Intercostal nerve block in pediatric minimally invasive thoracic surgery

Laura Lukošienė1, Lina Kalibatienė1, Vidmantas Barauskas2

1 Department of Anesthesiology, Hospital of Lithuanian University of Health Sciences Kaunas Clinics
2 Department of Pediatric Surgery, Hospital of Lithuanian University of Health Sciences Kaunas Clinics

Background. Very severe postoperative pain is observed after minimally invasive repair of pectus excavatum (MIRPE), extremely in the early postoperative period. Pain is usually managed by either thoracic epidural block (TEB) or intravenous patient-controlled analgesia (PCA) with opioids. But the issue of optimal pain management is still controversial. The purpose of our study was to investigate efficiency and side effects of intercostal nerve block (ICNB) in children after MIRPE in comparison with only PCA.

Materials and methods. Records of 20 patients, given PCA with morphine (PCA group), were examined retrospectively. 27 patients, given intraoperative ICNB (single shot) and PCA with morphine (ICNB group), were examined prospectively. Postoperatively, we recorded morphine consumption, pain scores and side effects every 3 hours.

Results. There was no need of the initial dose of morphine in the ICNB group. Pain scores during the first 3 hours, morphine consumption during the first 3 hours and during 12 hours after surgery were significantly higher in the PCA group (p < 0.05). Later, morphine consumption and pain scores became approximately the same. Side effects were more frequent in the PCA group. Respiratory complications were rare and did not differ between the groups.

Conclusions. Intercostal nerve block is a safe, technically simple peripheral nerve block, which could be valuable in the early postoperative period after minimally invasive thoracic surgery in children. Further research should be done.

Key words: intercostal nerve block, children, postoperative pain

INTRODUCTION

Pain after thoracic surgery is one of the most severe pain. Especially severe postoperative pain is observed after MIRPE, extremely in the early postoperative period. Adequate management of postoperative pain relief in children is essential not only for ethical reasons. Postoperative pain decreases the total postoperative satisfaction, increases the incidence of complications, extends the hospitalization period, it may become a reason of psychosocial problems or may cause chronic pain development in later postoperative period (1, 2, 3).
The ideal approach for postoperative pain management in children after MIRPE is still the object of discussions. Usually, the choice is either systemic opioid analgesia either epidural blockade. However, the opinion which of these methods is more effective is quite controversial. But there is no doubt that pain management strategies must have multimodal approach, including systemic opioids with nonsteroidal anti-inflammatory drugs and different regional blocks, such as thoracic epidural blockade (TEB), paravertebral block or ICNB.

For adults the strategies of postoperative pain management after thoracic surgery and MIRPE are well-established. Majority of the authors indicate that the golden standard for that type of surgery is thoracic epidural blockade (4–6), but others prefer INCB. Some authors note that efficiency of INCB is comparable to TEB, it is safe and valuable for adults as an alternative of TEB or as an adjunct analgesia, especially in video assistant procedures, day surgery, and in the early postoperative period after thoracic surgery (7–13).

Studies of children’s ICNB are very limited and in our knowledge there are no published studies comparing ICNB with systemic analgesia after MIRPE.

ICNB is one of the oldest peripheral nerve blockades. For the first time, this blockade was briefly described by Braun in the second edition of the German textbook Die Lokalanastesie in 1907. Bartlett (in 1940) and Zollinger (in 1941) described the indication of INCB for postoperative pain relief after upper abdominal surgery. In 1948 McCleery, Zollinger and Lenahan described the positive effect of this block for postoperative respiratory complications and reduced the need of narcotic analgesics after upper abdominal surgery (14). The interest of INCB has grown. The first published study of INCB for children was by Fleming in 1977. He investigated 89 children undergoing thoracotomy and concluded that ICNB is valuable for children, it reduces the need for analgesics and shortens hospitalization compared with systemic analgesia (15). After 10 years, Shelly investigated ICNB in children after liver transplantation and concluded that this blockade is a suitable approach of pain relief after liver transplantation and can be valuable for other types of surgery in children (16). Later, a few more studies about INCB in children were published (17, 18, 19).

Children’s ribs are superficially, easy to palpate and this makes ICNB safe, technically easy to perform. Blockade can be done anywhere in the proximal of mid-axillary line, in children preferably at the mid-axillary line. It can be done in the prone, sitting, or lateral position. Preferably, under general anesthesia.

The aim of our study was to investigate the efficiency of ICNB in children for pain management after MIRPE in comparison with PCA.

MATERIALS AND METHODS

Participants of a combined retrospective and prospective study were children of 7–18 years undergoing MIRPE. Records of 20 patients, given PCA with morphine (PCA group), were examined retrospectively. After approval of the local bioethics committee, 27 patients, given intraoperative ICNB (single shot) and PCA with morphine (ICNB group), were examined prospectively. Block was performed under general anesthesia, in mid-axillary line, from Th6 to Th11 intercostal spaces with solution of bupivacaine 2–3 mg/kg with adrenaline 1 : 200 000. Settings of PCA: bolus 20 μg/kg, base 4–6 μg/kg/h, lock-out time 5–6 min, max dose within 4 hours 400 μg/kg. Concentration of morphine was 1 mg/ml. Initial dose was given on request. Postoperatively, we recorded the morphine consumption, pain scores and side effects every 3 hours.

Statistical analysis was performed using SPSS 13: the Student’s t-test and the Mann-Whitney test, comparing means of two groups, and more than two groups (ANOVA) Fischer and Kruskal-Wallis tests were used. Statistically significant difference was p < 0.05.

RESULTS

Age, weight and gender did not differ between the groups (Table). There was no need of the initial dose of morphine in the ICNB group. In the PCA group, the initial dose of morphine was necessary for all patients and it was 52.3–122.8 μg/kg.

| Table. Age, weight and gender of the study groups |
|----------------|----------------|
|                | PCA            | ICNB           |
| Age (years)    | 12–18          | 11–17          |
| Weight (kg)    | 43–68          | 37–65          |
| Gender F/M     | 6/14           | 9/18           |
Morphine consumption during the first three hours and during 12 hours after surgery was significantly higher in the PCA group (p < 0.05). Higher pain scores during the first 3 hours were in the PCA group (p < 0.05). About 12 hours after surgery, the morphine consumption and pain scores became approximately the same. Respiratory complications were rare and did not differ between the groups. Side effects (nausea/vomiting, urinary retention/catheterization, deep sedation, pruritus) were more frequent in the PCA group.

DISCUSSION

Matsota published a study (n = 20) and has concluded that ICNB with bupivacaine produces a satisfactory and safe analgesia for the early postoperative period after thoracotomy in children (20). Another publication (n = 30) presented the results of a randomized, controlled, prospective, double-blind study about the intercostal parasternal block with ropivacaine after sternotomy in children undergoing cardiac surgery. This author also concludes that the parasternal intercostal block is a simple, safe, and useful technique of supplementation of postoperative analgesia in children (21).

To our knowledge, our study is the first study of ICNB in children after MIRPE. The advantages of ICNB are safety, efficiency and technical simplicity.

Pain management only with systemic opioids after MIRPE is effective, safe, uncostly, but in the early postoperative period it is not sufficient, high initial doses of morphine may be necessary (22). Thoracic epidural block is an effective and valuable method of pain relief after MIRPE (23), but it is costly, time consuming and invasive, complications are very rare, but irreversible (24). Our study showed benefits of ICNB vs PCA, but further research should be done.

CONCLUSIONS

Intercostal nerve block is a safe, technically simple peripheral nerve block, which could be valuable in the early postoperative period after MIRPE and other types of surgery in children. Further research should be done.

References


Laura Lukošienė, Lina Kalibatienė, Vidmantas Barauskas

**VAIKŲ CHIRURGIJOS INTERKOSTALINĖS BLOKADOS YPATUMAI MINIMALIOS INVAZIJOS Į KRŪTINĖS LĄSTĄ METU**

**Santrauka**

Straipsnyje apžvelgiami vaikų chirurgijos interkostalinės blokados ypatumai ir pateikiami duomenys, leidžiantys palyginti šios blokados ir tik sisteminio skausmo malšinimo opioidais efektyvumą bei pašalinius reiškinius.

**Raktažodžiai:** interkostalinė blokada, vaikai, pooperacinis skausmas