Original Article

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Efficacy and Safety of Subarachnoid Block among 8 to 14 years Old Children: A Retrospective Observational Study

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ABSTRACT

Background: Subarachoid Block (SAB) has been practicing as pediatric anesthesia from the very begining but still not popular in Bangladesh. There are all lots of fallacies regarding efficacy and safety of SAB in pediatric age guoup. Current study was carried out to assess the efficacy and safety of SAB among children of 8-14 years.

Materials & methods: This retrospective observational study was conducted in M A Rashid Hospital, Jamalpur from May 2023 to October 2023 by analyzing data of 32 patients (8-14 years) of ASA grading I who underwent different lower andominal and lower extremity surgeries under SAB. All the patients were evaluated following standard protocol in pre anesthetic checkup room Children were sedated with Inj. Ketamine 10 mg I/V along with Inj. Midazolam 1mg I/V. SAB was given with 25G spinocaine needle at the level of L4/L5 with 0.5% Bupivacaine hyperbaric 1.5 ml (7.5 mg) following local anesthetic (lidocaine 1% 1 ml) infiltration at the site of SAB in left lateral position. Demographic characteristics, type of surgery, duration of surgery, outcome of SAB, perioperative vital parameters (Pulse rate, systolic blood pressure, diastolic blood pressure, SPO2, ECG) characteristics of sensory and motor block, duration upto first pain complain and complication were recorded as study data by analyzing anesthesia documents and postoperative records.

Results: Mean age of the study population was 10.00 ± 2.02 years, 53.13% patients were male and all the patients were from ASA grading I. Mean operative time for surgeries was 33.59± 11.23 minutes. Circumcision (40.63%) was the commonest procedure. Success rate of SAB was 100%. Onset and duration of sensory block was 5± 2.0 minutes and 120.23± 12.34 minutes respectively. Onset of motor block could not be assessed as patients were sedated. And duration of motor block was 112.19± 12.76 minutes.Time duration for first complain of pain was 150.31± 14.64 minutes. Vital parameters of studied population were stable in perioperative period. There was not a single incidence of complication like nausea, vomiting, itching, chest pain, restlessness, shivering, urinary retention, neurological complications, Post Dural Puncture Headache (PDPH).

Conclusion: Subarachnoid block could be an effective and safe alternative for the anesthetic management of pediatric patients while performed by experienced anesthesiologist.

KEY WORDS

Complications; Children; Pediatric anesthesia; SAB; Spinal anesthesia; Subarachnoid block; Success rate.

INTRODUCTION

Spinal Anesthesia or Subarachnoid Block (SAB) the first major regional technique evolved accidentally at the end of 19th century, remains one of the most popular forms of anesthesia.[1] SAB in children was first studied by August Bier in 1899 and became popular because of its safety and efficacy compared with the practice of general anesthesia of that era.[2,3] With introduction of various skeletal muscle relaxants and inhalational anesthetics, methods of general anesthesia improved and some potential complicationsof SAB surfaced those reduced the use of SAB in children for a while.[4] In early 1980s, it was reintroduced as an alternative to General Anesthesia (GA) especially in high-risk and preterm infants.[5]

Spinal anesthesia is in common use for surgical procedures involving the lower abdomen, pelvis, perineal and lower extremities, it is beneficial for procedures below the umbilicus and for short procedures.[6,7,8] SAB could be preferred as an alternative to GA, particularly in patients with chronic respiratory disease, difficult intubation, and malignant hyperthermia.Studies found that SAB is linked withless incidence of hypotension, bradycardia, hypoxia and

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postoperative apnea in infants with higher risk of cardiovascular and respiratory instability while compared with GA.[9,10,11] A considerably large dose of local anesthetic (typically bupivacaine) is required in pediatric age group compared with adults. The duration of block is age-dependent and relatively shorter than in adults.[11,12] Various adjuvants are added with local anesthetics to prolong the duration of action.[11,13] In case of children, one important issue is whether SAB affects behavioral and cognitive function in long term and studies found no correlation between SAB and neurocognitive problems rather SAB was better in preservation of intraoperative blood pressure in children.[11,14] SAB could be a safer alternative to GA in resource constraint countries as it is cost-effective.[12,15]
Although there is positive evidence, still some controversies in practicing SAB in younger children.[11,13] The main barrier is experienced anesthesiologist is required for successful outcome of spinal anesthesia in children.[16] Recently with the advancement of regional anesthetic techniques in children along with trained personals, many healthcare facilities advocate the use of SAB not only in children where GA is contraindicated but also in most lower abdominal and lower extremity surgeries.[12,13] In Bangladesh, few studies were conducted in this aspect.[17-20] In this backdrop, current study was carried out to assess the efficacy and safety of SAB in pediatric patients.

MATERIAL AND METHODS

This study was carried out retrospectively by analyzing data of patients (Age 08-14 years old), who underwent different lower abdominal and lower extremity surgeries under SAB at M A Rashid Hospital, Jamalpur between May 2023 to October 2023. Demographic data, such as age, gender, weight, ASA (American Society of Anesthesiologists) grading, name of operations, diagnoses of patients were recorded from the preoperative anesthesia evaluation form. Patients having ASA grading I, otherwise healthy children were included in the study. Data of total 32 patients were analyzed.
All the patients were evaluated following standard protocol in pre anesthetic checkup room and written informed consent was taken from parents. They were kept fasting for 06 hours before procedure. In preoperative room, 20G intravenous (I/V) cannulation was done, followed by premedication inj. ondansetron (0.1mg/kg body weight) I/V was given. Patients were sedated with Inj. Ketamine 10 mg I/V along with Inj. Midazolam 1mg I/V. Oxygen supplementation was given through facemask. SAB was given with 25G spinocaine needle at the level of L4/L5 with 0.5% Bupivacaine hyperbaric 1.5 ml (7.5 mg) following local anesthetic (Lidocaine 1% 1 ml) infiltration at the site of SAB in left lateral position. Sensory blockade was assessed with skin prick test. As patients were sedated, onset of motor blockade could not be assessed. Patients were asked to move great toe after they were awake and time duration was recorded. Duration upto first pain complain was also recorded and Inj. pethidine 0.5 mg/kg body weight I/V was given for analgesia. Vital parameters (Pulse, SPO_2, blood pressure, temperature, ECG) were monitored in regular interval. Patients were monitored whether there was any a side effect or complication like nausea, vomiting, itching, chest pain, restlessness, shivering, urinary retention, neurological complications, Post Dural Puncture Headache (PDPH) etc.Patients were visited at OPD after 07 days of procedure and were asked about PDPH.Anesthesia documents and postoperative records were examined retrospectively, and duration of surgery, duration of motor blockade, incidence of complications were recorded as study data.

Data was compiled, presented andresults are expressed asmean ± SD and percentage.

RESULTS

Total 32 children were included in this study. Mean age of the study population was 10.00 ± 2.02 years, 53.13% patients were male and all the patients were from ASA grading I. Mean operative time for surgeries was 33.59± 11.23 minutes (Table I).

Table I Demographic data (n= 32)

Age (Year)□ □	(Mean ± SD) 10.00 ± 2.02	
Weight (kg)□	28.56 ± 4.93	
Operative time for surgeries (Minutes)□	33.59± 11.23	
Gender□	Frequency□	Percentage (%)
Male□	17□	53.13%
Female□	15□	46.88%
ASA grading□	□	
I□	32□	100.00%
II□	00□	0.0%
III□	00□	0.0%
IV□	00□	0.0%

Patients underwent different types of lower abdominal and orthopedic procedures, among which circumcision (40.63%) was the commonest procedure (Table II).

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Table II Types of Surgeries (n= 32)

Types of surgeries	Frequency	Percentage (%)
Circumcision	13	40.63%
Herniotomy	02	6.25%
Urethroplasty	02	6.25%
Incision and drainage of perianal abscess	02	6.25%
Incision and drainage of thigh abscess	02	6.25%
Rectal polypectomy	02	6.25%
Herniorrhaphy	01	3.13%
Cystoscopy	01	3.13%
Incision of imperforated vagina	01	3.13%
Vaginal polypectomy	01	3.13%
Examination Under Anesthesia (EUA) of vagina	01	3.13%
Curettage of osteosarcoma	01	3.13%
K-wire insertion in great toe	01	3.13%
Repair of club foot	01	3.13%
Hydrocelectomy	01	3.13%

Success rate of SAB was 100% (Figure 1). Vital parameters (heart rate, systolic blood pressure, diastolic blood pressure, SPO_2, ECG) were stable in perioperative period (Table III).

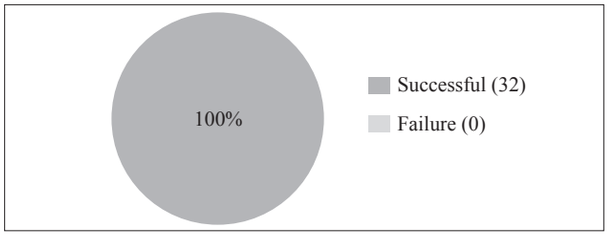

Figure 1 Outcome of SAB (n= 32)

Table III Perioperative vital parameters (n= 32)

Time	Heart rate/min (Mean ± SD)	Systolic Blood Pressure (mm Hg) (Mean ± SD)	Diastolic Blood Pressure (mm Hg) (Mean ± SD)	SPO_2(%) (Mean ± SD)	ECG
Baseline	90± 5.7	85± 6.2	50± 4.4	100±0.2	Sinus rhythm
Immediately after SAB	110± 4.9	85± 4.5	45± 5.8	100±0.4	Sinus rhythm
10 minutes after SAB	112± 6.1	80± 7.6	50± 6.7	100± 0.2	Sinus rhythm
20 minutes after SAB	112± 5.3	85± 6.6	55± 4.1	100±0.6	Sinus rhythm
30 minutes after SAB	105± 7.2	85± 5.4	60± 5.4	100±0.4	Sinus rhythm
40 minutes after SAB	107± 8.1	80± 4.7	55± 6.3	100±0.2	Sinus rhythm
50 minutes after SAB	102± 5.7	85±8.2	55± 7.2	100±0.4	Sinus rhythm
60 minutes after SAB	97± 4.8	85± 5.8	55± 5.9	100±0.2	Sinus rhythm

Table IV showed that onset and duration of sensory block was 5± 2.0 minutes and 120.23± 12.34 minutes respectively. Onset of motor block could not be assessed as patients were sedated. And duration of motor block was 112.19± 12.76 minutes. Time duration for first complain of pain was 150.31± 14.64 minutes.

Table IV Characteristics of block and first complain of pain (n= 32)

Type of block	Sensory block	Onset of block (minutes)(Mean ± SD)	5 ± 2.0
		Duration of block (Minutes) (Mean ± SD)	120.23± 12.34
	Motor block	Onset of block (Minutes) (Mean ± SD)	could not be assessed
		Duration of block (Minutes) (Mean ± SD)	112.19 ± 12.76
First complain of pain block (Minutes) (Mean ± SD)			150.31± 14.64 minutes

There was not a single incidence of complication like nausea, vomiting, itching, chest pain, restlessness, shivering, urinary retention, neurological complications, PDPH (Figure 2).

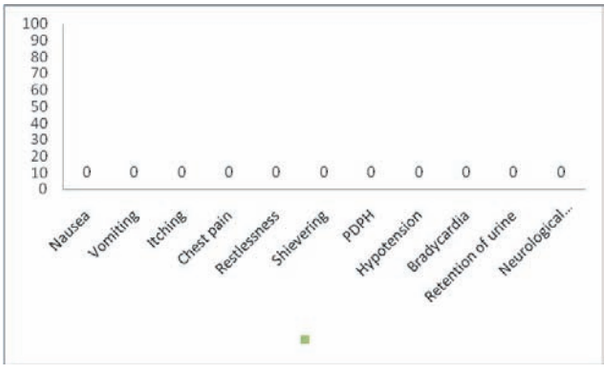

Figure 2 Complications of SAB (n= 32)

DISCUSSION

Mean age of study population was 10.00 ± 2.02 years. Previously conducted study regarding this aspect was done in more younger.[18-21]And 53.13% patients were male which was similar to previous literatures.[17-21] Circumcision (40.63%) was the commonest procedure that was concurrent with studies done by Ahmed et al. Islam et al. but other studies found inguinal hernia was more prevalent. [17-21]

Success rate of SAB was 100% in current study, and 96.1% and 97.1% success rate was observed in two related studies.[18, 21] Hyperbaric bupivacaine was used for SAB in this study. Researchers found that higher success rate of SAB when hyperbaric bupicaine is used in comparison with plain bupivacaine.[18,21,22] Children are apprehensive from the fear of parental separation, pain of surgery, and use of needles. Older children require some premedication (Midazolam, atropine, ketamine alone or in combination) for provision of sedation and anxiolysis.[23] Performing spinal puncture in a struggling, agitated child may injure delicate neurovascular structures and should be avoided. Most children require additional sedation for performing spinal infiltration and surgical procedure.[24] In this study, Inj. Ketamine 10 mg I/V along with Inj. Midazolam 1mg I/V were used for procedural sedation. Another

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fact is unique anatomical features make SAB in children challenging. Bloody tap and difficulty in aspiration are associated with failure of SAB.[13] Lumbar puncture in this age group must be performed below the 4th or 5th lumbar vertebrae (L4-L5 or L5-S1 interspace), for additional safety due to the risk of reaching the spinal cord with the needle.[25] In this study spinal block was performed either L4-L5. Technical difficulties and failure may thus be a matter ofindividual skill and experience so it was recommended to perform the spinal infiltration by experienced anesthesiologist which was done in our study.[16]

SAB in adults are frequently associated with fall of systolic blood pressure that often requires medical intervention. However, children undergoing SAB usually do not show significant hemodynamic instability because of smaller peripheral blood pool, immature sympathetic autonomic system, and compensatory reduction in vagal efferent activity.[11,12,13] In current study, no remarkable changes were observed in vital parameters in perioperative period and it was concordance with published findings.[17,18, 20, 22]

After SAB there are dense sensory and motor blockade following sympathetic blocks. Sensory block is expected to be up to T6 (Thoracic 6) level. A block above T5 is associated with several complications like hypotension. Hypotension following SAB is compensated by tachycardia in children. A pin prick test is usually used to assess sensory block. Motor block correspond with spinal nerves block of those same segment. Bromage test is used for assessment for motor block.[12,13] In this study, onset and duration of sensory block was 5± 2.0 minutes and 120.23± 12.34 minutes respectively and that was concordance with previous studies.[17,21] Onset of motor block could not be assessed as patients were sedated. And duration of motor block was 112.19± 12.76 minutes and that was similar to one study conducted in India.[21]

Complications of SAB in children are usually minor and infrequent. Hypotension anddesaturation are rare in children. If at all, it is usually dueto high block or use of sedatives. PDPH is the most common complication in children. There was not a single incidence of complication like nausea, vomiting, itching, chest pain, restlessness, shivering, urinary retention, neurological complications, PDPH in current study. Similar type of safety profile of pediatric spinal anesthesia was observed in related studies.[10.18,21]

SAB provides all components of balanced anesthesia withminimum cardiorespiratory depression and postoperative nausea, vomiting, early ambulation and rapid return of appetite. Endotracheal intubation and respiratory effects of GAcan be avoided in high-risk childrenwith limited respiratoryreserve.[11,26] The effect of SAB lasts for a couple of hours so there is less requirement for opioid analgesics.[13] In this research, duration upto first pain complain was 150.31± 14.64 minutes. It could be a cheaper alternative in countries with limitedresources, due to rapid recovery, shortened hospitalstay and more procedures performed on day care basis.[13,15,16]

CONCLUSIONS

SAB could be an essential tool for the anesthetic management of pediatric patients. Current study found it as effective and safe technique for performing lower abdominal and lower extremity surgeries among children of 8-14 years. As pediatric patients are different in their anatomy and physiology, experienced anesthesiologists should be performing SAB.

DISCLOSURE

Both the authors declared no conflict of interest.

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