

## CLINICAL STUDY

## Left retroperitoneal versus transperitoneal approach for abdominal aortic surgery – retrospective comparison of intraoperative and postoperative data

Tosenovsky P, Janousek L, Lipar K, Moravec M

Department of Transplant Surgery, Vascular Unit, Institute for Clinical and Experimental Medicine, Prague, Czech Republic. patriktosenovsky@hotmail.com

### Abstract

**Background:** The aim of our study was to evaluate the potential advantages of the left retroperitoneal (RP) approach for abdominal aortic surgery and compare the aortic exposure with the transperitoneal (TP) approach which is widely used.

**Patients and methods:** Total 55 consecutive patients who underwent elective aortic surgery between 1998 and 1999 were evaluated retrospectively. Thirty three patients underwent the RP exposure and 22 the TP approach in the treatment of abdominal aortic aneurysm or aortoiliac occlusive disease. Demographic data and premorbid status were not significantly different between these two groups. Fourteen intraoperative and postoperative parameters were monitored and statistically analyzed.

**Results:** We found statistically significant differences in three of 14 intraoperative and postoperative parameters. Patients operated with the RP approach to the abdominal aorta were able to take clear fluids orally sooner. A statistically significant difference was also detected in the postoperative extubation time as RP patients were extubated almost one hour sooner than TP patients. Bowel function onset was statistically significantly faster return in the RP group. In the rest of recorded data there were no significant differences, however in all of follow-up parameters we found results in favour of RP group.

**Conclusion:** We conclude that the RP group of patients had statistically significant improvements three of 14 postoperative clinical parameters. (Tab. 3, Ref. 18.)

**Key words:** left retroperitoneal approach, transperitoneal approach, abdominal aortic surgery, postoperative extubation.

The first abdominal aortic repair was performed by Dubost early in 1952 using a thoracoabdominal incision with a retroperitoneal approach (1).

The most widely used exposure of the infrarenal abdominal aorta is the transperitoneal approach in our country, however retroperitoneal exposure of the infrarenal aorta has gained wider acceptance among vascular surgeons worldwide (2, 3). Several studies have been published comparing transperitoneal (TP) and retroperitoneal (RP) approaches to the abdominal aorta in last few years (1–17). The aim of these studies was to find an optimal approach which yielded a lower cost, low postoperative morbidity and mortality and a short hospital stay. Some of these papers presented better intraoperative and postoperative parameters in favour of the RP groups. There reported significantly lower percentages of pulmonary (10), cardiac (11, 12), and gastrointestinal complications (12) in particular when the RP approach

was used. Unfavourable results in the RP groups were seen in the length of operating time, which was significantly longer (12) and in wound complication rates (10). Some studies did not verify statistically significant differences between the RP and TP approach in many intraoperative and postoperative parameters (2, 13).

This retrospective study examined 14 intraoperative and postoperative parameters in 55 consecutive patients who underwent an aortic surgery at the Department of Transplant Surgery, IKEM Prague. The aim was to confirm our impression that patients who

---

Department of Transplant Surgery, Vascular Unit, and Department of Anesthesiology, Resuscitation and Intensive Care, Institute for Clinical and Experimental Medicine, Prague, Czech Republic

**Address for correspondence:** P. Tosenovsky, MD, IKEM, Videnska 800, CZ-120 00 Praha 4, Czech Republic.

**Tab. 1. Demographic and medical data.**

	Total (n)	RP (n)	TP (n)	RP (%)	TP (%)	p value
No of patients	55	33	22	60	40	NS
AAA	9	1	8	3	36	<0.01
AIQD	46	32	14	97	64	NS
BMI		25±4	27			NS
Age (years)		57±7	62			NS
Sex (MvsF)		23vs10	19	69.3vs30.3	86.4vs13.6	NS
DM	21	13	8	39.4	36.4	NS
ASA (2 vs 3-4)		7:26	4:18	21vs79	18vs82	NS

underwent the RP approach to abdominal aorta surgery have better postoperative courses.

### Patients and methods

A total of 55 consecutive patients underwent elective aortic surgery between October 1998 and December 1999. Operations on 33 patients were performed with the retroperitoneal (RP) approach – 32 patients with aorto-iliac occlusive disease (AIOD) and one patient with abdominal aortic aneurysm (AAA). Twenty two patients were operated with transperitoneal (TP) approach – 14 of them with AIOD and 8 with AAA. The selected of approach to abdominal aorta depended only on the surgeon's preference. Two surgeons preferred RP approach and only one TP aortic exposure. Aortofemoral bilateral bypass was performed in the majority of patients with AIOD in both RP and TP groups, and aortoiliac bilateral bypass was performed only on two patients (one in RP and one in TP group). Resection and substitution of abdominal aorta (AA) was performed in seven cases using the tube graft. In two cases (both from TP group) the bifurcated aortoiliac graft was used. Patients on whom simultaneous renal artery revascularisation or infringuinal bypass were performed were excluded. Patients with AAA had computer tomography before their elective operation and the AAA diameter was 50–90 mm. In patients with AIOD an angiographic examination preceded their elective bypass surgery. These patients suffered mostly from moderate-to-severe claudication.

Transperitoneal approach was carried out with a long midline xyphoid-to-pubis laparotomy and the transverse colon and small bowels were evacuated out of the abdominal cavity. Resected abdominal aortic aneurysm was substituted with a tube graft using inclusive technique in all patients. Surgery on patients with AIOD were performed using a bypass with an end-to-side proximal anastomosis below renal arteries and distal anastomosis in end-to-side fashion to common femoral arteries in groins. A nasogastric tube was introduced in all patients of the TP group during surgery. In the RP group an oblique incision from the left subcostal space to the lateral border of rectus muscle was made. The left kidney was ventrally and proximally mobilized. Surgery was done under general anesthesia. A nasogastric tube was not

introduced in RP group. Patients were transported to ICU after the operation and then to standard bed.

Demographic data and premorbid status were not significantly different between the TP and RP group (Tab. 1). The number of AAA patients was significantly higher in the TP group (TP vs RP,  $p<0.01$ ). Retrospectively, we have monitored 14 parameters: duration of operation, length of cross-clamp, blood loss, number of blood units given during first 24 hours, pulmonary complications, time to extubation, presence of peristalsis after the operation (bowel action), body temperature after surgery in ICU bed, perioperative volume substitution (crystalloids, colloids), total hospital stay, start of oral feeding by clear fluids, wound-healing complications (laparotomy), hernia and bulging appearance in the 11 months' follow-up and 30-day mortality rate.

Continuous variables were tested by the Student t test and by the Mann–Whitney test. Discrete variables were tested by  $\chi^2$  test. All tests were two-tailed and  $p<0.05$  were assumed as significant.

### Results

We found out statistically significant differences in three of 14 intraoperative and postoperative parameters (Tables 2 and 3). Patients with the RP approach to the abdominal aorta were fed orally sooner ( $p=0.016$ ). A statistically significant difference was also detected in the postoperative extubation time as RP patients were extubated almost one hour sooner than TP patients (RP group 2.2 hrs vs TP group 3.4 hrs,  $p=0.02$ ). The bowel function onset (presence of peristalsis) was in both group between 1.5 and 2 days, however, the RP group experienced significantly faster return of bowel function ( $p=0.03$ ).

In the rest of recorded data we did not find any significant differences, however, the mean hospital stay was two days shorter in RP group (9.4 days vs 11.6 days,  $p=0.15$ ). The number of transfusion units given during the hospital stay was also lower in the RP group (1.7 T.U. vs 1.8. T.U. in TP group,  $p=0.67$ ), and the perioperative blood loss also turns more beneficial in RP group, although insignificant (612 ml in RP group vs 775 ml in TP group,  $p=0.18$ ). The mean aortic cross-clamp time was 46–47 minutes (46 in RP vs 47 in TP group), and the mean operating time was not significantly shorter in the RP group (143 minu-

**Tab. 2. Intraoperative and ICU data.**

	RP	TP	p
Median cross-clamp time (min)	46 ± 18	48 ± 12	0.74
Median operating time (min)	143 ± 35	156 ± 29	0.12
Median blood loss (ml)	612 ± 458	775 ± 418	0.18
Median temperature in ICU (°C)	35.4 ± 0.8	35.3 ± 1.0	0.8
Median 24 h blood transfusions (T.U.)	1.7 ± 3	1.8 ± 2	0.67
Median perioperative volume subst. (ml)	2690 ± 1260	2810 ± 1010	0.72
Median extubation time (hours)	2.2 ± 2.1	3.3 ± 2.1	0.02
Pulmonary complications (%)	0	9.1	0.3

**Tab. 3. Postoperative course data.**

	RP	TP	p
Mean hospital stay (days)	9.5 ± 3.8	11.6 ± 7.0	0.15
Mean oral clear fluids (days)	1.3 ± 0.6	2.0 ± 1.0	0.005
Mean bowel action (days)	1.5 ± 0.7	2.0 ± 1.0	0.03
Incisional hernia (%)	6.1	9.1	1
30 days mortality rate (%)	0	13.6	0.12
Wound (laparotomy) complications (%)	3	9.1	0.72

tes vs 157 minutes in TP group,  $p=0.12$ ). Body temperature immediately after surgery in the ICU was almost the same in both groups (TP group 35.3 vs 35.4 in RP group), and perioperative volume substitution was slightly higher in TP group (RP 2690 vs TP 2810). An incisional hernia in the laparotomy occurred twice in each group (RP 6 % vs TP 9 %,  $p=1.0$ ) in 11 months of follow-up. Three patients died in the TP group within thirty days due to perioperative myocardial infarction, and none died in RP group ( $p=0.12$ ). We found one case of a wound-healing complication in RP group (3 %) and two cases in the TP group (9 %) ( $p=0.7$ ). Despite the fact that we did not find any pulmonary complications in patients in the RP group and three patients in the TP group suffered from postoperative pneumonia, this difference was not statistically significant (RP 0 % vs TP 9 %,  $p=0.3$ ).

## Discussion

Several studies have presented benefits of the retroperitoneal approach to abdominal aorta (3–5, 7, 10–12, 14–17). Many of these studies were non-randomized (4, 5, 11, 12, 14, 15, 16, 17). The randomized study of Sicard et al implies that the incidence of intraoperative complications was the same in both RP and TP group, nevertheless, patients in RP group had shorter ICU stays and also shorter hospital stays. Furthermore, they had a lower incidence of postoperative ileus and smaller bowel obstruction and also lower hospital costs (5). On the other hand the RP group had higher incidence of incisional pain (5). The patients in Sicard's study (AAA vs AIOD) was similar to our groups. Another randomized study of Darling et al investigating only AAA patients favoured the RP approach in terms of blood loss, blood transfusion requirements and peroral feeding (7).

The surgical exposure of the infrarenal abdominal aorta is the same in both aneurysmal and occlusive disease however, these

two types of abdominal aortic diseases have a different character. The study of Cambria et al (13) was criticized for its non-homogeneous representation of AAA vs. AIOD patients by Siensaurine et al (2). Therefore Siensaurine randomized patients in his study with aneurysmal and occlusive diseases separately to get comparable groups (2). This study did not prove the intraoperative benefits of RP approach – the postoperative course of patients was similar in both RP and TP groups. Moreover, the authors found a higher incidence of wound complications in the RP group in the long-term follow-up. They concluded that the RP approach is a useful technique for vascular surgeons and is favourable especially for the treatment of suprarenal aortic disease (2). Cambria et al concluded their randomized study similarly. They noted insignificant differences between RP and TP groups and did not recommend the retroperitoneal approach for its adoption as the preferred technique (13). Conversely, Darling et al concluded in their retrospective study of 2340 aortoiliac reconstructions that the RP approach offers certain physiological advantages associated with minimal effects on the gastrointestinal and respiratory functions and reduced ICU and hospital stays (14). Furthermore, Darling and Siensaurine both stated described that when using the RP approach the suprarenal aorta is easily to approach (2, 14).

Demographic and preoperative medical data in our study were similar, without statistically significant differences between the TP and RP groups but the total number of AAA patients was significantly higher in the TP group. Conversely, a significantly lower number of AIOD patients were seen in the TP group. Despite the fact that exposure of the abdominal aorta with atherosclerotic disease is more difficult we did not find a higher blood loss. On the contrary all of the monitored parameters were in favour of the RP group. We did not use cell-saver device in our clinic. Patients with right iliac artery aneurysm, renal artery stenosis or renal artery involved in on abdominal artery aneurysm were

excluded from our study. Yet, based on our experience we can say that all the above-mentioned diseases are approachable from a left-flank incision. This is in agreement with Siensaurine's study. Moreover an exclusion of the right iliac artery aneurysm can be handled from the left retroperitoneal approach without the need to use an occlusive hemostatic balloon or an accessory contra-incision. Renal artery revascularisation is also feasible from this left RP approach because of an easy suprarenal aortic cross-clamping. Among 14 parameters we found significant differences in only three. However, the RP group achieved better results in all remaining parameters. Patients with the RP approach to abdominal aorta were extubated one hour sooner, they had a oral feeding sooner and a faster return of gut function. Our findings are in agreement with Darling's results that the retroperitoneal approach is more physiological for a patient (14). The incidence of postoperative pulmonary complications was higher in the TP group in our study. The cause of pulmonary complications was pneumonia in three patients and we believe that the transperitoneal approach in particular could be responsible for development of this postoperative pulmonary complication. A wide laparotomy and small bowel manipulation during the surgery (18) lead to a postoperative paralytic ileus which tends to raise up the diaphragm with a higher probability of atelectasis and pleural effusion development. Both conditions have a higher risk for triggering pneumonia. The other risk for lung infection development could be bacterial translocation in the paralytic gut.

We have noticed swollen testes after the RP approach in four patients similar to Siensaurine who attributed it to peritoneal rotation (2). The left-flank incision was always satisfactory and provided a relatively wide manipulation space. Within the time we could eventually shorten the length from 20–25 cm to 12–15 cm when an aorto-iliac bypass was performed. Thus the former, relatively long, oblique incision was modified to a short transverse one located in the left subcostal space and this was sufficient. Early return of gut function mentioned in the papers of Sicard et al (4) and Siensaurine et al (2) was also confirmed in our study.

In our opinion, the left flank incision is more physiologic in comparison to the transperitoneal approach to the abdominal aorta, however this was a nonrandomized and retrospective study. Unlike Siensaurine et al (2) we did not find a higher incidence of wound complications in the RP group in our follow-up period. Nevertheless bulging could be expected even after a long period. We conclude that despite the sceptical conviction of several authors the retroperitoneal approach to the abdominal aorta can be preferred during aortic surgery for both the aneurysm resection and the aorto-femoral bypass procedure because patients recover better in the postoperative course. In all monitored parameters the RP group was assessed better, but statistically significant differences were found only in three of fourteen parameters.

## References

- Dubost C, Allory M, Oenocomos N.** Resection of an aneurysm of the abdominal aorta; reestablishment of the continuity by preserved human arterial graft with result after 5 months. *Arch Surg* 1952; 64: 405–408.
- Siensaurine K, Lawrence-Brown MD, Goodman MA.** Comparison of transperitoneal and retroperitoneal approaches for infrarenal aortic surgery: early and late results. *Cardiovasc Surg* 1997; 5 (1): 71–76.
- Ballard JL, Yonemoto H, Killen JD.** Cost-effective Aortic Exposure: A Retroperitoneal Experience. *Ann Vasc Surg* 2000; 14: 1–5.
- Sicard GA, Freeman MB, Vander Woude JC, Anderson CB.** Comparison between the transabdominal and retroperitoneal approach for reconstruction of the infrarenal abdominal aorta. *J Vasc Surg* 1987; 5: 19–27.
- Sicard GA, Reilly JM, Rubin BG et al.** Transabdominal versus retroperitoneal incision for abdominal aortic surgery: report of a prospective randomised trial. *J Vasc Surg* 1995; 21: 174–183.
- Leather RP, Shah DM, Kaufman JL, Fitzgerald KM, Chang BB, Feustel PJ.** Comparative analysis of retroperitoneal and transperitoneal aortic replacement for aneurysm. *Surg Gynecol Obstet* 1989; 168: 387–393.
- Darling RC III, Shah DM, McClellan WR, Chang BB, Leather RP.** Decreased morbidity associated with retroperitoneal exclusion treatment for abdominal aortic aneurysm. *J Cardiovasc Surg* 1992; 33: 65–69.
- Sicard GA, Allen BT, Munn JS, Anderson CB.** Retroperitoneal versus transperitoneal approach for repair of abdominal aortic aneurysms. *Surg Clin North Amer* 1989; 69: 795–806.
- Lacroix H, Van Hemerlijck J, Nevelsteen A, Suy R.** Transperitoneal versus extraperitoneal approach for routine vascular reconstruction of abdominal aorta. *Acta Chir Belg* 1994; 94: 1–6.
- Quiñones-Baldrich WJ, Garner CH, Caswell D et al.** Endovascular, transperitoneal, and retroperitoneal abdominal aortic aneurysms repair: Results and costs. *J Vasc Surg* 1999; 30: 59–67.
- Carrel T, Niederhauser U, Laske A, Bauer E et al.** Retroperitoneal approach in selective surgery of the infrarenal aorta. *Helv Chir Acta* 1992; 58 (4): 583–588.
- Kirby LB, Rosenthal D, Atkins CP, Brown GA et al.** Comparison between the transabdominal and retroperitoneal approaches for aortic reconstruction in patients at high risk. *J Vasc Surg* 1999; 30 (3): 400–405.
- Cambria RP, Brewster DC, Abbot WM, Freehan M et al.** Transperitoneal versus retroperitoneal approach for aortic reconstruction: A randomized prospective study. *J Vasc Surg* 1990; 11: 314–325.
- Darling 3rd C, Shah DM, Chang BB, Paty PS, Leather RP.** Current status of the use of retroperitoneal approach for reconstruction of the aorta and its branches. *Ann Surg* 1996; 224 (4): 501–506.
- Butler PEM, Grace PA, Burke PE, Broe PJ, Bouchier-Heyes D.** Risberg retroperitoneal approach to the abdominal aorta. *Brit J Surg* 1993; 80 (8): 971–973.
- Gregory RT, Wheeler JR, Snyder SO, Gayle RG, Love LP.** Retroperitoneal approach to aortic surgery. *J Cardiovasc Surg (Torino)* 1989; 30 (2): 185–189.
- Nakajima T, Kawazoe K, Komoda K, Sasaki T, Ohsava S, Kamada T.** Midline retroperitoneal versus midline transperitoneal approach for abdominal aortic aneurysm repair. *J Vasc Surg* 2000; 32: 219–223.
- Brinkmann A, Wolf CHF, Berger D et al.** Perioperative endotoxemia and bacterial translocation during major abdominal surgery: Evidence for the protective effect of endogenous prostacyclin? *Critical Care Med* 1996; 24: 8.

Received September 20, 2003.

Accepted October 27, 2003.