Combined Epidural v/s General Anaesthesia (CEGA) alone in Vascular Surgery

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The role of regional techniques, primarily epidural anaesthesia, in the anaesthetic management of aortic surgery patients is still a subject of discussion. As opposed to general anaesthesia alone, many clinicians use an epidural catheter for intraoperative anaesthesia and postoperative pain management in combination with a general anaesthetic, sufficient to produce unconsciousness, amnesia, and tolerance of the endotracheal tube. Epidural anaesthesia has been used as the sole anesthetic for infrarenal surgery performed through the retroperitoneal approach, and CSEA in open abdominal aortic aneurysm surgery in patients with severe chronic pulmonary obstructive disease (1).

The advantages of regional anaesthesia are claimed to be improved postoperative pulmonary function with shorter time to extubation, possibly a reduction in pulmonary infections, and superior postoperative pain control compared with systemic opioids, a reduced incidence of deep venous thrombosis and pulmonary embolism, and reduction in postoperative gastrointestinal ileus (2, 3, 4).

Among the physiological effects of regional anaesthesia, a possible decrease in the postoperative stress response, a decrease in postoperative hypercoagulability, a possible increase in myocardial oxygen delivery, and decrease in oxygen consumption could potentially have beneficial effects on cardiac morbidity (5, 6).

Aortic Surgery

1a. Cardiovascular Complications

Major vascular surgery is typically considered to be a high-risk procedure. The incidence of perioperative myocardial infarction is 5 – 10 (7). Contributing factors are increased sympathetic nervous system activity, which increases myocardial oxygen demand by increasing heart rate, arterial blood pressure, and contractility. In addition, sympathetic activation may enhance perioperative hypercoagulability, which may contribute to perioperative coronary thrombosis or vasospasm, thus reducing myocardial oxygen supply (8, 9).

Experimental data suggest that thoracic epidural anaesthesia with local anaesthetics can reduce sympathetic activation and provide a favourable balance of myocardial oxygen. In humans, thoracic epidural anaesthesia may increase myocardial oxygen supply by selectively increasing the diameter of stenotic epicardial coronary arteries in patients with coronary artery disease, while maintaining coronary perfusion pressure even in the presence of sympathetic stimulation (10).
In addition to improving myocardial oxygen supply, thoracic epidural anaesthesia may decrease myocardial oxygen demand by decreasing pain, heart rate, and systemic vascular resistance. The combination of reduced sympathetic activity, improved oxygen supply, and decreased demand may explain the successful ability of thoracic epidural anaesthesia to treat medically refractory angina (11). Of note might be an experimental study showing that TEA inhibited the positive inotropic response of the right ventricle to increased afterload, which deteriorated the hemodynamic effects of pulmonary hypertension (12). Lumbar epidural anaesthesia may not provide the same physiologic benefits as thoracic epidural anaesthesia.

Experimental studies have reported a compensatory increase in sympathetic activity above the level of blockade for lumbar epidural analgesia (LEA) (13) and clinical studies have noted increased incidences of left ventricular wall dysfunction with lumbar versus thoracic epidural anaesthesia.

RCT's

In early studies some investigators have reported a decrease in myocardial ischaemia and/or cardiovascular complications after vascular surgery with the use of epidural anaesthesia/analgesia (14, 15), whereas others have not (16, 17). Use of the epidural catheter during operation or exact location of the catheter is not described in all trials, the local anaesthetics mixtures are possibly dilute or solely opioids and the results are mainly describing the postoperative course of analgesia and not the intraoperative use of epidural catheter.

In a double-blind, good-quality efficacy trial of patients undergoing abdominal aortic surgery, investigators randomly assigned patients to 1 of 4 combined anaesthetic and analgesic protocols (18). The trial standardized the entire procedure of anaesthesia and pain management to optimize efficacy in all 4 groups. The primary outcome measure was length of stay; secondary outcomes included postoperative pulmonary complications. Sample sizes were small (37, 38, 39 and 46 participants, respectively), and median length of stay (7 to 8 days for all groups) or postoperative pulmonary complication rates did not differ among the groups. Postoperative outcomes were similar among the four treatment groups with respect to death, myocardial infarction, myocardial ischaemia, reoperation, pneumonia, and renal failure. Epidural patient-controlled analgesia was associated with a significantly shorter time to extubation (P = 0.002). Strengths of the trial include the double-blind design and equally highly standardized protocols for both anaesthesia and analgesia (19, 20). Potential weaknesses, regarding prevention of postoperative pulmonary complication, include length of stay as the primary outcome measure and small sample size (21,22).

Meta-Analysis

An earlier meta-analysis (2001) by Beattie et al (23) more specifically examined use of postoperative epidural analgesia for mixed surgical procedures for 24 h or more after surgery. This meta-analysis identified 11 RCT's (through 1998) with 1173 patients undergoing mixed but primarily major vascular surgery. The incidence of mortality was not significantly reduced with epidural analgesia (3.1% vs 4.4%, P=0.3). Subsequently 9 RCT's with 632 patients were used for sub-analysis
of myocardial infarction, which was significantly lower in those who received epidural analgesia (rate difference 3.8% with 95% CI of 7.4% to 0.2%; P=0.049). This subgroup analysis on myocardial infarction was performed almost exclusively on vascular surgery patients (579 of 632 patients), and revealed that TEA but not LEA provided a significant reduction in the rate of myocardial infarction (3.6% vs 8.5%, rate difference 5.3% with 95% CI of 9.9% to 0.7%).

The VACS trial (24) did not note a significant reduction in cardiovascular complications (myocardial infarction, heart failure, dysrhythmias, severe hypotension) with use of epidural morphine (8.6% vs 11.2%) for all patients. However, the abdominal aortic surgery subgroup (n = 374) had significantly lower incidences of cardiovascular complications (9.8% vs 17.9%, P= 0.03) primarily because of reduction in myocardial infarction (2.7% vs 7.9%, P= 0.05). This finding was somewhat unexpected, as patients received only epidural morphine and no local anaesthetics for postoperative analgesia.

The MASTER trial (25) also did not observe cardiovascular benefit from epidural analgesia (2.6% vs 2.4%) but was limited by poor protocol compliance in the epidural group, as only 225/447 patients fully completed the protocol. A subgroup analysis of aortic surgery patients (η=164) was performed but no significant differences in cardiovascular complications were noted (4.5% vs 4.7%) (26).

In a recent more procedure-specific Cochrane Library meta-analysis of open abdominal aortic surgery (27) 13 RCTs with 1.224 patients randomized to epidural analgesia versus systemic opioid (through June 2004) were analyzed. Significant reduction in the risk of cardiovascular complications (RR 0.74 with 95% CI 0.56-0.97) and myocardial infarction (RR 0.52 with 95 CI 0.29-0.93) with epidural versus systemic analgesia was observed. Subgroup analysis again indicated that only TEA and not LEA was associated with reduced risk of myocardial infarction. These findings would support the experimental data demonstrating physiologic cardiac benefits of TEA but not necessarily LEA. Mortality rates were similar between groups (3.5% v/s 4.3%) in this and earlier studies, but insufficient subject numbers to assess mortality was acknowledged.

In summary there is consistent evidence that TEA may reduce the risk of cardiovascular complications, especially myocardial infarction, in patients undergoing major vascular surgery. This is likely due to a higher underlying rate of cardiovascular complications after major vascular surgery and the high-risk population (28).

Ib. Epidural Anaesthesia / Analgesia and Pulmonary Function

Major abdominal and thoracic surgery often induces postoperative pulmonary dysfunction. Pain-free patients may overcome respiratory dysfunction more easily. Recent large-scale meta-analyses have clearly demonstrated the advantages of thoracic epidural anaesthesia /analgesia (TEA) vs. parenteral opioid analgesia with regard to the effectiveness of postoperative pain control (29, 30). However several effects of surgery and general anaesthesia on diaphragmatic function are not directly related to pain and analgesia. More recent studies have suggested a reflex inhibition of phrenic nerve or diaphragmatic activation. In addition, changes in chest wall compliance may result in pulmonary dysfunction. Epidural anaesthesia may block the inhibitory reflex and may result in an
improvement in diaphragmatic and pulmonary function. Overall, high thoracic epidural anaesthesia seems not to affect lung function more in patients with COPD and bronchial hyper reactivity than in patients free from respiratory diseases. Although epidural anaesthesia alone can reduce lung function, and in gross overdose even block the function of the diaphragm, the overall effect with respect to the systemic effects of the local anaesthetics leads to an improvement in postoperative lung function and a reduction in postoperative pulmonary complications. Thus, the effect of epidural anaesthesia improves postoperative VC and FRC, provides better analgesia than any other technique, and reduces the rate of postoperative pulmonary complications (31).

In 1997, the first meta-analysis on pulmonary outcome depending on analgesic regimen showed that, in a mixed surgical population, epidural analgesia with local anaesthetics reduced pulmonary infections to a third, and overall pulmonary complications to about a half, of the infections and complications under systemic analgesia (32). This analysis was followed in 2000 by an even larger meta-analysis, looking at 141 randomized trials, with almost 10,000 patients, analyzing the effects of regional anaesthesia on perioperative morbidity and mortality. As well as other effects, these researchers found a reduction in postoperative pneumonia of 39% of the rate under epidural anaesthesia compared with a systemic analgesic regimen, and a reduction in mortality of about one third (33).

In the above mentioned Cochrane review, in open abdominal aortic surgery (27) the epidural analgesia group showed significantly lower visual analogue scale for pain on movement (up to postoperative day three), regardless of the site of epidural catheter and epidural formulation. Postoperative duration of tracheal intubation and mechanical ventilation was significantly shorter by about 20% in the epidural analgesia group. The occurrence of prolonged postoperative mechanical ventilation, overall cardiac complication, myocardial infarction, gastric complication and renal complication was also reduced by epidural analgesia, especially thoracic.

Ic. Other Advantages

Experimental and clinical studies have demonstrated that TEA may be useful in providing protection against splanchnic hypoperfusion during ischaemia and reperfusion. The intraoperative stress response and blood loss were decreased and the duration of postoperative ileus was shortened. However, these observations are only valid for blocking sympathetic nerve fibres on a mid – thoracic level (Th5 - Th10). In contrast, lumbar epidural block does not have favourable effects on intestinal perfusion and motility (33, 34). Thoracic epidural anaesthesia may improve intraoperative tissue oxygen tension outside the area of the epidural block, and possibly blunts generalized vasoconstriction caused by surgical stress and adrenergic responses (35).

Although epidural analgesia per se minimally impacts fast-track surgery, as a component of multimodal management strategy it can provide superior analgesia and physiologic advantages that facilitate attainment of clinical pathway goals after major surgery (36, 37).
Endovascular Surgery (EVAR)

In a retrospective study the cardiopulmonary morbidity and mortality rates after endovascular abdominal aortic aneurysm (EAAA) repair with local anaesthesia (LA) with intravenous sedation versus general anaesthesia (GA) was compared, and no difference was found (38).

From July 1997 to August 2004, 5,557 patients who underwent EVAR repair in 164 centers were enrolled in the EUROSTAR registry (39). Data were compared among three groups: a general anesthesia group (GA-G) of 3,848 patients (69), a regional anesthesia group (RA-G) of 1,399 patients (25), and the local anesthesia group (LA-G) of 310 patients (6). The duration of the operation was reduced in the LA-G, compared with the RA-G and GA-G. Admission to the intensive care unit was significantly less for LA-G patients (2) than RA-G and GA-G, but RA-G still had a distinct advantage (P < .0001) over GA-G. Hospital stay was significantly shorter in LA-G, v/s GA-G, but RA-G still had an advantage (P < .0001) v/s GA-G (6.2 vs. 8.5 days). Systemic complications were significantly lower both for LA-G (6.6) and RA-G (9.5), than for GA-G (13.0). Thus the EUROSTAR data indicate that patients appeared to benefit when a loco-regional anaesthetic technique was used for EVAR, even though there was no reference on the Nr of LA's who were converted to GA's and the bigger Nr of LA's were performed in one center.

Peripheral Vascular Surgery

Most studies have demonstrated that there is no significant difference in cardiac outcome between general and regional anaesthetic techniques. Bode et al (40) conducted a prospective, randomized controlled clinical trial involving 423 patients. They were randomly assigned to receive general, epidural, or spinal anaesthesia for femoral to distal artery bypass surgery. The recorded cardiac outcomes were MI, angina, and congestive heart failure (CHF). There was no statistically significant difference cardiovascular morbidity and mortality between the groups. Christopherson et al (41) performed a randomized, controlled clinical trial involving 100 patients scheduled for elective peripheral vascular surgery. They were randomized to receive either epidural anaesthesia followed by epidural analgesia or GA followed by intravenous patient-controlled analgesia (PCA). They reported no significant differences in 6-month mortality, cardiac-related mortality, non-fatal MI, or unstable angina. Sprung et al (42) conducted a retrospective analysis of risk factors for MI and cardiac mortality after major vascular surgery using the Vascular Surgery Registry at the Cleveland Clinic. Of 6,948 procedures performed, 107 patients were identified as having suffered a PMI during the same hospital stay. GA, in contrast to neuraxial blockade, was a significant predictor of PMI by univariate analysis but not by multivariate analysis. Additionally, the likelihood of cardiac death was not related to the type of anaesthetic technique used. Continuous spinal anaesthesia (CSA) has been compared with single shot spinal anaesthesia (SS) in peripheral vascular surgery. The described technique offered good haemodynamic control, ease of maintaining spinal anaesthesia, and ease of providing a new spinal block for revision. The combination of low-dose ropivacaine and morphine for CSPA did not offer any benefit compared with the higher ropivacaine dose alone (43). In another study comparing CSA with SS for vascular surgery of the legs, no difference in the haemodynamic response to SS or CSA was found. SS is easier to apply and is recommended when
the duration of surgery allows for it (1). Compared with general anaesthesia, combined sciatic and femoral nerve blocks reduce the frequency of intraoperative myocardial ischemia in patients undergoing lower extremity vascular surgery (45).

No distinct advantage is apparent between regional and general anaesthesia, when considering perioperative cardiac morbidity and mortality in peripheral vascular surgery. However, there is some evidence to support regional anaesthesia over general anaesthesia in an effort to optimize graft patency if the regional technique is extended into the postoperative period to provide neuraxial analgesia (41).

References


