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Preemptive Analgesia in Children with Caudal Blocks

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Abstract

Introduction: The aim of this study was to evaluate the preemptive analgesic effect and duration of postoperative analgesia after caudal blocks in children.
Methods: Forty-five children who underwent distal hypospadias surgery were assigned to group one (n=23) received caudal bupivacaine (0.25%) 0.5 mg kg-1 and midazolam 0.05 mg kg-1 before the surgical incision, and group two (n=22) who received caudal bupivacaine (0.25%) 0.5 mg kg-1 and midazolam 0.05 mg kg-1, after the surgical incision. Anesthesia was induced with propofol and fentanyl and maintained with sevoflurane and nitrous oxide. Postoperative pain was rated on objective pediatric pain scale.
Results: Analgesic requirement was higher in the second group.
Conclusion: Preemptive analgesia with caudal blocks may prevent the intensity and frequency of postoperative wound pain.

Introduction

Preemptive analgesia involves the introduction of an analgesic before the onset of noxious stimuli. Prevention of the initial neural cascade could lead to eliminating the hypersensitivity produced by noxious stimuli (1-3). One of the techniques for prevention of postoperative pain in children involves the use of caudal block.

Single-shot caudal epidural blockade is one of the most widespread techniques to provide intra and postoperative analgesia in pediatric patients, which is relatively easy to perform (4-6). Caudal block can be performed prior to surgery in combination with general anesthesia, after surgery to be used for postoperative analgesia, or instead of general anesthesia for low abdominal and lower extremity procedures (7).

The aim of this study was to evaluate the preemptive analgesic effect and duration of postoperative analgesia after caudal blocks with bupivacaine and midazolam, given before or after surgical incision, during the surgical treatment for hypospadias in children.

Methods

This prospective, randomized, double-blinded study was approved by our institution's ethics committee and written informed consent was obtained from the parents of each participant. The subjects were 45 boys aged 1 to 9 years. All were ASA physical status I or II. Each patient was assigned randomly to either group, once for each operation. Patients were excluded if they had a known allergy to any of the drugs involved in the study, patients with ASA physical status >II and if caudal block failed.

Each child was premedicated with oral midazolam (0.5 mg·kg-1) 30 minutes before anesthesia induction. The intravenous line was put in both groups of children before the induction of anesthesia. Anesthesia was induced with propofol and fentanyl and laryngeal mask was inserted. Anesthesia was maintained with sevoflurane in 50% nitrous oxide and oxygen. After induction, in a lateral decubitus position a 22 gauge intravenous catheter was inserted in the caudal space. Patients in group one received 0.25% caudal bupivacaine 0.5 mg kg-1 and midazolam 0.05 mg kg-1 before the surgical incision, and patents in group two (n=22) received 0.25% caudal bupivacaine 0.5 mg kg-1 and midazolam 0.05 mg kg-1, after the surgical incision.

Pressure-controlled ventilation was administered throughout the operation. Anesthesia was discontinued after the last suture was tied. The laryngeal mask was removed when the child was breathing spontaneously (on 100% oxygen) and airway reflexes were restored.

In each case, we recorded heart rate, blood pressure, arterial O2 saturation, and end-tidal CO2 concentration (Compact 5XL, Medical ECONET, Germany), at fixed intervals throughout the operation.

In order to keep the study double-blinded,two separate anesthesiologists were involvedin each case. First blinded anesthesiologist collected following data: age, weight, premedication, preoperative anxiety, type of anesthesia, type of surgery, and duration of surgery and anesthesia. The anesthesiologist was blinded to the specifity of the caudal solution. In the post-anesthesia care unit, the second anesthesiologist, blinded as to the specifity of caudal solution, observed

and collected following data: recovery time, pain and adverse effects.

Objective Pain Scale (OPS) (minimum score: 0 = no pain; maximum score: 10 = extreme pain) was used to assess pain severity (8). This scale is composed of 5 items and each are scored (Illustration 1). Assessments were made at 15-min intervals for the first hour, 30-min intervals for the second hour and 3, 4, 5, 6, and 24 hr recovery from anesthesia. The observer scored pain on each time (none/insignificant pain (1-3); moderate pain (4-6); severe pain (7-10)). Patients with pain score ≥4 were treated with additional dose of analgesics. Patients with pain score ≥4, received diclofenac suppository (1-2 mg kg-1).

Recovery time (defined as the time until eye opening on command or the time of first response to command after anesthesia), preoperative anxiety, agitation during the emergence period and time to first analgesia administration, were also noted. Preoperative anxiety was assessed (after premedication until the anaesthetic induction) using observational scale, the modified Yale Preoperative Anxiety Scale (YPAS-m) (9). The child was consider anxious if the YPAS-m >30.

Adverse effects during surgery, hypotension and bradycardia and after removal of laryngeal mask (intense coughing, hypersalivation, laryngospasm), nausea and vomiting and muscle weakness were also recorded.

Demographic data (age, sex, weight), duration of surgery, recovery time, preoperative anxiety, intraoperative data and pain are presented as median and percentiles, and differences between the 2 groups were analyzed using paired t tests. Nonparametric data, incidence of adverse events, are expressed as median and range, and differences between the 2 groups were analyzed using the Wilcoxon ranked-sum test, exact Fisher test and chi-squared test. P values less than 0.05 were considered significant.

Results

Group I (n = 23) represented 51% of the total children in the study and group II (n = 22) represented 49%. There were no significant differences between the 2 study groups with respect to age, sex distribution, weight, proportions of patients with physical status ASA I and physical status ASA II, or type of operation, and frequency of preoperative anxiety or emergence agitation (P > 0.05) (Illustration 2).

Illustration 3 lists the frequencies of different adverse effects that were noted in the 2 groups. Four patients (17.4%) in group I and 3 (13.6%) in group II developed hypotension intraoperativelly. These differences were significant. None of the 45 children required treatment with vasoactive agents. Motor block was present only in one child in group I and one in second groups.

Table 4 shows the results for first requirement of analgesics. The mean time for group II was significantly shorter than the corresponding mean for group I (4.6 ± 1.3 vs 5.2 ± 2.4 hours respectively; P< 0.01).

Group II had a significantly higher proportion of patients who exhibited postoperative pain than group I (40.9% vs.8.7%, respectively; P < 0.05). The OPS score in group I was 3 (range, 0–10), whereas the corresponding in group II was 8 (range, 1–10). The difference between these results was statistically significant (P < 0.01) (Illustration 4).

Discussion

Knowledge that preemptive analgesic interventions are more effective than conventional treatment in managing acute postoperative pain remains controversial. Several reviews have very different conclusions. For example, some reviews have concluded that preemptive analgesia is effective as such (10,11), but some have concluded it to be effective only for certain analgesic drugs (1,12). The evidence on preemptive analgesia in animal studies is very credible (13); results from human clinical studies remain controversial.

Our study with comparation of pre-incisional and post-incisional caudal block with bupivacaine and midazolam revealed an effectiveness of preemptive analgesia. The significantly higher frequency of postoperative pain was during realizing a block after surgical incision (40.9% vs. 8.7%, respectively).

Several studies have compared the effect of preoperative and postoperative anesthesia infiltration for inguinal herniorrhaphy. No firm evidence was observed regarding the timing of analgesic treatment that has important effects on postoperative pain control (14, 15).

Katz and colleagues studied patients scheduled for elective thoracic surgery, which received epidural fentanyl before incision and the same dose of epidural fentanyl after incision. They found that pain scores were significantly less in patients who applied epidural block before surgical incision (16).

The other study which supports our findings was from Amr et al. they applied pre-incisional epidural bupivacaine and fentanyl in patients undergoing thoracic surgery and demonstrate the significant lower score of postoperative pain (17).

Arici et al. demonstrates that preemptively administered iv paracetamol 1 g in patients undergoing a total abdominal hysterectomy operation, ensures an effective analgesia during the postoperative period and reducing postoperative morphine consumption and side effects (18).

As mentioned, research has established that multiple factors are associated with postoperative pain. Some of the possible causes include anxiety just prior to surgery, or emergence delirium. A number of groups have looked at the correlation between preoperative anxiety, postoperative agitation and postoperative pain. Kain and colleagues evaluated the relationship between preoperative anxiety and both postoperative delirium and new maladaptive behaviours using data from several previous studies (19). They found that higher levels of preoperative anxiety put patients at increased risk for postoperative pain. In our study, our data demonstratea similar incidence of preoperative anxiety (8.7% versus 4.5% respectively) and emergence agitation (1.3 ± 0.6 versus 1.4 ± 0.7 respectively) in first and second group (Tab.2).

The incidence rates of adverse effects were low in both our treatment groups (Tab.3).

Findings in our study demostrate the significant difference in time until first anesthesia request in group I and II (4.6 ± 1.3 vs 5.2 ± 2.4 hours respectively; P< 0.01).

Conclusion(s)

In summary, postoperative pain in children remains a significant problem. Our results indicate that, caudal block with bupivacaine and midazolam before surgical incision is associated with a lower incidence of postoperative pain intensity and reduced postoperative analgesics requirements when compared with the caudal block applied after surgical incision. Preemptive analgesia may prevent the intensity and frequency of postoperative wound pain.

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Illustrations

Illustration 1

Objective Pain Scale (OPS) of Hanallah et al. for Postoperative Pain Assessment

Parameter	Finding	Points
systolic blood pressure	Increase <20% of preoperative blood pressure	0
	Increase 20-30% of preoperative blood pressure	1
	Increase >30% of preoperative blood pressure	2
crying	Not crying	0
	Responds to age appropriate nurturing (tender loving care)	1
	Does not respond to nurturing	2
movements	No movements relaxed	0
	Restless moving about in bed constantly	1
	Thrashing (moving wildly)	2
	Rigid (stiff)	2
agitation	Asleep or calm	0
	Can be comforted to lessen the agitation (mild)	1
	Cannot be comforted (hysterical)	2
complains of pain	Asleep	0
	States no pain	0
	Cannot localize	1
	Localizes pain	2

Illustration 2

Demographic data, durations of surgery and anesthesia, recovery time, frequencies of preoperative anxiety and emergence agitation scores in the first and second groups (groups I and II)

	Group I (*n* =23*)*	**Group II (*n* =22 *)***
Age (y)	5.0 ± 1.5	5.0 ± 1.6
Weight (kg)	19.4 ± 6.1	19.0 ± 5.7
Sex (F/M)	0/23	0/22
ASA (I/II)	12/11	10/12
Duration of surgery (min)	40.6 ± 9.0	42.2± 11.3
Duration of anesthesia (min)	68.1± 23.2	69.0 ± 28.5
Preoperative anxiety *n* (%)	2 (8.7%)	1 (4.5%)
Emergence agitation	1.3 ± 0.6	1.4 ± 0.7
Recovery time (min)	16.1 ± 4.3	15.5 ± 5.4

Values are listed as median (percentile), number of patients, or mean ± SD

Illustration 3

Side effects noted in the 2 study groups.

	Group I (*n* = 23)	**Group II (*n* = 22)**	***P* value**
Hypotension	4 (17.4%)	3 (13.6%)	0.041*
Bradycardia	5 (21.7%)	5 (22.7%)	0.864
Cough	2 (8.7%)	2 (9.1%)	0.925
Laryngospasm	2 (8.7%)	1 (4.5%)	0.609
Hypersalivation	3 (13.0%)	3 (13.6%)	0.924
Nausea/Vomiting	2 (8.7%)	2 (9.1%)	0.817
Muscle weakness	1 (4.4%)	1(4.5%)	0.934
* significant difference			

Illustration 4

Results postoperative pain scored using the Objective Pain Scale (OPS) and incidence and recovery to first analgesic time, in group I and group II.

	Group I (*n* = 23)	**Group II (*n* = 22)**	***P* value**
OPS score	2 (0-10)	8 (0–10)	<0.01*
Pain *n* (%)	2 (8.7%)	9 (40.9%)	<0.05*
Recovery to first analgesic time (h)	5.2 ± 2.4	4.6 ± 1.3	<0.01*
* significant difference			

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