Clinics in Surgery

Research Article
Published: 20 Apr, 2017

Fast Track Pathways: Early Ambulation after Open Aortic Surgery in Elderly Patients Is Not Only Safe but Recommendable

Piero Brustia[1], Renato Cassatella[1], Alessandra Renghi[2], Luca Gramaglia[2], Michele Aronici[1] and Francesco Casella[1]*

[1]Department of Vascular Surgery, University Hospital "Maggiore della Carità", Italy

[2]Department of Anaesthesia, University Hospital "Maggiore della Carità", Italy

Abstract

Introduction: Bed rest has always been an integral part of traditional perioperative care, but there is no evidence that it has any significant beneficial effect, especially in elderly patients. Conversely, the immediate recovery of ambulation improves outcomes after complex surgical procedures. We devised a multidisciplinary programme to achieve early ambulation after abdominal aortic surgery in elderly patients.

Methods: We carried out a prospective study of patients older than 70 years who were scheduled for abdominal aortic surgery from January 2009 to December 2011. All patients were treated with minilaparotomy, light general anaesthesia and thoracic epidural anaesthesia. The postoperative programme consisted of continuous epidural analgesia and early mobilisation.

Results: We enrolled 130 patients. The mean age was 76.1 years (95% CI=75.33-76.79). The patients began walking at a mean time of 175.2 (95% CI=145.3-205.2) min after the surgery. On the day of surgery, the mean ambulation time was 33.7 (95% CI=27.3-40.1) min, and the patients covered an average distance of 172.3 (95% CI=124.3-220.3). On the day after surgery the mean ambulation time was 157.7 (95% CI=146.8-168.6) min, and the patients covered an average distance of 1130.3 (95% CI=884.7-1375.9) metres. The perioperative mortality was 0.8% and the global morbidity was 12.3%. The patients had no pulmonary complications. We observed no side effects in connection with the early ambulation. The average time for the discharge to home was day 4 after surgery (range 2-24).

Conclusion: In elderly patients, a multidisciplinary approach with mininvasive surgery, pain control and postoperative intensive rehabilitation allowed the rapid and safe recovery of ambulation after abdominal aortic surgery thereby contributing to an improved postoperative outcome.

Keywords: Aortic surgery; Elderly patients; Prolonged bed rest; Postoperative pain; Functional decline; Perioperative care; Fast Track pathways

OPEN ACCESS

Correspondence:
Piero Brustia, Department of Vascular Surgery, University Hospital "Maggiore della Carità", 18 Corso Mazzini, Novara 28100, Italy. Tel: +39 335 6623835; E-mail: brustiapiero@aruba.it

Received Date: *02 Feb 2017*
Accepted Date*: 14 Apr 2017*
Published Date*: 20 Apr 2017*

Citation:
Brustia P, Cassatella R, Renghi A, Gramaglia L, Aronici M, Casella F. Fast Track Pathways: Early Ambulation after Open Aortic Surgery in Elderly Patients Is Not Only Safe but Recommendable. Clin Surg. 2017; 2: 1407.

Introduction

Pain, ileus, fatigue and postoperative morbidity significantly affect the resumption of daily life after major abdominal vascular surgery. The enhanced recovery after surgery pathway suggests a multidisciplinary approach to improve outcomes after complex elective surgical procedures [1,2]. This approach includes stress-free anaesthesia, mininvasive surgical techniques and postoperative enforced rehabilitation, such as early feeding and ambulation. Early ambulation has always been a controversial point in medical procedures, including surgery [3,4]. However, early ambulation is possible thanks to a programme of accelerated recovery, and it represents a fundamental step towards improving postoperative outcomes [5,6]. As proof, bed rest causes a functional decline in elderly patients [7] and, during the postoperative period, leads to a decrease in whole-body protein synthesis, is responsible for postoperative fatigue and impairs pulmonary and cardiovascular functions [8,9].

Since April 2000, in our Vascular Unit, we have introduced a multidisciplinary protocol for abdominal aortic surgery based on left sub costal minilaparotomy, thoracic epidural anaesthesia and analgesia and aggressive postoperative rehabilitation, including early mobilisation and feeding [2]. In this paper, we evaluate the clinical impact of early mobilisation and ambulation after abdominal

aortic surgery in elderly patients.

Materials and Methods

We performed a prospective study of consecutive patients older than 70 years of age who were scheduled for elective abdominal aortic surgery for aneurysm or obstructive disease from January 2009 to December 2011.

All patients were treated by the same surgical team. To promote their full cooperation, the patients were assessed in the preoperative clinic, and a written perioperative programme was explained to them and their relatives by a team of surgeons, anaesthesiologists and nurses. The premedication, protocolled for all patients, consisted of 0.1 mg/kg subcutaneous morphine two hours before surgery. An epidural catheter was placed at the T6-T7 interspace, and 15-25 ml of 0.5% levobupivacaine was administered to achieve sensory block (pin prick) between the T4 and L5 dermatomes. The induction of light general anaesthesia was achieved with 1 mg/kg propofol. A laryngeal mask was inserted, without need of curare and spontaneous ventilation was maintained with 80% oxygen. The anaesthesia was continued with the infusion of sevoflurane to obtain a minimum alveolar concentration (MAC) of 0.8%. Curare was not administered. An epidural infusion of 0.5% levobupivacaine at a rate of 4-5 ml/h was ensured throughout surgery. Absence of curare, associated with continous infusion of intratecal anaesthetic, performing a trasversal mininvasive access, with previous study and skills by anaesthsiological and surgical team, doesn't give major troubles to perform the operation. A great advantage for patient is manteining a spontaneus breathing in laryngeal mask, with capacity of acid omeosthasis and no need of prolonged tracheal intubation at end of surgery.

The aortic bypass was performed via transperitoneal access. A left subcostal incision, parallel to the costal edge and, 10-15 cm long, was performed on the supine patient. Once the aortic graft was inserted, the abdominal wall was sutured without the use of surgical drains. A nasogastric tube was not placed. At the end of the surgery, the laryngeal mask was removed, and the patient was transferred to the surgical ward, where skilled nurses assisted by the anaesthesiologist started monitoring the patient.

Postoperative analgesia was achieved with a continuous epidural infusion of 0.25% levobupivacaine at a rate of 3-6 ml/h for 48 hours, supplemented by 600 mg oral ibuprofen every eight hours. For the additional demand for analgesia 100 mg intravenous ketoprofen was scheduled. Opioids were not used. As soon as the general conditions were stable, the patients were encouraged to take sugared drinks, and a semisolid diet was offered two to six hours after surgery. The patients were forced to perform breathing exercises. An oxygen mask was provided during the first two postoperative nights. Shortly after the surgery, the patients started bed exercise and foot pumps. The patients were forced to ambulate with assistance in the absence of motor block and in the presence of stable haemodynamic parameters. The bladder catheter was removed on the afternoon of the day of surgery as soon as an ice test check showed that there was no sacral-nerve block. Every two hours, the clinical parameters were recorded: non-invasive arterial pressure, heart rate, oxygen peripheral saturation using a pulse oximeter, urine output, pain intensity using the visual analogue scale (VAS), and the evaluation of the motor block. All parameters were recorded before and after ambulation on day of surgery (DAY 0). The minutes and metres of each ambulation were also recorded.

The readiness to discharge the patients from the hospital to home was determined according to standard criteria (tolerance of solid food, passage of stool, absence of infection and ambulation without assistance). A consultation with the medical team was scheduled 6 days after surgery. For up to thirty days following the hospital discharge, the medical team kept a record of the medical and surgical complications, and the rate of readmission. The primary outcome measurements were related to the postoperative recovery of ambulation. The following data were recording: demographic characteristics, ASA (American Society of Anaesthesiologists) class, Goldman Cardiac Risk Index, Goldman et al. [10], NYHA (New York Heart Association) class, type of surgery, intraoperative variables, postoperative motor block using the Bromage test (on a scale where a total motor block was 1 and the absence of a motor block was 4), postoperative recovery parameters of ambulation (defining time zero as the end of surgery), the visual analogue score (VAS) on a scale 0 to 100 (where 0 represents no pain and 100 the worst imaginable pain) at rest and upon moving and postoperative complications.

Table 1: Patient characteristics and anaesthetic and surgical features.

		number	%
Disease	aorto-iliac obstructive disease	8	6.2
	aortic or aorto-iliac aneurysm	122	93.8
Graft	aorto-aortic	70	53.85
	aorto-bisiliac	20	15.39
	aorto-bifemoral	27	20.77
	aorto-femoral-iliac	13	10
ASA risk	II	19	14.6
	III	70	53.9
	IV	41	31.5
Goldman risk	1	18	13.9
	2	99	76.1
	3	13	10
NYHA class	1	69	53.1
	2	45	34.6
	3	16	12.3
Chronic diseases	respiratory	80	61.5
	cardiac	70	53.9
	cerebrovascular	29	22.3
	renal	16	12.3
	diabetes	17	13.1
	hypertension	83	63.9
	hyperlipidaemia	57	43.9

Nominal variables were described by relative and absolute frequencies. Ordinal variables were described as medians with range. Variables considered to be continuous were described as the means and 95% CI (confidence interval). The data were analysed using Epi Info (CDC, Atlanta, GA, USA). The statistical analysis was performed using two-tailed Student's t-test for independent variables that are normally distributed. A p value of less than 0.05 was considered significant.

Results

From January 2009 to December 2011, we studied 130 patients, including 122 men and 8 women. Their ages ranged from 70 to 89 years (median 75.5, mean 76.1 with 95%CI=75.33-76.79): 76 patients

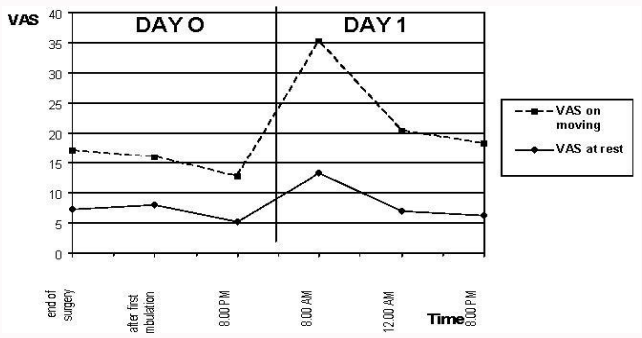

Figure 1: Pain control: evaluation with the visual analogue scale (scale 0 to 100).

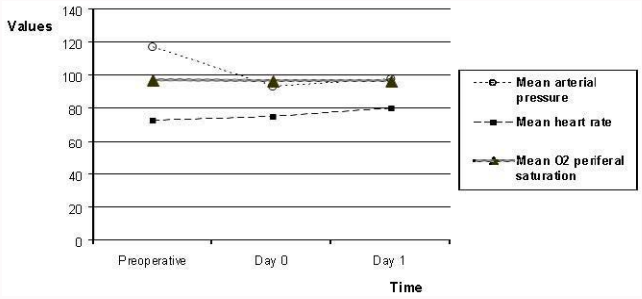

Figure 2: Haemodynamic parameters.

(58.5%) were older than 75 years.

The average body mass index was 25.1 (95%CI=24.61-25.57). The patient characteristics and the anaesthetic and surgical data are shown in (Table 1). A large number were high-risk patients: 85.4% had an ASA score of 3-4.

In all patients, the abdominal surgical approach was a left subcostal mininvasive incision. Only 3 (2.3%) patients required an enlargement in the bilateral subcostal incision because of anatomical difficulties. The mean duration of surgery was 145.4 minutes (95%CI 136.2-154.7). The mean blood loss was 796.9 ml (95%CI=705.1-888.6). In all patients, we used the cell saver, with an average of 430.7 ml (95%CI=375.8-485.5) of autologous blood transfusion; 18 patients received a homologous transfusion with 2 units of blood each, and 4 patients needed a plasma transfusion for intraoperative coagulation disorders, solved before the end of surgery.

At the end of the surgery, all patients were transferred to the surgical ward, where a skilled team of nurses assisted by an anaesthesiologist take care immediately of the patient. During the postoperative period, the pain control at rest and on walking was optimal (Figure 1).

A pain peak was observed at 8 am on the day after the surgical intervention. Only 24 patients (18.5%) needed a rescue dose of ketoprofen, which had a beneficial effect.

The postoperative sensory block (determined using the ice test) had an average extension from T3 (range: C3-T8) to L1 (range: T4-S4). Two hours after surgery, the motor block was minimal. As a consequence of the epidural blockade, there was a reduction of the mean arterial pressure of less than 30%, compared with the preoperative values. The haemodynamic parameters are shown in (Figure 2).

Table 2: Characteristics of first ambulation.

	mean	95% CI	p-value
Time of first ambulation (minutes)	175.2	145.3-205.2	
Mean arterial pressure before ambulation	92.3	90.1-94.5	0.63
Mean arterial pressure after ambulation	91.2	88.6-93.8	
Heart rate before ambulation	74.4	72.1-76.7	0.85
Heart rate after ambulation	73.9	71.4-76.4	
O2 peripheral saturation before ambulation	93.7	93.2-94.3	0.00034
O2 peripheral saturation after ambulation	95.6	95.1-96.0	

Table 3: Ambulation data.

		mean	95% CI
DAY 0	Minutes of ambulation	33.7	27.3-40.1
	Metres of ambulation	172.3	124.3-220.3
DAY 1	Minutes of ambulation	157.7	146.8-168.6
	Metres of ambulation	1130.3	884.7-1375.9

In the afternoon of the day of surgery 128 patients (98.5%) were able to ambulate; only 2 patients (1.5%) were unable to perform the protocol and ambulated the day after. The characteristics of the first ambulation are shown in (Table 2).

The haemodynamic parameters were stable; furthermore, a significant increase in the oxygen peripheral saturation was observed after the patients first got up. A first get-up failure affected six patients: four cases were caused by hypotension and two cases by lower limb weakness. In four patients, a return to bed and epidural infusion optimisation solved these symptoms, and a successful get-up was achieved after two hours. Persistent weakness did not allow two patients to ambulate until the morning after the surgery. The ambulation data are shown in (Table 3).

With a programme of enforced mobilisation, the patients were able to ambulate more than 1 kilometre on the day after surgery without dangerous haemodynamic effects.

Eight patients suffered episodes of vomiting, without affecting the postoperative programme. We registered the passage of stool a mean of 40.2 hours (SD 11.5) after surgery.

One patient (0.8%) died after surgery: this patient, suffering from severe coronary arteries disease, experienced angina two days after surgery, was transferred to the Intensive Cardiologic Unit and died twenty days later. The postoperative morbidity was 12.3%. No patient needed to be transferred to the Intensive Care Unit. Cardiac complications were investigated using an electrocardiogram and measurements of the level of plasma troponin I: one patient (0.8%) experienced an episode of atrial fibrillation, which resolved spontaneously. No pulmonary complications (investigated with chest-radiography) were recorded. Six patients (4.6%) exhibited a transient increase in the creatinine plasmatic level; one patient required three dialysis sessions. Four embolectomies (3.1%) were performed due to postoperative lower limb ischaemia (Figure 1). One patient previously affected by a distonia of colon, presented a progressive distension of right colon in second day after surgery and needed a right emicolectomy because of complicated megacolon disease. Four patients (3.1%) developed inguinal lymphorrhea, only one needed a new suture in groin side.

All patients were discharged home. The median day of discharge

was day 4 after the surgery (range 2-24), and the mean discharge time was 4.6 days (95% CI=3.9-5.29). Only two patients (1.5%) were readmitted within 30 days after discharge: one patient after 11 days because of inguinal lymphorrhea, and one patient after 20 days because of surgical abdominal wound dehiscence.

Discussion

A functional decline in elderly patients occurs after a few days of hospitalisation [11] and is linked to age, delirium, immobility and bed rest [7,12]. Bed rest is considered a potentially harmful measure in a large number of medical conditions [4]. Bed rest can cause several complications in the immediate and long-term periods: loss of skeletal muscle mass due to decreased basal protein synthesis, systemic inflammation, decreased insulin sensitivity, pulmonary atelectasis, reductions in blood and plasma volume and post-discharge decreased physical functioning [9,12-14].

Although traditional perioperative care involves bed rest, there is no evidence that it has any significant beneficial effect when used after surgery [3]. Conversely, complications often result from prolonged bed rest, especially in older patients [15]. Bed rest predisposes individuals to orthostatic intolerance and instability while standing up [16]. Immobilisation increases the risk of thromboembolism and atelectasis with pulmonary complications [6,16,17]. Postoperative hypoxaemia is more pronounced in the supine position with potential adverse effects on cardiac, cerebral and wound functions [18]. In surgery patients, changes in protein metabolism are pronounced due to stress-related hypercortisolaemia and produce a threefold greater loss of skeletal muscle mass than bed rest alone [8]. Conversely, early ambulation and mobilisation may contribute to the anticatabolic effect of epidural analgesia [19]. Moreover, early ambulation may improve wound healing [5] and contribute to the reduction of "trash foot" after abdominal aortic surgery [20].

Removing the hazard of hospitalisation requires interdisciplinary care that involves surgeons, anaesthesiologists and nurses, to improve the postoperative recovery after complex elective surgical procedures, particularly in elderly patients [1,6,21]. Enhanced recovery after surgery (ERAS) strategies includes stress-free anaesthesia, mininvasive techniques and postoperative enforced rehabilitation, such as early feeding and ambulation.

Abdominal aortic disease is characteristic of an aging population and often presents in patients with several cardiac, respiratory and renal impairments. These comorbidities have a significant effect on the outcome of subsequent aortic repair, characterised by perioperative mortality ranging from 4% to 8% and morbidity ranging from 15% to 30%. Traditional care after open aortic surgery includes a postoperative stay in the Intensive Care Unit (ICU) and an average hospital stay of 9 days [22,23].

A fast-tracking multidisciplinary programme reduces periprocedural complications and permits an immediate rehabilitation with early mobilisation and ambulation [2,22].

In our experience [25] , this aim has been pursued by mininvasive surgery, optimal pain relief and an accelerated postoperative recovery programme. A transverse left subcostal minilaparotomy was performed, which resulted in less wound traction, less pain and reduced respiratory impairment [24,25]. The patients received thoracic epidural anaesthesia and analgesia, which minimises motor blockade and thus facilitates early mobilization [26]. The postoperative care included an intensive nursing programme of muscular exercises in bed and encouragement to move round.

In our series, the patients walked for the first time after an average of three hours. The patients walked an average of 150 metres on the day of surgery and 1 kilometre the day after. Early mobilisation and ambulation did not cause problematic haemodynamic alterations. Only two patients got up later than the day of the surgery.

No variations on the heart rate and mean arterial pressure related to standing up were recorded. Interestingly, the oxygen peripheral saturation increased during the postoperative period after the first ambulation. Early mobilisation proved possible due to optimal pain relief, the absence of motor block and haemodynamic stability in the first 48 h after the surgical intervention.

We believe that early mobilisation contributed to the avoidance of pulmonary complications in these patients. No side effects due to early ambulation were observed. In contrast the patients enjoyed a fast resumption of their daily activities and showed a high degree of compliance. All patients were discharged to home an average of 4 days after surgery, and there were no readmission due to the early ambulation program.

However, a learning period of one year is required for the medical and nursing staff to apply this multidisciplinary protocol, which should be noted.

Conclusion

With a multidisciplinary approach, including mininvasive surgery, stress-free anaesthesia and an intensive nursing programme, early ambulation after abdominal aortic surgery is possible and safe and contributes to improved postoperative outcomes.

References

1. Aarts MA, Okrainec A, Glicksman A, Pearsall E, Victor JC, McLeod RS. Adoption of enhanced recovery after surgery (ERAS) strategies for colorectal surgery at academic teaching hospitals and impact on total length of hospital stay. Surg Endosc. 2012;26:442-50.
2. Brustia P, Renghi A, Fassiola A, Gramaglia L, Della Corte F, Cassatella R, et al. Fast-track approach in abdominal aortic surgery: left subcostal incision with blended anesthesia. Interact Cardiovasc Thorac Surg. 2007;6:60-4.
3. Briegher GH. Early ambulation. A study in the history of surgery. Ann Surg. 1983;197:443-9.
4. Allen C, Glasziou P, Del Mar C. Bed rest: a potentially harmful treatment needing more careful evaluation. Lancet. 1999;354(9186):1229-33.
5. Kehlet H. Multimodal approach to control postoperative pathophysiology and rehabilitation. Br J Anaesth. 1997;78(5):606-17.
6. Wilmore DW, Kehlet H. Management of patients in fast track surgery. BMJ. 2001;322(7284):473-6.
7. Vidan AMT, Sanchez Garcia E, Alonso Armesto M, Montero Errasquin B, Martinez de la Casa A, Ortiz FJ, et al. Functional decline during hospitalization in elderly patients. Benefits of admission to the geriatrics service. Rev Esp Geriatr Gerontol. 2008;43(3):133-8.
8. Ferrando AA, Paddon-Jones D, Wolfe RR. Bed rest and myopathies. Curr Opin Clin Nutr Metab Care. 2006;9(4):410-5.
9. Brower RG. Consequences of bed rest. Crit Care Med. 2009;37(10 Suppl):S422-8.
10. Goldman L, Caldera DL, Nussbaum SR, Southwick FS, Krogstad D, Murray B, et al. Multifactorial index of cardiac risk in noncardiac surgical procedures. N Engl J Med. 1977;297(16): 845-50.

11. Hirsch CH, Sommers L, Olsen A, Mullen L, Winograd CH. The natural history of functional morbidity in hospitalized older patients. J Am Geriatr Soc. 1990;38(12):1296-303.

12. Graf C. Functional decline in hospitalized older adults. Am J Nurs. 2006;106(1):58-67, quiz 67-8.

13. Gill TM, Allore H, Guo Z. The deleterious effects of bed rest among community-living older persons. J Gerontol A Biol Sci Med Sci. 2004;59(7):755-61.

14. Drummond MJ, Dickinson JM, Fry CS, Walker DK, Gundermann DM, Reidy PT, et al. Bed rest impairs skeletal muscle amino acid transporter expression, mTORC1 signaling, and protein synthesis in response to essential amino-acids in older adults. Am J Physiol Endocrinol Metab. 2012;302(9): E1113-E1122.

15. Harper CM, Lyles YM. Physiology and complications of bed rest. J Am Geriatr Soc. 1988;36(11):1047-54.

16. Carli F. Perioperative factors influencing surgical morbidity: what the anesthesiologist needs to know. Can J Anaesth. 1999;46(5 Pt 2):R70-9.

17. Von Rueden KT, Harris JR. Pulmonary dysfunction related to immobility in the trauma patient. AACN Clin Issues. 1995;6(2):212-28.

18. Mynster T, Jensen LM, Jensen FG, Kehlet H, Rosenberg J. The effect of posture on late postoperative oxygenation. Anaesthesia. 1996;51(3):225-7.

19. Carli F, Schricker T. Modulation of the catabolic response to surgery. Nutrition. 2000;16(9):777-80.

20. Kuhan G, Raptis S. 'Trash foot' following operations involving the abdominal aorta. Aust N Z J Surg. 1997;67(1):21-4.

21. Bardram L, Funch-Jensen P, Kelhet H. Rapid rehabilitation in elderly patients after laparoscopic colonic resection. Br J Surg. 2000;87(11):1540-5.

22. Moll FL, Powell JT, Fraedrich G, Verzini F, Haulon S, Waltham M, et al. Management of abdominal aortic aneurysms clinical practice guidelines of the European society for vascular surgery. Eur J Vasc Endovasc Surg. 2010;41:S1-S58.

23. Chaikof EL, Brewster DC, Dalman RL, Makaroun MS, Illig KA, Sicard GA, et al. The care of patients with abdominal aortic aneurysm: The Society for Vascular Surgery practice guidelines. J Vasc Surg. 2009;50:S2-S49.

24. Brustia P, Porta C. Left sub costal minilaparotomy in aortic surgery. Minerva Cardioangiol. 2001;49(1):91-7.

25. Brustia P, Renghi A, Aronici M, Gramaglia L, Porta C, Musiani A, et al. Fast-track in abdominal aortic surgery: experience in over 1,000 patients. Ann Vasc Surg. 2015;29(6):1151-9.

26. Carli F, Klubien K. Thoracic epidurals: is analgesia all we want? Can J Anaesth. 1999;46(5 Pt 1):409-14.