

Thoracic epidural analgesia for coronary artery surgery. A bridge too far?

We already know one another profoundly as human beings as we share the same goals: we all seek happiness and do not want suffering.

Dalai Lama

Worldwide close to 1 million patients a year undergo coronary artery bypass grafting (CABG). Current estimations of postoperative mortality and morbidity in the form of myocardial infarction following grafting are 1.7% and 2.4%, respectively [1]. Despite these impressively low figures they translate into a very unimpressive 17 000 deaths and 24 000 postoperative infarcts worldwide every single year. Can we do better?

One of the major worldwide controversies currently being debated amongst cardiac anaesthetists is whether thoracic epidural analgesia (TEA) improves outcome after CABG surgery and if so, is it safe to do so in view of the prerequisite for intraoperative iatrogenic coagulopathy. Current recommendations regarding thoracic epidural analgesia and CABG are notable for their absence. Clinical practice in North America reflects this controversy. A survey of cardiothoracic anaesthetists in the USA found that only 7% of anaesthetists incorporated an epidural into the management of adults undergoing cardiac surgery. Forty percent inserted the epidural before induction, 12% after induction, 33% after surgery and 15% on the first postoperative day [2]. International and national variations in current practice reflect the lack of consensus on this subject [3–5].

A recently published meta-analysis assessed whether there is any evidence for improved outcomes with thoracic epidural analgesia in CABG patients [6]. Fifteen trials involving 1178 patients were included in the meta-analysis which concluded that there were no differences in the rates of postoperative mortality or myocardial infarction after CABG with thoracic epidural analgesia. Whether this result is caused by insufficient power from a

limited sample size or by a true lack of treatment effect is unclear and this is acknowledged by the authors. However, there were faster times to extubation, reduced pulmonary morbidity, decreased incidence of cardiac dysrhythmias and lower postoperative pain scores. On the basis of these findings is thoracic epidural analgesia for CABG worth the risk?

Cardiac anaesthesia should ideally provide intraoperative cardiovascular stability together with a stable and pain free recovery, thereby maintaining a balance between myocardial oxygen supply and demand. In patients undergoing cardiac surgery, perioperative myocardial ischaemia is most commonly observed during the immediate postoperative period (25–38% incidence) and this is related to patient outcome [7,8]. It is recognized that inadequate analgesia and increased stress-response hormones (norepinephrine, epinephrine and cortisol) during the postoperative period may result in myocardial ischaemia, muscle catabolism, impaired immunity and haemostatic sequelae, such as platelet activation and impaired fibrinolysis [9–11].

Benefits of epidural analgesia in non-cardiac surgery

The perioperative use of epidural analgesia in non-cardiac surgery has been widely accepted as being beneficial. The benefits cited include reduced overall 30 day mortality and reduced incidences of deep venous thrombosis, pulmonary embolism, perioperative bleeding, postoperative bleeding, transfusion requirements and postoperative pneumonia. Other benefits include superior analgesia with reduced opioid requirement and associated reduction of opioid-related side-effects, such as sedation, respiratory depression, atelectasis, nausea and vomiting, pruritus, constipation and urinary retention [12].

Correspondence to: Damon Kamming, 190 Regents Park Road, London NW1 8XP, UK. E-mail: damonkamming@hotmail.com; Tel: +44 20 7722 8793

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Benefits of thoracic epidural analgesia in CABG

The perioperative use of thoracic epidural analgesia in patients undergoing CABG may reduce morbidity and mortality by attenuating the stress response from surgery, reducing sympathetic tone, blocking cardiac accelerator fibres and achieving excellent postoperative analgesia without the requirement for large doses of opioids [13]. Against this background, however, there is also some evidence for reduced morbidity and mortality with the aggressive use of a continuous infusion of intravenous (i.v.) opioids for postoperative pain [14]. However, a reduction in postoperative opioids has been shown to reduce the time to tracheal extubation and to decrease the incidence of postoperative pneumonia.

The benefits cited for thoracic epidural analgesia in CABG are as follows:

- Excellent postoperative analgesia and high patient satisfaction allowing for faster mobilization and opportunity for fast-tracking recovery.
- Opioid and general anaesthesia sparing effect of regional analgesia allowing earlier weaning from mechanical ventilation and subsequent tracheal extubation [15,16]. A large prospective randomized study showed the opiate sparing effect of thoracic epidurals to reduce postoperative confusion and postoperative respiratory complications [4]. Other reduced opioid side-effects including nausea and vomiting, pruritus, constipation and urinary retention can only be of benefit to the patient.
- Attenuation of the stress response to surgery [17].
- TEA with local anaesthetic may benefit cardiac surgical patients by blocking cardiac sympathetic nerve activity (T1–T5), thereby improving the myocardial oxygen supply–demand balance [18]. This may also improve the graft patency of the internal mammary artery, and improve flow in other ungrafted stenotic coronary arteries.
- A combination of attenuated stress response and thoracic cardiac sympathectomy may lead to better blood pressure (BP) control perioperatively.

Risks of thoracic epidural analgesia in CABG

As CABG surgery is already relatively safe is there any point in trying to improve matters when the risk of the procedure may far outweigh any proposed benefit. Remember 'first do no harm'. One small study comparing TEA against postoperative parenteral opioid analgesia demonstrated comparable clinical outcomes [19]. Another study found that although epidural analgesia allowed earlier weaning

from mechanical ventilation it did not affect hospital discharge time [16]. Also if the sympatholytic effect of thoracic epidural analgesia is proposed as an indication for thoracic epidural analgesia in CABG would perioperative beta blockade not be a safer and simpler alternative?

The main risks of thoracic epidural analgesia in CABG are as follows:

- Epidural haematoma may occur in the presence of systemic anticoagulation prerequisite for cardiac surgery on cardiopulmonary bypass (CPB) and may cause spinal cord compression with catastrophic irreversible neurological damage. The estimated incidence of haematoma formation after epidural instrumentation is approximately 1:150 000 in non-cardiac surgery. Almost 50% of all cases develop after catheter removal [20]. Epidurals have been safely used in patients undergoing vascular surgery although the degree of anticoagulation is not as great as in cardiac surgery [21]. Different methods of limiting the risk involve selecting only those patients with normal coagulation function and either inserting the epidural at least 1 h before systemic heparinization or insertion postoperatively after the demonstration of a normal activated clotting time. In the event of a bloody tap on a patient having an epidural sited preoperatively it has been suggested that it would be prudent to delay surgery for 24 h which has significant moral, organizational and financial implications [20]. Every patient should be closely monitored postoperatively using a standard protocol to assess any symptoms or signs of spinal cord compression. It has been suggested that adherence to a set of standard safety measures may avert the occurrence of symptomatic epidural haematomas. A recent case report supports this and concludes that for good neurological recovery to be possible after an epidural haematoma a prompt diagnosis must be made immediately followed by effective surgical intervention in the form of a decompressive laminectomy [22]. The current estimated risk of spinal haematoma associated with thoracic epidural analgesia in CABG has been calculated as being 1:1500 [23]. This is a 100-fold increased risk compared with the non-cardiac patient population.
- Hypotension from excessive sympathetic blockade is relatively common when epidural local anaesthetics are used in the setting of cardiac surgery [24]. This may compromise coronary perfusion, spinal cord perfusion and cerebral perfusion pressure [25]. Volume replacement and vasoconstrictors are required in 50–90% of these patients [26]. Vasoconstrictor dependence may delay discharge to a ward-based environment. Persistent hypotension

resulting in increased fluid loading may also be detrimental in congestive cardiac failure.

- Bradycardia and myocardial depression may also result from extensive sympathetic blockade [27]. This may increase the requirement for postoperative pacing with its attendant risks.
- Thoracic spinal cord injury may occur if epidural insertion is difficult.
- Potential for system errors including inadvertent i.v. injection of local anaesthetic and also inadvertent epidural injection of i.v. agents.
- Epidural abscess formation. The incidence has been reported as being as high as 1 : 800 in non-obstetric epidurals if the catheter is left in longer than 48 h [28].
- Failure of technique. Epidurals have failed to achieve adequate analgesia in between 33% and 50% of patients in two large studies [29,30]. This fact prompts the question of whether you would expose a patient to all of the above risks, if there is a 50% chance of the intervention being unsuccessful during the postoperative period.

What to do? Imagine yourself in your patient's shoes

The meta-analysis failed to detect a difference in the rates of mortality or myocardial infarction after CABG with TEA in the fifteen trials included. It has to be remembered that as the numbers of patients involved in each study were small a significant clinical difference may not have been demonstrated. It should be noted however that faster times to tracheal extubation, decreased pulmonary complications, reduced postoperative dysrhythmias and pain scores were demonstrated. The world awaits a well-designed large international randomized prospective multi-centre study to confirm or contradict the findings from this interesting meta-analysis. In the meantime if you were the patient (which some of us may be in years to come) what would you want?

Conclusion

Strong consideration should be made toward the setting up of an international database of complications relating specifically to thoracic epidurals in cardiac surgery as this would go a long way to quantifying the real and present danger that this technique presents to our patients. National and international guidelines could then be developed based on evidence, experience and consensus as opposed to apocryphal stories or a few random case reports.

Until such time as we can accurately quantify the added risk to the patient of a devastating spinal cord compression complication, a decision to insert a thoracic epidural in a patient for cardiac surgery

should be made very carefully. The risk–benefit ratio should be assessed for each individual patient. In short, are the suggested benefits worth the risk in your specific patient?

Fully informed consent should be an integral part of the decision. The patient should be warned of the risk of epidural haematoma being 1 : 1500 (100-fold higher than the non-cardiac patient population), the risk of epidural abscess being 1 : 800, the risk of dural puncture being 1 : 200 and the risk of epidural failure being 1 : 2.

If the patient agrees to thoracic epidural analgesia for CABG and the decision is made to proceed, then it is essential that postoperative thoracic epidural management be protocol driven in order that nursing staff can identify potential neurological damage secondary to epidural haematoma or abscess formation. Finally, full provision should also be made for epidural failure, as this is not an uncommon occurrence post-operatively leaving the patient suffering without any effective analgesia and completely negating any advantage for placing the epidural in the first place. Only then will the patient, anaesthetist and surgeon sleep soundly in their own beds at night.

D. Kamming
Specialist Registrar in Anaesthesia
University College London Hospitals
NHS Foundation Trust
London, UK

W. Davies
Consultant Anaesthetist
University College London Hospitals
NHS Foundation Trust
London, UK

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