.G. Robinson, et al., Laparoscopic surgery is safe for large adrenal lesions, *Eur. J. Surg. Oncol.* 34 (2008) 67–70.
- [6] A.N. Dalvi, P.M. Thapar, V.B. Thapar, S.A. Rege, A.A. Deshpande, Laparoscopic adrenalectomy for large tumours: single team experience, *J. Minim. Access Surg.* 8 (4) (2012) 125–128.
- [7] O.A. Castillo, G. Vitagliano, F.P. Secin, M. Kerkebe, L. Arellano, Laparoscopic adrenalectomy for adrenal masses: does size matter? *Urology* 71 (6) (2008) 1138–1141.
- [8] G.P. Bernini, P. Miccoli, A. Moretti, et al., Sixty adrenal masses of large dimensions: hormonal and morphologic evaluation, *Urology* 52 (1998) 920–925.
- [9] M. Tanaka, Y. Ono, T. Matsuda, Terachi, et al., Urological laparoscopic surgery guideline committee, Japanese society of endourology and ESWL: guidelines for urological laparoscopic surgery, *Int. J. Urol.* 16 (2) (2009 Feb) 115–125.
- [10] Y. Erbil, U. Barbaros, G. Karaman, A. Bozboora, S. Ozarmagan, The change in the principle of performing laparoscopic adrenalectomy from small too large masses, *Int. J. Surg.* 7 (2009) 266–271.
- [11] A. Agrusa, G. Romano, G. De Vita, G. Frazzetta, D. Chianetta, G. Di Buono, G. Gulotta, Adrenal gunshot wound: laparoscopic approach. Report of a case, *Int. J. Surg. Case Rep.* 5 (2) (2014) 70–72.
- [12] A. Agrusa, G. Romano, G. De Vita, G. Frazzetta, D. Chianetta, G. Di Buono, G. Gulotta, Laparoscopic adrenalectomy: single centre experience, *G. Chir.* 34 (Suppl. 1) (2013) 78.
- [13] G. Conzo, M. Musella, F. Corcione, M. De Palma, F. Ferraro, A. Palazzo, S. Napolitano, M. Milone, D. Pasquali, A.A. Sinisi, V. Colantuoni, L. Santini, Laparoscopic adrenalectomy, a safe procedure for pheochromocytoma. A retrospective review of clinical series, *Int. J. Surg.* 11 (2013) 152–156.
- [14] G. Conzo, M. Musella, F. Corcione, M. De Palma, N. Avenia, M. Milone, C. Della Pietra, A. Palazzo, D. Parmeggiani, D. Pasquali, A. Sinisi, L. Santini, Laparoscopic treatment of pheochromocytomas smaller or larger than 6 cm A clinical retrospective study on 44 patients. Laparoscopic adrenalectomy for pheochromocytoma, *Ann. Ital. Chir.* 84 (2012) 417–422.
- [15] NIH state-of-the-science statement on management of the clinically inapparent adrenal mass ("incidentaloma"), *NIH Consens. State Sci. Statements* 19 (2002) 1–25.
- [16] G. Lal, Q.Y. duh, Laparoscopic adrenalectomy: indications and technique, *Surg. Oncol.* 12 (2003) 105–123.
- [17] F. Porpiglia, P. Destefanis, C. Fiori, et al., Does adrenal size real affect safety and effectiveness of laparoscopic adrenalectomy? *Urology* 60 (5) (2002) 801–805.
- [18] G. Ramacciato, P. Mercantini, M. La Torre, F. Di Benedetto, G. Ercolani, M. Ravaioli, M. Piccoli, G. Melotti, Is laparoscopic adrenalectomy safe and effective for adrenal masses larger than 7 cm? *Surg. Endosc.* 22 (2008) 516–521.
- [19] G. Pisano, P.G. Calò, S. Piras, U. Pisano, A. Nicolosi, Laparoscopic adrenalectomy in a case of congenital duplication of the inferior vena cava. Case report, *Ann. Ital. Chir.* 84 (2013 Jul 25).
- [20] C. Surgeon, W.T. Shen, O.H. Clark, et al., Risk assessment in 457 adrenal cortical carcinomas: how much does tumor size predict the likelihood of malignancy? *J. Am. Coll. Surg.* 202 (2006) 423–430.
- [21] A.A. Gumbs, M. Gagner, Laparoscopic adrenalectomy, *Best Pract. Res. Clin. Endocrinol. Metab.* 20 (2006) 483–499.
- [22] N. Tsuru, K. Suzuki, T. Ushiyama, S. Ozono, Laparoscopic adrenalectomy for large adrenal tumors, *J. Endourol.* 19 (2005) 537–540.
- [23] C.P. Lombardi, M. Raffaelli, C. De Crea, M. Boniardi, G. De Toma, L.A. Marzano, P. Miccoli, F. Minni, M. Morino, M.R. Pelizzo, A. Pietrabissa, A. Renda, A. Valeri, R. Bellantone, Open versus endoscopic adrenalectomy in the treatment of localized (stage I/II) adrenocortical carcinoma: results of a multiinstitutional Italian survey, *Surgery* 152 (6) (2012 Dec) 1158–1164.