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Original Research Article

"Spinal Anaesthesia in Paediatric Patients of District Level Hospital, Tangail, Bangladesh"

Md. Rafiqul Alam Talukder[1*], Mohammad Mahbube Mostafa[2], Kamal Ahmed Chowdhury[3], Md. Fazlul Haque[4], Saiful Islam[5], Athid Mohammad Mollah[6], Mahmudul Hasan[7]

[1]Assistant Professor (Anaesthesia), Sheikh Hasina Medical College, Tangail, Bangladesh
[2]Anesthesiologist, Jigma Dorji Wangchuk National Referral Hospital, Thimphu, Bhutan
[3]Junior Consultant (Anesthesiology), Sir Salimullah Medical College Mitford Hospital (SSMCMH) Mitford, Dhaka, Bangladesh
[4]Assistant Professor (Anaesthesia), Sheikh Hasina Medical College, Tangail, Bangladesh
[5]Junior Consultant (Pediatrics), General Hospital, Tangail, Bangladesh
[6]Assistant Professor (Anaesthesia), Shaheed Suhrawardy Medical College, Dhaka, Bangladesh
[7]Assistant Professor (Pediatrics), Sheikh Hasina Medical College, Tangail, Bangladesh

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Abstract: ***Background:*** Spinal anaesthesia consists of inserting a spinal needle into the subarachnoid space and, when a free flow of cerebrospinal fluid (CSF) is obtained, injection of a solution of local anaesthetic directly into the CSF. In Paediatric Patients Spinal Anaesthesia is used for subumbilical surgeries but still there is a concern about its safety & feasibility. ***Objective:*** To assess the spinal anaesthesia in paediatric patients of district level hospital, Tangail, Bangladesh. ***Materials and Methods:*** In this prospective study was conducted in the Dept. of Anaesthesia, Sheikh Hasina Medical College Hospital, Tangail, Bangladesh from January to June 2021. 32 paediatric patients of aged 2-10 years were included undergoing sub umbilical surgery. Under all aseptic precautions and sedation, subarachnoid block was given with 27g quineke needle through L3-L4 or L4-L5 subarachnoid space & hyperbaric 0.5%. Bupivacaine was administered according to the weight of children. The dose of Bupivacaine used was 0.1ml\kg for child (<5kg), 0.08ml\kg (5-15kg), 0.06ml\kg (>15kg). Demographic data, vital parameters, sensory –motor block characteristics & complications were noted. ***Results:*** The mean and standard deviation of age is 5.17+2.83 (2-10) years and Mean Weight (Kg) 15.23+7.43 (7.8-23). Out of the 32 cases, 24 were males whereas the remaining 8 were females. In this study indication of high perception RIH 10 (31.25%), Fracture shaft of femur 4 (12.5%), LIH 4 (12.5%), Umbilical Polyp 2 (6.25%), Distal Hypospadias 5 (15.62%), Re-Circumcision 2 (6.25%), Undescended testicle 3 (9.37%), Appendicitis 1 (3.12%) and Mucous Cyst 1 (3.12%). In our study common SA Herniotomy 14 (43.75%), Circumcision 2 (6.25%), Urethroplasty 5(15.62%), Excision polyp 2(6.25%), Orchiopexy 3(9.37%), Ortho surgery 4 (12.5%), Mucous Cyst Excision 1 (3.12%). There was no significant change in vital parameters. Mean peak sensory level was T 6.20 ±1.20 (T4- T8). Mean sensory level at the end of surgery was T8.11±1.42 (T6-T12) Modified Bromage score was 3 in all patients. Sensory and Motor block recovery was complete in all patients. Mean time to two segment regression was 42.91±10.72 (30-70) min. Incidence of complications was minimal with shivering in 2 patients (6.25%) difficulty in breathing in 1 patient (3.12%) & also in 1 patient (3.12%) nausea & vomiting. ***Conclusion:*** Paediatric spinal anaesthesia is safe feasible & effective anaesthetic technique for subumbilical surgeries of limited duration (70-80) minutes with negligible side effects.

Keywords: Paediatric, spinal anaesthesia, infraumbilical, complications, hemodyamics.

I. INTRODUCTION

Spinal anaesthesia consists of inserting a spinal needle into the subarachnoid space and, when a free flow of cerebrospinal fluid (CSF) is obtained, injection of a solution of local anaesthetic directly into the CSF. Regional anaesthesia in children was first studied by August Bier in 1899. In 1900, Bainbridge reported a case of strangulated hernia repair under spinal anaesthesia in an infant of three months. Thereafter, in 1909-1910 Tyrell Gray, a British surgeon published a series of 200 cases of lower abdominal surgeries in infants and children under spinal anaesthesia [1-4]. After some years it fell into disuse because of the introduction of various muscle relaxants and inhalational agents and was almost unused after World War II. In the last decade, it started being advocated again by many centers due to increasing knowledge on pharmacology, safety information and availability of

***Corresponding Author:** Md. Rafiqul Alam Talukder

specialized equipment for regional anaesthetic techniques and monitoring in children. In this population, SA has been proposed as a means to reduce postoperative complications [5], especially apnea and postoperative respiratory dysfunction, although this utility has been questioned. In the coming times, paediatric spinal anaesthesia will not only be used in cases where general anaesthesia is risky or contraindicated but also be the preferred choice in most lower abdominal and lower extremity surgeries in children. Spinal anaesthesia is gaining popularity in infants & children but its safety, feasibility & reliability can be established with greater use & research.

II. MATERIALS & METHODS

In this prospective study was conducted in the Dept. of Anaesthesia, Sheikh Hasina Medical College, Tangail, Bangladesh from January to June 2021. All paediatric patients from 2 to 10 years of age group, American society of anesthesioly grade I-II, without any cardiorespi-ratory abnormility scheduled for elective infraumbilical surgeries like congenital inuinal hernia, congenital hydrocele, undescended testis, hypospadiasis, fracture shaft femur, were selected. Total 32 cases were done. The preanaesthetic checkup was done one day prior of scheduled day surgery. Patients with known contraindictation to spinal anaesthesia were excluded. All patients were kept nil by mouth for 6hrs (solid) and 3 hours (clear fluid) before anaesthesia. Relevant investigation were done e.g. haemoglobin, complete blood count, kidney function test etc. Special investigation like chest xray, coagulation profile only if needed. On the day of surgery in preoperative room vital parameters (Heart Rate, Respiration, Blood Pressure, Spo2) were noted & iv line was established .All patients were premedicated with iv midazolam 0.03mg\kg body weight. After that when child became calm, was taken inside OT keeping all emergeny drugs, endotracheal tubes of appropriate sizes, Laryngoscopes, & bain circuit ready. Multipara monitor for Heart rate, noninvasive Blood pressure, spo2, respiratory rate & temperature monitoring attached. All above baseline vital parameters were noted & iv fluid ringer lactate 5ml/kg was given over 15 minutes. To keep the child immobile and cooperative IV ketamine was given in 1mg\kg body weight & o2 with mask was given at 3-4 lit\min given. Then under all aseptic precautions Subarachnoid block was given via midline approach with 26g hypodermic needle through L3-L4 or L4-L5 interspinal space in left lateral position. After getting free flow of CSF, 0.5% hyperbaric Bupivaccaine was given intrathecally according to the weight of child. The end of spinal drug injection was taken as zero hour for further data recording. After injecting the drug, child was kept supine for 10 minutes. Vitals Heart Rate, systolidistolic blood pressure, Respiratory Rate, SPO2, Temperature were recorded every 1minutes for first 10 minutes & then every 10 minutes till the completion of surgery.

In paediatric patient it was very difficult to assess the onset & level of sensory & motor block as child was sedated & difficulty in understanding our commands. Arbitrarily, we checked the response of child by pin prick with plastic tip of iv set and to firm skin pinch and assessed the response of child to that dermatomal level5 .The desired peak sensory level was aimed to be at T10 level for defining the successful Spinal Anaesthesia Similarly modified Bromage scale was assessed by pin prick given on thigh & observed the response of lower limbs & modified Bromage scale was noted. After 10 minutes of spinal Anaesthesia if peak sensory level was T10 and or Bromage scale was 3 surgeries was allowed to start. If there was no response to surgical stimulus it was considered as successful spinal Anaesthesia block (Grade A.)If the peak sensory level was below T10 and or Bromage scale was<3then it was defined as failed spinal an aesthesia block. (Grade C) And these cases were done under General Anaesthesia and it was excluded from study. All successful spinal block patients were kept sedated intermittently with o2 & halothane on spontaneous respiration with bain circuit when child was crying without pain but due to new surrounding environment inside OT. If intraoperatively pain, or lack of relaxation was observed supplemental anaesthesia was given in the form of intravenous (iv) ketamine 1mg\kg along with iv propofol 1mg\kg and O2 and halothane was given with bain circuit on spontaneous respiration and the case was considered as partial spinal block. (Grade B). At the end of surgery all patients received Paracetomol suppository (20mg\kg) was given. After surgery all patients were transferred to post Anaesthesia care unit for monitoring of vital signs & regression of block till the complete recovery of spinal anaesthesia & that time was noted.

Demographic data, Type & duration of surgery, Vital parameters were noted. Requirement of supplemental sedation, local anaesthetic dose used, & number of attempts for lumber puncture were noted. Quality of Sensory block, motor block, & complications related to spinal anaesthesia, such as total spinal, high spinal, vomiting, shivering, urinary retention, post dural puncture headache, neurological deficit were recorded. The patients were monitored until full recovery. The data analyzed using MS Excel and IBM SPSS 19.0 (Statistical Package for the social Sciences).

III. RESULTS

The mean and standard deviation of age is 5.17+2.83 (2-10) years and Mean Weight (Kg) 15.23+7.43 (7.8-23). Out of the 32 cases, 24 were males whereas the remaining 8 were females Table 1. In this study indication of high perception RIH 10 (31.25%), Fracture shaft of femur 4 (12.5%), LIH 4 (12.5%), Umbilical Polyp 2 (6.25%), Distal Hypospadias 5 (15.62%), Re-Circumcision 2 (6.25%), Undescended testicle 3 (9.37%), Appendicitis 1 (3.12%) and Mucous Cyst 1 (3.12%) (Table-2). In our study common SA

Herniotomy 14 (43.75%), Circumcision 2 (6.25%), Urethroplasty 5(15.62%), Excision polyp 2(6.25%), Orchiopexy 3(9.37%), Ortho surgery 4 (12.5%), Mucous Cyst Excision 1 (3.12%) (Table-3). There were no significant changes in the mean value of systolic blood pressure, diastolic blood pressure, respiratory rate, and oxygen saturation after subarachnoid block at all time period. In successful spinal cases, mean peak sensory level after 10 minute of SAB was T6.20+1.20(T4-T8) and the median was T6. Mean sensory level at the end of surgery was T8.11+1.42 (T6-T12) and the median was T8 (Table-4).

Table-1: Showing Demographic characteristics.

Variables	Findings
Mean Age (years)	5.17+2.83 (2-10)
Mean Weight (Kg)	15.23+7.43 (7.8-23)
Sex (male\female) (%)	24 (75%)/8(25%)

Table-2: Type of indication& its individual number (n=32).

Type of indication	N (%)
RIH	10 (31.25%)
Fracture shaft of femur	4 (12.5%)
LIH	4 (12.5%)
Umbilical Polyp	2 (6.25%)
Distal Hypospadias	5 (15.62%)
Re-Circumcision	2 (6.25%)
Undescended testicle	3 (9.37%)
Appendicitis	1 (3.12%)
Mucous Cyst	1 (3.12%)

Table-3: Type of Surgery & its individual number (n=32).

Type Of Surgery	N (%)
Herniotomy	14 (43.75%)
Circumcision	2 (6.25%)
Urethroplasty	5 (15.62%)
Excision polyp	2 (6.25%)
Orchiopexy	3 (9.37%)
Appendectomy	1 (3.12%)
Ortho Surgery	4 (12.5%)
Mucous Cyst Excision	1 (3.12%)

Table-4: Showing Characteristics of Subarachnoid Block.

Sensory & Motor Block Charactertics	Observations
Mean Peak Sensory Level	T 6.20 +1.20 (T4-T8)
Mean Sensory level at the end of surgery	T 8.11+1.3 (T6-T12)
Time to two segment Regression (min)	42.91+10.72(30-70)
Modified Bromage Score 3	90%

Table-5: vital Parameters.

Timing	SBP(mmhg)	DBP(mmhg)	HR\min	RR\min	SPO2%
Before SAB	85(78-96)	64(66-70)	98(100-120)	14(13-15)	100
After Premedicati on	92(80-97)	62(63-72)	110(98-135)	13(11-14)	99
5minutes after SAB	90(80-95)	67(60-70)	105(116-128)	12(10-13)	100
10 minutes after SAB	86(78-93)	64(62-72)	100(97-120)	10(9-11)	100
20 minutes after SAB	84(76-94)	59(60-66)	94(92-1190	14(12-16)	100
60 minutes after SAB	87(80-94)	62(63-72)	89(90-103)	14(12-16)	100
PACU ROOM	88(77-96)	66(62-72)	95(99-108)	13(12-14)	100

Table-6: Number of patients Showing Intraoperative complications.

Complications Noted	Number of Patients
Difficulty in Breathing	1
Shivering	2
Nausea & Vomiting	1

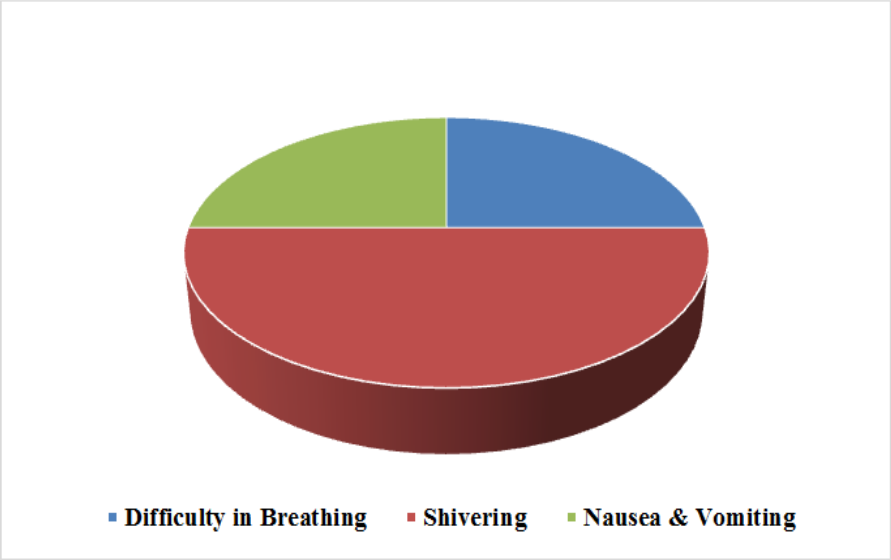

Fig-1: Patients Showing Intraoperative complications.

Table-7: Number of patients operated in different grades of Spinal Anaesthesia.

Grades of Spinal Anaesthesia	Number of patients operated (n=32)
Grade-A (With any iv supplementation)	28(87.5%)
Grade-B (With once intraoperative iv supplementation)	2(6.25%)
Grade-C (conversion to GENERAL ANAESTHESIA)	2(6.25%)

In all successful spinal block the modified bromage scale was 3 which were seen in 90% of patients. Mean time to two segment regression was 42.91+10.72 (30-70) min. Sensory and motor block recovery was complete in all patients (Table-5). Heart rate showed increases to 110 (11.2%) after 5 min of subarachnoid block as compared to baseline. This can be due to glycopyrolate & ketamine which were used for premedication & before giving SAB. However afterwards mean heart rate showed no significant change from baseline. Only one patient developed difficulty in breathing immediately after SAB but there was no fall in oxygen saturation & managed with oxygen on mask with bain circuit on spontaneous respiration (Table-5). Difficulty in Breathing was noted in one patient (2.5%) who was managed with oxygen on mask and patient get stable in 10 minutes. Shivering was noted in two patients (6.25%) and treated with IV pentazocine 0.2mg|kg. Nausea & vomiting observed in one patient (3.12%) and treated with IV ondansterone 0.1mg\kg. No other complications were noted such as bradycardia, hypotension, and urinary retention, total spinal & neurological deficit (Table-6). Total twenty eight patients (87.5%) were operated under spinal anaesthesia without any intravenous supplementation. Two patients (6.25%) were operated along with once intravenous supplementation. Two patients (6.25%) were operated after conversions into general anaesthesia in view of inadequate spinal effect (Table-7).

IV. DISCUSSION

This prospective study was done to evaluate the perioperative haemodynamic changes, feasibility & safety of spinal anaesthesia in paediatric patients of 2-10 years of age. As compared to general anaesthesia decreased stress response & recovery is very fast following spinal anaesthesia [7]. In our study mean and standard deviation of age is 5.17+2.83 (2-10) years and Mean Weight (Kg) 15.23+7.43 (7.8-23). Out of the 32 cases, 24 were males whereas the remaining 8 were females. In this study indication of high perception RIH 10 (31.25%), Fracture shaft of femur 4 (12.5%), LIH 4 (12.5%), Umbilical Polyp 2 (6.25%), Distal Hypospadias 5 (15.62%), Re-Circumcision 2 (6.25%), Undescended testicle 3 (9.37%), Appendicitis 1 (3.12%) and Mucous Cyst 1 (3.12%). In our study common SA Herniotomy 14 (43.75%), Circumcision 2 (6.25%), Urethroplasty 5(15.62%), Excision polyp 2(6.25%), Orchiopexy 3(9.37%), Ortho surgery 4 (12.5%), Mucous Cyst Excision 1 (3.12%). Since the childrens are uncooperative, crying during any invasive procedure adequate premedicaton in the form of analgesia & sedation is very important for smooth regional procedures. Thus to make the child sedated, calm and thus cooperative during lumber puncture. It may be supplimented by iv ketemine, and iv midazolam, or iv propofol, or inhalations anaesthetics Halothane during the procedure. In our study premedication was done with iv midazolam 0.03mg\kg+iv glycopyrolate 4 microgm\kg in preoperative room. Inside the operation theatre, iv Ketamine 1mg\kg was given before lumber puncture & o2 with mask was given. In left lateral position after cleaning & draping of lumber area, with 26g hypodermic needle lumber puncture was done at L3-L4 or L4-L5 space & with clear free flow of CSF 0.5% heavy Bupivaccaine was injected according to the weight of children. During lateral position the neck was

in extension as cervical flexion may obstruct the airway during the procedure. After that child was kept supine & intraoperatively children was kept sedated with O2 and halothane on mask with bain circuit on spontaneous respiration intermittently when they were moving the upper part of body. Sedative effects of SAB itself have also been documented in the literature. Hermanns *et al*. [8] conducted the study to evaluate the sedation during spinal anaesthesia in infants. The presumaed mechanism for sedation after SAB is decreased afferent conduction to reticulothalamo-cortical projection pathways which reduces the excitability & arousal level of brain. In our study lumber puncture was successful in first attempt in 24 childrens (60%) & second attempt in 16 childrens (40%). Not more than two attempts are required for lumber puncture which proved the ease & feasibility of procedure in well sedated childrens. The volume of CSF is more in spinal space & these affects the pharmacokinetics of intrathecal drugs. Among the various drugs approved by FDA for paediatric intrathecal use 0.5% bupivacaine both hyperbaric & isobaric are commonly used. In our study the desired sensory level of T10 was achieved in 90% of patients after 10 minute of SAB & they were considered as successful spinal blockade (Grade-A). In 5% of patients intraoperative iv ketamine 1mg\kg + iv propofol 1mg\kg was given along with O2 & Halothane with bain circuit on spontaneous respiration and surgery was completed. In 5% of patients T10 level was not achieved after 10 minutes of SAB & hence general anaesthesia was given for surgery & considered as failed spinal block (Grade C) The mean peak sensory level was T6.20 + 1.20 and the mediam was T5. Meantime two segment regression was 42.91+10.72 (30-70) min. Since the level of surgery was below T10in all the patients adequate dermatome level was present until the end of surgery. Ahmed *et al*. [9] conducted the study on 78 children aged between 2-6 years of age undergoing different types of surgeries in the lower part of body & observed that sensory block showed wide variation of level of spinal block from T1-T7 and median was T4 It is speculated that the drug uptake is faster in the SAB space in children owing to proportionally greater blood flow to the spinal cord as compared to adults. With faster drug distribution & elimination childrens spinal block regression is 5 times faster than in adults. This restricts the use of SAB in surgeries of duration 60-70 minutes. The most common complications in our study observed were Shivering. It was noted in 2 patients (5%) and was treated with iv pentazocine 0.3mg\kg. One patient developed difficulty in breathing immediately after SAB & was managed with O2 on mask with bain circuit on spontaneous respiration gets cured within 10 minutes. One patient developd nausea & vomiting & was managed with iv ondensterone (0.8mg\kg). No other complications noted such as total spinal, hypotension, bradycardia, urinary retention & any neurological deficit. Ahmed *et al*. [9] conduc ted the study to evaluate the characteristics of spinal blockade on 78 children aged between 2-6 years & reported that shivering occurred in 5 patients & vomiting noted in 1 patient, 2 patients suffered from hypotension which was treated with iv ephedrine & bradycardia was noted in 1 patient which was treated with iv atropine. Devendra verma *et al*. [10] studied spinal anaesthesia in infants & children and noted shivering in 2.9% & hypotension in 2% of patients.

V. CONCLUSION

In our experience no gross intraoperative hemodynamic changes observed & also no permanent adverse complications occurred. The technique of spinal anaesthesia provides a good alternative to general anaesthesia in paediatric patients with increased general anaesthesia related risks (Malignant Hyperthermia, Difficult airway, Laryngospasm, delayed recovery etc), & for patients undergoing lower abdominal or lower extremity surgery, lasting less than 60-70 minutes of duration. Economically also spinal anaesthesia is very cheap compared to general anaesthesia .Since our number of study patients were very less this topic requires large number of studies of paediatric patients for further confirming our observations.

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