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# A Prospective Observational Study of Spinal Anaesthesia in Children Attending Pediatric OPD in A Tertiary Care Hospital

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***Abstract***
***Introduction:*** *Regional anesthesia in children was first studied by August Bier in 1899. Since then, spinal anesthesia was practiced for years, and a number of cases were published in 1909-1910. After some years, it fell into disuse owing to the introduction of various muscle relaxants and inhalational agents. In early 1980s, it was reintroduced as an alternative to general anesthesia (GA), especially in high-risk and preterm infants.*
***Materials and Methods:*** *This study was conducted in 40 patients Attending Pediatric OPD in MGM Medical College, Jamshedpur, Jharkhand. Informed consent was obtained from parents of each child included in this study. All paediatric patients from 2 to 8years of age group, American society of anesthesioly grade I-II, without any cardiorespiratory abnormality scheduled for elective infraumbilical surgeries like congenital inguinal hernia, congenital hydrocele, undescended testis, hypospadiasis, fracture shaft femur, were selected.*
***Results:*** *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. In all successful spinal block the modified bromage scale was 3 which was 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.*
***Conclusion:*** *Paediatric spinal anaesthesia is safe feasible & effective anaesthetic technique for subumbilical surgeries of limited duration (70-80) minutes with negligible side effects.*
***Key Words:*** *Regional anesthesia, undescended testis, hypospadiasis, fracture shaft femur.*

## I. Introduction

Regional anesthesia in children was first studied by August Bier in 1899. Since then, spinal anesthesia was practiced for years, and a number of cases were published in 1909-1910. After some years, it fell into disuse owing to the introduction of various muscle relaxants and inhalational agents. In early 1980s, it was reintroduced as an alternative to general anesthesia (GA), especially in high-risk and preterm infants.[1]

Spinal anesthesia is a useful technique in infraumbilical and lower limb orthopedic surgeries. Infants and children are at an increased risk for GA-related complications.[2] Thus, spinal anesthesia could also be indicated as an alternative to GA, especially in situations such as chronic respiratory disease, potentially difficult airway, and malignant hyperthermia.[3] Spinal anesthesia in infants has been associated with decreased incidence of hypotension, hypoxia, bradycardia, and postoperative apnea as compared to GA; therefore, providing a high-degree of cardiovascular and respiratory stability. An important limiting factor for pediatric spinal anesthesia is duration, which can be prolonged by the addition of opioids and clonidine.[4]

Spinal anesthesia though gaining popularity in infants and children, the misconceptions regarding its overall safety, feasibility, and reliability can only be better known with greater use and research.[5] Spinal anaesthesia is gaining popularity in infants & children but its safety, feasibility & reliability can be established with greater use & research. Only. Hence we design this prospective study to analyzes the hemodynamic stability & to observe any complications related to spinal anaesthesia in paediatric patients aged 2-8 years of age.

## II. Materials And Methods

This study was conducted in 40 patients Attending Pediatric OPD in MGM Medical College, Jamshedpur, Jharkhand from January 2017 to December 2017. Informed consent was obtained from parents of each child included in this study. All paediatric patients from 2 to 8years of age group, American society of anesthesioly grade I-II, without any cardiorespiratory abnormality scheduled for elective infraumbilical surgeries like congenital inguinal hernia, congenital hydrocele, undescended testis, hypospadiasis, fracture shaft femur, were selected.

Total 40 cases were done. The preanaesthetic check up was done one day prior of scheduled day surgery. Patients with known contraindication 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, iv glycopyrolate 4 microgm\kg body weight. After that when child became calm, was taken inside OT keeping all emergeny drugs, endotracheal tubes of appropriate sizes, Laryngoscopes, & JRM 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, systoli-distolic 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 level. 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 surgery 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 <3 then it was defined as failed spinal anaesthesia 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 & sevoflurane on spontaneous respiration with JRM 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 sevoflurane was given with JRM 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 16.0 (Statistical Package for the social Sciences).

## III. Results

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. In all successful spinal block the modified bromage scale was 3 which was 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.

| Variables | Findings |
|---|---|
| Mean Age (years) | 5.17+2.83 (2-8) |
| Mean Weight (Kg) | 15.23+7.43 (7.8-23) |
| Sex(male\female){ %} | 32(80%)\8 (20%) |

**Table 1: Demographic characteristics**

| Type of Surgery | Number(n=40) |
|---|---|
| Congenital Hernia | 18 |
| Congenital Hydrocele | 8 |
| Undescended Testis | 6 |
| Hypospadiasis | 4 |
| Nailing for fracture shaft Femur | 3 |
| Debridement of Wound in lower limb | 1 |

**Table 2: Type of Surgery & its individual number**

| 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 3: Characteristics of Subarachnoid Block**

| Timing of Observation | SBP(mm hg) | DBP(mm hg) | HR\min | RR\min | SPO2 % |
|---|---|---|---|---|---|
| Before SAB | 85(78-96) | 64(66-70) | 98(100 -120) | 14(13-15 | 100 |
| After Premedication | 92(80-97) | 62(63-72) | 110(98 -135) | 13(11-14) | 99 |
| 5 minutes after SAB | 90(80-95) | 67(60-70) | 105(11 6-128) | 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 4: Vital Parameters**

There was 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. 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 JRM circuit on spontaneous respiration.

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

**Table 5: Number of patients Showing Intraoperative complications**

| Grades of Spinal Anaesthesia | Number of patients operated (n=40) |
|---|---|
| Grade A( without any iv supplementation) | 36(90%) |
| Grade B ( With once intraoperative iv supplementation) | 2(5%) |
| Grade C ( conversion to GENERAL ANAESTHESIA) | 2(5%) |

**Table 6: Number of patients operated in different grades of Spinal Anaesthesia**

Total thirty six patients (90%) were operated under spinal anaesthesia without any intravenous supplementation. Two patients (5%) were operated along with once intravenous supplementation. Two patients (5%) were operated after conversions into general anaesthesia in view of inadequate spinal effect.

## IV. Discussion

In many studies it was shown that spinal anaesthesia in children is safe, cost effective & ideal for day case subumbilical surgeries & also very useful in limited resources. As compared to general anaesthesia decreased stress response & recovery is very fast following spinal anaesthesia.[6]

Since the children's 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 Sevoflurane during the procedure.[7]

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.[8]

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 sevoflurane on mask with JRM circuit on spontaneous respiration intermittently when they were moving the upper part of body.[9]

Sedative effects of SAB itself have also been documented in the literature. Hermanns et al(2006).conducted the study to evaluate the sedation during spinal anaesthesia in infants. The presumaed mechanism for sedation after SAB is decreased afferent conduction to reticulo-thalamo-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 then 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. Baricity is one of the most significant factor to affect the distribution of local anaesthetic agent and hence success & spread of the level of spinal blockade.

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 JRM 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 medium 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 (2010) 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 children's 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 was 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 JRM circuit on spontaneous respiration gets cured within 10 minutes. One patient developed 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.[10]

Ahmed et al (2010) conducted 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 (2014) 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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