How-to-do-it

Thoracic epidural anesthesia for off-pump coronary artery bypass without intubation

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Abstract

Thoracic epidural anesthesia without intubation was used in 10 patients undergoing off-pump coronary artery reconstruction performed through median sternotomy. Considering the preoperative finding of impaired pulmonary function, all were moderate-risk patients for surgery using conventional general anesthesia with intubation. All patients had an uneventful postoperative course. In indicated cases, we regard thoracic epidural anesthesia as a suitable method again modifying the term ‘minimally invasive’ in cardiac surgery.

Keywords: Thoracic epidural anesthesia; Off-pump coronary artery surgery

1. Introduction

The term ‘minimally invasive’ in cardiac surgery should imply ‘minimal side effects’ for the patient [1]. Seen from this point of view, ‘minimally invasive’ could refer not only to non-use of extracorporeal circulation but, also, to avoidance of general anesthesia with intubation and, consequently, all the risks associated with this type of anesthesia. Thoracic epidural anesthesia (TEA) is used in some departments of cardiac surgery; however, a combination of general anesthesia with intubation and TEA is involved [2]. The benefits include, most importantly, earlier extubation, especially so in procedures ‘on the beating heart’ [3]. Coronary artery bypass grafting, using left or right anterior small thoracotomy in patients without endotracheal general anesthesia, was first reported by Karagoz et al. in 2000 [4]. Our article describes a technique of TEA without intubation for off-pump coronary artery bypass (OPCAB) grafting through conventional median sternotomy in moderate-risk patients because of impaired pulmonary function as assessed by pre-operative spirometry.

2. Patients and technique

From October 1999 through December 2000, we operated on 10 patients using TEA without intubation; OPCAB was performed in all. Their basic demographic data, results of preoperative spirometry, left ventricular ejection fraction, sites of distal anastomoses and left internal thoracic artery (LITA) usage are shown in Table 1.

Immediately before surgery, 15–20 ml of 0.5% bupivacaine (Marcain Astra, Sweden) was administered to the sitting patient, after locating epidural space, with access via midline in the region between thoracic vertebrae 2 and 3. Subsequently, an epidural catheter (20G with bullet tip, Pajunk, Germany) was advanced 5 cm cranially. Once the catheter had been fixed, the patient was placed horizontally and 1–1.5 ml sufentanil (Sufenta Janssen, Belgium) was administered into the catheter. Fifteen to 20 min after introducing the epidural catheter, patients started receiving small i.v. doses of general anesthetics so as not to block respiration but to allow painless catheter passage into the central venous bed, to remove venous grafts in the lower limbs, and to perform sternotomy with adequate amnesia. For this purpose, we used midazolam (Dormicum Hoffmann-La Roche, Switzerland) at single doses of 2.5 mg, and ketamine (Calypsol Gedeon Richter, Hungary) at single doses of 50 mg. The total intravenous dose of midazolam for the whole procedure was 5–10 mg, that of ketamine was 250–500 mg. The total doses of drugs delivered perioperatively into the
epidural catheter were 20–25 ml 0.5% bupivacaine and 2–3 ml sufentanil. Some of the patients experienced respiratory relief soon after the administration of the local anesthetic into epidural space, still before the administration of general anesthetics; no bronchospasm or bronchial hyperreactivity due to sympathetic blockade was observed. During surgery, we provided patients with oxygen face masks thus maintaining oxygen saturation levels consistently over 90%, as measured by pulse oximetry. Intraoperative blood gas values were determined by several collections of arterial blood from the radial artery (Fig. 1).

After sternotomy and graft harvesting, we sutured peripheral anastomoses using an Access Ultima System mechanical stabilizer (CardioThoracic Systems, Cupertino, USA); in some cases, an intraluminal Flo Coil Shunt (CardioThoracic Systems, Cupertino, USA) was used. The last five patients tolerated well LITA harvesting or short-term opening of the left pleural space, managed immediately by pleural suture and suction drainage. Chest and heart movement was not a major problem for an enthusiastic surgeon with enough experience with the OPCAB technique.

The epidural catheter was left in situ until the next day, with the administration of bupivacaine 0.5% 5 ml into the catheter filter at an interval of 4–6 h providing for good postoperative analgesia.

### 3. Results

The perioperative course of all patients was uneventful. No development of Horner’s syndrome (as the landmark of cervical sympathetic blockade) was observed. The somatosensory and motor block at T1 to T8 was achieved (with intercostal muscle paralysis) while adequate diaphragmatic respiration was preserved. There was no respiratory arrest, no patient was converted to general anesthesia with intubation.

None of the patients developed hemorrhagic complication or epidural compression caused by the use of low-dose heparin (1 mg/kg), despite the epidural puncture done directly before surgery; the careful and strictly atraumatic technique of epidural catheter placement was essential. TEA was not used in patients receiving aspirin for 5 days prior to surgery.

An initial drop in systemic blood pressure caused by vasodilatation in TEA was merely moderate and was controlled by i.v. administration of crystalloid/colloidal solution (500–1000 ml) or by repeated single doses of methoxamine (Vasoxine Glaxo Wellcome, UK) of up to 20 mg. The hemodynamic stability of TEA patients during manipulation with the heart did not vary from those under standard general anesthesia. The patients tolerated well Trendelenburg positioning. If this increase in preload failed to restore adequate hemodynamic values (mean arterial pressure >60 mmHg, mixed venous oxygen saturation >60%), repeated single i.v. shots of methoxamine or ephedrine (Ephedrin

<table>
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a DA, diagonal artery; EF, left ventricular ejection fraction; FEV₁,1-second forced expiratory volume; FVC, forced vital capacity; LAD, left anterior descending; LITA, left internal thoracic artery used as conduit; MEF 50, maximal expiratory flow in the middle of expirium; OM, obtuse marginal; PD, posterior descending; PEF, peak expiratory flow; RCA, right coronary artery.

![Fig. 1. Intraoperative and the first postoperative arterial blood gas results. Open circles represent PaO₂ and closed circles PaCO₂. Time 1 = before sternotomy; 2 = sternal retraction; 3 = 30 min after sternotomy; 4 = end of the procedure; 5 = the first post-op results.](https://academic.oup.com/ejcts/article/20/4/858/377588)
up to a total dose of 50 mg were used again. In two patients dobutamine (Dobutrex Lilly, Germany) 3–5 μg/kg per min was started, but there was no need for a pulmonary artery catheter.

Contact with the patients could be established immediately after the procedures (lasting 216 min on average), and their pulmonary and general rehabilitation could be initiated. The technique of TEA without intubation was subjectively tolerated well by all patients. The postoperative course was smooth with a maximum length of hospital stay 5 days.

4. Discussion

The above technique eliminates the potential pulmonary complications associated with general anesthesia plus intubation [5]. Our report shows the method may benefit even patients with impaired pulmonary function. None of our patients experienced deterioration of pulmonary disease; the latest five cases indicate that the method could allow for even complete revascularization with the use of arterial grafts. Our experience with all these first patients is excellent but, as with all new techniques, many questions arise (e.g. the actual benefit to the patient including improvement of ventilation-perfusion relationships [6] and a decrease in perioperative stress and troponin release [7], criteria for performing TEA procedure without intubation), which warrant future studies.

References