

Chest Wall and Paraspinal Fascial Plane Blocks in Thoracic Surgery: Have They Replaced the Paravertebral Block?

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ABSTRACT

Thoracic surgery produces some of the most severe postoperative pain in surgical practice, and inadequate control carries measurable consequences: splinting, retained secretions, atelectasis and, in a proportion of patients, persistent post-thoracotomy pain. Thoracic epidural analgesia was for decades the reference technique, and the thoracic paravertebral block subsequently established itself as an equally effective alternative with a better side-effect profile. The shift to video-assisted and uniportal thoracoscopic surgery has changed the calculation again, because a less invasive operation may not justify a technique with the failure and complication rates of an epidural. Into this space have come the fascial plane blocks — the erector spinae plane block and the serratus anterior plane block foremost among them — which are technically simpler, performed at a distance from the neuraxis and the pleura, and safer in the anticoagulated patient. This review examines whether they have earned the place they now occupy. The randomized evidence for the erector spinae plane block against the paravertebral block is broadly one of non-inferiority, though at least one well-conducted multicentre trial found no benefit over standard care. The serratus anterior plane block has an even more mixed record, with a rigorous placebo-controlled trial finding no improvement in early recovery. Procedure-specific guidance accordingly positions these blocks as reasonable alternatives rather than established equivalents, and the newer paraspinal variants remain investigational.

Keywords: erector spinae plane block; serratus anterior plane block; thoracic paravertebral block; video-assisted thoracoscopic surgery; postoperative analgesia; thoracic surgery

INTRODUCTION

Pain after thoracic surgery arises from several sources simultaneously — the intercostal nerves at the port or incision sites, the parietal pleura, the diaphragm, the mediastinum, and, characteristically, the chest drain, which frequently outlasts the operative pain as the dominant complaint. A regional technique for thoracic surgery must therefore cover a multi-dermatomal somatic territory reliably, must not be defeated by the presence of a drain in a segment it does not reach, and must be compatible with early mobilization and with the anticoagulation regimens common in this population.

Thoracic epidural analgesia meets the first requirement better than anything else but at the cost of hypotension, urinary retention, a failure rate that is not negligible, and a contraindication profile that excludes many patients. The thoracic paravertebral block was shown to provide comparable analgesia with fewer of these problems, and became the default in many thoracic centres. The question this review addresses is whether the fascial plane blocks that have proliferated since 2016 have displaced it, or merely widened the choice.

WHAT PROCEDURE-SPECIFIC GUIDANCE SAYS

The PROSPECT working group's guideline for video-assisted thoracoscopic surgery represents the most rigorous attempt to synthesize this literature, and its conclusions are appropriately cautious: paravertebral

blockade is recommended, with the erector spinae plane block and the serratus anterior plane block regarded as alternatives when paravertebral blockade is not feasible, and with basic analgesics and intraoperative intercostal blockade forming the foundation of the regimen [1]. This is a weaker endorsement of the fascial plane blocks than their popularity in practice would suggest, and the reason lies in the quality and consistency of the underlying trials.

THE ERECTOR SPINAE PLANE BLOCK

The erector spinae plane block was first described in 2016 for thoracic neuropathic pain, with local anesthetic deposited deep to the erector spinae muscle at the tip of a transverse process [2]. Cadaveric and clinical spread studies indicate that injectate travels craniocaudally in the paraspinal plane and, to a variable extent, anteriorly into the paravertebral and intercostal spaces; the variability of that anterior spread is the principal reason the block is less predictable than a true paravertebral injection. A recent narrative review has drawn together the mechanistic and spread data for both techniques [3]. The block was applied to thoracoscopic surgery within two years of its description [4].

Randomized comparisons with the paravertebral block are now numerous. A meta-analysis restricted to thoracoscopic surgery concluded that the two techniques provide comparable analgesia [5], and a three-arm double-blind non-inferiority trial comparing erector spinae plane, retrolaminar and paravertebral blockade in single-incision thoracoscopic surgery supported that conclusion [6]. Several further randomized trials have found equivalence or near-equivalence [7–10], and a network meta-analysis of regional techniques for video-assisted thoracic surgery placed the erector spinae plane block among the more effective options [11]. A pragmatic randomized trial comparing continuous erector spinae plane blockade with video-assisted paravertebral blockade found comparable quality of recovery, which is the outcome that arguably matters most [12]. Effects beyond analgesia have also been examined, including gastrointestinal recovery [13] and respiratory function [14].

The most important dissenting result is a multicentre double-blinded randomized trial which found that the erector spinae plane block did not improve pain-related outcomes or recovery after video-assisted thoracoscopic surgery compared with a control regimen [15]. A single negative trial does not overturn a positive meta-analytic literature, but this one was well designed and multicentre, and it is a reminder that the effect size of the block within a good multimodal regimen may be smaller than single-centre trials suggest.

Because the block is a single-shot technique applied to pain lasting several days, duration is again the constraint. Adjuvants have been studied in this setting [16,17], and a continuous catheter is a practical alternative. The abrupt resolution of the block is itself a recognized problem, and one trial has specifically examined rebound pain after thoracoscopic lobectomy [18].

THE SERRATUS ANTERIOR PLANE BLOCK

The serratus anterior plane block deposits local anesthetic superficial or deep to the serratus anterior muscle at the mid-axillary line, targeting the lateral cutaneous branches of the intercostal nerves. It is the most superficial and technically the easiest of the chest wall blocks, and it covers the lateral chest wall well — which corresponds closely to the port sites of a thoracoscopic operation.

Meta-analyses have reported reduced pain scores and opioid consumption compared with no block [19,20], and a comparison with paravertebral and intercostal techniques found it broadly comparable [21]. Narrative reviews of its role in thoracoscopic surgery are generally favourable [22,23].

Against this stands a rigorous randomized, blinded, placebo-controlled trial published in *Anesthesiology*, which found that the serratus anterior plane block did not improve early recovery after thoracoscopic lung resection [24]. As with the corresponding erector spinae plane trial, the result is best interpreted not as evidence that the block does nothing but as evidence that its incremental value within a well-constructed multimodal regimen — including surgical intercostal infiltration — is limited. The block's territorial

limitation is also relevant: it does not cover the posterior chest wall, so a posteriorly placed chest drain or a posterior utility incision will be outside its distribution. Combining it with an erector spinae plane block has therefore been studied and compared with paravertebral blockade with encouraging results [8].

NEWER PARASPINAL VARIANTS

Two newer techniques deserve mention as investigational rather than established. The serratus posterior superior intercostal plane block, described by Tulgar and colleagues, is a periparavertebral injection intended to cover the upper thoracic segments with a superficial and reproducible landmark [25]. The intertransverse process block group, which includes the retrolaminar and midpoint transverse process to pleura approaches, deposits local anesthetic closer to the paravertebral space than the erector spinae plane injection and may achieve more reliable anterior spread; a randomized comparison with continuous erector spinae plane blockade in uniportal thoracoscopic surgery is underway [26]. These techniques are anatomically rational and may eventually resolve the trade-off between the safety of a superficial injection and the reliability of a deep one, but the evidence does not yet support their routine adoption.

PRACTICAL SYNTHESIS

Several conclusions follow from this literature for everyday practice. First, no chest wall or paraspinal block is a substitute for a complete multimodal regimen; the trials that found no benefit were those in which the control group received good baseline analgesia, which is the correct comparator. Second, for thoracotomy, where the somatic injury is greatest and the analgesic requirement highest, thoracic epidural or paravertebral blockade retains its place, and the fascial plane blocks are best regarded as alternatives when those are contraindicated. Third, for video-assisted and uniportal thoracoscopic surgery, an erector spinae plane block — or a serratus anterior plane block where the incisions are wholly lateral — is a reasonable and safe choice, and is likely to be what most patients receive in practice given its simplicity and its safety in the anticoagulated. Fourth, the plan must extend to the resolution of the block, whether by catheter, by adjuvant, or by scheduled systemic analgesia, since the pain of a chest drain does not end when the block does.

CONCLUSION

The fascial plane blocks have not replaced the paravertebral block so much as displaced it from the majority of cases by being easier and safer rather than by being better. The evidence supports the erector spinae plane block as approximately equivalent to paravertebral blockade for thoracoscopic surgery and the serratus anterior plane block as adequate for laterally confined incisions, while two well-conducted negative trials caution that the incremental benefit of either within a good multimodal regimen is modest. The next useful step is not another comparison of two blocks in a single centre but adequately powered multicentre trials using quality of recovery and pulmonary function as endpoints.

AUTHOR CONTRIBUTIONS

The author confirms sole responsibility for the following: study conception, literature search and appraisal, interpretation of the evidence, and manuscript preparation and revision.

CONFLICT OF INTEREST

The author declares that there is no conflict of interest.

ETHICS STATEMENT

This article is a narrative review of previously published literature. It does not report any study involving human participants or animals performed by the author, and therefore ethics committee approval and informed consent were not required.

ARTIFICIAL INTELLIGENCE DISCLOSURE

Artificial intelligence tools were used to assist with literature retrieval and language editing. All scientific content, interpretation, and conclusions are the responsibility of the author, who has reviewed and verified the final manuscript.

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