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Clinical Study

Transperitoneal Laparoscopic Adrenalectomy: Assessment of the Surgical Learning Curve

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Background. We report a single surgeon's experience of 52 transperitoneal laparoscopic adrenalectomies (LAs) performed between 2001 and 2010. In addition, we compared this series with our first published series of LAs performed between 1994 and 2001. *Methods.* Our series includes 24 left, 20 right, and 4 bilateral LAs performed in 48 patients. To estimate the learning curve, we chronologically divided the sample of unilateral LAs into two groups of 22 patients and compared the operating time, estimated blood loss, maximum diameter of the lesion, complications, and length of hospital stay. *Results.* Mean operating time was significantly lower (94 versus 78 min, $P < 0.05$) and mean intraoperative blood loss was significantly lower (156 versus 60 mL, $P < 0.05$) after more experience had been gained. Additionally, a trend towards removing larger lesions was observed. There was no significant difference in terms of hospital stay. *Conclusions.* Observing a single surgeon's experience of nine years in laparoscopic adrenalectomy, this study indicates that it takes approximately 20–25 procedures to flatten the learning curve. Thus, for single centers with a volume of approximately five LAs performed per year, we suggest a selection of a few experienced surgeons to perform LAs in order to improve outcomes.

1. Background

Since its first performance in 1992, laparoscopic adrenalectomy (LA) has quickly become the standard method for surgical treatment of benign and selected malignant adrenal pathologies [1, 2]. Although there are no randomized controlled studies comparing open adrenalectomy versus LA, the multitude of retrospective analyses and case reports clearly demonstrate the benefits of LA in terms of feasibility, safety, morbidity, hospital stay, and recovery time [2–7]. We have already affirmed the benefits of LA with our first series of 22 LAs performed between 1994 and 2001. Compared with open adrenalectomy, LA resulted in less blood loss, lower postoperative analgesic requirements, and shorter hospital stays [8].

The aim of this paper is to present our subsequent series of 52 consecutive transperitoneal LAs performed between 2001 and 2010 in order to evaluate the learning curve associated with this technique. We reevaluated the major parameters (indications, morbidity, hospital stay, blood loss, and lesion size) and especially focused on operative duration over time.

2. Methods

For this survey, we retrospectively included all patients in whom unilateral or bilateral transperitoneal LA was performed between April 2001 and November 2010. The most common indication was a functional adrenal mass that led to clinical symptoms.

All patients underwent a preoperative outpatient endocrine workup and radiologic imaging using computed tomography and/or magnetic resonance tomography. In cases of a suspected pheochromocytoma, patients received an additional meta-iodo-benzyl-guanidine scintigraphy to prove or exclude contralateral or extra-adrenal manifestations of their tumors.

All operations were performed under general anesthesia and with antithrombotic prophylaxis using subcutaneous

Table 1: Patient demographics and preoperative findings.

	Laparoscopic adrenalectomies (2001–2010)
Unilateral laparoscopic adrenalectomies	44 (20 right, 24 left)
Bilateral laparoscopic adrenalectomies	4
Total laparoscopic adrenalectomies	52
Age median (range, ±SD)	51 (21–69, ±11)
Gender (m/f)	19/29
Indications	
Pheochromocytoma	13
Aldosterone-secreting adenoma	13
Cortisol-secreting adenoma	7
Cushing's syndrome (pituitary ACTH source)	3
Adrenal hyperplasia (ectopic ACTH production)	1
Androgen-secreting adenoma	1
Metastasis	4
Others (nonfunctional adenomas, incidentalomas)	6

SD: standard deviation; ACTH: adrenocorticotropic hormone.

low-molecular-weight heparin (Fragmin). The senior surgeon (D.O.) was present during all procedures either as the operating surgeon or as an instructing surgeon together with less experienced colleagues. The lateral transabdominal adrenalectomy was chosen as described in our earlier paper as the most popular procedure [8–11]. To summarize, the patient was positioned in a lateral decubitus position. Four trocars for the right adrenalectomy and three (and an optional 4th trocar in obese patients) were used for access to the left adrenal gland. For tissue dissection, we routinely used the Ultracision sealing device (Ethicon/Johnson & Johnson). Postoperative mobilization, pain management, and nutrition depended on the general physical condition of the patients.

The evaluation includes the age, gender, indication, operating time, estimated blood loss, intra- and postoperative complications, length of hospital stay, and histology and maximal diameter of the postoperative specimen measured by the pathologist. Blood loss was measured with a laparoscopic suction device.

Complications were defined as any deviation from the usual peri- or postoperative course, for example, conversion into open surgery, severe bleeding (more than 3 blood transfusions) and complications leading to lasting disability, organ resection, or the death of a patient.

In order to evaluate the learning curve over time, we chronologically divided our series of a total of 44 unilateral transperitoneal LA, performed between 2001 and 2010, into two samples of 22 cases. We compared the early (Group 1) versus late (Group 2) results in terms of operating time, estimated blood loss, and lesion diameter using a two-sample t-test. The 4 bilateral LAs performed in that series were excluded in the intergroup comparison.

A logarithmic regression analysis was used to illustrate and estimate the learning curve in terms of operating time and blood loss.

We also compared the results with our former study of 22 LAs published in 2002 [8].

Data are presented as the mean ± standard deviation, where appropriate. P values of <0.05 are considered significant. The collected data were digitized in Excel, and Stata Software was used for all statistical analyses.

3. Results

The mean age of the 48 patients (29 women and 19 men) who underwent a transperitoneal LA between 2001 and 2010 was 51 years (range: 21–69 years). The procedures included 20 right, 24 left, and 4 bilateral transperitoneal LAs. Indications were mainly pheochromocytoma ($n = 13$ (27%)), aldosterone secreting adenoma ($n = 13$ (27%)), and cortisol secreting adenoma ($n = 7$ (15%)).

The four bilateral adrenalectomies were performed to treat uncontrollable hypercortisolism related to Cushing's disease that had proven to be refractive to neurosurgical treatment. In contrast to our former published series of 22 LAs [8] with benign indications, we now also included four patients with isolated adrenal metastases from bronchial carcinomas and Sertoli cell tumors of the testis, for which the laparoscopic procedure was suitable. Patient demographics and detailed indications are shown in Table 1.

Table 2 compares the early 22 unilateral LAs (Group 1) with the subsequent 22 LAs (Group 2) performed between 2001 and 2010 in terms of operative time, estimated blood loss, and mean lesion size using two-sample t-test analysis. Except for estimated blood loss, all parameters were significantly lower in Group 2.

The mean operating time for the unilateral LAs was 86 min and ranged from 40 to 170 min. There is no significant difference in operative time between left and right adrenalectomies (82 min. versus 89 min., $P = 0.22$). Overall, there are two statistical outliers. In a patient with a large solitary adrenal metastasis of a bronchial cancer (max. tumor diameter 7 cm), the LA took 170 min due to a technical problem

Table 2: Intergroup comparisons (early versus late group) of intraoperative parameters.

	Groups 1 + 2 ($n = 44$)	Group 1 ($n = 22$)	Group 2 ($n = 22$)	P value (two-sample t-test)
Left LA		13	11	—
Right LA		8	11	—
Mean operating time (min.); (range, ±SD)	86 (40–170, ±19.9)	94	78	<0.03 (s)
Mean estimated blood loss (mL); (range, ±SD)	108 (5–1000, ±115)	156	60	<0.045 (s)
Mean lesion size (cm); (range, ±SD)	3.8 (1.2–15, ±1.8)	3.4	4.2	0.8396 (ns)

LA: laparoscopic adrenalectomies; s: significant ($P < 0.05$); ns: not significant ($P \geq 0.05$).

Table 3: Estimating a learning curve.

	(1)	(2)	(3)	(4)
Dependent variable	Operating time (min.)		Ln of blood loss (mL)	
Surgeon's experience	−12.8	−12.8	−0.59	−0.59
Ln of no. of operations	[4.88]*	[4.97]*	[0.21]**	[0.21]**
Ln of patient's age		3.59		−0.08
		[11.84]		[0.73]
Constant	122.3 (min.)	108.4 (min.)	5.303	5.6079
	[15.4616]**	[51.0835]*	[0.6451]**	[2.9463]
Observations	44	44	44	44
R-squared	0.16	0.16	0.13	0.13

Ln: natural logarithm; robust standard errors in brackets; *significant at 5%; **significant at 1%.

with the application of a titan vessel clip that subsequently led to extensive arterial bleeding of approximately 1000 mL. In the other patient with a pheochromocytoma, the LA took 130 min when additional resection of the pancreatic tail had to be performed because of severe adhesions (status post pancreatitis).

The mean operating time for a bilateral LA was 193 min, ranging from 150 to 230 min. The largest lesion diameter was a suspicious 15 cm mass in the left upper abdomen that proved to be a benign cyst.

The results of the learning curve estimations are presented in Table 3. Because the effect of increasing the surgeon's experience by one operation is initially very large and then becomes smaller, it is reasonable that the experience is measured by the logarithm of the number of operations the surgeon has performed.

In the estimation in Column (1), the operator's experience is related to the operative time. The coefficient is statistically significant ($P < 0.05$) and is estimated to be −12.83. Thus, a statistically significant relationship can be detected between the operator's experience and the operative time. The constant is estimated at 122, which means the surgeon's first operation was estimated to take 122 min ($122 - 12.83 * \ln(1)$—with $\ln(1) = 0$). Thereafter, the surgeon was predicted to decrease the operative time by approximately 12.8 min whenever his/her experience increases by a factor of e ($e = 2.73$).

For example, a surgeon performing the 10th operation is predicted to take only 92 min ($122 - 12.83 * \ln(10)$), that is, 30 min less than the time required in the first operation.

Column (2) of Table 3 investigates the effect of the patient's age (again measured on a logarithmic scale) on the operative time. No significant effect was found.

Column (3) of Table 3 investigates the effect of the operator's experience on the patient's blood loss. Because the blood loss varies much more than the operative time (ranging from 5 mL to 1000 mL), blood loss is also evaluated on a logarithmic scale. The effect of experience is again statistically significant (this time even at the 1% level). The coefficient is estimated as −0.5929 and the constant as 5.3. In detail, for a surgeon performing his or her first operation, a blood loss of 200 mL (exp(5.3)) is expected, while for a surgeon with an experience of 10 operations, the expected blood loss is only 51 mL ($= \exp(5.3 - 0.5929 * \ln(10))$).

No significant effect is found on blood loss due to the patient's age, as shown in column (4) of Table 3.

Figures 1–3 illustrate the learning curve as a logarithmic trendline in terms of operative time (Figure 1), blood loss (Figure 2), and maximal lesion diameter (Figure 3).

In our series, there were two intraoperative complications (4%). One unilateral laparoscopic procedure had to be converted to open surgery due to a venous bleeding of a supra-adrenal vein that could not be controlled easily. Out of four bilateral adrenalectomies, one that was initially planned to be performed with a retroperitoneal approach had to be transferred into a bilateral transabdominal procedure due to a diaphragm injury. There was no peri- or postoperative mortality. Complications are summarized in Table 4. The mean length of hospital stay was 5.6 days and ranged from 2 to 10 days, equivalent to our first series of LAs [8].

4. Discussion

At our institution, a total of 74 LAs have been performed successfully over more than 16 years. Consistent with our study comparing the early experience of 22 LAs to open surgery,

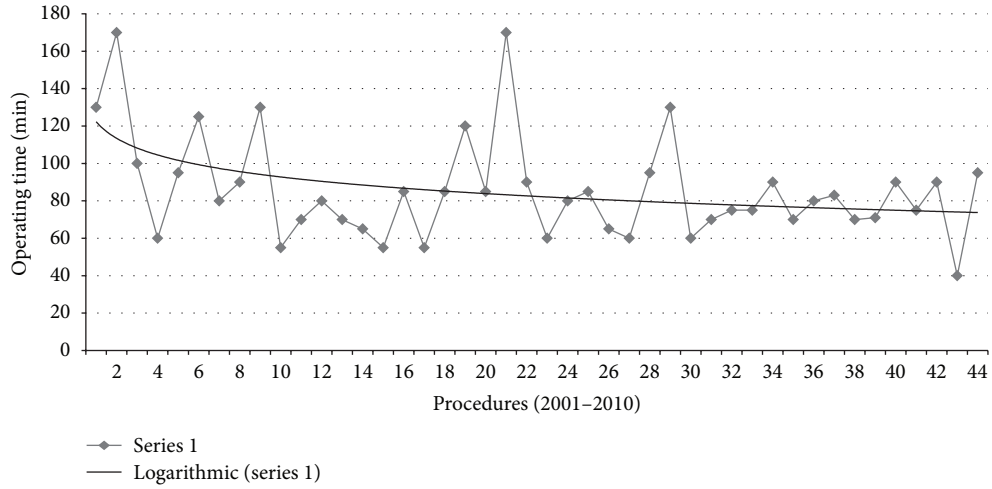

Figure 1: Operating time and logarithmic trend line (2001–2010).

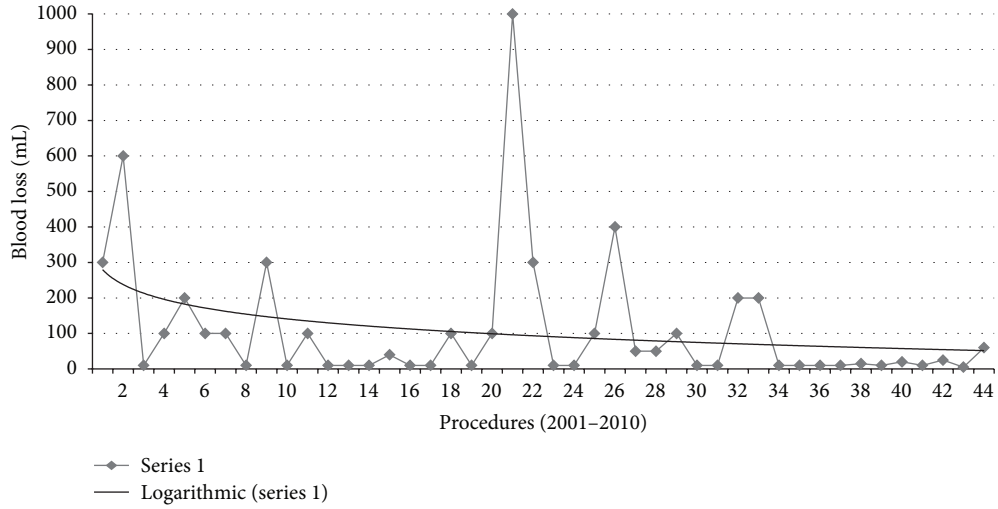

Figure 2: Blood loss and logarithmic trend line (2001–2010).

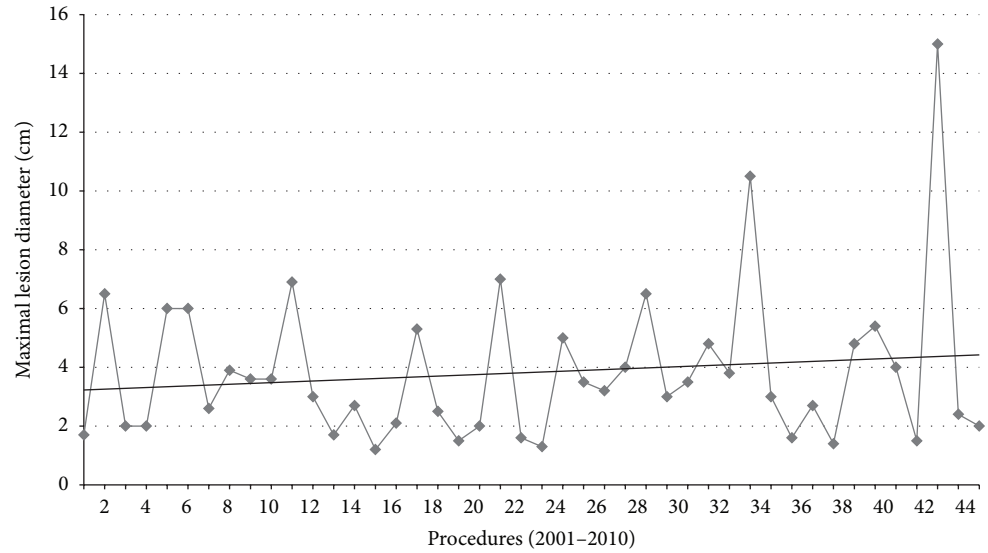

Figure 3: Maximal lesion diameter and trend line (2001–2010).

Table 4: Intra- and postoperative complication rates of unilateral and bilateral laparoscopic adrenalectomies.

Complications	Laparoscopic adrenalectomies 2001–2010 ($n = 52$)
Intraoperative	1 diaphragm injury, 1 conversion into open adrenalectomy (3.8%)
Postoperative	None

published in 2002 [8], we reaffirm the benefits of transperitoneal LA. This minimally invasive technique is the method of choice for the surgery of most adrenal tumors. Compared to our former series [8], the most frequent indications were hormone-secreting adenomas, such as pheochromocytomas, or tumors secreting aldosterone or cortisol. However, we have also started to use the laparoscopic approach when there is a small and isolated metastatic lesion of the adrenal gland. LA for malignancy has become increasingly accepted as safe oncological outcomes have been demonstrated [12–16]. Thus, the patient selection for LA has expanded over the years.

Whenever a new technique is introduced, the surgeon's performance and patient outcomes are expected to show a learning curve. Although LA is now performed worldwide as a standard method, it is still considered an advanced laparoscopic procedure due to the anatomical complexity and potentially severe morbidity.

In our first published series of 22 unilateral LAs, the mean operative time was 150 min [8]. The mean operative time of our following series of 44 unilateral LAs is significantly lower with a mean of 86 min.

In contrast to this series, the first operations in our institution were performed by more than two surgeons. Since 2001, all LAs were performed or assisted by the same senior surgeon. Therefore, our present study mainly shows the learning curve for a single surgeon. The first operations tended to take a prolonged period of time (mean operative time for procedures 1–22: 94 min). After approximately 20–25 LAs, the learning curve became stagnant (Figure 1), and we could show a significant difference in operative time between the first and last 22 unilateral procedures (Table 2). Those results are comparable to other studies evaluating the learning curve regarding the operative time [17, 18].

We also had an increased frequency of adrenalectomies performed per year, with an average of five LAs each year between 2001 and 2010 versus 2.8 LAs per year between 1994 and 2001 [8]. Furthermore, we decreased the mean intraoperative blood loss and the intra- and postoperative complication rates compared to our initial 22 LAs, published in 2002 [8]. In the literature, various complications ranging from hemorrhage to organ injury either due to adrenal disease or the minimally invasive technique have been reported [19].

We show that this procedure not only provides shorter procedure times but also a decline in blood loss due to improved surgical technique.

Although there was no significant difference between the maximal diameters of the lesions between the two groups, the tumors removed tended to increase in size, as shown in Figure 3.

The consensus in the recent literature states that there is no defined cut-off for a maximal size of the tumor that can be safely removed by the laparoscopic approach [20–24]. Accordingly, a successful laparoscopic resection is less affected by the size of the adrenal mass. However, to reduce intra- and postoperative morbidity, only experienced laparoscopic surgeons should pursue LA after a careful preoperative workup.

According to the literature, there is no consensus whether a transperitoneal or retroperitoneal approach should be used as the method of choice [25–29]. Both methods are accepted as standard procedures with no significant difference in terms of operative time or intra- or postoperative morbidity. The choice of the laparoscopic approach rests mainly upon the surgeon's preference and experience. It is obvious that most urologists prefer the retroperitoneal approach, whereas endocrine surgeons prefer the transperitoneal approach, according to their experience.

In summary, LA needs a thorough preoperative workup and patient selection for every type of adrenal lesion to reduce morbidity. There are still controversies concerning the eligibility of large and potentially malignant adrenal masses for LA, the role of partial adrenalectomy, and the management of bilateral adrenal disease (multiple endocrine neoplasia type II) and of incidentalomas with unknown biological relevance.

As a next-generation technology, there are an increasing number of centers that have begun to perform LAs with robotic systems, such as the Da Vinci system, in an experimental setup [30–35]. In this regard, more research needs to be performed to show the potential clinical benefits of these adjuncts.

5. Conclusion

Our study indicates that for a single surgeon with advanced laparoscopic skills, approximately 25 procedures are necessary to gain the experience to flatten the learning curve as measured by operative time. Although LA is a rarely performed procedure, the complication rate and intraoperative blood loss can be reduced with an increased volume of work. In summary, we conclude that LA should be the method of choice for the removal of most adrenal pathologies. Indeed, training is required to perform these types of advanced laparoscopic procedures to improve skill and provide better outcomes.

As our study reflects a single-center experience and the case load remains low, the results may not be generalized, and a concluding statement is difficult to make. In particular, the findings are not applicable to centers where the number of surgeons performing LA is higher and where a more aggressive approach, in terms of comorbidity, malignancy, and larger lesions is pursued. Nevertheless, complication rates, operative time, and intraoperative blood loss are comparable to other studies with an equal or greater number of LAs [7, 11, 19].

Conflict of Interests

The authors declare that they have no conflict of interests.

References

[1] M. Gagner, A. Lacroix, and E. Bolté, "Laparoscopic adrenalectomy in adrenalectomy in cushing's syndrome and pheochromocytoma," *The New England Journal of Medicine*, vol. 327, no. 14, article 1033, 1992.

[2] M. Gagner, A. Lacroix, R. A. Prinz et al., "Early experience with laparoscopic approach for adrenalectomy," *Surgery*, vol. 114, no. 6, pp. 1120–1124, 1993.

[3] R. Prinz, "A comparison of laparoscopic and open adrenalectomies," *Archives of Surgery*, vol. 130, no. 5, pp. 489–492, 1995.

[4] L. M. Brunt, G. M. Doherty, J. A. Norton, N. J. Soper, M. A. Quasebarth, and J. F. Moley, "Laparoscopic adrenalectomy compared to open adrenalectomy for benign adrenal neoplasms," *Journal of the American College of Surgeons*, vol. 183, no. 1, pp. 1–10, 1996.

[5] G. B. Thompson, C. S. Grant, J. A. Van Heerden et al., "Laparoscopic versus open posterior adrenalectomy: a case-control study of 100 patients," *Surgery*, vol. 122, no. 6, pp. 1132–1136, 1997.

[6] D. Hazzan, E. Shiloni, D. Golijanin, O. Jurim, D. Gross, and P. Reissman, "Laparoscopic vs open adrenalectomy for benign adrenal neoplasm: a comparative study," *Surgical Endoscopy*, vol. 15, no. 11, pp. 1356–1358, 2001.

[7] P. K. Gupta, B. Natarajan, P. K. Pallati, H. Gupta, J. Sainath, and R. J. Fitzgibbons Jr., "Outcomes after laparoscopic adrenalectomy," *Surgical Endoscopy and Other Interventional Techniques*, vol. 25, no. 3, pp. 784–794, 2011.

[8] M. Bolli, D. Oertli, J.-J. Staub, and F. Harder, "Laparoscopic adrenalectomy: the new standard?" *Swiss Medical Weekly*, vol. 132, no. 1-2, pp. 12–16, 2002.

[9] M. Gagner, A. Lacroix, E. Bolte, and A. Pomp, "Laparoscopic adrenalectomy. The importance of a flank approach in the lateral decubitus position," *Surgical Endoscopy*, vol. 8, no. 2, pp. 135–138, 1994.

[10] C. D. Smith, C. J. Weber, and J. R. Amerson, "Laparoscopic adrenalectomy: new gold standard," *World Journal of Surgery*, vol. 23, no. 4, pp. 389–396, 1999.

[11] L. M. Brunt, "Minimal access adrenal surgery," *Surgical Endoscopy and Other Interventional Techniques*, vol. 20, no. 3, pp. 351–361, 2006.

[12] C. Sturgeon and E. Kebebew, "Laparoscopic adrenalectomy for malignancy," *Surgical Clinics of North America*, vol. 84, no. 3, pp. 755–774, 2004.

[13] W. S. Cobb, K. W. Kercher, R. F. Sing, and B. T. Heniford, "Laparoscopic adrenalectomy for malignancy," *American Journal of Surgery*, vol. 189, no. 4, pp. 405–411, 2005.

[14] F. Sebag, F. Calzolari, J. Harding, M. Sierra, F. F. Palazzo, and J. F. Henry, "Isolated adrenal metastasis: the role of laparoscopic surgery," *World Journal of Surgery*, vol. 30, no. 5, pp. 888–892, 2006.

[15] V. E. Strong, M. D'Angelica, L. Tang et al., "Laparoscopic adrenalectomy for isolated adrenal metastasis," *Annals of Surgical Oncology*, vol. 14, no. 12, pp. 3392–3400, 2007.

[16] L. R. McCauley and M. M. Nguyen, "Laparoscopic radical adrenalectomy for cancer: long-term outcomes," *Current Opinion in Urology*, vol. 18, no. 2, pp. 134–138, 2008.

[17] G. David, M. Yoav, D. Gross, and P. Reissman, "Laparoscopic adrenalectomy: ascending the learning curve," *Surgical Endoscopy and Other Interventional Techniques*, vol. 18, no. 5, pp. 771–773, 2004.

[18] M. Guerrieri, R. Campagnacci, A. De Sanctis, M. Baldarelli, M. Coletta, and S. Perretta, "The learning curve in laparoscopic adrenalectomy," *Journal of Endocrinological Investigation*, vol. 31, no. 6, pp. 531–536, 2008.

[19] R. T. Strebel, M. Müntener, and T. Sulser, "Intraoperative complications of laparoscopic adrenalectomy," *World Journal of Urology*, vol. 26, no. 6, pp. 555–560, 2008.

[20] Y. Erbil, U. Barbaros, G. Karaman, A. Bozbora, and S. Özarmağan, "The change in the principle of performing laparoscopic adrenalectomy from small to large masses," *International Journal of Surgery*, vol. 7, no. 3, pp. 266–271, 2009.

[21] J. S. Rosoff, J. D. Raman, and J. J. Del Pizzo, "Laparoscopic adrenalectomy for large adrenal masses," *Current Urology Reports*, vol. 9, no. 1, pp. 73–79, 2008.

[22] I. Hara, G. Kawabata, S. Hara, Y. Yamada, K. Tanaka, and M. Fujisawa, "Clinical outcomes of laparoscopic adrenalectomy according to tumor size," *International Journal of Urology*, vol. 12, no. 12, pp. 1022–1027, 2005.

[23] M. G. Hobart, I. S. Gill, D. Schweizer, G. T. Sung, and E. L. Bravo, "Laparoscopic adrenalectomy for large-volume ($P < 0.05$ or = 5 cm) adrenal masses," *Journal of Endourology*, vol. 14, no. 2, pp. 149–154, 2000.

[24] P. S. H. Soon, M. W. Yeh, L. W. Delbridge et al., "Laparoscopic surgery is safe for large adrenal lesions," *European Journal of Surgical Oncology*, vol. 34, no. 1, pp. 67–70, 2008.

[25] L. Fernández-Cruz, A. Saenz, G. Benarroch, E. Astudillo, P. Taura, and L. Sabater, "Laparoscopic unilateral and bilateral adrenalectomy for Cushing's syndrome: ransperitoneal and retroperitoneal approaches," *Annals of Surgery*, vol. 224, no. 6, pp. 727–734, 1996.

[26] O. Miyake, K. Yoshimura, T. Yoshioka et al., "Laparoscopic adrenalectomy. Comparison of the transperitoneal and retroperitoneal approach," *European Urology*, vol. 33, no. 3, pp. 303–307, 1998.

[27] M. Takeda, "Laparoscopic adrenalectomy: transperitoneal vs retroperitoneal approaches," *Biomedicine and Pharmacotherapy*, vol. 54, supplement 1, 2000.

[28] Y. Naya, M. Nagata, T. Ichikawa et al., "Laparoscopic adrenalectomy: comparison of transperitoneal and retroperitoneal approaches," *BJU International*, vol. 90, no. 3, pp. 199–204, 2002.

[29] M. Rubinstein, I. S. Gill, M. Aron et al., "Prospective, randomized comparison of transperitoneal versus retroperitoneal laparoscopic adrenalectomy," *Journal of Urology*, vol. 174, no. 2, pp. 442–445, 2005.

[30] J. M. Winter, M. A. Talamini, C. L. Stanfield et al., "Thirty robotic adrenalectomies: a single institution's experience," *Surgical Endoscopy and Other Interventional Techniques*, vol. 20, no. 1, pp. 119–124, 2006.

[31] L. Brunaud, A. Ayav, R. Zarnegar et al., "Prospective evaluation of 100 robotic-assisted unilateral adrenalectomies," *Surgery*, vol. 144, no. 6, pp. 995–1001, 2008.

[32] L. Brunaud, L. Bresler, A. Ayav et al., "Robotic-assisted adrenalectomy: what advantages compared to lateral transperitoneal laparoscopic adrenalectomy?" *American Journal of Surgery*, vol. 195, no. 4, pp. 433–438, 2008.

[33] E. S. Hyams and M. D. Stifelman, "The role of robotics for adrenal pathology," *Current Opinion in Urology*, vol. 19, no. 1, pp. 89–96, 2009.

[34] A. M. Bruhn, E. S. Hyams, and M. D. Stifelman, "Laparoscopic and robotic assisted adrenal surgery," *Minerva Urologica e Nefrologica*, vol. 62, no. 3, pp. 305–318, 2010.

[35] A. S. Merseburger, T. R. Herrmann, S. F. Shariat et al., "EAU guidelines on robotic and single-site surgery in urology," *European Urology*, vol. 64, no. 2, pp. 277–291, 2013.