The Journal of International Medical Research
2001; 29: 421 – 424

Cost-effectiveness of Minimally Invasive Intervention in Aortofemoral Revascularization

E Silistreli[1], H Çatalyürek[1], Ö Karabay[2], H Hepağuşlar[3] and Ü Açıkel[1]

[1]Department of Thoracic and Cardiovascular Surgery, Dokuz Eylul University, School of Medicine, Izmir, Turkey; [2]Department of Thoracic and Cardiovascular Surgery, Alsancak State Hospital, Izmir, Turkey; [3]Department of Anaesthesiology and Reanimation, Dokuz Eylul University, School of Medicine, Izmir, Turkey

Minimally invasive surgical procedures have become popular recently because they offer several advantages over conventional operative techniques. A person undergoing a minimally invasive procedure usually experiences less pain, is discharged earlier from hospital, returns to work sooner and has a less obtrusive post-operative scar. Excluding highly technical techniques (e.g. laparoscopic surgery), operations performed using mini-laparotomy are usually more cost-effective than conventional procedures, largely because they are less expensive to perform. Our paper investigates cost-effectiveness and other parameters relating to minimally invasive aortofemoral revascularization procedures performed at our clinic. We compared 20 similar cases, half where revascularization was undertaken using mini-laparotomy and half where conventional laparotomy was selected. From our findings we conclude that mini-laparotomy is safe and reliable for aortobifemoral bypass procedures and has several advantages over traditional techniques; namely, shorter operating time, earlier resumption of intestinal function, shorter duration of in-patient stay and reduced costs.

KEY WORDS: Aortofemoral bypass; Minimally invasive surgery; Mini-laparotomy; Cost-effectiveness

Introduction

Minimally invasive applications are now used widely, especially in abdominal, thoracic and vascular surgery, and have become routine for some procedures. These applications have grown in popularity because they offer several proven advantages over conventional techniques, such as shorter operation times, reduced requirement for blood transfusion, less post-operative pain, earlier post-operative mobilization and resumption of intestinal function, and reduced in-patient stay.[1] The cost-effectiveness of minimally invasive aortofemoral revascularization has been documented previously.[2,3] In our study, cases of aortofemoral and bifemoral bypass, performed using mini-laparotomy incisions, were compared with cases of revascularization using conventional laparotomy.

Patients and methods

Patients requiring aortofemoral and bifemoral bypass operations were randomly assigned to undergo minimally invasive or conventional surgical procedures and no specific selection process was applied. The patients presented with complex clinical histories: some were obese, one had already undergone seven laparotomies, and several had other vascular conditions or risk factors, e.g. coronary artery disease. We did not identify specific contra-indications to treatment.

All procedures were undertaken between January 1997 and December 2000, and parameters compared were aortic cross-clamp time, operation time, units of transfused blood required, duration of in-patient stay and other costs associated with in-patient treatment.

Operations were performed under endotracheal anaesthesia. The umbilicus was positioned in the mid-point of the left paramedian laparotomy incision, which extended 5 – 8 cm. Intestines were pushed to the abdominal wall with retractors and the retroperitoneum was opened. Abdominal aorta and common iliac arteries were clamped with Satinsky clamps; polytetra-fluoroethylene bifurcated graft (Gore-tex™, WL Gore and Associates Inc., Flagstaff, USA) was anastomosed with 3/0 polypropylene suture material using a continuous stitch. Femoral anastomoses were performed and femoropopliteal bypasses were undertaken, if required. Following haemostasis, incisions were closed in the anatomic position.

Costs relating to medical materials, intravenous (IV) fluids, prophylactic antibiotics, in-patient stay, units of transfused blood required, extra medical materials and post-operative physiotherapy were obtained for comparison, using a calculation where 1 000 000 Turkish lira (approximately US$0.86 or GB£0.60) was accepted as 1 unit.

Statistical calculations were made using SPSS for Windows® 8.0, Student Version (SPSS Inc., Chicago, USA). Two-independent-samples test (Mann–Whitney *U*-test) was used and the α-value was accepted as 0.05. *P*-values < 0.05 were considered significant.

Results

In total, 20 patients underwent aortofemoral bypass procedures (10 mini-laparotomies; 10 conventional surgery) over the study-period, and the costs associated with these procedures were evaluated. The mean costs of suture materials, IV fluids and prophylactic antibiotics used in these patients are listed in Table 1. Mean costs relating to patient parameters, in-patient stay, units of transfused blood, extra medical materials and post-operative physiotherapy are listed and compared, together with other medical costs, in Table 2.

Compared to patients undergoing conventional surgery, those who underwent mini-laparotomy had shorter lengths of operating time and in-patient stay, and required fewer transfused units of blood. A significant difference in terms of the total cost of procedures was observed (Table 2). All cases involving mini-laparotomy were discharged from hospital 4 – 6 days post-operatively and long-term follow-up of these patients has not revealed problems with the graft procedures. No significant difference in terms of aortic cross-clamp time was observed between the groups ($P > 0.05$).

Discussion

Atherosclerotic occlusive disease is a generalized condition, more common in males, that often involves aortoiliac arteries. Aortoiliac or aortofemoral revascularizations are common procedures that are indicated

TABLE 1:
Comparison of mean costs of suture materials, intravenous fluids and prophylactic antibiotics used

Parameter	Mini-laparotomy group (units)	Conventional group (units)
Suture material for abdominal closure	21.1	63.9
Intravenous fluids	5.6	10.2
Prophylactic antibiotics	20.2	30.3
Total	46.8	104.4

depending on the clinical presentation of lesions found in an individual. Minimally invasive surgical techniques have been introduced more widely in recent years, and the concept of mini-laparotomy has been described for abdominal incisions 3 – 10 cm long;[2,3] in the cases described in this paper, we limited the incision range to 5 – 8 cm for practical purposes. Our previous study revealed that mini-laparotomy offered several advantages over conventional methods, especially regarding minimized bleeding, decreased need for blood transfusions, earlier resumption of intestinal passage, shortened post-operative and intensive-care-unit periods and reduced abdominal scarring.[1]

Laparoscopic surgery is another technique used for aortofemoral bypass, although longer operative periods and 50% higher costs have been reported when laparoscopy has been compared with mini-laparotomy.[4] We did not use laparoscopy because of its association with longer operating times and

TABLE 2:
General data and compared parameters for both patient groups (defined as the mean value ± SD; statistics calculated using Mann–Whitney *U*-test. α-value accepted as 0.05)

Parameter	Mini-laparotomy group	Conventional group	*P*-value
Number of patients	10	10	
Sex (female/male)	1/9	2/8	
Age (years)	61.6 ± 5.6	60.2 ± 7.5	> 0.05
Aortic cross-clamp time (min)	13.3 ± 3.2	13.3 ± 3.8	> 0.05
Operation time (min)	93.1 ± 8.3	125.8 ± 16.4	< 0.05
Units of transfused blood required	0.9 ± 0.5	1.8 ± 0.9	< 0.05
Duration of hospital stay (days)	4.4 ± 1.1	6.4 ± 1.0	< 0.05
Cost (units)			
Suture materials, intravenous fluids, antibiotics	46.8 ± 0.4	104.4 ± 0.8	< 0.05
Other costs (units)			
Blood units, physiotherapy, additional medical materials	204.4 ± 65	399.9 ± 130	< 0.05

insufficient aortic exposure.

In minimally invasive operations, resumption of intestinal passage and oral nutrition, and in-patient discharge, occur more quickly than when standard techniques are used.[5,6] In our series, the mean period of in-patient stay was 4.4 ± 1.1 days for mini-laparotomy patients compared with 6.4 ± 1.0 days for those undergoing conventional surgery. The cost of in-patient stay is less expensive in Turkey than elsewhere, which makes wide comparison of this parameter difficult, but other advantages of the procedure are clear. For example, the need for blood transfusions in patients undergoing mini-laparotomy was half that of the control group, and as serologicical screening and transfusion costs are relatively high in Turkey, this finding is particularly important. When calculating the amounts of suture material required, we focused on the laparotomy incision, because the distal anastomotic sites and closing techniques were similar and standard in both groups. In closing the laparotomy incision, we observed a significant difference in the amount of suture material required, which is also important in Turkey because suture materials need to be imported, thus there is an impact on our national economy.

In conclusion, we believe mini-laparotomy to be a feasible, safe and cost-effective technique for aortofemoral revascularization.

• Received for publication 18 June 2001 • Accepted 26 July 2001

©2001 Cambridge Medical Publications

References

1 Açikel U, Karabay O, Silistreli E, Turan A, Sanosmanoglu N: A new minimally invasive method of aortofemoral revascularisation. *Vasc Surg* 2001; **35:** 175 – 179.
2 Neufang T, Post S, Markus P, Becker H: Manually assisted laparoscopic surgery – realistic evolution of the minimally invasive therapy. Initial experiences with the 'Endohand' (in German). *Chirurg* 1996; **67:** 952 – 958.
3 Rozsos I: Micro and modern minilaparotomy in biliary tract surgery (in Hungarian). *Orv Hetil* 1996; **137:** 2243 – 2248.
4 Perrotti M, Gentle DL, Barada JH, Wilbur HJ, Kaufman RP, Jr: Mini-laparotomiy pelvic lymph node dissection minimizes morbidity, hospitalization and cost of pelvic lymph node dissection. *J Urol* 1996; **155:** 986 – 988.
5 Fabiani JN, Mercier F, Carpentier A, Le Bret F, Renaudin JM, Julia P: Video-assisted aorto-femoral bypass: results in seven cases. *Ann Vasc Surg* 1997; **11:** 273 – 277.
6 Berens ES, Herde JR: Laparoscopic vascular surgery: four reports. *J Vasc Surg* 1995; **22:** 73 – 79.

Address for correspondence
Dr E Silistreli
Mithatpasa Cad. Number 257/5, 35340 Balcova, Izmir, Turkey.
E-mail: silistreli@yahoo.com