

THE ANALGESIC EFFECTS OF ROPIVACAINE IN ILIOINGUINAL-ILIOHYPOGASTRIC NERVE BLOCK IN CHILDREN

- Concentration or Volume? -

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Abstract and Objectives: The aim of the present study was to compare the analgesic effects of ropivacaine when used as high concentration/small volume, versus its use as high volume/low concentration, in ilioinguinal-iliohypogastric nerve block in children.

Methods: This is a prospective single-blind randomized study consisting of 72 children ASA I & II, 3-9 years of age, scheduled for outpatient elective surgery. Children were randomly assigned into two equal groups (36 each), to receive ropivacaine 0.8 mg.kg⁻¹, for ilioinguinal-iliohypogastric block, either as:

1 mg.ml⁻¹ (0.8 ml.kg⁻¹) G1 group, or

2 mg.ml⁻¹ (0.4 ml.kg⁻¹) G2 group

The postoperative pain was assessed using the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS), at the end of surgery (H0), at one (H1), two (H2), four (H4) and six (H6) postoperative hours. Parents were requested to record their child's pain every 6 hours during the first 24 postoperative hours, using the postoperative pain measurement for Parent Scale.

Results: CHEOPS score H0 was significantly lower in G2 as compared to G1 group (p = 0.03). Only 2 children in G2 as compared to 8 children in G1 group, required i.v. paracetamol administration after surgery (p = 0.04). In group G1, two children required paracetamol at home and three developed a postoperative transitory femoral nerve block (p = 0.23).

Conclusions: Ropivacaine when used with high concentration/small volume is more efficient than when used a high volume/low concentration, for ilioinguinal-iliohypogastric nerve block in children.

Keywords: ilioinguinal block, ropivacaine, children.

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Introduction

Ilioinguinal-iliohypogastric (IL/IH) nerve block has been shown to produce adequate safe analgesia following peritoneo-vaginal canal surgery in children¹. Ropivacaine, a regional analgesic agent, is known to be a safer substitute, with lesser central nervous system effects and cardiac toxicity than bupivacaine^{2,3}.

Several concentrations of ropivacaine have been used in IL/IH nerve block in children: 0.75⁴, 0.5⁵ and 0.2^{6,7}. The appropriate concentration, however, is yet to be determined. To our knowledge no published study had compared the analgesic effects of ropivacaine when used in two different concentrations in the IL/IH nerve block in children. Therefore the purpose of the present study was to compare the analgesic effects of ropivacaine when used with high concentration/small volume, to its effects when used as high volume/low concentration, for IL/IH nerve block.

Materials and Methods

Following approval of the local Ethics Committee and obtaining the parent's informed consent, 72 ASA I-II children, 3-9 years of age, scheduled for outpatient elective surgery (unilateral hernia, hydrocelectomy, orchidopexy), were included in a prospective single-blind study. Children with a significant risk of pulmonary aspiration, malignant hyperthermia, known neurological or psychiatric pathology, or with any history of allergy to ropivacaine, were excluded. Children in which the IL/IH nerve block had failed, were also excluded.

All children were premedicated with oral hydroxyzine 2 mg.kg⁻¹, 2 hours before induction of anesthesia. Anesthesia was induced with sevoflurane 6% and maintained with isoflurane in N₂O/O₂. No other anesthetic or analgesic agents were given during surgery.

Children were then randomly allocated (using a random-number table) to receive ropivacaine 0.8 mg.kg⁻¹, either as 1 mg/ml⁻¹ (0.8 ml.kg⁻¹)-G1 group, or as 2 mg.ml⁻¹ (0.4 ml.kg⁻¹)-G2 group.

The peripheral block in all children was established

by the insertion of a short PLEXUFIX 24G beveled needle, using Dalen's technique¹. The intraoperative data was collected by another anesthetist who was not present in the OR during induction.

A painful stimulus was applied on the surgical site 10 min after the IL/IH nerve block. If the child reacted by an increase of the mean arterial pressure (MAP) and/or heart rate (HR) 20% above baseline values, the surgeon was asked to delay skin incision. If the signs of insufficient anesthesia persisted after another 5 min, the nerve block was declared failed, alfentanil 20 µg.kg⁻¹ was administered and child was excluded from the study.

In the Recovery Unit, pain was assessed using the Children's Hospital of Eastern Ontario Pain Scale (CHEOPS) which utilizes behavioral changes (facial expressions, body movements, intensity of crying), as indices of response to nociceptive stimuli.

Data was recorded at the end of surgery (H0), two (H2), four (H4) and six (H6) postoperative hours. If the CHEOPS score was higher than 7, children received paracetamol 15 mg.kg⁻¹. Pain was assessed 60 min later and nalbuphine 0.2 mg.kg⁻¹ was administered if the CHEOPS remained higher than 7.

Before leaving the Hospital, parents were instructed to evaluate their children's pain every 6 hours, during the first 24 postoperative hours, using the postoperative pain measurement for parents (PPMP). The PPMP includes 15 items of routine behavioral change^{8,9}. Parents were directed to medicate their child with oral paracetamol, if PPMP ≥6. Parents were contacted the following day to collect the PPMP scores, and the number of paracetamol required at home. They were also asked if they had been satisfied with the analgesic care of their children.

The study results were compared using Student t-test and Chi square test. A p value of <5% was considered statistically significant.

Results

Seventy-five ASA I children were originally included in the study. Three children (G1 = 2, G2 = 1)

were excluded because of failure of block. Therefore data of 72 children (G1 = G2 = 36) were analyzed.

There were no statistical differences between the two groups with regard to demographics, types and duration of surgery, anesthesia and preoperative HR and MAP (Table 1, Fig. 1).

Table 1

Patient characteristics data, surgical and anesthetic details

	G1 (n = 36)	G2 (n = 36)	p
Age (years)	6 ± 2	6 ± 2	0.54
Sex male (%)	33 (92%)	32 (89%)	1
Weight (kg)	21.6 ± 4.5	23.3 ± 6.7	0.22
Duration of surgery (min)	21	23	0.17
Duration of anesthesia (min)	33	33	0.87
Preoperative HR/min	101 ± 12	98 ± 15	0.43
Preoperative MAP (mmHg)	69 ± 10	69 ± 9	0.95

Data are mean ± SD except for number (%) of patients.

Intraoperative analgesia

Skin incision was delayed (accelerated HR) in 8 (G1) and 5 (G2) children (p = 0.36).

Intraoperative HR

At skin incision, the intraoperative HR was significantly lower in the G2 as compared to the G1 group (0 = 0.035), at 10 min (p = 0.027), at 20 min (0 = 0.008) and 30 min (p = 0.003) (Fig. 2). There was no statistical difference between the two groups with regard to the intraoperative MAP.

Fig. 1

Kinds of surgery & number of patients

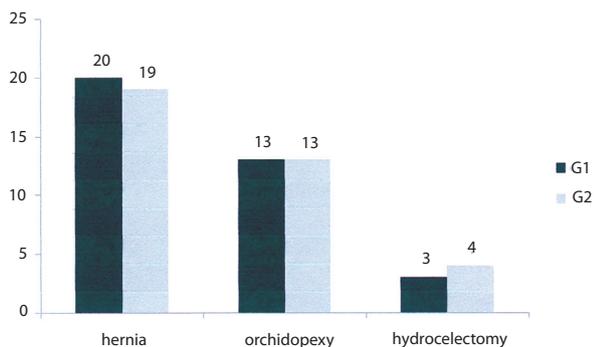
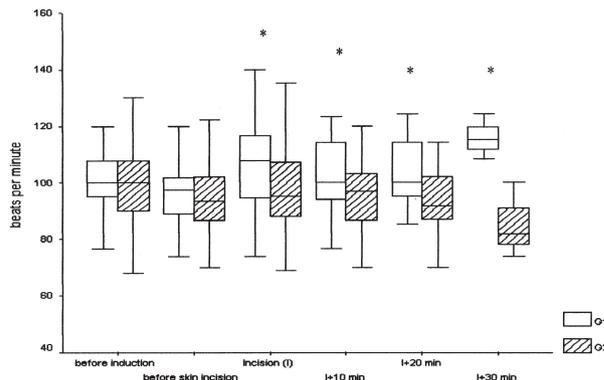


Fig 2
Intra operative heart rate



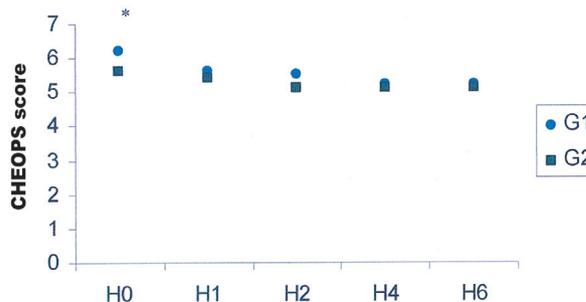
Heart rate obtained before induction, before incision then every 10 minutes after commencement of surgery *p<0.05 in comparison among group.

Postoperative analgesia

CHEOPS at H0 was significantly lower in G2 as compared to the G1 group (p = 0.03) (Fig. 3).

Fig. 3

Postoperative CHEOPS score



Mean CHEOPS score obtained every hour for two hours then every two hours for four hours in the recovery unit.

* p < 0.05 in comparison among groups.

Eight children (22%) in G1 required supplementary analgesia (paracetamol) after surgery (p = 0.04), compared to two children (6%) in the G2 group.

Eight children in G1 had received paracetamol at H0, whereas two children in G2 group had received paracetamol at H2 and at H6.

Tow children, both in the G1 group required paracetamol at home.

All parents were satisfied with the analgesic care of their children.

Discussion

Ropivacaine 0.8 mg.kg^{-1} in two different concentrations were used in this study: 0.1% (0.8 ml.kg^{-1} - G1) and 0.2% (0.4 ml.kg^{-1} -G2).

The G2 children had a better analgesic profile than those of G1, as evidenced by the lower postoperative pain score at the end of surgery and the amount of analgesic consumption.

The block had failed in 3 children among those originally enrolled. So our success rate was 96%, similar to that of Dalens's $\geq 95\%$ ¹, but higher than that of Lim's (76%). This variety of results could be explained by the varying definitions of "failure of the block".

The intra operative HR was significantly lower in G2 as compared to G1. Thus ropivacaine 0.1% seems to be less efficient than 0.2%.

Results show that increasing the volume of local anesthetic could hamper the surgical procedure. Others found that the importance of volume consists in favouring dissection of the aponeurotic planes.

Three patients in the G1 group had developed postoperative transient femoral nerve palsy due to the diffusion of the analgesic solution below the inguinal ligament to the femoral nerve. This side effect had been described in adults^{11,12} as well as in children¹³⁻¹⁶. Erez et al¹³ had observed 6 femoral nerve blocks in a total of 2624 IL/IH nerve blocks using a mixture of bupivacaine 0.5% and lidocaine 0.5%. Lip et al¹⁷ reported an incidence of 8.8%, using 0.25 ml.kg^{-1} of

bupivacaine 0.25%.

The appropriate dose of ropivacaine has been variable. Dalens et al in 2001⁵ report the use of 3 mg.kg^{-1} . Our use of the 0.8 mg.kg^{-1} ropivacaine dose has proven to be satisfactory. Only 12 children had required complementary analgesia for an observation period of 24 hours. The paracetamol was sufficient to calm the pain in all cases.

Ivan et al⁶ had successfully used the same dose of ropivacaine together with clonidine $2 \text{ }\mu\text{g.kg}^{-1}$ for IL/IH nerve block in children. On the other hand, Shimoda et al¹⁸ used three concentrations of ropivacaine: 1.875, .9375 and .5625 mg.kg^{-1} in nerve blocks in children for inguinal hemiorrhaphy and found that the postoperative pain scores were significantly higher in the third concentration.

Conclusions

Our study showed that ropivacaine, when used with high concentration/small volume in IL/IH nerve block, is more efficient than with high volume/low concentration. The dose of 0.8 mg.kg^{-1} ropivacaine seems to be appropriate and is recommended for IL/IH nerve blocks in children.

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