



## Case Series

## Posterior retroperitoneoscopic adrenalectomy—Case series

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## ABSTRACT

**INTRODUCTION:** Posterior retroperitoneoscopic adrenalectomy has advantages over transperitoneal technique. However many surgeons prefer the transperitoneal technique because they get a familiar and wider working space.

**MATERIAL AND METHODS:** A retrospective analysis of the first 10 patients submitted to posterior retroperitoneoscopic adrenalectomy was conducted. Data collected included: diagnosis, size, operation time, blood loss, conversion rate, morbidity and mortality, in-hospital length of stay. Compare our outcomes with worldwide bigger series, and take conclusions on the feasibility of the technique was the objective.

**RESULTS:** We included 2 pheochromocytomas, 1 giant cystic pheochromocytoma, 4 Conn's, 2 Cushing's, 1 non-functioning tumor with 4 cm. Mean operation time was 46,7 min for lesions ranging from 1,8 to 14 cm. Blood loss was negligible. One patient (10%) was converted to laparotomy because of a past clinical history of dorsal and lumbar trauma. No morbidity and no mortality. Mean hospital length of stay was 2,2 days.

**DISCUSSION:** Mean operation time found in bigger series published in worldwide literature is 40–105,6 min. Complication rate reported ranges from 0 to 14,4%. No mortality has been ever reported. Blood loss reported in other series is 10–50 ml. The data found in our study matches other studies data. Since the same surgeon who had never performed the technique before operated all patients, makes us believe the technique is safe and feasible.

**CONCLUSION:** Posterior retroperitoneoscopic adrenalectomy has a small learning curve. It is technically safe and feasible. More patients will be collected to validate these results.

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## 1. Introduction

In 1992 Gagner [1] performed the first laparoscopic adrenalectomy and since then it become the gold standard for benign adrenal lesions [2,3]. The advantages of laparoscopy over open surgery were evident: less postoperative pain and ileus, less morbidity, less in-hospital stay, faster recovery and return to normal activity, better cosmetic results [2,3]. Since the adrenal gland is located in the upper retroperitoneal space, other approaches were developed. One of these is the posterior retroperitoneoscopic (PR) technique, which proved to have benefits comparing to the transperitoneal (TP) approach, providing a rapid and direct access to the gland

without incursion into the intra-peritoneal space eliminating the risk of incidental trauma to abdominal viscera. Even though, many surgeons prefer the TP technique because they get a familiar and wider working space [3]. Subsequent studies concluded for a reduction in operative time, faster recovery and less need for painkillers when the PR approach was used [2].

Because of these reasons the authors elected the PR technique as the standard approach for adrenal tumors  $\leq 6$ –8 cm, and without features suggestive of malignancy. The technique was learned from Prof. Dr. Martin Walz, German surgeon responsible for the widespread of this minimally invasive technique. The objective of this study is to analyze the first 10 cases operated in a single center by the same surgeon, and to take conclusions on its feasibility.

## 2. Material and methods

A retrospective analysis was conducted on the first 10 patients submitted to posterior retroperitoneoscopic adrenalectomy by the same surgeon. All patients with functioning or non-functioning

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**Table 1**

Characteristics of the 10 patients submitted to posterior retroperitoneoscopic adrenalectomy and operative outcomes. Duration and post-op days of patient 8 were not included in the mean value because the procedure was converted to laparotomy.

		Gender	Age	Diagnosis	Size (cm)	Side	Conversion	Duration (min)	Post-op days	Complications	Mortality
<b>Patient</b>	<b>1</b>	M	63	Conn	2,0	right	no	40	2	no	no
	<b>2</b>	F	53	Non-fun	4,0	right	no	30	2	no	no
	<b>3</b>	M	54	Cushing	1,8	left	no	75	2	no	no
	<b>4</b>	M	52	Pheo	14,0	right	no	70	4	no	no
	<b>5</b>	F	63	Conn	1,8	left	no	30	2	no	no
	<b>6</b>	F	70	Pheo	3,0	left	no	45	4	no	no
	<b>7</b>	F	38	Cushing	2,8	left	no	30	2	no	no
	<b>8</b>	M	60	Pheo	5,0	left	yes	–	–	no	no
	<b>9</b>	F	43	Conn	2,0	left	no	30	1	no	no
	<b>10</b>	F	50	Conn	4,3	right	no	70	1	no	no
<b>Mean</b>			<b>54,6</b>		<b>4,1</b>			<b>46,7</b>	<b>2,2</b>		

adrenal tumors  $\leq 6$ –8 cm and without features suggestive of malignancy were included. Additionally, one patient with a 14 cm cystic pheochromocytoma treated by retroperitoneoscopic approach was also included in this analysis. We excluded patients with concomitant abdominal pathologies, and those with BMI > 35. This study is a case series of consecutive patients treated in a single center (Academic Hospital) between April 2015 and January 2018. Data collected included gender, age, pre-operative diagnosis, tumor size, right or left adrenal, operation time, blood loss, conversion, post-operative in-hospital length of stay, morbidity and mortality rates. A three months minimum follow-up was accomplished for each patient. A comparison with published data on laparoscopic and retroperitoneoscopic adrenalectomy was discussed.

This study has the research registry number 3955. No ethical approval was needed because posterior retroperitoneoscopic adrenalectomy is a well-known procedure and a valid option to treat adrenal masses. Written informed consent was obtained from all patients for publication of this case series. This paper has been reported in line with the PROCESS criteria [4].

### 3. Results

Between April 2015 and January 2018, ten (10) patients were submitted to PR adrenalectomy in our department. The same surgeon with experience in colorectal and hepatobiliary laparoscopic procedures but who had never performed the technique before, operated all patients. PR technique was learned with Prof. Dr. Martin Walz from Essen, Germany, during April 2014.

From the 10 patients, four (40%) were male and six (60%) were females. Mean age was 54,6 years old (43yo – 70yo). Pre-operative diagnoses were as follows: Conn's syndrome – 4; Pheochromocytoma – 3 (including a giant cyst); Cushing's syndrome – 1; Non-functioning tumor ( $\geq 4$  cm) – 1. Mean lesion size was 4,1 cm; largest lesion was 14 cm. Six tumors were located in the left adrenal gland, and four in the right one [Table 1](#).

Three trocars were used to perform PR adrenalectomy: 12 mm balloon trocar (tip of the 12th rib), 5 mm (tip of the 11th rib) and 10 mm (midline between 12 mm trocar and spine). A 30° camera was used. A 5 mm laparoscopic LigaSure and a non-traumatic grasper were the only instruments used. Gland and tumor were retrieved in an *endobag*. Operative field was washed at the end with saline solution. No drainage. The fascial plane was closed with absorbable sutures, and skin was sutured with nylon.

Nine (9) patients were submitted to complete PR adrenalectomy, and one patient was converted to laparotomy (10%) because of extensive fibrosis precluding access to retroperitoneal space, following a dorsal and lumbar trauma years before. Operation time for complete PR adrenalectomy was between 30 and 70 min, with a mean of 46,7 min. The first patient was diagnosed with a Conn's syndrome in the right adrenal, and surgery took only 40 min, without

complications. Blood loss was negligible in all patients submitted to complete PR approach (<20 ml).

Post-operative in-hospital length of stay for complete PR technique was 1 to 4 days (mean of 2,2 days). There were no complications (0%), and no mortality (0%). [Table 1](#). At three months of follow-up there were no complaints from any patient.

### 4. Discussion

Posterior retroperitoneoscopic adrenalectomy has advantages comparing to transperitoneal approach. The former allows for an easy and direct access to the adrenal, contrasting with the latter that has the abdominal viscera in front of the gland, with risk for incidental trauma during mobilization [3,5]. Because the majority of surgeons with experience in laparoscopy feel safer and more confident when working in the traditional peritoneal space, they are renitent to use the PR approach [3]. Another reason is the lack of anatomical references in the beginning of a PR adrenalectomy, which gives the idea of extreme difficulty to whom is initiating the technique. Learning the procedure and tips with an experienced surgeon is crucial. First, is easy to enter the retroperitoneal space only with the scissors. Second, place second trocar with digital control in the retroperitoneal space. Third, open the Gerota's fascia and lower all the fat before placing the third trocar. Forth, first step is to find an anatomical reference, which is the upper pole of the kidney, by cutting through the Gerota's fat.

In that setting, after learning the technique with Prof. Dr. Martin Walz in Germany, one of the most worldwide experienced surgeons performing PR adrenalectomy, the first author (with experience in colorectal and hepatobiliary laparoscopic procedures) initiated the technique with his team in Portugal. The first patient was diagnosed with a Conn's syndrome in the right adrenal, and surgery took only 40 min, without complications. The following cases of PR adrenalectomy had a mean operation time of 46,7 min. In 2014, Cabalag et al. [6] reported a mean operation time of 70,5 min for the first 50 cases of PR adrenalectomy, decreasing to 60,1 min after a learning curve of 15 cases. Kiriakopoulos et al. [7] from Greece, reported a mean operation time of 105,6 min for PR technique (mean tumor size of 3,7 cm) and a mean operation time of 137 min for laparoscopic approach. In 2012, Cho Rok Lee et al. [3] published a comparison study of TP and PR approaches. There was a significant shorter mean operation time in PR group (TP: 108,3 min vs. PR: 87,2 min;  $p = 0,042$ ). In Italy, Porpiglia et al. [8] reported a mean operation time of 90 min (45–210 min) for PR technique performed in 48 patients. Walz et al. [5] reported in a study of 560 procedures a mean operation time of  $67 \pm 40$  min, declining from the early procedures ( $106 \pm 46$  min) to the later ones ( $40 \pm 15$  min). The data presented in our study reveals an inferior operation time comparing to several studies, and matches the data reported by experienced surgeons. This fact supports the idea of a small learning

**Table 2**  
Data published in worldwide literature (mean values). Our mean operation time was inferior to the majority of other authors. Blood loss was <20 ml, similar to more experienced surgeons. No morbidity or mortality. Conversion rate was higher than other studies. (N/A – not available).

	Walz et al. [5]	Cabalag et al. [6]	Porpiglia et al. [8]	Kiriapoulos et al. [7]	Lee et al. [3]	CE Costa Almeida et al.
N	560	50	50	19	17	<b>10</b>
Size (cm)	2,9	N/A	N/A	3,7	2,64	<b>4,1</b>
Operation time (min)	40	70,5	90	105,6	87,2	<b>46,7</b>
Blood loss (ml)	10	N/A	50	N/A	20	<b>&lt;20</b>
Conversion (%)	2 (11/560)	0	8 (4/50)	0	0	<b>10 (1/10)</b>
In-hospital days	N/A	1	N/A	2,1	3	<b>2,2</b>
Morbidity (%)	14,4	8	12,5	N/A	0	<b>0</b>
Mortality (%)	0	0	0	0	0	<b>0</b>

curve for the PR technique, enhancing its applicability by surgeons with laparoscopic experience.

Literature reports a complication rate for PR adrenalectomy of 0–14.4%, including pleural tear, pneumothorax, pneumonia, surgical site infection, bleeding, hypoesthesia and/or relaxation of abdominal wall [3,5,6,8]. Munch et al. [9] concluded that not opening the peritoneal cavity reduces post-op ileus and intestinal complications. It is easy to understand that PR technique avoids adhesions from previous surgeries and avoids inadvertent intraperitoneal organ injury during bowel mobilization, as can occur in TP approach [3]. Additionally, it has been demonstrated that PR has advantages over TP approach in terms of in-hospital length of stay (there are reports of same-day discharges for PR), minimal blood loss, reduced postoperative pain and faster recovery [3,6,7,10]. Walz et al. [5] presented a conversion rate of 2.0% to open or laparoscopic surgery. Porpiglia et al. [8] reported an 8% conversion rate. In contrast, there are authors reporting a conversion rate of 0% [3,6,7]. In our series of 10 patients there were no complications (0%) and one procedure was converted to laparotomy (10%). This conversion rate is higher than other studies data, however 10 patients represent a very small population, which is a drawback of this study. The conversion case occurred in a male patient with a 5,0 cm pheochromocytoma, and was due to a past clinical history of dorsal and lumbar trauma with a retroperitoneal hematoma years before, which precluded working in the retroperitoneal space. The extensive fibrosis found surrounding the adrenal was the major factor to conversion to laparotomy and not laparoscopy. Blood loss was negligible in all patients treat by the author, matching other studies reporting a mean blood loss of 10–50 ml, without the need for transfusion [3,5,8].

A reduced in-hospital length of stay is presented as an advantage over TP approach. Cho Rok Lee et al. [3] present a mean hospital stay of 3 days and 5,92 days in PR group and TP group, respectively ( $p=0,003$ ). Similarly, a mean hospital stay of 2,1 days and 40 days for PR and TP respectively, is reported in a comparative study conducted by Kiriapoulos [7]. In the present study, a mean in-hospital length of stay of 2,2 days (range 1–4) is reported, matching the published literature. The last two patients (Conn) were discharge home in the day after, contrasting with the first three patients (Conn, non-functioning, Cushing) who were discharged home in the second post-op day. An increasing confidence by the surgeon is probably responsible for this small great difference with a positive economic impact. Pheochromocytoma patients were in-hospital for 4 days because of a 24 h period in the Intensive Care Unit (ICU) and for blood pressure surveillance.

Adrenalectomy is indicated for all functioning adrenal tumors, and for those suspected of harboring a cancer [11]. Minimal invasive techniques have shown efficacy and safety for lesions up to 6 cm, but Lee et al. are using both TP and PR techniques for adrenal tumors up to 8–10 cm [3,12]. According to Walz et al. [5] PR approach has a size limit of 7 cm (occasionally 10 cm) for benign lesions. Bigger masses (>8–10 cm) and those that may harbor a malignancy (hypersecretion of multiple steroid hormones, local and/or vascular

invasion, adenopathy, metastasis) should be resected by open anterior approach to ensure an R0 resection [3,5,11,12]. The authors are using PR adrenalectomy as the standard treatment for functioning benign adrenal tumors up to 6–8 cm, and for nonfunctioning benign lesions with 4–8 cm. The mean tumor size in our series was 4,1 cm (range from 1,8 to 14 cm), with only one non-functioning tumor included (4,0 cm). The 14 cm lesion was a giant cystic pheochromocytoma, and using PR approach in this setting was a challenge and a first worldwide try. We decided to use PR approach in such a huge lesion because there were no local invasion or metastasis, it was not solid, and besides having >10 cm, size is not an absolute criterion for malignancy [11,13]. To minimize the risk of a pheo crisis due to intraoperative manipulation, phenoxybenzamine was administrated during the previous 3 weeks. Our aim was to dissect the entire cyst and promote content aspiration to avoid cell spillage (benignity had not yet been confirmed at surgery time). Unfortunately, an incidental disruption occurred, supporting the size limit presented above. However, studies comparing open and minimally invasive techniques for large adrenal tumors are lacking. Although we cannot indicate PR approach in giant lesions, this was the first worldwide-published report of a giant cystic pheochromocytoma treated by PR adrenalectomy [11].

This study supports the idea of a small learning curve for PR technique, if a surgeon has already gained experience in other fields of laparoscopic surgery. Table 2 resumes the outcomes from other authors, showing that our preliminary results are similar or better than bigger series. After performing 10 procedures it was possible to match both operation time and complications rate reported by more experienced surgeons. The feasibility and safety of this technique makes it an easy procedure to learn if laparoscopic experience has already been gained.

More patients will be collected to validate these results, since the small number of patients included is the major drawback of our study. Although a comparison between PR and TP approaches was not performed in this study, PR technique may offer less postoperative pain and faster recovery according to several reports [3,7,10].

## 5. Conclusion

Posterior retroperitoneoscopic adrenalectomy has a small learning curve. It is technically safe and feasible if laparoscopic experience has already been gained. This retrospective analysis supports other studies data, and highlights the feasibility of this minimal invasive technique.

## Conflicts of interest

None.

## Funding

None.

## Ethical approval

No ethical approval was needed since this paper describes the use of a well-known technique. Posterior retroperitoneoscopic approach is a valid option to treat adrenal tumours.

## Consent

Written informed consent was obtained from all patients (ten) for publication of this case series. A copy of all the written consents is available for review by the Editor-in-Chief of this journal on request.

## Author contribution

CE Costa Almeida – study design, data collection, data analysis, writing, review.

T Caroço – writing, review.

MA Silva – review.

MN Albano – review.

JM Louro – review.

LF Carvalho – data collection, review.

CM Costa Almeida – review.

## Registration of research studies

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## Guarantor

Carlos M Costa Almeida.

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