Local Anesthetic Infiltration of the Wound for Postoperative Pain Management in Pediatric Cases

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Two pediatric patients for whom local anesthetic infiltration of the wound was used for postoperative pain management are reported. Case 1 was an 11-year-old male undergoing pyeloplasty. Surgery was performed by a lumbodorsal approach. During wound closure, an 18-gauge multi-hole catheter was placed on the layer above the transversus abdominis muscle. Postoperatively, 20 ml of ropivacaine 0.375% were administered through the catheter, and continuous infusion of ropivacaine 0.2% at 3 ml/h was performed. As additional analgesia, fentanyl 0.2 μg/kg/h was infused intravenously. Pain scores on the Numerical Rating Scale (NRS) and the Prince Henry Pain Scale (PHPS) were low (NRS: 0-2, PHPS: 1) until the catheter was removed. No side effects were observed. Case 2 was a 2-year-old female with congenital biliary dilatation. Surgery was performed through a right upper quadrant transverse incision. As in case 1, during wound closure, a catheter was placed on the layer under the rectus abdominis muscle. Postoperatively, 5 ml of ropivacaine 0.375% were administered through the catheter, and continuous infusion of ropivacaine 0.2% at 2 ml/h was performed. Fentanyl 0.2 μg/kg/h was infused intravenously. Until the catheter was removed, pain scores were 1 on the FACES Pain Rating Scale. These cases show that this approach can provide pain relief for postoperative pediatric cases.

Key words: local anesthetic infiltration of the wound, ropivacaine, pediatric surgery

Introduction

Epidural analgesia is the most effective method of postoperative pain management even for pediatric patients, especially in cases of abdominal surgery. However, there are some problems with the use of epidural analgesia in pediatric cases, including informed consent and technical difficulties. Moreover, the surgical procedure must be performed under general anesthesia, meaning the effect of epidural analgesia cannot be judged beforehand. Local anesthetic infiltration of the wound (LAIW) is an analgesic method used when epidural analgesia is difficult to perform, such as when the patient is undergoing anticoagulant therapy. In recent years, LAIW has come into wide use in adults because it requires no special skills, has no major complications, and can be performed easily and safely under general anesthesia[1]. Recently, as postoperative analgesia for laparotomy in pediatric surgery, in addition to epidural analgesia, multimodal methods, such as peripheral nerve blocks and intravenous analgesia, have come to be used; the use of LAIW has also been reported[2]. Two pediatric cases in which this method was effectively used for postoperative pain management following abdominal surgery are presented. In these two cases, continuous epidural analgesia would usually have been used for postoperative analgesia, and continuous epidural analgesia was proposed when anesthesia was explained to the patients’ parents, but consent was not obtained because of its risks. Therefore, the use of LAIW was considered as an alternate method of continuous analgesia. LAIW was approved by the ethics committee of our hospital in 2009 and had been used as analgesia for various surgical procedures in adults, but it had not yet been used in any pediatric cases. LAIW was explained to the patients’ parents, including our results with it up to that point in adult patients, its safety, and the risk of local anesthetic toxicity, and their consent for its use was obtained.
Case reports

Case 1
The patient was an 11-year-old boy (135 cm, 30 kg). Pyeloplasty was performed for ureteropelvic junction obstruction. General anesthesia with sevoflurane and remifentanil was used. The incision was a lumbodorsal incision with the patient in the lateral decubitus position. A catheter was placed on the layer above the transversus abdominis muscle in the closed wound where the surgeon divided the muscle layers and created a space over which the drug would spread (Figure-1). A 20-mL single bolus of 0.375% ropivacaine, followed by continuous 0.2% ropivacaine at 3 mL/h was given (for 48 hours). Intravenous infusion of fentanyl at 0.2 μg/kg/h was given as additional analgesia.

Case 2
The patient was a 2-year-old girl (87 cm, 12 kg). Cyst excision and hepaticojejunostomy were performed for congenital biliary dilatation. General anesthesia with sevoflurane and remifentanil was used. The incision was a right upper quadrant transverse incision with the patient in the supine position. A catheter was placed on the layer under the rectus abdominis muscle where the surgeon had divided the muscle layers in the closed wound and created a space for the drug to spread, as in Case 1. A 5-mL single bolus of 0.375% ropivacaine, followed by continuous administration of 0.2% ropivacaine at 2 mL/h was given for 48 hours.

Assessment of pain intensity
To assess pain, the Numerical Rating Scale (NRS) and the Prince Henry Pain Scale (PHPS) were used in Case 1, and the FACES Pain Rating Scale (FPRS) was used in Case 2. Pain was assessed at the completion of surgery and 24 and 48 hours later.

In Case 1, the pain intensity on the NRS was ≤2 at rest and 5 during body movement (Figure-2), and on the PHPS, the pain intensity was 1 (Figure-3). In Case 2, the pain intensity was 1 on the FPRS (Figure-4). The only additional analgesic was an NSAID administered once in Case 1. No side effects, such as nausea, vomiting, drowsiness, narcosis, respiratory disorder (respiratory rate < 10/min), or circulatory disorder (mean blood pressure < 50 mmHg) were seen in either case.

Discussion
LAIW has attracted attention as an analgesic method in cases when epidural anesthesia cannot be performed because of the risk of hematoma, such as when anticoagulant therapy is used to treat pulmonary thromboembolism. This method is easy to perform and requires no special skills. There are no major complications of hematoma or nerve damage. Many reports about the effects of this method have been published, but Gupta et al. reported that LAIW did not reduce pain intensity in...
most patients undergoing non-orthopedic surgeries). From our experience, we consider that the effect of this method varies by the incision or shape of the wound and catheter position. It is thought that, in some cases, not only a simple effect from infiltration of local anesthetic but also a periwound nerve block effect can be expected. As in the present cases, when the incisions are made lumbodorsally and horizontally, the muscle layers can be divided, and spaces over which the drugs can spread are created. If the catheter is placed in spaces where peripheral nerves pass, this can provide the same effect as continuous peripheral nerve block, such as transversus abdominis plane block. However, in upper abdominal surgery with a midline incision, such spaces cannot be created, so continuous rectus sheath block on both sides is indicated in such cases. We want to consider incorporating the method of Forastiere et al. in the future to increase the analgesic effect of placing multiple catheters to fit a wound layer.

Local anesthetic doses were determined with reference to adult cases that underwent abdominal surgeries in our hospital. After a single bolus of 3 mg/kg, continuous infusion at 0.3 mg/kg/h was given. After 24 hours, the blood concentration was 1.5 to 2.0 μg/ml, not reaching the toxic range of 2.5 μg/ml. In Case 1, a single bolus of 2.5 mg/kg was administered, followed by continuous infusion at 0.2 mg/kg/h; the blood concentration after 24 hours was 2.08 μg/ml. In Case 2, a single bolus of 1.56 mg/kg was administered, followed by continuous infusion at 0.33 mg/kg/h. Unfortunately, the blood concentration was not measured. There were no findings suggestive of local analgesic toxicity in either case, and safety with regard to the dose was not thought to be a problem.

In recent years, not only epidural analgesia but also nerve blocks are increasingly used as postoperative analgesia in pediatric cases, but the timing of implementation is a problem with both methods. In adults, it is thought that they should be
implemented before starting general anesthesia, with the aim of avoiding nerve damage, but in pediatric cases, it is difficult to perform unless the patient is under general anesthesia. In this case, the risk of nerve damage increases, and there may be an effect on subsequent growth and development. The effect of LAIW is thought to be inferior to that of epidural analgesia or nerve blocks, but its safety is superior. In addition, by using LAIW together with opioid-based analgesia, it becomes possible to reduce the required opioid dose, which should contribute to reducing the occurrence of nausea, respiratory depression, and other opioid side effects. This report includes only two cases but is thought to show the future possibility of postoperative analgesic methods including LAIW in pediatric cases. We would like to continue investigating LAIW with more pediatric cases in the future.

Conclusions

We consider that LAIW can be applied safely as a method of postoperative pain management following abdominal surgery in children. Further consideration of local anesthetic blood concentrations is needed for use of this method in children.

References