Thoracic Epidural Anesthesia for Cardiac Surgery: 
A Randomized Trial in 654 patients

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Background

Thoracic epidural anesthesia (TEA) during cardiac surgery promotes sympathicolysis, attenuates the stress response to surgery and may enhance coronary perfusion.\textsuperscript{1,2} TEA may therefore improve myocardial oxygen balance and reduce the incidence of tachyarrhythmias and perioperative myocardial infarction.\textsuperscript{1,3} Moreover, the excellent analgesia that is associated with TEA facilitates early tracheal extubation and may prevent respiratory complications.\textsuperscript{1,4,5} TEA in cardiac surgery, however, is controversial because the insertion of an epidural catheter in patients requiring full heparinization for cardiopulmonary bypass may lead to an epidural hematoma.\textsuperscript{6}

Most randomized controlled studies on TEA in cardiac surgery have compared TEA with traditional opioid-based general anesthesia (GA). Over the last two decades, however, fast-track cardiac anesthesia has gained widespread popularity. Like TEA, fast-track cardiac anesthesia facilitates early tracheal extubation and may decrease length of intensive care and hospital stay, but without the need to insert an epidural catheter.\textsuperscript{7,8}

Despite the apparent advantages of both techniques separately, few studies have directly compared TEA and fast-track cardiac anesthesia. We therefore designed a randomized controlled trial to compare the effect of fast-track GA with TEA versus fast-track GA alone on major complications in patients undergoing elective cardiac surgery.

Methods

The study was designed as a randomized clinical trial. Six hundred fifty-six patients were randomly assigned the day before surgery to the GA group or the combined GA and TEA group. Patients were eligible if scheduled for elective cardiac surgery. Exclusion criteria included severe aortic valve stenosis and preoperative impaired coagulation status. The local human research ethics committees of the two participating centers approved of the study, and written informed consent was obtained from all patients.

The primary endpoint was 30-day survival free from myocardial infarction, pulmonary complications, renal failure, and stroke. Secondary outcomes included the components of the primary endpoint separately, postoperative cardiac arrhythmias, postoperative cardiac enzyme
release, postoperative pain, duration of mechanical ventilation, length of stay in the ICU, and total length of stay in the hospital.

In the TEA group, the epidural catheter was inserted in the thoracic 2-3 or thoracic 3-4 intervertebral space. Before the start of GA, an epidural injection of 0.1 ml/kg was administered of a solution of 0.08 mg/ml morphine and 0.125 mg/ml bupivacaine, followed by a continuous infusion of 4-8 ml/h of the same solution. The GA technique for both groups consisted of 0.1-0.3 mg/kg etomidate, 0.15 mg/kg pancuronium, and 100-200 mcg remifentanil at induction, followed by a continuous infusion of 1-4 mg/kg/h propofol or 1-1.5% sevoflurane, and 0.01 mg/ kg/h remifentanil.

Postoperative analgesia in the TEA group was continued through the epidural catheter with continuous infusion of bupivacaine/morphine. The GA group received an injection of 0.2 mg/kg morphine 1 h before the end of the operation. In the ICU an infusion of 1-4 mg/h morphine was continued. The patients were extubated as soon as they met predefined extubation criteria. In the TEA group, the epidural catheter was removed before transfer to the general ward and after infusion of a 0.15-mg/kg morphine bolus.

Results*

Six hundred fifty-six patients were randomized, and 632 patients received the allocated treatment. Thirty-day survival free from myocardial infarction, pulmonary complications, renal failure, and stroke was 85.2% in the TEA group and 89.7% in the GA group (RR 0.95; P = 0.23). Thirty patients in the TEA group and 19 patients in the GA group had suffered a pulmonary complication (P = 0.12), and in both groups, 16 patients had a myocardial infarction (P = 0.98). Renal failure occurred in five patients in the GA group and in 12 patients in the TEA group (P = 0.14). Two patients in the TEA group and one patient in the GA group suffered a stroke (P = 0.56).

A total of 156 (48%) patients in the TEA group and 173 (53%) in the GA group developed supraventricular arrhythmia postoperatively (P = 0.24). Also, no significant difference of creatine kinase muscle-brain isoenzyme plasma concentration was found. The duration of mechanical ventilation, length of stay in the ICU, and total length of stay in the hospital were similar for both groups. Median pain scores on the first postoperative day were 2 in the TEA group and 3 in the GA group (P < 0.001).

Discussion

This randomized trial in 654 cardiac surgical patients could not confirm the benefits of TEA that were found in older studies. This might be explained by the fact that the older studies compared TEA with a light GA, to conventional anesthesia with high-dose, long-acting opioids. In contrast, the current study compared TEA with fast-track general cardiac anesthesia that is based on lower doses of short-acting opioids. The study showed that both anesthetic techniques offer the same benefits of early extubation and a low rate of pulmonary complications.

It has already been argued that although this study is the largest randomized trial of TEA in cardiac surgery to date, it was entirely predictable that we did not find a benefit of TEA. Although the primary endpoint was correctly estimated at approximately 15%, we powered
the study to find a 50% reduction in combined incidence of myocardial infarction, pulmonary complications, renal failure, and stroke. A 50% reduction in perioperative complications by using an epidural, however, is probably far too ambitious and instead of being “clinically relevant”, such a result would actually be fantastic and astounding.  

However, the study also failed to demonstrate a benefit of TEA on less important outcome measures such as time to extubation, ICU and hospital stay, and postoperative atrial fibrillation. The only benefit of TEA was a slightly lower pain score, but the pain scores were very low in both groups anyway. A decline in median pain score from 3 to 2 is probably not enough to justify the insertion of an epidural catheter.

In conclusion, we were unable to demonstrate a benefit of TEA on any clinically relevant outcome measure after elective cardiac surgery, compared with fast-track cardiac anesthesia without epidural anesthesia. Given the potentially devastating complications of an epidural hematoma after insertion of an epidural catheter, it is questionable whether this procedure should be applied routinely in cardiac surgical patients who require full heparinization.

* The results of this study have been recently published:

References


9. Royse CF. Epidurals for cardiac surgery: can we substantially reduce surgical morbidity or should we focus on quality of recovery? Anesthesiology 2011; 114:232–3