Number of cases of post-thoracotomy pain is high in premature neonates. Although epidural analgesia is the gold standard, there are many drawbacks. Opioid-sparing analgesia is desired, but the standard of care for thoracic pain in premature neonates is unclear. Continuous erector spinae plane (ESP) blocks have been used in adults and older children for pain management after thoracotomy. However, there are no reports of ESP blocks in premature neonates.

We report the case of a premature neonate who underwent lower thoracotomy and presented with marked postoperative pain. After failure of rectal acetaminophen and epidural analgesia, we inserted an ESP catheter with continuous chloroprocaine infusions. Pain control was excellent, without significant side effects. This case highlights the advantages of ESP blocks in premature neonates and suggests further study of this technique.
Novel treatment (new drug/intervention; established drug/procedure in new situation)

was confirmed with 0.5 mL normal saline and 2 mL 3% chloroprocaine. The catheter was tunnelled away from the planned surgical site (figure 1B–D) and secured with a sterile dressing. A posterolateral thoracotomy incision was made and the chest wall was opened between the fourth and fifth ribs. We chose 1.5% chloroprocaine for local anaesthetic solution; however, it was not readily available from our pharmacy to administer a loading bolus dose. While awaiting chloroprocaine infusion preparation, 1 mL 0.1% (0.44 mg/kg) ropivacaine bolus was administered prior to incision. One hour later, an infusion of 1.5% chloroprocaine was initiated at 0.25 mL/kg/hour (3.75 mg/kg/hour). We took care to ensure that the administered doses were significantly lower than the maximum allowed doses for each local anaesthetics individually and in their current combination. The patient received remifentanil 0.1 mcg/kg/min during the first half of the case, but no other intraoperative opioids. Following chest tube placement between the seventh and the eighth ribs and completion of the surgery, the patient was extubated and transferred to the neonatal intensive care unit.

OUTCOME AND FOLLOW-UP
Postoperative analgesia was supplied via chloroprocaine infusion and scheduled rectal acetaminophen. The Neonatal Pain, Agitation and Sedation Scale (N-PASS) was recorded every 2 hours to assess postoperative pain. Our patient received two doses of morphine (0.05 mg/kg per dose) on each of the postoperative days (POD) 1 and 2 for N-PASS scores of 5–7. The remainder of N-PASS scores was recorded as 0–2. Oxygen supplementation via nasal cannula was titrated off POD 2. The erector spinae catheter was removed without complication on POD 5. A repeat INR was 1.17 prior to catheter removal, and there were no signs of impaired haemostasis. The patient was discharged home on POD 8. No short-term or long-term complications related to the ESP block were observed.

DISCUSSION
This case suggests that continuous erector spinae blocks may have a role in managing perioperative pain in premature neonates undergoing thoracotomy, similar to the few published case reports in older infants. Pain management following thoracotomy is especially challenging in premature neonates. Uncontrolled pain generates a pattern of rapid shallow breathing, which predisposes to atelectasis. Conversely, opioid use in this population may contribute to respiratory complications. For example, respiratory depression requiring non-invasive positive pressure ventilation or reintubation can stress delicate suture lines. Opioid-sparing regional anaesthesia may be the ideal solution, but approaches are often contraindicated in these patients by comorbid conditions of prematurity. With continuous ESP block, our patient had low postoperative pain scores and minimal need for supplemental opioids.

Our patient had both coagulopathy, INR 1.6 and sacral anatomic abnormalities as relative contraindications to caudal epidural catheter placement. An INR greater than 1.2 is considered a contraindication to neuraxial needle placement by the guidelines issued by ASRA. The European Society of Anaesthesiology (ESA) considers an INR of 1.4 as the cut-off for neuraxial procedures. Moreover, ASRA advises against performing paraneuraxial blocks, such as paravertebral blocks, in coagulopathic patients due to the inability to compress those compartments should bleeding occur. While the bleeding risk associated with ESP catheter placement is still being determined, the compressibility of the location and its distance from the neuraxis may reduce bleeding risk compared with epidural placement. This unknown bleeding risk must be carefully weighed in a coagulopathic patient as an unrecognised bleeding event may have severe consequences. We viewed the potential analgesic and respiratory benefits to outweigh the risk of ESP catheter placement.

To our knowledge, this is the first case report of a preterm neonate undergoing thoracotomy with a continuous ESP block within the first week of life. While these patients present anatomy favourable for placement of these blocks, their management requires careful attention to detail. First, the location of catheter placement is much closer to the surgical field than that of a caudal catheter. We were able to tunnel our catheter subcutaneously across the midline to the satisfaction of our surgical team. Second, the choice of local anaesthetic and infusion method may significantly impact the success of this technique. The aminooamide local anaesthetics bupivacaine and ropivacaine are used almost universally for continuous peripheral nerve blocks, including in infants and neonates. In contrast to other published case reports of neonatal continuous ESP blocks, we elected to infuse 1.5% chloroprocaine postoperatively. Given the immature hepatic function in patients at this age, we believe that substituting this for the more commonly used aminooamide local anaesthetics may reduce these patients’ risk of local anaesthetic toxicity. We chose the infusion rate as it was published in several successful paediatric ESP catheter case reports, and it is a safe rate of chloroprocaine infusion. ESP catheter placement is feasible for premature neonates, and it provides effective intraoperative and postoperative analgesia for thoracotomy. It may contribute to a strategy for early extubation and reduce pain or opioid-related respiratory depression during recovery. It is likely lower risk than neuraxial block in the setting of mild-to-moderate coagulopathy, though this case report does not amount to evidence of absolute safety in these patients. Chloroprocaine may be the ideal local anaesthetic in the erector spinae compartment in neonates to allow for high-volume infusion while minimising the risk of toxicity. Although the paediatric literature comprises of mostly case reports, there are a growing number of successful applications of ESP blocks in infants and children. We are encouraged to use this technique in future cases to validate its usefulness and establish a specific dose range of...
chloroprocaine infusion. However, prospective randomised clinical trials are required to assess the effectiveness and safety of this technique compared with other, traditional perioperative analgesia methods.

In conclusion, this case is the first demonstration in our practice of the potential value of continuous ESP blocks in this difficult patient population. Our patient was extubated at the end of surgery and required minimal postoperative opioids without any obvious adverse events associated with the regional technique.

Learning points

► Erector spinae block is a feasible regional anaesthesia technique for premature neonates.
► Erector spinae plane may be a favourable substitute to conventional epidural analgesia in the setting of mild-to-moderate coagulopathy.
► Chloroprocaine may be an effective local anaesthetic option for continuous erector spinae blocks in preterm neonates.

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Contributors ASS directed anaesthetic care for the patient and helped write and edit the manuscript and approved it for submission. JF participated in block placement and helped edit the manuscript and approved it for submission. DH performed the surgery, supervised postoperative care and helped edit the manuscript and approved it for submission. BH performed the erector spinae block and helped write and edit the manuscript and approved it for submission.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Parental/guardian consent obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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