

## Paramedian retroperitoneal approach for revascularization of aortoiliac occlusive disease

*Aortoiliyak tıkkayıcı hastalık revaskülarizasyonunda paramedian retroperitoneal yaklaşım*

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### ABSTRACT

**Background:** This study aims to examine unilateral and bilateral revascularization of aortoiliac occlusive disease via paramedian incision and retroperitoneal approach.

**Methods:** Between January 2005 and December 2012, 74 patients (67 males, 7 females; mean age 61.6±9.5 years; range 24 to 79 years) underwent surgical revascularization for aortoiliac occlusive disease via paramedian incision and retroperitoneal approach [aortofemoral bypass (n=40), iliofemoral bypass (n=14), aortoiliac bypass (n=2) and aortobifemoral bypass (18)]. Data of the patients for unilateral aortoiliac revascularization were compared with those for bilateral aortoiliac revascularization. The preoperative characteristics and perioperative data of the patients were analyzed.

**Results:** Three patients (3.9%) died postoperatively due to myocardial infarction and pulmonary complications. No intraoperative complications occurred. Six patients required subsequent reoperation: two for acute distal embolism to the contralateral limb, two for distal anastomosis leakage, and two for local distal wound infection. These patients were successfully treated. The patients were discharged from the hospital on antiplatelet therapy. There was no significant difference in the length of intensive care unit stay, time to oral intake, preoperative and postoperative hemoglobin levels, hematocrit levels, creatinin levels, and need for transfusion between the unilateral and bilateral revascularization patients.

**Conclusion:** Based on our experience, the retroperitoneal aortoiliac approach with a paramedian incision has few complications and reasonable outcomes.

**Keywords:** Ischemia; retroperitoneal space; revascularization; surgery.

### ÖZ

**Amaç:** Bu çalışmada paramedian insizyon ve retroperitoneal yaklaşım ile aortoiliyak tıkkayıcı hastalığın tek taraflı ve iki taraflı revaskülarizasyonu incelendi.

**Çalışma planı:** Ocak 2005 - Aralık 2012 tarihleri arasında 74 hastaya (67 erkek, 7 kadın; ort. yaş 61.6±9.5 yıl; dağılım 24-79 yıl) aortoiliyak tıkkayıcı hastalık nedeniyle paramedian insizyon ve retroperitoneal yaklaşım ile cerrahi revaskülarizasyon [aortofemoral baypas (n=40), iliyofemoral baypas (n=14), aortoiliyak baypas (n=2) ve aortobifemoral baypas (n=18)] yapıldı. Tek taraflı aortoiliyak revaskülarizasyon yapılan hastaların verileri, iki taraflı aortoiliyak revaskülarizasyon yapılan hastalar ile karşılaştırıldı. Hastaların ameliyat öncesi özellikleri ve ameliyat sırası verileri incelendi.

**Bulgular:** Üç hasta (%3.9) miyokard enfarktüsü ve pulmoner komplikasyonlar nedeniyle ameliyat sonrası kaybedildi. Ameliyat sırası komplikasyon gözlenmedi. Takiben altı hastaya yeniden cerrahi yapıldı: iki hastaya karşı taraf ekstremiteye akut distal emboli, iki hastaya distal anastomoz kaçağı ve iki hastaya da lokal distal yara yeri enfeksiyonu nedeniyle. Bu hastalar başarılı bir şekilde tedavi edildi. Hastalar antitrombosit tedavisi ile hastaneden taburcu edildi. Yoğun bakımda kalma süresi, oral gıdaya kadar geçen zaman, ameliyat öncesi ve ameliyat sonrası hemoglobin düzeyleri, hematokrit düzeyleri, kreatinin düzeyleri ve transfüzyon ihtiyaçları açısından tek taraflı ve iki taraflı revaskülarizasyon hastalarında anlamlı bir fark bulunmadı.

**Sonuç:** Deneyimlerimize göre, paramedian insizyon ile retroperitoneal aortoiliyak yaklaşımın az sayıda komplikasyonu ve kabul edilebilir sonuçları vardır.

**Anahtar sözcükler:** İskemi; retroperiton boşluğu; revaskülarizasyon; cerrahi.



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Various surgical approaches to the infrarenal abdominal aorta have been reported to date. The midline transperitoneal approach is most widely used. The extraperitoneal approach has been reported by many authors to have physiologic advantages over those of the transperitoneal approach.<sup>[1]</sup> Transverse and vertical incisions may be preferred for retroperitoneal aortoiliac exposure. Transverse incisions are muscle cutting incisions made for wider exposures. Midline, pararectal, paramedian, and Mayo-Robson modification of paramedian incisions are vertical incisions which may be done for retroperitoneal exposure. Oblique muscle-cutting incision, an eponym of the Rutherford-Morrison incision, may be also used for retroperitoneal exposure. Retroperitoneal access to the suprarenal aorta may be performed through a thoracoabdominal incision.<sup>[2]</sup> Anterolateral, retroperitoneal, and left posterolateral retroperitoneal approaches have been described for aorta and its branches in wide series.<sup>[3]</sup> Exposure of iliac arteries through bilateral anterior paramedian retroperitoneal approach with a 6-10 cm incision made median and transverse, 2 cm above the pubic spine, has been also described for bilateral iliac artery exposure.<sup>[4]</sup> Currently, laparoscopic surgery for aortoiliac occlusive diseases has yielded comparable results to the conventional techniques.<sup>[5-7]</sup> For some of the aortoiliac occlusive lesions which are typically described in the Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II), published in 2007, endovascular procedures have been replacing major surgery.<sup>[8]</sup>

In this study, we aimed to examine unilateral and bilateral revascularization of aortoiliac occlusive disease via paramedian incision and retroperitoneal approach.

## PATIENTS AND METHODS

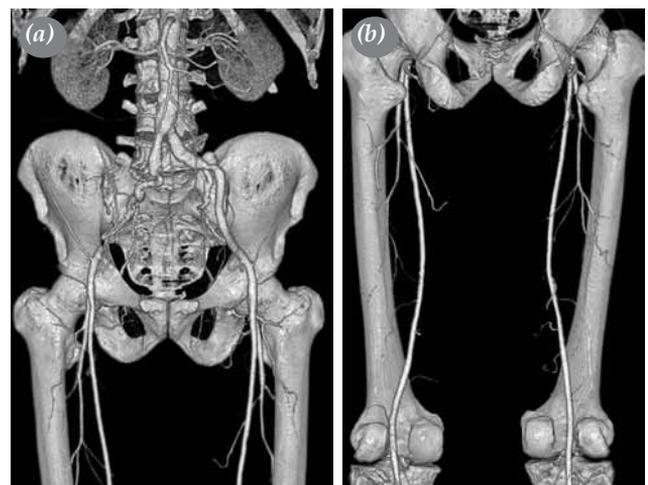
In this retrospective study, the data of the patients consecutively operated by the same surgeon were analyzed. Seventy-four patients (67 males, 7 females; mean age  $61.6 \pm 9.5$  years; range 24 to 79 years) were operated for aortoiliac occlusive disease between January 2005 and December 2012. All patients had aortoiliac occlusive disease and underwent revascularization via paramedian incision and retroperitoneal approach. The surgical indications included relieving ischemic pain, healing ischemic ulcers, preventing a limb loss, improving function and quality of life of the patient, and prolonging survival, as described in the TASC II consensus.<sup>[5]</sup> Rutherford grades of the patients were Category 2 in six patients, Category 3 in 25 patients, Category 4 in 15 patients,

Category 5 in 24 patients, and Category 6 in four patients. The majority of the lesions were TASC C or D. The preoperative characteristics and perioperative data of the patients were analyzed. The patients were divided into two groups as aortobifemoral or unilateral revascularization groups.

Iliac lesions were not considered appropriate for the treatment via percutaneous transluminal angioplasty (Figure 1). Some patients had a coexisting distal arterial disease, which necessitated distal revascularization. Demographic characteristics of the patients are shown in Table 1.

The patients with multiple risk factors and those with symptoms of coronary artery disease (i.e. angina, ischemic changes on electrocardiography, ischemia on dipyridamole thallium scintigraphy or left ventricular wall motion abnormalities on stress echocardiography) were also evaluated by preoperative coronary angiography.

The operations were planned according to the computed tomography angiography or conventional peripheral digital subtraction angiography findings. The patients who had coronary ischemic signs or symptoms or ischemic findings on preoperative diagnostic tests had coronary angiography before the operation. Thirty-four patients had coronary artery disease, nine of whom had coronary artery bypass grafting and two had percutaneous coronary intervention before the peripheral arterial surgery. The remaining patients had non-critical coronary artery lesions and were medically treated. Three patients had also previous abdominal surgery.



**Figure 1.** Preoperative computed tomography angiography image of the right iliac artery lesion: (a) aortoiliac segment (anterior view), (b) femoropopliteal segment (posterior view).

**Table 1. Demographic characteristics of patients**

	Unilateral revascularization (n=56)		Bilateral revascularization (n=18)		<i>p</i>
	n	Mean±SD	n	Mean±SD	
Gender (ratio)					0.129
Male	49		18		
Female	7		0		
Age (year)		61±10		62±9	0.740
Hypertension	25		5		0.288
Diabetes mellitus	20		4		0.370
Coronary artery disease	32		6		0.137
Smoking	42		10		0.254
Hypercholesterolemia	24		7		0.933
Chronic obstructive pulmonary disease	21		6		0.896
Dacron/expanded polytetrafluoroethylene	42/14		18/0		0.008*
Epidural/general anesthesia	10/46		0/18		0.64
Mortality	2		1		0.667

SD: Standard deviation.

### Surgical techniques

All operations were performed under general anesthesia except for 10 who received regional epidural and spinal anesthesia. Epidural anesthesia was done upon the patient preference. Distal outflow arteries were first exposed in all patients. Paramedian incisions were performed via a vertical 7 to 8 cm incision approximately 6 cm to the left or right of midline, extending from a few centimeters above the umbilicus to near above the symphysis pubis (Figure 2). The anterior rectus sheath was incised at the external end of the rectus abdominis muscle and the posterior rectus sheath was incised above the semilunar line. The retroperitoneal space was, then, entered to attain an access to the aorta or the iliac artery.

Anticoagulation was administered using 100 IU/kg body weight of heparin, until a target activated clotting time of 250 to 350 sec was achieved. Proximal end-to-side anastomosis was performed first on the side-clamped or cross-clamped inflow artery.

The following operations were performed: aortofemoral bypass (n=40), iliofemoral bypass (n=14), aortoiliac bypass (n=2) and aortobifemoral bypass (n=18). Fourteen patients had an extensive infrainguinal occlusive disease which necessitated additional femoropopliteal bypass to the ipsilateral limb. One patient had additional femoropopliteal bypass to the contralateral limb.

### Statistical analysis

Statistical analysis was performed using the PASW statistical software version 17.0 (SPSS Inc.,

Chicago, IL, USA). The chi-square test was used to compare categorical data. Continuous variables were analyzed using t test and expressed in mean ± standard deviation (SD). A *p* value of <0.05 was considered statistically significant.



**Figure 2.** Postoperative view of the surgical incisions in the same patient.

**Table 2. Operative and postoperative data of patients**

	Unilateral revascularization (n=56)		Bilateral revascularization (n=18)		<i>p</i>
	Mean±SD	Range	Mean±SD	Range	
Length of intensive care stay (day)	0.7±0.8	0-3	0.6±0.9	0-3	0.693
Length of hospitalization (day)	7.0±4.2	2-23	5.4 ±1.6	4-11	0.015*
Time to oral feeding (day)	1.2±0.5	1-3	1.3±0.6	1-3	0.378
Ankle-brachial index (preoperative)	0.5±1	0.3-0.7	0.5±10	0.3-0.6	0.545
Ankle-brachial index (postoperative)	1.0±0.1	0.6-1.2	1.0±0.1	0.7-1.2	0.883
Preoperative hemoglobin (g/dL)	13.3±1.5	9.5-17.5	13.3±2.0	9.1-16.3	0.927
Postoperative hemoglobin (g/dL)	11.0±1.3	8.5-14.2	11.4±1.7	8.5-14.7.5	0.295
Preoperative hematocrit (%)	39.4±4.3	29.7-52.0	39.4±5.1	29.3-47.9	0.982
Postoperative hematocrit (%)	32.6±3.5	26.3-41.3	33.5±4.2	27.2-41.3	0.376
Transfusion (bag of blood)	1.3±1.6	0-8	0.7±0.9	0-3	0.073
Preoperative glucose (mg/dL)	125±53	76-427	107±28	73-160	0.193
Preoperative creatinine (mg/dL)	0.9±0.3	0.50-1.66	1.1±0.9	0.50-4.80	0.342
Postoperative creatinine (mg/dL)	1.2±0.9	0.50-7.00	1.2±0.8	0.50-3.90	0.966
Postoperative follow-up (month)	23±11	1-45	28±11	10-45	0.098

SD: Standard deviation.

## RESULTS

Three patients (3.9%) died postoperatively due to myocardial infarction and pulmonary complications. No intraoperative complications occurred. Six patients required subsequent reoperation: two for acute distal embolism to the contralateral limb, two for distal anastomosis leakage, and two for local distal wound infection. These were successfully treated. Embolectomy was done for acute distal embolism, while revision of the distal anastomosis and primary suturing of the anastomosis were performed for distal anastomosis leakage. The distal wound infection was treated with debridement and primary suturing of the wound site. In case of distal anastomosis leakage, bleeding from the anastomosis was seen. The patients were discharged from the hospital on antiplatelet therapy. All patients were primarily treated by surgery and none had endovascular treatment during their hospital stay.

The comparative analysis of unilateral and bilateral revascularization groups showed that preoperative demographic data and the risk factors were similar between the groups (Table 1). There was no significant difference in the length of intensive care unit stay, time to oral intake [1.21±0.45 days (1-3 days) for unilateral revascularization, 1.33±0.59 days (1-3 days) for bilateral revascularization], preoperative and postoperative hemoglobin levels, hematocrit levels, creatinin levels, and need for transfusion between the groups (Table 2). The length of postoperative hospitalization was higher in the

unilateral revascularization group, as two patients had 23 days of hospitalization for chronic obstructive pulmonary disease.

In the unilateral revascularization group, 40 aortofemoral bypasses, 18 iliofemoral bypasses and two aortoiliac bypasses were done as the surgical procedure. Surgical success was achieved in all patients, as assessed by physical examination and ankle-brachial indices. There was a significant increase in the postoperative ankle-brachial indices, compared to the preoperative indices; however, the difference was not statistically significant.

In addition, the graft patency was evaluated by physical examination and Doppler ultrasonography. Upon the patients' hospital discharge, the primary graft patency was 100%. Follow-up was performed on 57 patients. Six patients underwent reoperation during the follow-up period: two for acute graft occlusion, two for femoropopliteal disease, and two for contralateral femoropopliteal occlusive disease. All patients had prior unilateral revascularization. Thrombectomy and femoropopliteal bypass surgery were successfully performed. None of the patients had limb loss.

## DISCUSSION

Although randomized, prospective studies have shown no significant differences in the outcomes, retroperitoneal approach for aortic surgery has gained popularity in recent years, as it may reduce cardiac stress, respiratory complications, postoperative ileus,

and third-space fluid losses.<sup>[9]</sup> In patients with multiple previous intra-abdominal surgical procedures, previous aortic surgery, and other hostile abdominal conditions, and sometimes if substantial juxtarenal or pararenal disease requires repair or when concomitant left renal arterial revascularization or other visceral arterial repair is necessary, retroperitoneal approach has some merits. However, control and repair of the right iliac artery can be challenging through a left retroperitoneal approach in obese patients, due to technical difficulties including poor access to the right renal artery.<sup>[10]</sup> Fortunately, we did not encounter such complications, as none of the patients suffered from morbid obesity in our study.

Controversies on the midline laparotomy such as prolonged ileus, higher incidence of chronic obstructive pulmonary disease, longer lengths of intensive care unit and the hospital stay, and increased hospitalization costs are to some extent excluded. Regional anesthesia in patients who are awake may be an option for particularly high-risk for general anesthesia. Postoperative incisional pain is generally well-tolerated with paramedian incision in patients operated under regional anesthesia which may also offer postoperative pain relief.

Rutherford Morrison's incision, an oblique muscle-cutting incision, is preferred by some surgeons for retroperitoneal exposure. Despite its good cosmetic outcomes, however, we believe that paramedian incision may produce fewer damages the collateral circulation of the inferior epigastric arteries, in particular. Of note, this is our personal experience and should be supported by scientific study findings. Besides, the paramedian incision has also very good cosmetic results with smaller incisions. However, it may induce complete denervation of the rectus abdominis muscle, leading to atrophy of the anterolateral abdominal muscle.<sup>[11]</sup> In the present study, none of the patients experienced a severe complication due to muscle atrophy during the follow-up period. However, it can be attributed to the fact that our follow-up period was relatively short. Therefore, further longer follow-up studies are needed.

Aortoiliac endarterectomy is suggested to the patients who are not candidates for aortobifemoral bypass grafting due to infection risk or small vessels, for patients with localized aortoiliac disease, and for those after removal of an infected graft (with or without an enteric fistula) which was initially placed end-to-side for aortoiliac occlusive disease.<sup>[11]</sup> Surgical exposure of the infrarenal abdominal aorta and the common iliac artery may yield excellent results with the paramedian incision. Therefore, proximal

common iliac lesions may be well-endarterectomized via paramedian incision.

In the current study, two patients experienced distal atheromatous embolism to the contralateral limb by the placement of side-biting clamps on the aorta. The complication did not occur, when aorta was cross-clamped. In some cases, the aorta from the outside with palpation may seem normal. However, when aortotomy is done, an atheromatous appearance may be seen with soft plaques. The aortic flow site of the side biting clamp may sweep the debris end embolize the distal non-lesioned artery. Therefore, the proximal anastomosis on the cross-clamped aorta to stop the aortic flow and to make it possible to flush the debris by backbleeding by opening the distal aortic clamp can be done. Some bleeding from the anastomosis site before the sutures should be ligated to expel the atheromatous debris or thrombi in the aorta.

Furthermore, acute graft occlusions were seen in two patients with mildly stenotic superficial femoral arteries. These were detected one and two years after the initial procedure and were treated by thrombectomy. Despite the lack of evidence, poor run-off may be blamed for these acute occlusions and it can be speculated that end-to-end anastomoses would have provided a better hemodynamic performance. Suture line stenosis and atheromatous stenosis of the native run-off artery have been reported to be the two most common causes in the literature.<sup>[12]</sup>

After obtaining a short learning curve, retroperitoneal approach via a paramedian incision affords an easy access and rapid exposure of the retroperitoneal vascular structures. Time gain is much during the surgical site closure. Although it has not been statistically compared with the conventional technique, paramedian incision yields a clear time gain according to our experience. Approximate surgical durations are 1.5-2 hours for unilateral, 2-2.5 hours for bilateral revascularizations. In addition, one the most important benefit of this procedure is the short duration of hospitalization and convalescence period. In our study, most patients started oral feeding in the first postoperative day, which is a common problem for a transperitoneal approach due to paralytic ileus. As a result, our patients became well in a very short time of period. In addition, hospitalization may be short as two days only in these patients, as seen in one patient in our study. On the other hand, the Enhanced Recovery After Surgery (ERAS) protocol has been shown to improve hospital outcomes in open abdominal surgery.<sup>[13]</sup> This may be also adapted to the vascular surgery in transperitoneal approach to decrease the hospital

stay. In addition, it may be adapted to retroperitoneal approach which may further improve the outcomes.

In conclusion, the retroperitoneal aortoiliac approach with a paramedian incision has few complications and reasonable outcomes. Therefore, we use this approach as the first choice for the most of the aortoiliac occlusive diseases.

#### **Declaration of conflicting interests**

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