Original Article

RECOVERY STATUS IN CHILDREN AFTER GENERAL ANAESTHESIA: ROLE OF PRE-EMPTIVE LOCAL ANAESTHETIC INFILTRATION

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ABSTRACT

This prospective clinical study was carried out in the dept. of Anaesthesia, Analgesia and Intensive Care Medicine, BSMMU. Dhaka during the period of January 04 to September 04. The study was done to emphasize the importance of giving analgesics preemptively instead of waiting for the child to complain or express their pain and to improve post operative recovery status and associated response by reducing the immediate post operative pain with simple local anaesthetic infiltration. The children scheduled for elective herniotomy operation through a hernial incision under general anaesthesia were recruited in this study. Immediate recovery status in children was compared with preemptive (group-1 and without preemptive (group-II) local infiltration of 0.25% bupivacaine in herniotomy operation. No. of patients was 20 in each group. Pulse, systolic, diastolic and mean pressure, oxygen saturation, pain (scored by TPPPS), anaesthetic recovery (scored by steward recovery system) and mental status if the children were observed postoperatively at different time interval up to one hour.

Pulse, systolic, diastolic, mean pressure were stable in group-1 then group-II. Oxygen saturation in both the groups were in clinically acceptable range but in group-11 5 mins after extubation fall more than that of group- l and statistically significant. Pain score (TPPPS) in group-1 was lower all the time period but in group-II the score was high, all the children required rescue pethidine within 10 mins after extubation, mean dose reqd, in group-II was 23.6+3.6mg. Steward recovery score in both group was not significant at early period but after 10 mins. P value become significant The mental state of group-I was calm & quite only 3 were excited, on the other hand in group-11 all children were excited & irritable and required rescue pethidine. So preemptive local infiltration of 0.25 bupivacaine improved the recovery status in children by reducing the immediate postoperative pain and there by decrease in postoperative morbidity.

INTRODUCTION

Recovery constitutes the transition state from general anaesthesia to the baseline state[1]. The definition of recovery is difficult because some drowsiness may persist for many hours. The period of recovery is the end of surgery to when the patient is alert and physiologically stable.

Pain is the major cause of distress during the emergence and immediate postoperative period, this is also true for infants & young children, even premature infants at 28 weeks of gestation show marked endocrine responses (epinephrine, nor epinephrine, glucagons, lactate and pyruvate) to surgically induced stress[2].

The goal of preemptive analgesia is to prevent the establishment of central sensitization, which amplifies postoperative pain; post injury analgesia usually has a reduced effect because central sensitization already has been established[3].

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The physiological basis of preemptive analgesia is complex and involves modification of pain pathways.

There are many methods for suppression of pain pathways eg.central neural block, local infiltration, NSAIDs, opioid etc. for management of postoperative pain but the local anaesthetics are most potent in relieving pain and which have also deferent mode of administration[5].

Analgesic effect after topical application of local anaesthetics are due to both local effect caused by nerve block at incision site and systemic effect due to absorption at raw surface and followed by central modulation mechanism[6].

There are several scoring system are used to quantify recovery from anaesthesia[1]. The most useful are Aldrete recovery score and Steward recovery score. The Aldrete scale is oriented toward adults; steward developed a more suitable scale for children[1]. The Steward Recovery scale scores airways, consciousness, and movement from 0-2 points, maximum points is-6.

This study was performed to see the immediate recovery profile in paediatric patients after preemptive wound infiltration with 0.25% Bupivacaine.

MATERIALS AND METHODS:

This randomised, prospective clinical study was carried out in the Department of Anaesthesia, Analgesia and Intensive Care Medicine, Bangabandhu Sheikh Mujib Medical University Hospital, Dhaka during the period of January 04 to September 04. Children aged between 3-5 years with ASA grade I & II and scheduled for herniotomy under general anaesthesia were recruited in this study. Any physically or mentally retarded, hormonal imbalance, congenital abnormal children other than cong. Ing. hernia, and Children with known allergy to study drugs with hepatic, cardiac, hemorrhagic diathesis etc. were excluded from this study.

After recruitment, the children were randomly divided into two groups, 20 in each by card sampling. Group-1 - Infiltrate 0.25% bupivacaine (2 mg/kg) around the incision site and Group- II - Infiltration with distilled water of same volume at around the incision site.

All children were examined preoperatively and preoperative baseline (pulse, blood pressure, oxygen saturation) were recorded. Measuring tools for pulse, blood pressure and oxygen saturation were Multi Parameter Monitor. All children were given general anaesthesia. After pre-oxygenation for 2-3 min. with 100% oxygen, induction of anaesthesia was done with thiopentone sodium 3 mg/kg IV and tracheal intubation was done after giving atracurium besylate 0.5 mg/kg IV. Maintenance of anaesthesia with N_20 70%, 0_2 30% and halothane 0.5% with long acting muscle relaxant atracurium besylate and IV opioid analgesic: Pethidine 0.70 mg/kg. Ing. Local infiltration with inj. 0.25% bupivacane (2 mg/kg) was given in group-I & distilled water of same volume was given in group-II around the incision site 5 min. before incision.

Peroperative parameters (pulse. Blood pressure, 02 saturation etc.) was done accordingly. Peroperative fluid balance was done by 0.45 % NaCI with 5 % dextrose solutions at a rate of 4 ml/kg/hr. Residual effect of neuromuscular blocking drug was antagonised by Inj. Neostigmine 50 μg/kg with atropine 20 μg/kg and then tracheal extubation was performed.

In the postoperative period heart rate, blood pressure, Oxygen saturation, mental status(excitable or calm, quite), steward recovery score, pain score (TPPPS), requirement of rescue pethidine, any complication like nausea, vomiting etc. ware recorded in prescribed data sheet. In the postoperative period patients were monitored at least one hour. Inj. pethidine (1.50 mg/kg) was given to the patient who had TPPPS >3.

RESULTS

Baseline characteristics of the patients:

Table I describes the baseline characteristics of the patients participated in the study. The table shows that all the demographic variables like age and sex as well other parameters of interest were identical in both the groups.

Table-I

Baseline (preoperative) characteristics of the patients:

Group Characteristics	Gr-I (n = 20)	Gr-II (n = 20)	*P-value*
Age (months)	49.60 ±7.88	50.40 ± 8.00	0.752*
Sex (Male/Female)	14/6	14/6	0.634
Weight (Kg)	15,55+2.45	1572 ± 2.40	0826
Preoperative Pulse/m	93.70±7.69	92.30 ±17.87	0.573
Preoperative Systolic BP	91,75+7.00	9115± 8.92	0.814
Preoperative Diastolic BP	56.00 ± 4.58	56.15 ± 5.77	0.928
Preoperative mean pressure	67.92 ± 5.13	67.82 ± 6.64	0.958
Preoperative Saturation (%)	100.15 ± 2.37	99.75+44	0.462

Data are expressed as mean ± SD or is frequency as applicable. Sex is expressed as male-female ratio.

* ANOVA statistics was used to analyze the data and level of significance was 0.05. p-value <0.05 was considered as significant

Monitoring of *pulse* at different time intervals in postoperative ward:

Pulses of the group -1 were comparatively good through the 1st one hour period while the pulses of the group -II were somewhat higher than the former group for the 1st 20 minutes.

Monitoring of systolic BP at different time intervals

It was seen that systolic BP of the group -1 were in normal states throughout the 60 minutes , while the BP of the group -II were somewhat higher than the former group for the 1" 20 minutes. However the BP came down to normal level at 40 minutes interval following rescue analgesic administration p- values are <0.05, < 0.05, <0.05, <0.05,>0.05 and> 0.05 respectively.)

Monitoring of diastolic BP at different time intervals:

Diastolic BP of the group -1 were in better state through the 1st one hour period, while the BP of the group -II were comparatively high for the I 't 20 minutes and returned to normal level at 40 minutes interval as postoperative rescue analgesic was given (IT-values are <0.05 , < 0.05, <0.05, <0.05,>0.05 and> 0.05 respectively.)

Monitoring of mean pressure at different time intervals:

The mean pressure immediately, at 5,10 and 20 minutes after extubation were quite different between the two groups (p<0.05 in each case). However the mean pressures of the two groups became nearly equal at 40 minutes interval following administration of rescue analgesic and maintained the same thereafter (p- values >0.05, >0.05 respectively)

Monitoring of oxygen saturation at different time intervals:

There was no difference in the two groups with respect to oxygen saturation at any of the above intervals, except at 5 minutes, during the 1st one-our period (p>0.05). The mean oxygen saturation at 5 minutes interval in group-1 was (100 ± 0.31)% where as in group -II was (99 ± 0.79) % and the difference between the two groups was found to be statistically significant (p<0.001) .

Changes in TPPPS at different time intervals

The TPPPs was found always to be staggeringly higher in group -II compared to group - 1 (p<0.001), accept at interval of 60 minutes).

Monitoring of *Steward recovery score* at different time intervals:

Table-II explains the Steward recovery score of the patients at different time intervals (immediately, 5, 10, 20, 40 and 60 minutes after extubation) while getting recovered from GA. The table shows that Steward recovery scores immediately and at 5 minutes after extubation for both the groups were exactly equal (so significance level was undefined). But the two groups were significantly different at 10, 20, 40 and 60 minutes interval with respect to the same variable. (p-values <0.05, <0.05, <0.05, <0.05, respectively).

Table-II

Monitoring of Steward recovery score at different time intervals:

Steward recovery score	Group Gr-l (n = 20)	Gr-2 (n = 20)	P-values
Steward score immediately# after extubation	6.00 ± 0.0	6.00 ± 0.0	Undefined*
Steward score 5 minutes after extubation	6.00 ± 0.0	6.00 ± 0.0	Undefined
Steward score 10 minutes after extubation	6.00 ± 0.0	5.80 ± 0.41	0.036**
Steward score 20 minutes after extubation	6.00 ± 0.0	5.85 ± 0.37	0.075
Steward score 40 minutes after extubation	6.00 ± 0.0	5.80 ± 0.41	0.036
Steward score 60 minutes after extubation	6.00 ± 0.0	5.95 ± 0.22	0.324

All the variables are expressed as mean ± SD as ANOVA statistics was used to analyse the data.

** Level of significance was 0.05. Any p-value <0.05 was considered as significant

Mental state at different time intervals :

It was found that out of 20 patients in group -1, only 3 were excitable immediately after extubation, but none was excitable there after. Where as in the group-II 17, 20, 16 and 3 patients were excitable at immediately, 5 minutes, 10 minutes and 20 minutes after extubation respectively . However at 40 minutes interval all the patients of the latter group became calm and quite as rescue analgesic (pethidine) was given. The difference between the 2 groups in respect of mental state after extubation was found to be significant ($p<0.05$).

Rescue analgesic (pethidine):

All 20 cases in group -II needed rescue analgesic where as only one needed the same in group - 1. The difference between the two groups was statistically significant ($p<0.005$).

Distribution of complications :

Table 3 shows the distribution of complications between the 2 groups. A total of 10 patients developed complications like nausea and vomiting. Of them 7 (35%) developed in group -II and the rest 3 (15%) developed in group-1. The association between the group and complications was statistically significant ($p = 0.001$).

Table -III

Type of complications	Group-1	Group -II	
Nausea	02(33.3%)	04(66.7%)	06
Vomiting	01(25.0%)	03(75.0%)	04
Total	03(30.0%)	07(70.0%)	10

Table-III shows the type of complications in the two groups. Of the total 10 complications 6 (2 in group-1 and 4 in group -II) were nausea and 4 (1 in group-1 and 3 in group -II) were vomiting.

DISCUSSION

There are many factors that make the child unstable during the recovery stages. Among them the most important is surgical pain. Due to this pain or trauma there is increased sympathetic activity, hormonal changes(elevation of serum catecholamine, glucocorticoid, glucagon, growth hormone concentration [1]) that elevate the blood pressure, metabolic changes, make the patient restless, disoriented ultimately unstable the recovery status of the child.

Pain is the major cause of distress during the emergence and immediate postoperative periods[2]. Doxon and others, 1984 proved that pain causes prolonged disruption of behavioral development [7]. Patient outcome become worse if pain is not adequately treated[8].

Preemptive analgesia is an antinociceptive treatment that prevents establishment of altered central processing of afferent input from sites of injury[9]. The most important conditions for establishment of an effective preemptive analgesia are the establishment of an effective level of antinociception before injury and the continuation of this effective analgesic level well into the post injury period to prevent central sensitization during the inflammatory phase. The concept of preemptive analgesia was formulated by Crile at the beginning of previous century on the basis of clinical observation[10]. Later revival of this idea was associated with a series of animal studies started by Wolf[11,12]

There are lot of works using preemptive analgesia with different drugs along or in combination and thus reducing the postoperative pain and improved the postoperative recovery status.

In our study we randomly selected the patient in two groups. Preemptive local infiltration was given in group-I & preemptive local infiltration of distilled water of same volume was given in group-II before surgical incision. Then we see & compared the immediate recovery status within one hour, specially the pain, mental status, cardiovascular variabilities (Pulse, Blood pressure), oxygen saturation, requirement of analgesic and other vital functions etc. It was shown that the group-1 is improved recovery status in children after general anaesthesia.

Badner and colleagues demonstrated that administration of 0.5% bupivacaine in Knee surgery resulted in reduced morphine requirements[13]. Preemptive blockade of peripheral nerves with local anesthetics can have a beneficial effect on pain after hernia repair, outlasting the duration of the nerve block even when the repair is performed with spinal anesthesia[14]. Eriksson -Mjoberg-M and his colleagues also have shown significantly reduced morphine consumption in preincisional subcutaneous infiltration with 0.25% bupivacaine than placebo[15]. In against of these positive outcome of preincisional infiltration with bupivacaine Bourget JL and his colleagues have shown no difference between preincisional and postincisional infiltration with 0.25% bupivacaine in relation to pain score or morphine consumption[16]. Cobby-TF also has shown no difference in pain score or in morphine consumption with bupivacaine infiltration between study and control group after abdominal hysterectomy[17].

In non- surgical cases topical opioid has been used successfully by Krajnik and his colleagues with rapid relief of pain and analgesia lasted 7-8 hours[18]. Wound irrigation with dexamethasone acetate [19] and with triamcinolone[20] after lumber surgery reduces pain score and 24 hours morphine consumption significantly.

Analgesic effect of topical local anaesthetics are due to nerve block and anti inflammatory effect at incisional area and systemic effect due to absorption at raw surface and then by central modulatory mechanism in the dorsal horn by activation of the endogenous opioid system [21].

In our study it was shown that cardiovascular parameter (pulse, systolic, diastolic and mean pressure) was higher in group-II compared to group-1. Significant result was found before 40 minutes after extubation. After 40 minutes P-values was become insignificant, due to control of pain in group II by administration of IM pethidine. It is well established that in response to pain there is increase concentration of serum catecholamine (sympathetic activity) and other stress hormone like glucocorticosteroid, glucagons, growth hormone, which ultimately causes increased blood pressure(systolic, diastolic, and mean) and pulse. Hypertention, tachycardia and other pain-related behaviors are almost always results from pain and the treatment is administration of analgesic agents[1].

Oxygen saturation in our study was found insignificant at all time interval except at 5 minute where the p-value is significant. Although the $_{02}$ saturation in both the groups at all time interval was maintained clinically acceptable range but at 5 minute interval in group-II 02 saturation fall more in comparison with group- ($p<0.001$).

There are several scoring system used to quantify recovery from anaesthesia, the most useful are aldrete recovery score and Steward recovery score [1]. The aldrete recovery score is oriented towards adult, steward developed a more suitable scale for children [22]. In the group-I as because patients ware

awake at all the time period, so that higher score was found , where as in group-11 after giving rescue pethidine the score gradually become less. In this study at immediately and 5 minutes after extubation p-values is undefined but thereafter the values are significant.

Clare McCarthy and his colleagues investigate & found TPPPS to be suitable for the assessment of pain in children[13]. TPPPS (Toddler preschooler postoperative pain scale) is an observation scale and is suitable for children because the parameter is not depends on the patient comment. Preschool children usually lake the verbal and cognitive skills to describe their feeling of pain or physical discomfort[24]. At different tine interval TPPPS is highly significant. In group-II initially the score was higher but gradually become lower due to rescue pethidine, but in group-I there was least pain and the TPPPS was lower in comparison with group-II There are many study proved that the preemptive local infiltration reduces the postoperative pain score & less analgesic requirement, Huang-SJ and his colleagues have shown significantly less pain score at rest and with cough in lower abdominal operation in female, in this study 0.125% bupivacaine used for infiltration before incision. Morphine consumption was also less in study group from 6th hour to 24th than control group[25.]

Pain at awakening is the major cause of postoperative agitation and excitement, adequate analgesia minimizes the incidence of excitement in the recovery period [2]. Compared between this two groups at different time period found significant result. In group-I only 1 patient was excited at immediately after extubation but in group-II all patient ware excited & agitated at different time period, which was gradually reduced after giving pethidine.

Rescue pethidine was given IM when patient shown higher TPPPS (>3), excited and or pain related response. In group-II all the patient needed rescue pethidine within 10 minutes after extubation {no. 5(25%) at immediately, no.10 (50%) at 5 minutes and no. 5(25%) at 10 minutes after extubation} but in group-I most (19) of the patient needed no rescue pethidine, only one patient needed pethidine at immediately after extubation. The difference between the two groups was statistically significant. The mean dose of pethidine needed to bring the patients to calm & quite in group-II was 23.6 ±3.6 mg, where as in group-I all patients were calm & quite without any rescue pethidine except one case. Total duration of analgesic effect of bupivacaine is long, Karsten Hannibal & his colleagues has result with 0.25% bupivacane infiltration with late request of analgesic at 345 minutes (5.65 hrs) after incision ~.

Another study of Meena N Cherian and her colleagues has shown request for first dose of analgesic at 807.7 minute (13.45 hrs) after operation in 0.375% bupivacaine infiltration [27].

Preemptive local and regional anaesthesia leads to smoother emergence; the incidence of nausea and vomiting is decreased, since narcotics are avoided [28]. In our study nausea and vomiting seen in both the groups, but higher incidence (>double) 35% was found in group-II (Nausea-4, vomiting-3) where as in group-I the incidence was 15% (nausea-2, vomiting-1), which is statistically significant. Nausea and vomiting is a relatively frequent & unpleasant complication of anaesthesia in children at recovery room [2]. In this study group-I developed less complication (15%) compared with group-II (35%). In our study except nausea & vomiting there was no other complication seen in both the groups.

CONCLUSION:

It is concluded that preemptive local infiltration with 0.25% bupivacaine in children produces no or insignificant pain and pain related responses. There is no or less requirement of analgesics & improved comfort ness of the patients, also reduces the postoperative complications. Thus preemptive local infiltration reduces immediate postoperative morbidity which is turn improved immediate recovery status of the children..

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