

Best evidence topic - Thoracic non-oncologic

In patients undergoing thoracic surgery is paravertebral block as effective as epidural analgesia for pain management?

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Abstract

A best evidence topic in cardiac surgery was written according to a structured protocol. The question addressed was: in patients undergoing thoracic surgery is paravertebral block (PVB) as effective as epidural analgesia for pain management? Altogether >184 papers were found using the reported search, seven of which represented the best evidence to answer the clinical question. All studies agreed that PVB is at least as effective as epidural analgesia for pain control post-thoracotomy. In one paper, the visual analogue pain score (VAS) at rest and on cough was significantly lower in the paravertebral group ($P=0.02$ and 0.0001 , respectively). Pulmonary function, as assessed by peak expiratory flow rate (PEFR), was significantly better preserved in the paravertebral group. The lowest PEFR as a fraction of preoperative control was 0.73 in the paravertebral group in contrast with 0.54 in the epidural group ($P<0.004$). Oximetric recordings were better in the paravertebral group (96%) compared to the epidural group (95%) ($P=0.0001$). Another article reported that statistically significant differences (forced vital capacity 46.8% for PVB and 39.3% for epidural group $P<0.05$; forced expiratory volume in 1 s (FEV₁) 48.4% in PVB group and 35.9% in epidural group, $P<0.05$) were reached in day 2 and continued until day 3. Plasma concentrations of cortisol, as marker of postoperative stress, increased markedly in both groups, but the increment was statistically different in favour of the paravertebral group ($P=0.003$). Epidural block was associated with frequent side-effects [urinary retention (42%), nausea (22%), itching (22%) and hypotension (3%) and, rarely, respiratory depression (0.07%)]. Additionally, it prolonged operative time and was associated with technical failure or displacement (8%). Epidurals were also related to a higher complication rate (atelectasis/pneumonia) compared to the PVB (2 vs. 0). PVB was found to be of equal efficacy to epidural anaesthesia, but with a favourable side effect profile, and lower complication rate. The reduced rate of complication was most marked for pulmonary complications and is accompanied by quicker return to normal pulmonary function. We conclude intercostal analgesia, in the form of PVB, can be at least as effective as epidural analgesia. © 2010 Published by European Association for Cardio-Thoracic Surgery. All rights reserved.

Keywords: Intercostal analgesia; Epidural analgesia

1. Introduction

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

2. Three-part question

In [patients undergoing thoracic surgery] is [paravertebral block] as effective as [epidural analgesia] for [pain management]?

3. Clinical scenario

You are in theatre about to perform a procedure requiring a thoracotomy. The anaesthetist wants to insert an epidural catheter for analgesia but you are worried about possible complications and would prefer a paravertebral block (PVB). He contends that epidural remains the gold standard to compare other pain relief modalities. You resolve to check the literature yourself.

4. Search strategy

Medline 1950 to August 2009 using OVID interface [postthoracotomy.mp OR thoracotomy.mp] AND [paravertebral.mp] AND [epidural.mp].

5. Search outcome

One hundred and eighty-four papers were found using the reported search. From these seven papers were identified, that provided the best evidence to answer the question. These are presented in Table 1.

6. Results

Joshi et al. [2] conducted a systematic review of data between 1966 and May 2004. Seven articles specifically dealt with paravertebral analgesia techniques vs. epidural analgesia. Scatter-plot analysis of pain scores among studies demonstrated that, overall, continuous PVB was as effective as thoracic epidural analgesia with local anaesthetic (both with or without opioid) at day 1, whereas when opioid was added to local anaesthetic in either or

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Table 1
Best evidence papers

Author, date and country Study type (level of evidence)	Patient group	Outcomes	Key results	Comments
Joshi et al., (2008), Anaesthe Analg, USA, [2] Systematic review (level 1a)	64 randomised trials were included in the review 171 patients in 7 trials specifically looked to evaluate paravertebral analgesia compared to epidural analgesia	Primary outcome measures were postoperative pain scores, analgesic use and complication rate	Continuous PVB was as effective as thoracic epidural analgesia with local anaesthetic but was associated with a reduced incidence of hypotension PVB reduced the incidence of pulmonary complications	Thoracic epidural analgesia with LA plus opioid or continuous PVB with LA can be recommended
Davies et al., (2006), Br J Anaesth, Australia, [3] Meta-analysis of randomised trials (level 1a)	520 patients from 10 trials	Pain scores Pulmonary complications Complications	There was no significant difference between paravertebral and epidural groups for pain scores at 4–8, 24 or 48 h, weighted mean difference 0.37 (95% CI: –0.5, 121), 0.05 (–0.6, 0.7), –0.04 (–0.4, 0.3), respectively Pulmonary complications occurred less often with paravertebral analgesia, OR 0.36 (0.14, 0.92) Urinary retention, OR 0.23 (0.10, 0.51), nausea and vomiting, OR 0.47 (0.24, 0.53), and hypotension, OR 0.23 (0.11, 0.48), were less common with paravertebral analgesia. Rates of failed block were lower in paravertebral analgesia group, OR 0.28 (0.2, 0.6)	Paravertebral and epidural analgesia provide comparable pain relief after thoracic surgery, but paravertebral analgesia has a better side-effect profile and is associated with a reduction in pulmonary complications
Detterbeck, (2005), Ann Thorac Surg, USA, [4] Systematic review (level 1a)	619 patients from 17 trials	Pain control Respiratory function preservation Complications	It was as good if not better in the paravertebral group All studies except one found a better preservation of the FEV ₁ Epidural block was associated with frequent side-effects [urinary retention (42%), nausea (22%), itching (22%) and hypotension (3%) and rarely respiratory depression (0.07%)]. Additionally, it prolonged operative time and was associated with technical failure or displacement (8%)	PVB is as good as epidural analgesia if not better, with fewer side effects
Richardson et al., (1999), Br J Anaesth, UK, [5] Prospective randomized trial (level 1b)	100 adult patients	Pain control Pulmonary function	The VAS at rest and on cough was significantly lower in the paravertebral group ($P=0.02$ and 0.0001, respectively) Pulmonary function, as assessed by PEFR, was significantly better preserved in the paravertebral group. The lowest PEFR as a fraction of preoperative control was 0.73 in the paravertebral group in contrast with 0.54 in the epidural group ($P<0.004$)	PVB is as effective as epidural and better in terms of pulmonary function, neuroendocrine stress response and side effects

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Table 1 (Continued)

Author, date and country Study type (level of evidence)	Patient group	Outcomes	Key results	Comments
Kaiser et al., (1998), Ann Thorac Surg, Switzerland, [6] Prospective randomized trial (level 1b)	30 patients were evaluated for extra- pleural vs. epidural analgesia post- thoracotomy	Oximetry	Oximetric recording were better in the paravertebral group (96%) compared to the epidural group (95%) ($P=0.0001$)	Extrapleural intercostal analgesia is a valuable alternate to epidural analgesia
		Plasma cortisol concentration	Plasma concentrations of cortisol increased markedly in both groups, but the increment was statistically different in favour of the paravertebral group ($P=0.003$)	
		Hypotension	Seven patients in the epidural group became hypotensive compared to 0 in the paravertebral group	
		Length of stay	Mean hospital stay was 6.7 days (range 4–11) for the paravertebral group and 6.7 (range 3–16) ($P=NS$) for the epidural group	
		Pain control	PVB was superior to epidural in the first 24 h postoperatively	
Casati et al., (2006), Eur J Anaesth, Italy, [7] Prospective randomized trial (level 1b)	42 patients undergoing lung resection	Recovery in ventilatory function	Statistically significant differences (FVC 46.8% for PVB and 39.3% for epidural group $P<0.05$; FEV ₁ 48.4% in PVB group and 35.9% in epidural group, $P<0.05$) were reached in day 2 and continued until day 3	PVB is as effective as epidural blockade in controlling post-thoracotomy pain, but is associated with less haemodynamic effects
		Pulmonary complications	Epidurals were related to a higher complication rate (atelectasis/pneumonia) compared to the PVB (2 vs. 0)	
		Area under the curve of the VAS during coughing (AUCVAS). The aim was to detect a 96-cm h ⁻¹ difference in the AUCVAS during the 48 h observation period with an expected S.D. ranging between 60 and 85 cm h ⁻¹ accepting a two-tailed α -error of 5% and a β -error of 5%, for a final power of 95%	The AUCVAS over time was 192 (60–444) cm h ⁻¹ in the epidural group and 228 (72–456) cm h ⁻¹ in the PVB group ($P=0.29$)	
		Rescue morphine analgesia	It was required in four patients of epidural group (19%) and five patients of PVB group (23%) ($P=0.99$)	
		Reduction in PaO ₂ /FiO ₂	The PaO ₂ /FiO ₂ ratio reduced significantly from baseline values in both groups without between-group differences	
		Reduction in systolic blood pressure	The median percentage reduction of systolic arterial pressure from baseline was –9 (0 to –9)% in group PVB and	

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Table 1 (Continued)

Author, date and country Study type (level of evidence)	Patient group	Outcomes	Key results	Comments
			-17 (0 to -38)% in epidural group ($P=0.02$); while clinically relevant hypotension (systolic arterial pressure decrease $<30\%$ of baseline) was observed in four patients of epidural group only (19%) ($P=0.04$)	

CI, confidence interval; OR, odds ratio; PVB, paravertebral block; FEV₁, forced expiratory volume in 1 s; VAS, visual analogue pain score; PEFR, peak expiratory flow rate; AUCVAS, area under the curve of the VAS during coughing; S.D., standard deviation; LA, local anesthetics.

both groups, PVB tended to be associated with higher pain scores in the early postoperative period. There was no statistically significant difference between the two modalities. PVB was associated with a reduced incidence of hypotension and pulmonary complications.

Davies et al. [3] conducted a meta-analysis of 10 randomized control trials (RCTs) between 1989 and 2005 including 520 patients. There was no significant difference in paravertebral and epidural groups for pain scores [95% confidence interval (CI): -0.5, 121], $P < 0.05$ at 8, 24, 48 h. PVB was associated with fewer pulmonary complications [odds ratio (OR) 0.36 [0.14, 0.92]], urinary retention (OR 0.23 [0.10, 0.51]), nausea and vomiting OR 0.47 ([0.24, 0.53]) and hypotension, (OR 0.28 [0.2, 0.6]). Thus, PVB provided equally effective analgesia to epidural but with a better side-effect profile.

Detterbeck [4] reviewed 619 patients from 17 trials. Pain control was as good if not better in the paravertebral group. All studies except one found a better preservation of the forced expiratory volume in 1 s (FEV₁). Epidural block was associated with frequent side-effects (urinary retention (42%), nausea (22%), itching (22%) and hypotension (3%) and rarely respiratory depression (0.07%). Additionally, it prolonged operative time and was associated with technical failure or displacement (8%). PVB provided most effective pain-relief with less side-effects.

Richardson et al. [5] conducted a prospective randomized study between thoracic epidural and paravertebral bupivacaine in 100 adult patients. The visual analogue pain score (VAS) at rest and on cough was significantly lower in the paravertebral group ($P=0.02$ and 0.0001 , respectively). Pulmonary function, as assessed by peak expiratory flow rate (PEFR), was significantly better preserved in the paravertebral group. The lowest PEFR as a fraction of preoperative control was 0.73 in the paravertebral group in contrast with 0.54 in the epidural group ($P<0.004$). Oximetric recordings were better in the paravertebral group (96%) compared to the epidural group (95%) ($P=0.0001$).

Plasma concentrations of cortisol increased markedly in both groups, but the increment was statistically different in favour of the paravertebral group ($P=0.003$). Seven patients in the epidural group became hypotensive compared to 0 in the paravertebral group. Mean hospital stay was 6.7 days (range 4–11) for the paravertebral group and 6.7 (range 3–16) ($P=NS$) for the epidural group. PVB is as effective as epidural and better in terms of pulmonary function, neuroendocrine stress response and side effects.

Kaiser et al. [6] looked at pain control, recovery of ventilatory function and pulmonary complications in 30 thoracic surgery patients undergoing lung resection. PVB was superior to epidural in the first 24 h postoperatively. Statistically significant differences (FVC 46.8% for PVB and 39.3% for epidural group $P<0.05$; FEV₁ 48.4% in PVB group and 35.9% in epidural group, $P<0.05$) were reached in day 2 and continued until day 3. Epidurals were related to a higher complication rate (atelectasis/pneumonia) compared to the PVB (2 vs. 0).

Casati et al. [7] conducted a prospective, randomized, blinded study comparing the efficacy of the PVB vs. epidural analgesia in 42 patients undergoing lung resection. The main outcome variable was expressed as the area under the curve of the VAS during coughing (AUCVAS). The aim was to detect a 96-cm h^{-1} difference in the AUCVAS during the 48 h observation period with an expected standard deviation (S.D.) ranging between 60 and 85 cm h^{-1} accepting a two-tailed α -error of 5% and a β -error of 5%, for a final power of 95%. With these assumptions, the AUCVAS over time was $192\text{ (60–444) cm h}^{-1}$ in the epidural group and $228\text{ (72–456) cm h}^{-1}$ in the PVB group ($P=0.29$). Rescue morphine analgesia was required in four patients of epidural group (19%) and five patients of PVB group (23%) ($P=0.99$). The $\text{PaO}_2/\text{FiO}_2$ ratio reduced significantly from baseline values in both groups without between-group differences. The median percentage reduction of systolic arterial pressure from baseline was $-9\text{ (0 to }-9)\%$ in group PVB and $-17\text{ (0 to }-38)\%$ in epidural group ($P=0.02$); while clinically relevant hypotension (systolic arterial pressure decrease $<30\%$ of baseline) was observed in four patients of epidural group only (19%) ($P=0.04$). Thus, PVB is as effective as epidural blockade in controlling post-thoracotomy pain, but is associated with less haemodynamic effects.

7. Clinical bottom line

We conclude that PVB can be at least as effective as epidural analgesia. It also has a better side-effect profile and a lower complication rate than epidural analgesia.

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