Fast-track approach in abdominal aortic surgery: left subcostal incision with blended anesthesia

Piero Brustia, Alessandra Renghi, Andrea Fassiola, Luca Gramaglia, Francesco Della Corte, Renato Cassatella, Andrea Cumino

Department of Vascular Surgery, ‘Maggiore della Carità’ Hospital, Corso Mazzini, 18-28100-Novara, Italy
Department of Anesthesiology and Intensive Care, ‘Maggiore della Carità’ Hospital, Novara, Italy

Received 6 June 2006; received in revised form 30 October 2006; accepted 1 November 2006

Abstract

Objective: The introduction of fast-tracking multidisciplinary programs allows good results in postoperative outcome in many surgical specialties. We evaluated a multimodal clinical program (based on miniminvasive surgery, epidural anesthesia and early mobilization and feeding) in abdominal aortic surgery. Methods: Between June 2000 and October 2005, 323 unselected patients were treated for atherosclerotic aorto-iliac occlusive disease (aorto-femoral bypass) and aortic or aorto-iliac aneurysm (aorto-aortic graft or aorto-iliac bifurcated graft). The infusion of bupivacaine 0.5% through an epidural catheter at T6-T7 interspace allowed sensory block between T4-S3. A light general anesthesia was performed using sevoflurane by a laryngeal mask in spontaneous breathing; no nasogastric tube was used. The patients were placed in dorsal decubitus; a transperitoneal access was performed with a left subcostal incision parallel to the costal edge and spread from the linea alba to the edge of the rectus muscle. The bowel was maintained inside the abdominal cavity and manipulated with care. Standard surgical instrumentation was used. No drains were placed. Patients were transferred to the surgical ward at the end of surgery; they were early mobilized and enforced to drink and to eat. Analgesia was achieved with a continuous epidural infusion of bupivacaine 0.25% supplemented by oral ibuprofen on request. Results: We observed a mortality rate of 2.5% and a low postoperative morbidity: 1.4% of cardiac complications, 3.7% of transient creatinine increase, and no pulmonary complications. All patients ambulated a mean of 536 m (95% CI: 81.4) on the day of surgery and 2544 m (95% CI: 208.9) the day after. They consumed an oral diet, 36.2% of their daily caloric requirement on the same day of surgery and 1583 Kcal (95% CI: 105.2) the day after (77% of daily caloric requirement). Median hospital stay was three days (range 2–21). All patients were discharged home. Conclusions: Our experience suggested that hospital stay and morbidity after abdominal aortic surgery can be decreased by performing a miniminvasive surgical approach, thoracic epidural anesthesia–analgesia and an aggressive postoperative nursing on the ward. Therefore, this multidisciplinary program can be proposed to all patients undergoing aortic surgery without prior selection, major technological investments and long-term surveillance. © 2007 Published by European Association for Cardio-Thoracic Surgery. All rights reserved.

Keywords: Aortic aneurysm; Abdominal surgical procedures; Minimally invasive; Perioperative care; Postoperative complications; Anesthesia; Epidural

1. Introduction

Pain, ileus, fatigue and postoperative morbidity could affect the resumption of daily life and the mean of hospital stay after surgery [1]. In the last decade general efforts have been attempted to introduce new surgical techniques and clinical pathways in aortic surgery aimed to improve outcome and to reduce costs [2,3].

The introduction of fast-tracking programs in many surgical specialties demonstrated to facilitate early rehabilita-

tion after major surgical procedures [4]. These programs are based on a multidisciplinary approach that includes minimally invasive surgical techniques, stress-free anesthesia and enforced postoperative rehabilitation, such as early feeding and in ambulation.

Our experience began in 1998, when our team tried out a new approach to perioperative care of patients who had undergone elective abdominal aortic surgery. A left substernal minilaparotomy [5], thoracic epidural anesthesia and analgesia and an enforced postoperative rehabilitation [6] were the most important features of this approach.

Since the year 2000 we introduced this standardized protocol for all the patients scheduled for elective abdominal aortic surgery: this study investigated the impact of a multidisciplinary clinical program on postoperative morbidity and hospital stay in a set of 323 unselected patients.

2. Materials and method

We carried out a retrospective study of 323 consecutive unselected patients, scheduled from June 2000–October 2005 for open abdominal aortic surgery for aneurysm or
obstructive disease. Emergencies, twenty patients treated with extraperitoneal approach and endovascular repairs (in our hospital, 12% per year of eligible patients for aortic surgery) were excluded. All patients were treated by the same surgical and anesthesiological team.

In order to create the right atmosphere for patients and families, and to obtain their full cooperation and participation to the protocol, all patients had a preoperative examination with the surgeon and the anesthesiologist with the aim to be informed about the procedures he would have followed in the perioperative period. All patients also received a written protocol explaining general information about their disease and the surgical intervention.

Premedication consisted of 0.1 mg/kg morphine intramuscularly administered 2 h before surgery. Once in the operating room, after insertion of two large bore venous cannulae in the forearms, ceftazidime 2 g, ketoprofen 100 mg and metoclopramide 10 mg i.v. were administered. Then a catheter was inserted in the radial artery to monitor invasive arterial blood pressure. To achieve sensory block (pin prick tested) between T4 and L5 dermatomes, an epidural catheter was placed at T6–T7 interspace and 15–25 ml of 0.5% bupivacaine were administered. The induction of a light general anesthesia was achieved with 0.1 mg/kg midazolam and 1 mg/kg propofol. A laryngeal mask was inserted and a ventilation with 80% oxygen was performed while maintaining patients in spontaneous breathing. Anesthesia was continued with 0.4 MAC sevoflurane. No curare was administered. An epidural infusion of 0.5% bupivacaine at a rate of 4–5 ml/h was maintained throughout surgery. A thermal blanket placed to keep the exposed parts of the upper body warm allowed to maintain patients normothermic. Cell-saver was routinely used.

The aortic bypass was performed through a transperitoneal access, as described previously [5]. A curvilinear left subcostal incision, parallel to the costal edge, 10–15 cm long was performed on a supine patient. Evisceration was not practiced; the bowel was manually moved to the right side inside the abdominal cavity without the use of self-retaining retractors. A usual access to the groin was practiced in order to perform aorto-bifemoral bypass. Standard surgical instrumentation was used to make anastomoses. Once the aortic graft was inserted, the abdominal wall was closed with no drains placed. No nasogastric tube was inserted.

All patients awakened in the operating room. At the end of surgery patients received 1 mg flumazenil i.v.; the laryngeal mask was removed and the patients were transferred to the surgical ward. Analgesia was achieved with a continuous epidural infusion of 0.25% bupivacaine at a rate of 3–6 ml/h for 48 h, supplemented by 600 mg ibuprofen orally administered every 8 h. Ketoprofen 100 mg i.v. was scheduled for additional demand of analgesia. No opioids were used. As soon as general conditions were stable, patients were encouraged to take sugared drinks; a semisolid diet was offered between two and six hours after surgery. Once the patients were able to drink freely with no nausea, i.v. fluids were discontinued. Metoclopramide, 10 mg, was orally administered every 8 h. In addition, all patients received misoprostol, 200 mg every 8 h, and 10 mg of vegetable fiber (apple pectin) twice daily. Patients were forced to perform breathing exercises while resting in bed. An oxygen mask was provided during the first two postoperative nights. Soon after surgery, patients were encouraged to start bed exercises and foot-pump. When in the absence of motor block and when in the presence of stable hemodynamic parameters, patients were forced to ambulate with assistance. Oral administration of salicylic acid 100–325 mg/day was started four hours after surgery. No heparin was administered. On the afternoon of the day of surgery, the bladder catheter was removed as soon as an ice-test showed that there was no more sacral-nerve block.

Every hour on the day of surgery and every two hours the day after, clinical parameters were recorded: non-invasive arterial pressure, heart rate, oxygen peripheral saturation with a pulse oxymeter, urine output, intensity of pain with Visual Analogue Scale, evaluation of motor block. Laboratory tests (including troponin I) were executed daily; a 12-lead electrocardiogram and a Rx-chest in the second postoperative day were performed. Quality and quantity of drinks and food consumed were recorded. Time (minutes) and distance (meters) of each in ambulation were recorded as well. Readiness for discharging patients home was determined according to standard criteria (tolerance to solid food, passage of stool, absence of infection and in ambulation without assistance). All patients were provided with details of the course of postoperative care; precise instructions to be followed when discharged home were given. A consultation with the medical team was scheduled for six days after operation. For up to thirty days following hospital discharge the medical team kept a record of medical and surgical complications, as well as the rate of readmission.

The following data were investigated and recorded: ASA (American Society of Anesthesiologists) class of risk, type of surgery, intraoperative variables, postoperative recovery parameters of feeding and in ambulation (defining the end of surgery as time zero), pain evaluation at rest and on moving with a Visual Analogue Scale (VAS) (representing 0 as no pain and 100 as the worst imaginable pain), demand for additional analgesia, time of bowel movements (defining the end of surgery as time zero), postoperative complications, hospital stay and readmission rate.

Nominal variables were described by relative and absolute frequencies. Ordinal variables were described as median with range. Variables considered to be continuous were described as mean ± 95% confidence interval (95% CI).

3. Results

We studied 323 patients: 294 males and 29 females. Median age was 70 years (range: 50–87 years). The mean body mass index was 25.1 (95% CI: 0.66). Patients’ features, anesthetic and surgical data are shown in Table 1.

All patients were treated with a left subcostal minimal incision as surgical approach; in 29 patients (9%) an enlargement of the surgical access to bilateral subcostal incision was needed because of technical troubles or anatomical difficulties. Intraoperative data are shown in Table 2. Allogenic blood transfusion was necessary in 34 patients (10.5%), with a mean of 794.2 ml (95% CI: 131.6) of blood;
Table 1
Surgical features

<table>
<thead>
<tr>
<th>Disease</th>
<th>No. of patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aorto-iliac obstructive disease</td>
<td>43</td>
<td>13.3</td>
</tr>
<tr>
<td>Aortic or aorto-iliac aneurysm</td>
<td>280</td>
<td>86.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Graft</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Aorto-aortic</td>
<td>192</td>
<td>59.4</td>
</tr>
<tr>
<td>Aorto-bifemoral</td>
<td>80</td>
<td>24.8</td>
</tr>
<tr>
<td>Aorto-femoral dx-iliac sx</td>
<td>12</td>
<td>3.7</td>
</tr>
<tr>
<td>Aorto-femoral sx-iliac dx</td>
<td>9</td>
<td>2.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASA risk</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>40</td>
<td>12.4</td>
</tr>
<tr>
<td>III</td>
<td>181</td>
<td>56.0</td>
</tr>
<tr>
<td>IV</td>
<td>102</td>
<td>31.6</td>
</tr>
</tbody>
</table>

Table 2
Intraoperative data

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of surgery (min)</td>
<td>157.8</td>
<td>6.0</td>
</tr>
<tr>
<td>Duration of clamp (min)</td>
<td>73.1</td>
<td>3.4</td>
</tr>
<tr>
<td>Blood loss (ml)</td>
<td>783.8</td>
<td>86.7</td>
</tr>
<tr>
<td>Intraoperative infusion (ml)</td>
<td>1641.8</td>
<td>83</td>
</tr>
<tr>
<td>Urinary output (ml/h)</td>
<td>167.2</td>
<td>23.4</td>
</tr>
</tbody>
</table>

Cell-saver blood was used in 145 patients (44.9%), with a mean of 513.6 ml (95% CI: 54.2) of blood.

VAS at rest and on moving in postoperative period result were low (Fig. 1).

Additional demands for analgesia were 56 (17.3% of patients) on the day of surgery, and 42 (13% of patients) on the first postoperative day. Residual motor block, requiring optimization of epidural infusion, was present in 69 patients (21.4%) during the first postoperative hour, as a result of the high concentration of local anesthetic used.

Table 3 shows data in postoperative period.

Most patients started to ambulate on the same evening of the day of surgery, and they were able to stay out of bed for a mean period of 2 h. A first get-up failure affected 25 patients (7.7%): 17 cases were caused by orthostatic hypotension and eight cases by lower limb weakness. In nine patients, returning to bed and the optimization of epidural infusion solved these symptoms and a successful get-up was achieved after 2 h; another 16 patients were able to walk the day after surgery. On the first postoperative day the mobilization time increased to an average of 7 h.

On the same day of surgery all patients but 37 (11.4%) were able to tolerate a semi-solid diet; they consumed solid food within 6 h after surgery. We calculated that the oral intake satisfied 36.2% of daily caloric requirement on the day of surgery and 77.2% on the day after. Forty-two patients (13%) suffered from nausea or vomiting on the day of surgery and 19 (5.9%) on the first postoperative day, although interruption of oral intake was not required. Only patients with renal complications were treated with intravenous fluids. The patients had passage of stools a mean of 41.6 h (95% CI: 2.4) after their operation.

Eight patients (2.5%) died: seven were transferred to the Intensive Care Unit (ICU). One patient died on the second day because of acute extended myocardial infarction; one patient died on day eight because of massive esophageal bleeding; three patients died because of bowel ischemia (on day 2, 3, 11); three patients died as a consequence of multiorgan failure (on day 1, 2, 16). Four patients (1.2%) suffered cardiac complications (investigated with measurements of troponin I and ECG). Two patients had arrhythmias (2 atrial fibrillation and 1 atrial flutter) during the first postoperative day, successfully treated with pharmacological therapy without requiring admission to ICU. One patient suffered non-transmural ischemia on day one: the patient (asymptomatic) refused ICU transfer; on day three, after...
pharmacological therapy, the patient’s parameters were normal and it was possible to get him discharged on day four. Transient renal failure that implies a prolonged hospital stay (from 8 to 12 days) was registered in 10 patients (3.1%). No pulmonary complications (0.0%, investigated with RX-chest) were recorded. One patient developed a secondary digital embolism (requiring a hospital stay of 11 days), with spontaneous restoration within one month. One psychiatric patient developed postoperative delirium and was discharged on day 21 with the intervention of caring professionals.

The largest number of patients (70.3%) were discharged home within the third postoperative day (Fig. 2). The discharges between 4th and 7th days were connected in most cases to difficulties in home care or to living a considerable distance from the hospital.

After discharging, five patients (1.6%) needed readmission to the hospital within 30 days: on day 28, one patient required surgical intervention as a consequence of bowel bridile; three patients because of inguinal lymphorrhrea (on day 7, 12, 26); one patient on day 26 because of a problem with vomiting.

4. Discussion

Abdominal aortic surgery is associated with significant perioperative morbidity (approx. 3–4%) and mortality (approx. 30–50%) [2,7]. This implies a delayed recovery, admission to ICU, and a hospital stay between 7–13 days [2,7,8].

In the last decade, general efforts have been made to introduce new surgical techniques and clinical pathways aimed to improve outcome and to reduce costs [2,3,9–11].

The introduction of ‘fast-track’ management, including minimvasive surgery, stress-free anesthesia and analgesia and enforced postoperative rehabilitation, has provided important possibilities for enhanced recovery after surgical procedures, also in aortic surgery [4,12]. It is not clear at present what is the relative importance of individual, surgical or anesthetic features, in the enhancement of recovery. Certainly, limited effects on postoperative morbidity and mortality may be obtained only when each variable has been controlled [1,13].

In our program, the surgical team performs a minimal transverse incision, with a transperitoneal access without practicing evisceration [5]. Mini-laparotomy is associated with less hemodynamic instability, fluid shift and hypothermia, inflammatory response and immunosuppression, pain and ileus [14,15]. In addition, transverse laparotomy produces lower traction on the wound edges, therefore, requiring less muscle relaxation, better pain relief and lower respiratory impairment [5,16]. Many published studies reported a shortening in hospital stay by using mini-laparotomy techniques; nevertheless all patients stayed in ICU for 24–48 h, resumed regular oral diet after 2 or 3 days and the morbidity rate did not change [17,18].

In our program we combine mini-laparotomy with intraoperative regional anesthesia (light general anesthesia plus thoracic epidural anesthesia) and continue postoperative epidural infusion. Attenuation of the catabolic component of the stress response, provision of excellent pain relief which facilitates mobilization, reduction of pulmonary, cardiac and thrombotic complications, faster recovery of intestinal function, improvement of substrate utilization after surgery, decrease of postoperative protein breakdown and preservation of tissue protein, are the most important advantages of thoracic epidural anesthesia and analgesia, already acknowledged by literature [19,20]. Epidural analgesia could improve postoperative immediate and long-term outcome [21]. Nevertheless, thoracic epidural anesthesia and postoperative analgesia per se do not reduce morbidity after abdominal aortic surgery [22,23].

All these observations might imply that postoperative recovery depends on many factors, such as surgical techniques, optimal pain relief, early nutrition, early mobilization and an omission of regimens which inhibit the recovery process (such as drains, nasogastric tube, bladder catheter). From the analysis of these data, the multidisciplinary approach seems to be rational and necessary to achieve a major impact on postoperative morbidity [1].

The findings of the present study suggest that recovery following open abdominal aortic surgery can be improved with the introduction of a multidisciplinary program. In our study, in the postoperative period patients were not admitted routinely to ICU; they were able to eat, ambulate and mobilize on the same day of surgery. Thoracic epidural analgesia with bupivacaine, 0.25%, combined with non-steroidal anti-inflammatory drugs resulted in optimal pain relief, with low VAS value and few additional demands for analgesic drugs. On the postoperative period we implemented early oral intake. On the day of surgery patients were able to intake orally nearly 1500 ml of fluid. Oral nutrition was easily accepted and tolerated even in the immediate period after surgery. Interestingly, on the first postoperative day patients could consume the 77% of daily caloric requirement. Similarly, all patients tolerated early mobilization, this being possible by an excellent pain relief and absence of recovery-inhibiting regimens (i.v. infusion, nasogastric tube, drains, bladder catheter). A few hours after surgery patients were able to ambulate more than 500 m and on the first postoperative day walked nearly
2 km. Furthermore, early feeding and early in ambulation may have improved gastrointestinal function and may have contributed to suppress respiratory complications [24,25]. As a result of this program, patients were discharged home during the second or third day on average. While we have not pointed out the cost savings, nevertheless, we calculated that a merely reduction in hospital stay saved €2,550 for a single patient. No side effects or hospital readmissions due to protocol were observed. On the contrary, patients enjoyed the resumption of their daily activities and showed a high degree of compliance.

This multidisciplinary program can be proposed to all patients undergoing aortic surgery without prior selection, major technological investments and long-term surveillance. Nevertheless, this multidisciplinary approach required a period of almost two years, during which medical and nursing staff worked closely with patients in revising their protocol and constructing a care plan for the whole perioperative phase. There are limitations within this study: in particular we did not investigate the value of the impact of single intervention (surgical or anesthesiological or rehabilitative) in postoperative outcome; furthermore, we did not consider a control group.

In conclusion, the results hereby presented suggest that a multidisciplinary approach including a revision of traditional surgical care program combined with optimal pain relief by continuous epidural analgesia, early oral nutrition and enforced mobilization, would enhance recovery and reduce the length of hospital stay after abdominal aortic surgery. Further large-scale studies are required to document the safety of early rehabilitation and to establish if such improvement is preserved over a longer period.

References


ICVTS on-line discussion A

Author: Narcis Hudorovic, University hospital Sestre milosrdnice, Zagreb 10000, Croatia
Email Narcis Hudorovic
doi:10.1510/icvts.2006.137562A

The authors stated that they have not pointed out the cost savings, and they only calculated that merely reducing hospital stay saved €2,550 for a single patient in a fast-tracking multidisciplinary program in patients who had undergone elective abdominal aortic surgery [1]. This retrospective population-based study shows that results of the fast-track approach for abdominal aortic surgery can be achieved in the “real world”. However, these findings highlight the need for continuous outcome monitoring and associated quality improvement efforts to ensure that all further health providers and institutions involved are achieving desired outcomes. For that reason this multidisciplinary program could be based on research commissioned by the National Coordinating Centre for Health Technology Assessment (NCCHTA). The purpose of the NCCHTA method is to ensure that high quality research information on the costs, effectiveness and cost-effectiveness (CE) is produced in the most effective way for those who use, manage and provide care in the National Health System (NHS). Furthermore, every year the NCCHTA decide which of the many suggestions received from NHS and its users should become research priorities. The main objective of such a study could be the diffusion of state of the art evidence without any mandatory role regarding guidelines implementation or rationing in health care. However, collected results could not be questionable in the sense that an improvement of the quality of life is dependent on the pre-procedural...