ACTA MEDICA LITUANICA. 2012. Vol. 19. No. 3. P. 150–153

Intercostal nerve block in pediatric minimally invasive thoracic surgery

Laura Lukošienė[1],

Lina Kalibatienė[1],

Vidmantas Barauskas[2]

[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, morfine 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 minimaly 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).

Correspondence to: Laura Lukošienė, Department of Anesthesiology, Hospital of Lithuanian University of Health Sciences Kaunas Clinics, Eivenių 2, LT-50009 Kaunas, Lithuania. E-mail: laura.lukosiene@kaunoklinikos.lt

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 bloks, 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 childrens 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 morfine 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.

Received 31 July 2012
Accepted 1 August 2012

References

1. De Cosmo G, Aceto P, Gualtieri E, Congedo E. Analgesia in thoracic surgery: review. Minerva Anestesiol. 2009; 75(6): 393–400.
2. Kaplowitz J, Papadakos PJ. Acute pain management for video-assisted thoracoscopic surgery: an update. J Cardiothorac Vasc Anesth. 2012; 26(2): 312–21.
3. Reuben SS, Yalavarthy L. Preventing the development of chronic pain after thoracic surgery. J Cardiothorac Vasc Anesth. 2008; 22(6): 890–903.
4. Debreceni G, Molnár Z, Szélig L, Molnár TF. Continuous epidural or intercostal analgesia following thoracotomy: a prospective randomized double-blind clinical trial. Acta Anaesthesiol Scand. 2003; 47(9): 1091–5.
5. Sanjay OP, Prashanth P, Tauro DI. Intercostal nerve blockade versus thoracic epidural analgesia for post thoracotomy pain relief. Br J Anaesth. 2011; 106(4): 580–9.
6. Meierhenrich R, Hock D, Kühn S, Baltes E, Muehling B, Muche R, et al. Analgesia and pulmonary function after lung surgery: is a single intercostal nerve block plus patient-controlled intravenous morphine as effective as patient-controlled epidural anaesthesia? A randomized non-inferiority clinical trial. Br J Anaesth. 2011; 106(4): 580–9.
7. Wurnig PM, Lackner H, Teiner C, Hollaus PH, Pospisil M, Fohsl-Grande B, et al. Is intercostal block for pain management in thoracic surgery more successful than epidural anaesthesia? Eur J Cardiothorac Surg. 2002; 21(6): 1115–9.
8. Concha M, Dagnino J, Cariaga M, Aguilera J, Aparicio R, Guerrero M. Analgesia after thoracotomy: epidural fentanyl / bupivacaine compared with intercostal nerve block plus intravenous morphine. J Cardiothorac Vasc Anesth. 2004; 18(3): 322–6.
9. Detterbeck FC. Efficacy of methods of intercostal nerve blockade for pain relief after thoracotomy. Ann Thorac Surg. 2005; 80(4): 1550–9.
10. Luketich JD, Land SR, Sullivan EA, Alvelo-Rivera M, Ward J, Buenaventura PO. Thoracic epidural versus intercostal nerve catheter plus patient-controlled analgesia: a randomized study. Ann Thorac Surg. 2005; 79(6): 1845–9.
11. Takamori S, Yoshida S, Hayashi A, Matsuo T, Mitsuoka M, Shirouzu K. Intraoperative intercostal

nerve blockade for postthoracotomy pain. Ann Thorac Surg. 2002; 74(2): 338–41.
12. Bolotin G, Lazarovici H, Uretzky G, Zlotnick AY, Tamir A, Saute M. The efficacy of intraoperative internal intercostal nerve block during video-assisted thoracic surgery on postoperative pain. Ann Thorac Surg. 2000; 70(6): 1872–5.
13. Taylor R, Massey S, Stuart-Smith K. Postoperative analgesia in video-assisted thoracoscopy: the role of intercostal blockade. J Cardiothorac Vasc Anesth. 2004; 18(3): 317–21.
14. Bennett HA, Dodson HC, Bamfordth BJ. Intercostal nerve block in upper abdominal and chest surgery. Received for publication April 5, 1955. Available from: http://www.anesthesia-analgesia.org/
15. Fleming WH, Sarafian LB. Kindness pays dividends: the medical benefits of intercostal nerve block following thoracotomy. J Thorac Cardiovasc Surg. 1977; 74(2): 273–4.
16. Shelly MP, Park GR. Intercostal nerve blockade for children. Anaesthesia. 1987; 42(5): 541–4.
17. Downs CS, Cooper MG. Continuous extrapleural intercostal nerve block for post thoracotomy analgesia in children. Anaesth Intensive Care. 1997; 25(4): 390–7.
18. Matsota P, Livanios S, Marinopoulou E. Intercostal nerve block with Bupivacaine for post-thoracotomy pain relief in children. Eur J Pediatr Surg. 2001; 11(4): 219–22.
19. Jagannathan N, Suresh S. Truncal blocks in children. Tech Reg Anesth Pain Manag. 2007; 11(4): 260–4.
20. Matsota P, Livanios S, Marinopoulou E. Intercostal nerve block with bupivacaine for posthoracotomy pain relief in children. Eur J Pediatr Surg. 2001; 11(4): 219–22.
21. Chaudhary V, Chauhan S, Choudhury M, Kiran U, Vasdev S, Talwar S. Parasternal intercostal block with ropivacaine for postoperative analgesia in pediatric patients undergoing cardiac surgery: a double-blind, randomized, controlled study. J Cardiothorax Vasc Anesth. 2012; 26(3): 439–42.
22. Rugyte DC, Kilda A, Karbonskiene A, Barauskas V. Systemic postoperative pain management following minimally invasive pectus excavatum repair in children and adolescents: a retrospective comparison of intravenous patient-controlled analgesia and continuous infusion with morphine. Pediatr Surg Int. 2010; 26(7): 665–9.
23. Weber T, Mätzl J, Rokitansky A, Klimscha W, Neumann K, Deusch E. Superior postoperative pain relief with thoracic epidural analgesia versus intravenous patient-controlled analgesia after minimally invasive pectus excavatum repair. J Thorac Cardiovasc Surg. 2007; 134: 865–70.
24. St Peter SD, Weesner KA, Weissend EE, Sharp SW, Valusek PA, Sharp RJ, et al. Epidural vs patient-controlled analgesia for postoperative pain after pectus excavatum repair: a prospective, randomized trial. J Pediatr Surg. 2012; 47(1): 148–53.

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 apie blokados vaidmenį malšinant vaikų skausmą po minimaliai invazinių krūtinės ląstos deformacijų korekcijos. Pateikiami literatūroje iki šiol neaprašyti duomenys, leidžiantys palyginti šios blokados ir tik sisteminio skausmo malšinimo opioidais efektyvumą bei pašalinius reiškinius.

Raktažodžiai: interkostalinė blokada, vaikai, pooperacinis skausmas