Original Article

Penile block for paediatric urological surgery: A comparative evaluation with general anaesthesia

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ABSTRACT

Aim: Peri-operative pain relief in children can be provided by conventional general anaesthesia or by regional nerve blocks. The present study was carried out to evaluate and compare the effectiveness of penile block for penile surgery with the standard technique of general anaesthesia (GA) of short duration of less than two hours, and also to evaluate the postoperative pain relief obtained by penile block.

Materials and Methods: The study was carried out in the department of Anaesthesiology and Intensive care of our hospital, on 60 children in the age group of 1-10 years, belonging to American Society of Anesthesiologists (ASA) grades I and II, and divided randomly into two groups: Group B and group G, comprising of 30 patients each. Group B children received a penile block whereas group G children underwent a standard general anaesthetic procedure. Baseline, intra-operative and post-operative heart rate (HR), electrocardiogram (ECG), non-invasive blood pressure (NIBP) (systolic and diastolic) and pulse oximeter oxygen saturation (SpO_2) were recorded at regular intervals. The duration of post-operative pain relief, time to rescue analgesia and time to first feed were also evaluated and recorded. Statistical analysis was carried out using statistical package for social sciences (SPSS) 11 version for windows and employing analysis of variance (ANOVA), unpaired student *t* test, Chi-square test and Mann Whitney U test for various parameters. Value of $P<0.05$ was considered as significant and $P<0.0001$ as highly significant.

Results: The demographic characteristics were comparable in both the groups. Heart rate, systolic blood pressure, diastolic blood pressure and pulse oximetry showed remarkable differences at various time intervals during intra-operative and post-operative period, which were statistically significant on comparison ($P<0.05$ and $P<0.0001$). Post-operative pain relief, time to first rescue analgesia and time to first feed also showed statistically significant differences.

Conclusions: Penile block is very effective when used along with light sedation for distal penile surgeries of less than 2 hours duration as compared to standard GA as reflected by more stable haemodynamics in peri-operative period, excellent pain relief extending up to 6-8 hrs postoperatively and absence of any significant complications or side effects.

Key words: Bupivacaine, general anaesthesia, penile block, penile surgery

INTRODUCTION

Pain free surgery has now become an important aspect of anaesthetic care that includes even paediatric anaesthesia patients. Perioperative pain relief in children can be provided either by using various opioids or analgesics during a conventional general anaesthetic or by employing various regional nerve block techniques.

The techniques of regional anaesthesia progressively fell into disuse by early 20th century owing to numerous improvements in the conduct of general anaesthetics. Also paediatric regional anaesthesia calls for special skills.[1] However by late the 1970s, interest in paediatric regional anaesthesia resurfaced.[2] Over the years newer and safer local anaesthetic drugs have been developed and technical skills have also improved. The almost complete absence of hemodynamic effects of regional anaesthesia in children makes regional techniques all the more attractive.[1] Children have long been considered unsuitable for regional blocks.

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Also, most of the surgeons preferred that children be immobilized and should be unconscious on the operating table. Despite all these, paediatric anaesthesiologists have proved that regional anaesthesia provides an attractive alternative to general anaesthesia in children.[3] Regional techniques provide excellent post operative pain relief, with preservation of consciousness and normal ventilatory control. Recent experiences and research have made regional blocks a safe and feasible option in children undergoing surgical procedures.[3,4]

Regional anaesthesia can provide a predictable and consistent level of prolonged pain relief that allows for early discharge from hospital. The side effects viz., nausea and vomiting, somnolence or ventilator depression are minimal. Peripheral nerve blocks are useful adjuvant as well as an alternative to general anaesthesia in children. The main advantages of peripheral blocks include target nerve blockade, minimal associated motor blockade, use of a lower volume of local anaesthetic, minimal incidence of urinary retention and ability to be used in areas where central neuraxial blockade cannot be used (head and neck). It can also be very useful in patients who present for surgery in a non-fasting status.

Several painful penile surgeries viz., circumcision, urethral dilatation and hypospadias repair can be safely undertaken under block of dorsal nerve of penis.[1-3,5] Serour *et al*.[5] have advocated usage of dorsal penile nerve blocks alone for circumcision in paediatric patients. This block is easy to perform, safe and effective in most of the cases for relieving the postoperative pain of superficial penile surgery. With advancements in sedation techniques and monitoring facilities, it is possible to perform the entire surgery under penile block supplemented with sedation, thereby avoiding the morbidity and complications of general anaesthesia. Keeping the advantages of paediatric regional blocks in consideration, we designed a study in our hospital to evaluate and compare the effectiveness of penile block for penile surgery with standard technique of general anaesthesia of short duration of less than two hours and also to evaluate the postoperative pain relief obtained by penile block.

MATERIALS AND METHODS

The study was conducted in the Department of Anaesthesiology and Critical Care of our institute after the approval of the protocol by the Hospital Ethics Committee and obtaining a written and well informed consent from the parents. Sixty children between the age of 1-10 years belonging to American Society of Anesthesiologists (ASA) grades I and II were enrolled in the present study in a randomized manner and divided equally into two groups of 30 each: Group B and group G. The process of randomization was carried out with the help of computer generated coded envelopes and the entire record was maintained by the central station staff. Group B comprised of children who received a penile block, whereas group G children underwent a standard general anaesthetic procedure. On the basis of 30 minutes difference in the duration of post-operative pain relief, power analysis at 80% was carried out with the value of alpha at 0.05 and the sample size was calculated to be 27 in the present study.

A peripheral 24/22 gauge (G) intravenous (IV) cannula was secured in all the patients in the paediatric ward itself. Both groups received ketamine 0.5-1.0 mg/kg body weight and atropine 0.02 mg/kg body weight intravenously, 15 minutes before surgery as pre medication. The effect of the ketamine lasted for approximately 15-20 minutes in the children who were administered isolated local block. Baseline parameters like non invasive blood pressure monitoring (NIBP), pulse oximetry (SpO_2), heart rate (HR) and electrocardiogram (ECG) were observed and recorded.

In group B, the penile block was administered by the anaesthesiologist using 0.25% bupivacaine without adrenaline in a dose of 0.5 mg/kg body weight and it was used as an isolated local block. Taking all antiseptic precautions, a 30 mm 23 G needle was inserted in the midline after gently pulling down the base of the penis by the index finger and directed below the symphysis pubis through the Scarpa's fascia and into the sub-pubic space. After a negative aspiration for blood, 25% of the calculated volume of drug was injected. The needle was withdrawn by 1-2 mm and redirected to 11:00 O' clock and 1:00 O' clock positions and 25% of the calculated volume of drug was injected on either side of midline to block the two dorsal nerves. Entry of the needle through the Scarpa's fascia was appreciated as a 'give'. An additional puncture was made on the raphe line at the borderline between the penis and scrotum and the remaining 25% of the calculated drug volume was injected to alleviate possible pain arising from the skin innervated by the perineal nerves. All these injections were made very slowly, taking 100-120 seconds to reduce pain during injection. Analgesia was evaluated by gentle pinching of the skin of the penis with mosquito artery forceps approximately 15 minutes after completing the block. In case of insufficient analgesia, as evidenced by crying or wincing of the child, a second similar test was performed after 5 minutes. If pain was still perceived by the patient, standard general anesthetic was given and the patient was excluded from the study. This exclusion criterion was observed after the second unsuccessful attempt when the child still showed signs of pain on pinching. Intravenous midazolam in a dose of 0.01 mg/kg body weight was given to sedate the patients during the course of surgery.

Children in group G underwent a standard general anaesthetic. Induction of anaesthesia was achieved with a gas mixture of oxygen, nitrous oxide (50:50), sevoflurane (2-4%) and fentanyl 1-2 μg/kg body weight. Oral endotracheal intubation was performed with appropriately sized polyvinyl chloride

Table 1: Demographic profi le of the pediatric patients in the study in group B and group G and values of the median age, weight, haemoglobin (Hb) levels and duration of surgery in each group

	Group G (n=30)	Group B (n=30)	*P* value
Age (years)	4.52 ± 2.41	5.35 ± 2.70	0.218
Weight (kgs)	15.20 ± 5.82	16.87. ± 6.51	0.300
Hb (gm/dl)	10.89 ± 1.15	11.31 ± 1.02	0.139
Duration of surgery (minutes)	39.67 ± 25.05	35.33 ± 18.57	0.761

(PVC) endotracheal tubes, facilitated by succinylcholine in a dose of 1 mg/kg body weight. Maintenance of anaesthesia was done with oxygen, nitrous oxide (40:60) and sevoflurane (1-1.5%), and vecuronium bromide 0.1 mg/kg body weight was utilized for neuromuscular blockade. Ventilation was controlled with a closed circuit system connected to a paediatric anaesthetic ventilator (PENLON AV 900). During peri-operative period, any increase of heart rate or mean arterial pressure (MAP) >20% of the baseline was managed by 25% of the initial dose of fentanyl as and when required. At the end of the procedure, the residual neuromuscular block was reversed with neostigmine 0.05 mg/kg body weight and atropine 0.02 mg/kg body weight and patients were extubated after clinical assessment and thorough orophanyngeal suction.

Intra-operatively, HR, ECG, NIBP (systolic and diastolic) and SpO_2 were recorded at 5 minute intervals for the first 60 min and then at 15 minute intervals till the end of procedure. The presence or absence of tears and sweating was also noted at the similar intervals.Post operatively, HR, NIBP, SpO_2 and pain were assessed and recorded at 15 minutes, 1 hour, 4 hours and 8 hours. These parameters were recorded by the anesthesiologist in the post-anesthesia care unit (PACU) and then by trained nursing staff in the paediatric ward. The pain relief or absence was assessed for the children by their mother based on cry, irritability or restlessness of the child on a smiley faces score which had five faces corresponding to 0, 25, 50, 75 and 100% analgesia.

The time to first feed and the first rescue analgesic were also recorded. Any complications or side effects due to the block or GA were also observed and recorded. Data are expressed as mean±standard deviation (SD) and median (interquartile range- IQR) and statistical analysis was carried out using statistical package for social sciences (SPSS) 11 version for windows and employing unpaired student's *t* test, Chi Square test, analysis of variance (ANOVA) with Bonferroni's correction for continuous variables and Mann Whitney U test for post-operative pain score at different time intervals. Value of $P<0.05$ was considered significant and $P<0.0001$ as highly significant.

RESULTS AND OBSERVATIONS

The study was done on 32 patients in group B and 30 patients in group G. Two patients in group B had a failed block and were then excluded from the study. These two patients were administered general anaesthesia and were not included into the final statistical analysis. As the study was on per protocol basis, we did not carry out intention to treat analysis. The mean age (5.35 ± 2.70 yrs), weight (16.87 ± 6.51 kg), Hemoglobin (Hb) (11.31 ± 1.02 gm/dL) and duration of surgery (35.33 ± 18.57) in group B was comparable to the mean age (4.52 ± 2.41 yrs), weight (15.20 ± 5.82 kg), Hb (10.89 ± 1.15 g/dL) and duration of surgery (39.67 ± 25.05) in group G and statistically non significant [Table 1].

Table 2: List of the diagnosis of the condition and the type of surgery performed on the pediatric patients in each group of the study

	Group G	Group B
Diagnosis		
Phimosis	16	17
Distal penile Hypospadius	7	7
Urethral fistula	4	3
Religious reason	1	1
Traumatic prepucial oedema	1	0
Tight perpuce	1	1
Ventral chordae	0	1
Type of surgery		
Circumcision	18	18
Urethroplasty	7	7
Repair	4	3
Perpucal dilatation	1	1
Chordae Correction	0	1

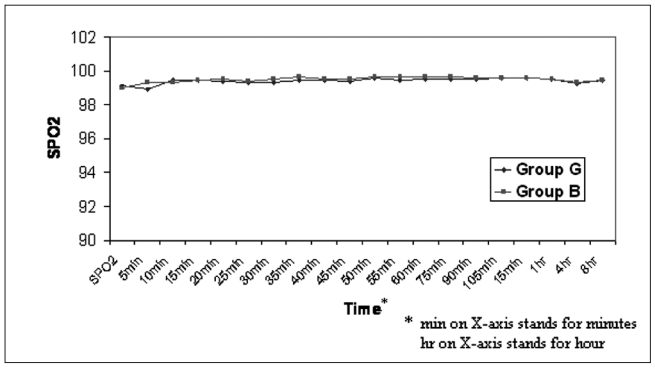

Figure 1: Comparison of SpO_2 values in pediatric patients in group G and group B at different time intervals post-operatively

The following table [Table 2] lists the diagnosis and the various surgical procedures which were performed on these children.

The comparison of mean intra-operative HR at various time intervals in the two groups shows significantly higher variations in group G as compared to group B at almost all

Table 3: Intra operative heart rate comparison between pediatric patients of group B and group G and its statistical signifi cance, recorded at time intervals of every 5 minutes, from the fi rst 5 minutes of the procedure till 90 minutes

	Groups	Mean ± SD	*P* Value
5 min	G	102.13 ± 3.7	0.021
	B	99.10 ± 5.87	
10 min	G	101.80 ± 4.37	0.019
	B	98.53 ± 5.99	
15 min	G	101.00 ± 5.43	0.021
	B	98.50 ± 4.94	
20 min	G	101.56 ± 5.83	0.011
	B	97.62 ± 5.41	
25 min	G	101.90 ± 5.21	0.004
	B	96.74 ± 5.69	
30 min	G	102.71 ± 4.95	0.012
	B	97.86 ± 5.05	
35 min	G	101.00 ± 3.57	0.128
	B	98.50 ± 4.52	
40 min	G	101.85 ± 3.69	0.005
	B	97.09 ± 3.73	
45 min	G	103.64 ± 4.80	0.006
	B	96.63 ± 4.90	
50 min	G	103.80 ± 4.05	0.003
	B	96.43 ± 4.61	
55 min	G	104.89 ± 4.91	0.009
	B	96.83 ± 5.08	
60 min	G	106.00 ± 5.45	0.003
	B	95.00 ± 4.36	
75 min	G	104.67 ± 8.08	0.238
	B	96.00 ± 7.21	
90 min	G	106.00 ± 7.21	0.284
	B	98.00 ± 5.66	

Table 5: Post operative change in heart rate in the group B and group G of the pediatric patients in the study seen at 15 minute and 1, 4 and 8 hour interval

	Groups	Mean ± SD	*P* value
15 min	G	116.40 ± 5.47	0.0001
	B	96.90 ± 4.72	
1 hr	G	109.80 ± 5.88	0.0001
	B	92.44 ± 18.03	
4 hr	G	103.03 ± 6.02	0.0001
	B	93.70 ± 4.06	
8 hr	G	97.80 ± 5.22	0.0001
	B	91.87 ± 4.5	

time intervals ($P<0.05$) except at intervals of 35 min, 75 min and 90 min [Table 3].

Similarly, the mean intra operative fluctuations in mean arterial blood pressure at various time intervals in the two groups showed statistically higher significant values in group G than in group B ($P<0.05$) except at interval 20, 25, 55 and 60 minutes [Table 4].

Table 4: Intra operative fluctuations in mean arterial blood pressure for the pediatric patients of group B and group G and its statistical significance, recorded at time intervals of every 5 minutes, from the first 5 minutes of the procedure till 90 minutes

Time Interval (in minutes)	Groups	Mean ± SD	*P* value
5	G	68.46 ± 3.98	0.016
	B	64.88 ± 1.86	
10	G	67.12 ± 3.32	0.025
	B	64.27 ± 2.16	
15	G	66.94 ± 3.46	0.033
	B	63.78 ± 2.43	
20	G	65.86 ± 3.08	0.072
	B	63.52 ± 1.98	
25	G	65.78 ± 2.67	0.086
	B	63.14 ± 1.63	
30	G	65.62 ± 2.58	0.042
	B	62.92 ± 1.56	
35	G	65.66 ± 1.96	0.008
	B	62.74 ± 1.78	
40	G	66.14 ± 1.84	0.002
	B	62.89 ± 1.16	
45	G	66.48 ± 2.12	0.000
	B	63.12 ± 1.72	
50	G	66.74 ± 2.96	0.007
	B	63.26 ± 1.86	
55	G	66.68 ± 3.04	0.46
	B	63.78 ± 2.12	
60	G	66.86 ± 4.12	0.73
	B	64.12 ± 1.82	
75	G	68.32 ± 3.08	0.002
	B	63.98 ± 1.76	
90	G	68.54 ± 3.68	0.006
	B	63.86 ± 1.48	

Table 6: Post-operative change in mean arterial pressure in pediatric patients of group B and group G at different time intervals

Time Interval	Groups	Mean ± SD	*P* value
15 minutes	G	68.46 ± 3.86	0.000
	B	64.12 ± 1.41	
1 hr	G	67.16 ± 3.42	0.002
	B	64.38 ± 1.88	
4 hr	G	64.56 ± 3.34	0.246
	B	64.12 ± 1.73	
8 hr	G	63.28 ± 2.26	0.054
	B	64.28 ± 1.98	

The mean SpO_2 values during the intra operative period in group G were significantly lower in the first 5 minutes as

Table 7: Pain score at different time intervals post operatively in group G and group B of the pediatric patients

Pain Scores		15min/1hr/4hr/8hr				*P* value
		25	50	75	100	
Groups	G	0/0/0/18	0/0/3/11	11/9/21/1	14/14/6/0	0.0001 (at 15min/ 1hr/4hr)
	B	10/22/21/20	19/5/4/1	1/2/5/5	0/1/0/4	0.002at 8hr 5/7/0/0 0/0/0/0

compared to group B (*P*=0.017). At 30 min interval too, the mean SpO_2 value in group G was found significantly lower than in the group B (*P*=0.020). The values at other intervals of time were comparable between the groups [Figure 1].

None of the patients in group B required any additional local anaesthetic or supplemental analgesia. However, all children in this group had to be given midazolam 0.01 mg/kg to allay anxiety and to alleviate minor movements of limbs. All the children in group G where surgery lasted 45 minutes or longer needed additional top up doses of fentanyl (*n*=10).

Post operatively, the heart rate in group G was significantly higher than group B at all the four time intervals (*P*<0.0001) [Table 5]. The mean arterial blood pressure in group G was significantly higher than group B at 15 min and 1 hour after surgery (*P*=0.000, 0.002). Mean arterial blood pressure values were comparable at 4 and 8 hour interval and were statistically non-significant on comparison [Table 6].

The post operative SpO_2 values in the two groups were comparable (not significant, *P*>0.05) at all the 4 intervals.

At 15 min post operatively, in group G, 11 patients scored at 50% on pain scale (n=11, 36.63%), 14 at 75% on pain scale (*n*=14, 46.62%) and 5 patients had 100% pain (*n*=5, 16.65%). Comparatively, 10 patients in group B reported no pain (*n*=10, 33.3%) 19 reported 25% pain (*n*=19, 63.27%) and only 1 had 50% pain (*n*=1, 3.33%). This was statistically very highly significant (*P*=0.0001). At 1 hour post operative pain assessment, 9 patients in group G reported 50% pain (*n*=9, 29.97%) while 14 patients scored 75% pain (*n*=14, 46.62%) and 7 reported 100% pain (*n*=7, 23.31%). Comparatively, in group B, 22 children were fully pain free (score 0) (*n*=22, 73.26%), 5 had a score of 25% pain (*n*=5, 16.65%), 2 had 50% pain (*n*=2, 6.66%) and only 1 had 75% pain (*n*=1, 3.33%). The values were once again statistically very highly significant (*P*=0.0001). At 4 hours after surgery 3 patients in group G had only 25% (*n*=3, 9.99%). A further 21 had 50% pain (*n*=21, 69.93%) and 6 patients reported 75% pain (*n*=6, 19.98%). On the other had, 21 patients in group B (*n*=21, 69.93%) reported non pain, only 4 had 25% pain (*n*=4, 13.32%) and 5 had 50% pain (*n*=5, 16.65%). These values were again statistically very highly significant (*P*=0.0001) [Table 7].

Eight hours after surgery, 18 patients (*n*=18, 59.94%) in group G had no pain (score 0), 11 had 25% pain (*n*=11, 36.63%) and only 1 had 50% pain (*n*=1, 3.33%). Comparatively, 20 children in group B reported no pain (*n*=20, 66.6%), 1 had 25% pain (*n*=1, 3.33%) 5 had 50% pain (*n*=5, 16.65%) and 4 (*n*=4, 13.32%) had 100% pain. These values were once again highly significant (P=0.002) [Table 7].

Table 8: Time of intake of fi rst food and rescue analgesia in group G and group B pediatric patients in the study in minutes after the operation was completed

	Group G (Mean ± SD)	Group B (Mean ± SD)	*P* value
Time of intake of first food	287 ± 54.40	77.5 ±17.65	<0.001
Time of first rescue analgesia	91 ± 49.97	562 ± 300	<0.001

The average time of rescue analgesia was 287.0 ± 54.4 minute in group G while it was 562.0 ± 300 in group B (*P*<0.001). The mean time to first feed post operatively was 91 ± 49.97 in group G whereas it was 77.5 ± 17.76 minute in group B (*P*<0.001) [Table 8].

There were no complications due to the block, viz., edema, hematoma or bleeding perurethra. Only two children in group G had post operative vomiting and two children had transient desaturation (SPO_2-88-90%). No children in either group suffered from any drowsiness, restlessness or respiratory depression. The children undergoing surgery under GA (group G) had a steady depth of anaesthesia as recorded by the absence of tears or sweating during the course of the surgery. Owing to the nature of the surgery, many of the patients were catheterized pre operatively. Hence, occurrence of urinary retention was not studied. However, all the other children passed urine of their own and post operative catheterization of the bladder was not required for any patient in either of the groups.

DISCUSSION

In the early part of the twentieth century, regional blocks were not the technique of choice for surgery in children, mainly because of the evolution of better techniques of general anaesthesia and probably the lack of skill for performing the blocks in paediatric patients. In the last 10 years regional nerve blocks have been proven safe and effective even in the very young. The advantages of regional anaesthesia include a decreased requirement of general anaesthesia allowing early extubation and providing long lasting analgesia extending well into the post operative period.[3,4]

Regional anaesthesia is now being considered as complimentary to general anaesthesia. This is especially true in paediatric practice, where regional blocks are essentially performed under sedation or general anaesthesia, since the association of the two techniques dramatically cuts down the risk of both procedures.[6,7]

Paediatric penile surgeries are usually superficial ones; however, the post operative pain they cause can permanently scar the child psychologically. Parenteral narcotics or topical analgesia do not always provide sufficient analgesia, and caudal blocks with the possibility of motor blockade of lower limbs appear to be controversial for minor surgeries.[8,9]

In this study, the effectiveness of penile block was compared with general anaesthesia in children undergoing penile surgery with emphasis on intra operative and post operative analgesia achieved by the block. In the present study, the sample size of 30 children each in group G and B is comparable to the earlier studies. Plain bupivacaine 0.25% solution was used and injected at a slower rate taking 100-120 seconds, and the maximum value of the drug to be injected was kept at 8 ml to avoid pressure effects in a very tiny tissue compartment.[10]

Penile block was administered under ketamine 0.5-1.0 mg/kg intravenously along with atropine 0.02 mg/kg on boys aged 1 to 10 years and penile surgery was performed comfortably in all these patients. Studies have been carried out earlier also but using penile blocks alone in paediatric patients and only the pain scores were evaluated in a manner similar to the present study.[5,11] Some series were fairly large; however, the children in those studies were all aged 3 years and older. In the present study, it was decided to have a quiet child with intact protective reflexes; hence the use of ketamine along with atropine was preferred. Additional midazolam 0.01 mg/kg was given to sedate the patients during the course of surgery. The effect of ketamine lasted for 20-25 minutes in patients who underwent isolated penile block as evident from the movement of the limbs and other activities. The effect of ketamine could not be assessed in the other group as patients were under the influence of general anaesthesia. Similar earlier studies have been carried out for circumcision and hypospadias repair under penile block.[5,11-14] Although, in the present study, the majority of cases were for circumcision and hypospadias repair, there were other surgical indications as well [Table 2].

The reported technical failure rate for penile block varies from 2.9 to 6.7%.[5,11,14] In the present study also, the block failure occurred in 2 out of 32 patients (6.2%) which is comparable to earlier studies. Intention to treat analysis was carried for the two drop-out children in our study.

Numerous earlier studies have evaluated the efficacy of penile block given under GA.[12,13,15-17] In the present study, we were successfully able to administer the block under sedation with ketamine. As also highlighted by all the earlier studies, the block was easy to perform and there were no technical difficulties while giving the block. Most of the children did not move significantly during this step; however, some had reactive abdominal muscle contraction, and mild flexion of the lower limbs. In the earlier studies not much significance was given to the comparison of vital signs such as heart rate, respiratory rate, pulse oximetry, etc but only pain scores were the focal point of study. The pain scores were almost similar to earlier study but the comparison of vital signs could not be performed due to paucity of available data.

The penile block was performed by a subpubic approach[18] and also included an additional injection at the penoscrotal junction on the raphe line as advocated by Serour *et al*.[5,11] During the course of surgery, none of the group B (penile block) patients suffered from pain. On the other hand, all the group G children (n=10) where surgery lasted 45 minutes or longer needed additional top up doses of fentanyl.

All the 30 children in group B made uneventful recovery after the surgery. Two out of 30 children in group G had post operative vomiting while 2 more had transient fall in SpO_2 (88-90%) lasting about 10 seconds. None of the group G patients exhibited any evidence of light plane of anaesthesia as noted by absence of tears and sweating. Although pressure, heart rate, sweating, tears (PRST) score is not the best method to monitor depth of GA, in the absence of bispectral index (BIS) monitor, it was the closest one available. Also, due to premedication with ketamine and atropine, two of the components, viz., heart rate and blood pressure became confounded and were not considered for evaluating depth of GA.

Intra operatively, it was noted that the heart rate and mean arterial pressure in group G remained significantly higher than in group B. At most of the time intervals, this observation could be explained either as a stress response to anaesthesia and surgery or intra operative pain. The exact explanation for this observation was not possible in our current study design. Premedication with ketamine also could have been a contributing factor.

SpO_2 during the course of surgery in both the groups was essentially comparable. The significant decrease in SpO_2 in first 5 minutes could be due to the gap in ventilation during induction-intubation sequence.

Post operatively, group G patients had significantly higher heart rate than group B at all 4 time intervals. This could be due to perception of post operative pain and residual effect of anticholinergics. The initial significantly higher mean arterial pressure at 15 minute and 1 hour in group G

patients could be due to residual effects of anticholinergics and pain.

The pain score was significantly higher in group G at 15 min and 1 hour after surgery with 14 patients each reporting 75% pain and 5 and 7 patients reporting 100% pain at these intervals, respectively. This value decreased steadily after rescue analgesics that were given mostly in the period of 15 minute to 1 hour post operatively. At 4 hours and 8 hours post operatively, only 6 patients in group G had 75% pain while no patients reported 100% pain as the rescue analgesics took effect. The dosage and type of rescue analgesics were not in the protocol of this study and hence have not been recorded.

The pain score in group B was significantly lower at 15 minute, 1 hour and 4 hours intervals post operatively. 10, 22 and 21 patients in this group reported no pain at 15 minutes, 1 hour and 4 hours while 19, 5 and 4 patients reported only 25% pain at these intervals. At 8 hours post operatively, 20 patients in this group had no pain while 4 patients reported 75% pain thus reflecting the wearing off of the effect of the block.

In group B the largest pain free period is 24 hours where as the shortest one is 1 hour. Most of the children had oral intake earliest at 1 hour and latest by 2 hours.

The incidence of nausea and vomiting was remarkably low in our study (only 2 in group G and none in group B). No block related complications like bleeding, hematoma or edema were noted in group B patients at any point of time.

Dorsal penile nerve blocks are easy to perform, occasional failures being usually due to technical difficulties.[19] Few minor complications like bleeding, hematoma and minor bruising have been reported.[20] There was no such complication in our study. A slow rate of injection taking 100-120 seconds avoided causing pain to the children while giving the block which is also supported by studies of Serour *et al*.[21]

The use of dorsal penile nerve block under sedation thus avoids the usage of general anaesthesia with its inherent risks of laryngospasm, oxygen desaturation, post extubation sore throat, nausea and vomiting and somnolence. The block provided good intra operative and post operative analgesia for superficial penile surgeries in children. The children were comfortable, happy and had an earlier recovery and food intake as compared to children having undergone surgeries under GA. We had several children with distal hypospadias in our study. It is to be emphasized that hypospadias of the shaft and perineal part of the penis will be better covered by caudal than dorsal penile nerve block.[4]

CONCLUSIONS

After considering all our observations, results and analysis it is concluded that:

1. Penile block is very effective when used along with light sedation for distal penile surgeries of duration less than 2 hours.
2. Penile blocks prove to be more effective for these surgeries than standard GA as reflected by more stable haemodynamics in peri operative period, excellent pain relief extending up to 6-8 hours post operatively, and absence of any significant complications and side effects.
3. The post operative analgesia offered by the penile block allowed for early recovery and feeding of the children.

LIMITATIONS

1. In the absence of BIS monitoring, the measurement of heart rate and MAP can be considered as a limitation of our study.
2. We did not design a detailed questionnaire regarding the surgical conditions and surgeons' satisfaction although no complaints were reported by any of the surgeons during the peri-op period in either of the group. This can be viewed as another limitation of the present study.

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