Received:23.2.2006 **Accepted: 2.10.2006**

Original Article

Effect of pre vs. post incision inguinal field block on postoperative pain after pediatric herniorrhaphy, a different approach

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Abstract

BACKGROUND: The aim of this study was to determine if preemptive local anesthesia yields better postoperative pain control than infiltration of local anesthesia at the time of wound closure.

METHODS: Forty patients aged between 1 and 10 years were randomly allocated to one of the two groups by using a sealed envelope technique. Group 1 received 0.5 mg/kg bupivacaine 20 minutes before the incision of skin and the same volume of normal saline at the end of skin suture. Group 2 received 0.5 mg/kg bupivacaine at the end of skin suture and the same volume of normal saline 20 minutes before the incision of skin. Pain scores of patients in the recovery room, 6, 12 and 24 hours after surgery were measured. If patients complained of post surgical wound pain, 30 mg/kg of acetaminophen was administered by rectal suppository. Data were analyzed by chi-square test, t -test and ANOVA.

RESULTS: There were no statistical significance between the two groups for age, weight and sex. The overall mean of pain was 4.6 ± 2.6 for group 1 and 18.6 ± 8.7 for group 2 and the difference between the two groups was statistically significant ($P<0.001$). The mean dosage of acetaminophen administration was significantly higher in group 2 compared with group 1 ($P<0.05$).

CONCLUSIONS: Pre-surgical infiltration of bupivacaine in the surgical field is a useful method in decreasing both post-surgical wound pain for up to 24 hours and analgesic consumption after inguinal hernia repair.

KEY WORDS: Preemptive analgesia, post-surgical pain, analgesic consumption, local anesthetics, bupivacaine, inguinal hernia repair.

JRMS 2007; 12(1): 1-6

Acute pain is one of the most common adverse stimuli experienced by children [1]. As seen in adults, under-treatment of acute pain occurs in a substantial percentage of children [1]. In addition, there are barriers unique to pediatric patients that may interfere with effective postoperative pain control [2]. One of the most important barriers to pain control in pediatric patients are the myths that children and infants do not feel pain, that pain is not remembered, and that there is no untoward consequence of experiencing pain [1].

Tissue injury causes an increase in the excitability of the dorsal horn neurons in the central nervous system [3]. This is a normal physiological response and contributes to pain in the postoperative period [4]. Preventing dorsal horn excitability by administering an analgesic drug before these changes occur may result in better postoperative analgesia than by giving it in the same dose at the end of surgery [3]. This method which has been named preemptive analgesia is

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This research was funded by Research Department, Isfahan University of Medical Sciences, Isfahan, Iran.

an antinociceptive treatment that prevents establishment of altered processing of afferent input, which amplifies postoperative pain [5].

Inguinal hernia repair is one of the most common surgical procedures [6]. There are some controversies about the effectiveness of peripheral nerve blocks before or after herniorrhaphy incisions. Some researches demonstrated that postoperative pain after inguinal herniorrhaphy is decreased if the surgery is performed using local anesthesia, but other studies fail to show such an efficacy [4,7-10]. These controversies raise the question of the benefit of preemptive analgesia at the local level in short- and long-term postoperative care. Thus, the present study was designed to compare the effectiveness of pre-emptive analgesia with that of post-incision analgesia on the incidence, intensity, and duration of post-surgical wound pain in children undergoing inguinal hernia repair.

Methods

Following the approval of the Local Ethics Committee, written informed consent was obtained from 40 patients aged 1-10 years with ASA physical status I or II, undergoing elective open repair of a unilateral inguinal hernia to include them in a double-blind, randomized clinical trial. Patients were excluded from the study if they had emergency surgery, were allergic to local anesthetic drugs, or used analgesics regularly for other reasons. Enrolled patients were randomly allocated to one of the two groups: pre-incision bupivacaine (group 1) or post-incision bupivacaine (group 2), by using a sealed envelope technique in the premedication room. Group 1 received 0.5 mg/kg bupivacaine 20 minutes before the incision of skin as code 1 and the same volume of normal saline at the end of skin suture as code 2. Group 2 received 0.5 mg/kg bupivacaine at the end of skin suture as code 2, and the same volume of normal saline 20 minutes before the incision of skin as code 1. Concentration of bupivacaine was 0.25% and the total volume of each syringe reached 10 milliliter. The first infiltration was done after sedation of patients with 0.1 mg/kg midazolam intravenously in the premedication room. The anesthesiologist was responsible for preparing and labeling the syringes. The surgeon was blind to the type of solution in the syringes. The field block was performed using four injections at the following sites: 1) 1-2cm medial to the anterior superior iliac spine and deep to the external oblique aponeurosis (4 ml); 2) 1.5 cm above the midpoint of the inguinal ligament (2 ml); 3) a subcutaneous weal was formed from the pubic tubercle towards the umbilicus (1.5 ml); 4) subcutaneous infiltration along the line of skin incision (2.5 ml).

All patients received a standard general anesthetic consisting of sodium thiopental 5 mg/kg, atracurium 0.6 mg/kg, fentanyl 1μg/kg and atropine 0.01mg/kg .The anesthesia was continued with 50% N_2O in O_2 and 1.2% isoflurane. Under general anesthesia, skin and subcutaneous layers were opened with a low crease incision. The nerves were preserved. After opening the external oblique aponeurosis, hernia sac was dissected free from cord and double ligated. Repair of inguinal canal button was not performed. Anatomic layers were closed separately. The pain scores of patients in the recovery room, 6, 12 and 24 hours after surgery were measured with the Oucher index by a blind observer [11]. Patients were given 30 mg/kg rectal acetaminophen if the Oucher index was above 40 during the first 24 hours after surgery. If the patients had more pain during the first 24 hours, acetaminophen was used after measurement of Oucher index. The mean cumulative dose of acetaminophen consumption at 24 hours after surgery was also recorded. Data were collected by questionnaires and later analyzed by SPSS. Chi-square test (2-sided Fisher exact test) was used to compare acetaminophen consumption in males and females. Student's T-test was used to compare age, weight and time of surgery between the two groups. ANOVA was used to analyze mean of VAS pain score between the two groups. Data were expressed as mean ± standard deviation. P values less than 0.05 were considered as statistically significant.

Results

Forty patients - 20 in each group - completed the study. There were no significant difference between the two groups in patients' age, weight, sex and duration of surgery (table 1). The distribution of pain in the two groups within 24 hours of surgery and the mean of pain (mean of Oucher scores at rest after surgery) in the two groups are shown in figure 1. According to the results of this study, the mean pain score was 4.6 ± 2.6 in group 1 and 18.6 ± 8.7 in group2, showing a statistically significant difference between the two groups (P<0.001). Furthermore, the results obtained by using the ANOVA method showed that the differences of pain scores between the two groups during the four stages were highly significant (P<0.001) (figure 2). Mean acetaminophen consumption during the first day after surgery was significantly different between the two groups (table 2) (P = 0.02).

Table 1. Patient characteristics and surgery time.

Groups / Variable	Group 1 (N = 20)	Group 2 (N = 20)
Mean age (years)	4 ± 2.4	3.4 ± 2.2
Mean weight (kg)	16.6 ± 5.6	15 ± 4.7
Sex (M/F)	19/1	18/2
Mean time of surgery (minutes)	35 ± 10	34 ± 11

Table 2. Frequency distribution of using acetaminophen.

	No analgesic use	Analgesic use	Total
Group 1	20	0	20
Group 2	14	6	20
Total	34	6	40

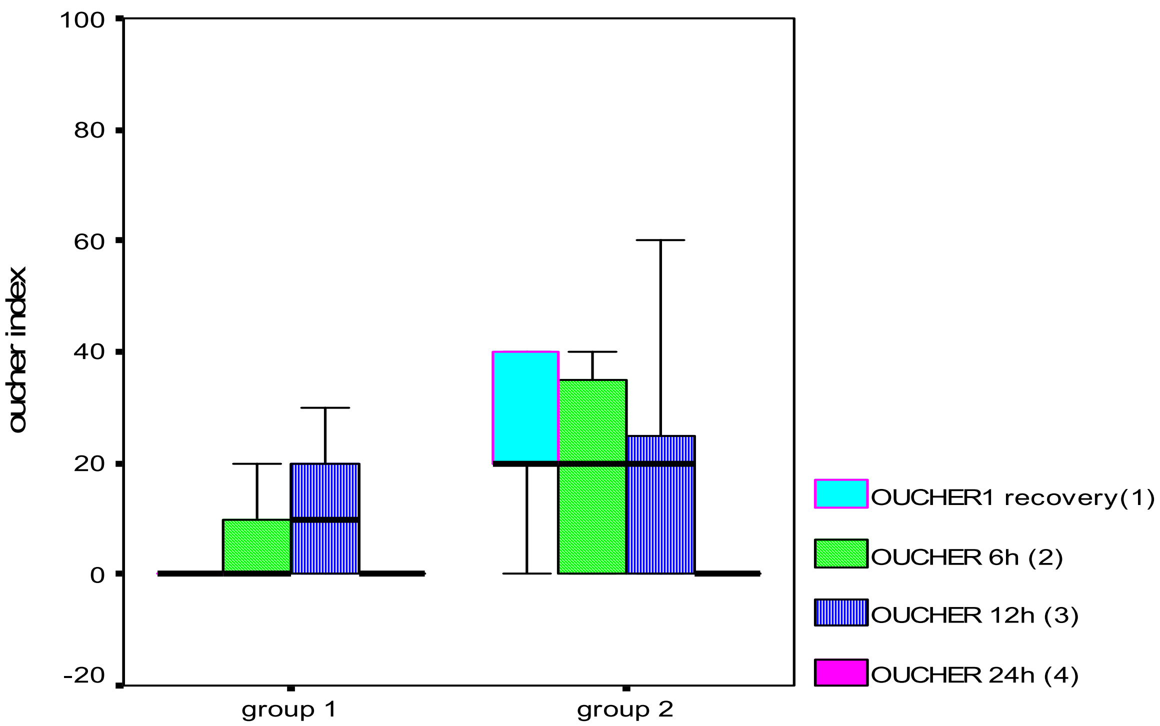

Figure 1. Frequency distribution of pain between two groups during 4 stages of study

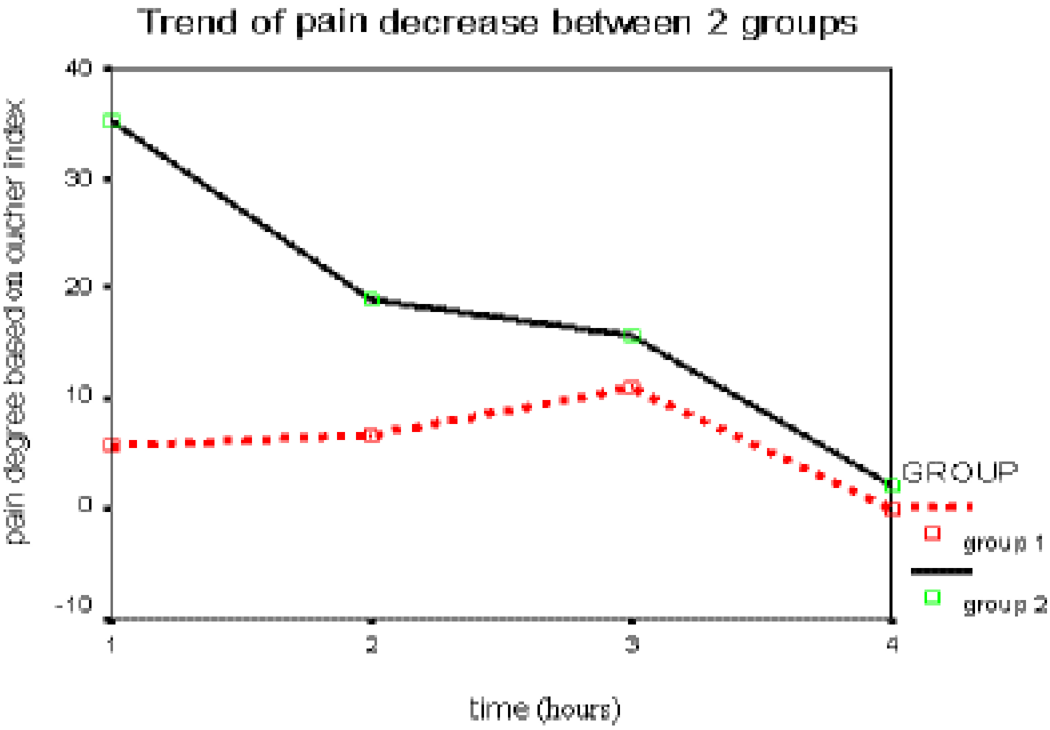

Figure 2. According to this diagram, pain was lower in group 1 during 4 stages of measurements, but pain levels became equal, 24 hours after the surgery.
1h: at recovery; 2h: 6 hours after surgery; 3h: 12 hours after surgery; 4h: 24 hours after surgery.

Discussion

This study showed that pre-incision field and nerve blocking provides significant analgesia in pediatric inguinal hernia repair, in comparison with the post-incision group, especially during the six hours post-operative period. Pre-emptive analgesic regimens are designed to deliver analgesics to patients before the operation. These regimens are based on the hypothesis that the most effective way to eliminate or reduce postoperative pain is to prevent the development of pain rather than simply to treat it. The basis of this hypothesis is a neurological principle known as "the wind-up phenomena" first described by Mendell in 1966 [8]. During an operation, the central nervous system (CNS) receives input from pain fibers peripherally or at the operative site. The continuous stimulation of the CNS may lead to hyperexcitable or "wind-up" nerve activity [8]. As a result, it is thought that patients have an increased perception of pain [8]. According to the study of Stefan Fischer and colleagues, pre-incision bupivacaine infiltration (pre-emptive analgesia) was associated with significantly less postoperative pain [8]. In their opinion, future studies should establish the optimal time to inject local anesthetics [8]. The finding of our study was broadly consistent with their study and demonstrated that infiltration of bupivacaine 20 minutes before incision was efficient. However, the study of Bourget and colleagues showed that pain was no better controlled with pre- incision infiltration of bupivacaine than it was with post-incision infiltration [9]. Also, a systematic review of pre-emptive analgesia pointed that because of the limited available data, conclusion about the positive effects of preemptive analgesia with peripheral nerve blocks is not allowed [12]. Then, we reviewed the methodology of these studies and we found that the time between use of local anesthetic and surgical incision was different in each study. In the former study, patients received bupivacaine infiltration 1.5 hours before incision, but in the later study patients received it five minutes before incision. Other available studies did not mentioned the exact time of infiltration. We then hypothesized that after infiltration of local anesthetics, a certain time period must have elapsed before the drug can act as a pre-emptive analgesia. An infiltration immediately before the incision would not have sufficient time to diffuse to all the structures in the inguinal area, so the pain fibers would remain hyper-excitable and able to send their signals to the CNS where the wind-up phenomenon could be initiated [8]. We concluded that the time between infiltration of bupivacaine and skin incision is important for the pre-emptive action of drug. As the nociceptive impulses need to be disrupted to control pain, it is necessary that the drugs be directed at the target area in order to achieve pealed effect. According to previous studies we used bupivacaine as our local anesthetic due to its long acting effects. The study by Dierking and colleagues suggested that the duration of action of lidocaine is too short to prevent postoperative central sensitization [13]. Also, the low pain score in both groups in the present study may obscure a significant pre-emptive effect in a surgical population that experiences greater postoperative pain, such as hysterectomy and arthroplasty. The limitation of our study was inability to evaluate the postoperative pain of the patients after 24 hours, because patients were discharged from the hospital.

Conclusions

In summary, we have shown that peripheral nerve blocking with 0.5% bupivacaine significantly reduces postoperative pain and analgesic requirements in pediatric patients undergoing unilateral repair of inguinal hernia under general anesthesia, as long as the time interval between infiltration of the drug and incision is maintained. Future studies should establish the optimal time of injection of the local anesthetics, and also interaction between different types of surgery and preemptive field block with long acting local anesthetics.

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