Original Research Paper Anaesthesiology

"SPINAL ANAESTHESIA IN CHILDREN FOR LOWER LIMB AND LOWER ABDOMINAL, INFRAUMBLICAL EXTRAPERITONEAL SURGERIES"

Dr Sweyta Shrivastava	Senior Resident, Department of Anaesthesiology, J K Hospital and L N Medical College, Bhopal
Dr Aparna Tamaskar	Associate Professor, Department of Anaesthesiology, J K Hospital and L N Medical College, Bhopal - Corresponding Author
Dr Sumit Bhargava	Professor, Department of Anaesthesiology, J K Hospital and L N Medical College, Bhopal

ABSTRACT

AIMS: To evaluate safety and efficacy of spinal anaesthesia in paediatric patients for lower limb and lower abdominal, infraumblical extraperitoneal surgeries.

Material & methods: an open, non-comparative prospective observational study was performed on 50 ASA status I – II patients of either sex, aged 2-14 years of age, scheduled for routine elective lower abdominal or lower limb surgeries drawn out of general surgeries and orthopedic paediatric procedures mainly infraumblical extraperitoneal surgeries.

Results : Advantage of spinal anaesthesia like early post-operative analgesia is evident by our study.Our study results suggests early ambulation of the patients and shows that patient can be discharged on the day of surgery

Conclusion: Spinal anaesthesia is safe for lower limb and lower abdominal mainly infraumblical extraperitoneal surgeries in paediatric patients.

KEYWORDS :

INTRODUCTION

Despite spinal anaesthesia being common practice in adults, its use on the paediatric population is still limited. Since its reintroduction in the 1980s, it has been mainly proposed for selected high-risk patients,ex-premature neonates or infants, naturally exposed to the postoperative risk of apnoea, have been treated with awake spinal anaesthesia.**[1]**

Even though spinal anaesthesia was first used over a century ago, and despite its common use in adults, and moreover in children it seems to be more accepted for treatment of complex high risk cases than for routine surgical procedures. The reasons for this conduct remain unclear. The efficacy and safety record of paediatric spinal anaesthesia are good. Several reports have proved that spinal anaesthesia is as simple, safe, and inexpensive in children as it is in adults Adverse effects are generally mild or infrequent.

However, a huge number of questions have yet to be answered, such as the relationships between age and dose, and age and duration, the highest safe allowable sensory block level in spontaneously breathing patients and use of adjuvants for prolonging duration or for postoperative analgesia.

A great variety of reports to date have proved the safety of the technique, but results are difficult to compare. Numbers are still limited: more extended databases will be necessary to find the right way of employing spinal anaesthesia in children.

Surprisingly, despite the huge collection of data regarding selected patients or diseases, only limited information is available on the usefulness of spinal anaesthesia in routine paediatric surgeries. Only limited databases of simple or medium surgical procedures performed under spinal anaesthesia have been published before now, and only few school or pre-school-aged patients have been submitted to this technique. Data resulting from different reports regarding dose, duration, and complications are still incomplete and not easily comparable.[2,3]

Spinal anaesthesia is ideal for day case surgeries and is safe and cost-effective. The drugs and equipment required are much less and cheaper besides the length of hospital stay which is also usually shorter. Spinal anaesthesia provides adequate anaesthesia without polypharmacy, endotracheal intubation and respiratory support, with minimal biochemical and physiological disturbances. It provides adequate postoperative analgesia and rapid return of feeding, without post operative nausea and vomiting. Minimal incidence of postoperative apneic spells oxygen desaturation and bradycardia. Because of these benefits, spinal anaesthesia has gained acceptance for children undergoing surgeries in the lower part of the body. As control of the airway is not compromised, there is a reduced risk of airway obstruction or the aspiration of gastric contents. This advantage may be lost if too much sedation is given. Spinal anaesthesia is relatively safer in all these instances where spontaneous airway can be maintained by the patient.[4,5]

METHODOLOGY

The present study entitled "Spinal anaesthesia in children for lower limb and lower abdominal, infraumblical extraperitoneal surgeries**.**" had been conducted in the Department of Anaesthesiology J K Hospital and L N Medical College, Bhopal between January 2016 to March 2017. After approval from institutional ethical committee and an explained informed written consent from parents of the patients, an open, non-comparative prospective observational study was performed on 50 ASA status I – II patients of either sex, aged 2-14 years of age, scheduled for routine elective lower abdominal or lower limb surgeries drawn out of general surgery and orthopedic paediatric proceedures.

Inclusion criterion

1. ASA Grade I&II
2. Age 2-14 years
3. Either sex

Exclusion criterion

1. Patient's refusal/ Non co-operation.
2. Abnormalities of lumbar vertebrae or spinal deformity eg. tethered spinal cord.
3. Bleeding disorders with coagulopathy (risks of epidural hematoma or SAH)
4. Any infection at the site of lumbar puncture.

A thorough pre-anesthetic evaluation had been carried out on every patient to access the condition of patient with particular emphasis of present and past illness and sensitivity to drugs of local anaesthetic group. A detailed history of patient was taken. Spinal column and back of the patient were examined to rule out any spinal deformity or any local skin infection. The whole procedure was explained to patients and their parents in details to get their co-

operation while performing the block and during the surgery.

Under all aseptic precaution lumbar puncture was done with 23G-25 G Quincke spinal needle at L5 –S1 or L4-L5 inter vertebral space by using a midline technique either sitting or lateral recumbent position . After free flow of CSF, Inj. Bupivacaine 0.5% heavy at a slow rate of 0.25 ml/sec was injected followed by placing in supine position. During surgery no further analgesic drugs was administered.

After successful placement, the patients were monitored continuously for block progression, haemodynamic parameters and complications. Block progression was ensured to be adequate for the surgical procedure and ensured that it does not progress too high. Monitoring of noninvasive blood pressure (NIBP), electrocardiography (ECG) and pulse oximetry (SpO2) and heart rate was done throughout the procedure.

After the operation, the patient was transferred to the Post Anesthesia Care {PACU} for continuous monitoring of vital signs for 4 hrs and recovery of motor and sensory block, and monitoring continued until discharge criteria were met .

Following observations were recorded:

1. Duration of sensory block/ Time to two segment regression of the block .
2. Intensity/Degree of motor block.
3. Duration of motor block/Time required for recovery to bromage " 0".
4. Duration of post operative analgesia /Time to first rescue analgesic request.
5. Assessment of pain relief(analgesic effect) was done by using FLACC Score in age group 2-4 Yrs and VAS Score in age group 4-14 Yrs.
6. Vital parameters- Physiological measures assessed were non invasive Blood pressure (Systolic and Diastolic), Heart rate, were recorded immediately after spinal injection and at predetermine interval upto 0 min,5 min,10 min, 15min,30 min, 1hrs, 2 hours,3 Hrs and 4 Hrs. Vigilant monitoring was done to notice any deviation from baseline values.

STATISTICAL ANALYSIS

As our study is an open, non-comparative prospective observational study, without control group, no statistical analysis was performed for descriptive results. Therefore these descriptive results were presented as mean (SD), range or number (percentage) of cases as appropriate. For continuous data Student's t test (paired t test) was applied to test the level of significance between means. Level of significance was set at $p<0.05$., P value<0.05 was considered to be significant.

OBSERVATION AND RESULTS

TABLE -1 Time to two Segment regression of block (Duration of sensory block)

Duration in Min	2-6 Yrs		7-14 Yrs		2-14 Yrs	
	No	%	No	%	No	%
25-50	4	18.18	1	3.57	5	10
50-75	7	31.82	7	25.00	14	28
75-100	7	31.82	6	21.43	13	26
100-125	4	18.18	11	39.29	15	30
125-150	0	0.00	3	10.71	3	6
Total	22	100.00	28	100.00	50	100
Mean	80.05		95		88.42	
SD	24.31		24.15		25.12	
Maximum	125		130		130	
Minimum	45		55		45	

In our study group mean duration of sensory block was 88.42±25.12 min.

Mean duration of sensory block of pre-school (2-6 Yrs) aged children was 80.05 ± 24.31 min.

Mean duration of sensory block of school aged children (7-14 Yrs) was 95±24.15 Yrs.

TABLE -2 Time to first rescue analgesic

Duration in Min	2-6 Yrs		7-14 Yrs		2-14 Yrs	
	No	%	No	%	No	%
50-100	5	22.73	1	3.57	6	12
100-150	16	72.73	8	28.57	24	48
150-200	1	4.55	14	50.00	15	30
200-250	0	0.00	4	14.29	4	8
250-300	0		1	3.57	1	2
Total	22	100.00	28	100.00	50	100
Mean	123.41		170.07		149.54	
SD	24.31		40.54		40.85	
Maximum	155		260		260	
Minimum	60		100		60	

In our study group mean time to first rescue analgesic was 149.54±40.85 min. Mean time to first rescue analgesia of pre-school (2-6 Yrs) aged children was 123.41±24.31 min.Mean time to first rescue analgesia of school aged children (7-14 Yrs) was 170.07 ± 40.54 Yrs.

TABLE -3 Time required for recovery to Bromage 0 (Duration of motor block)

Study group	2-6 Yrs		7-14 Yrs		2-14 Yrs	
Duration in Min	No	%	No	%	No	%
90-120	1	4.55	0	0.00	1	2
120-150	8	36.36	0	0.00	8	16
150-175	6	27.27	0	0.00	6	12
175-200	3	13.64	15	53.57	18	36
200-225	4	18.18	12	42.86	16	32
225-250	0	0.00	1	3.57	1	2
Total	22	100.00	28	100.00	50	100
Mean	162.27		200.89		183.9	
SD	30.46		14.47		29.8	
Maximum	210		230		230	
Minimum	120		180		120	

In our study group mean duration of motor block was 183.9±29.8 min. Mean duration of motor block of pre-school (2-6 Yrs) aged children was 162.27±30.46 min.Mean duration of motor block of school aged children (7-14 Yrs) was 200.89±14.47Yrs

TABLE 4: Variation in Systolic Blood Pressure

Study Group	Parameter	Pre- Spinal	5 Min after SAB	10 Min after SAB	15 Min after SAB	30 Min after SAB	1 hr after SAB	2 hrs after SAB	3 hrs after SAB	4 hrs after SAB
2-6 Yrs	MEAN	91.55	91.32	91.36	91.68	91.64	91.41	91.50	91.59	91.64
	S.D	4.18	3.34	3.90	3.82	4.44	4.63	4.26	4.57	4.41
	P Value		0.60	0.52	0.61	0.71	0.67	0.87	0.85	0.71
	Significance		NS	NS	NS	NS	NS	NS	NS	NS
7-14 Yrs	MEAN	105.04	99.36	97.04	96.00	104.68	104.79	104.75	104.82	104.86
	S.D	3.33	3.31	5.29	6.25	4.25	4.01	4.29	3.94	3.84
	P Value		<0.05	<0.05	<0.05	0.50	0.56	0.57	0.56	0.52
	Significance		S	S	S	NS	NS	NS	NS	NS

TABLE 5 Variation in Diastolic Blood Pressure

Study Group	Parameter	Pre- Spinal	5 Min after SAB	10 Min after SAB	15 Min after SAB	30 Min after SAB	1 hr after SAB	2 hrs after SAB	3 hrs after SAB	4 hrs after SAB
2-6 Yrs	MEAN	63.68	63.82	63.77	63.64	63.77	63.55	63.59	63.73	63.64
	S.D	2.68	2.54	2.94	2.89	2.84	2.69	3.19	2.88	2.89
	P Value		0.61	0.71	0.87	0.71	0.61	0.75	0.86	0.87
	Significance		NS	NS	NS	NS	NS	NS	NS	NS
7-14 Yrs	MEAN	67.86	63.32	61.46	60.86	67.61	67.64	67.57	67.64	67.46
	S.D	1.43	1.59	2.76	2.81	2.45	2.16	2.53	2.23	3.35
	P Value		<0.05	<0.05	<0.05	0.56	0.55	0.53	0.56	0.53
	Significance		S	S	S	NS	NS	NS	NS	NS

TABLE 6 Variation in Heart Rate

Study Group	Parameter	Pre- Spinal	5 Min after SAB	10 Min after SAB	15 Min after SAB	30 Min after SAB	1 hr after SAB	2 hrs after SAB	3 hrs after SAB	4 hrs after SAB
2-6 Yrs	MEAN	118.86	118.64	118.73	119.00	118.95	119.00	118.91	118.77	118.82
	S.D	8.42	8.77	8.38	8.34	8.39	8.67	8.38	8.21	8.50
	P Value		0.55	0.60	0.58	0.71	0.61	0.86	0.75	0.87
	Significance		NS	NS	NS	NS	NS	NS	NS	NS
7-14 Yrs	MEAN	100.07	105.00	106.64	108.00	100.36	100.25	100.29	100.25	100.21
	S.D	2.97	4.23	4.62	7.67	2.33	2.70	2.51	2.41	2.33
	P Value		<0.05	<0.05	<0.05	0.51	0.56	0.55	0.52	0.56
	Significance		S	S	S	NS	NS	NS	NS	NS

RESULTS

In our study, mean time to two Segment regression of block was 88.42 ± 25.12 minutes (range 45- 130 minutes) with minimum duration of sensory block 45 minutes and maximum duration was 130 minutes . Mean time to first rescue analgesic request was 149.54±40.85 minutes(60-260 minutes) which provided adequate early post-operative analgesia and is supported by other studies. The minimum duration was 60 minutes and maximum duration was 260 minutes (range 60-260 minutes). Mean time to first rescue analgesic of pre-school (2-6 Yrs) aged children was (123.412±4.31 minutes.) was less than counterpart school age children (170.07 ± 40.54 minutes). Mean time required for recovery to Bromage 0 was 192.8 ±33.64 minutes(range 130-290 minutes), with minimum duration of motor block as 130 minutes and maximum duration was 290 minutes. .Accesment of analgesia was done by FLACC SCORE(objective evaluation) in age group of 1-4 years while VAS SCORE(subjective evaluation) in 5-14yrs age group Intraoperative and postoperative values of the hemodynamic parameters (heart rate HR, systolic blood pressure SBP, diastolic blood pressure DBP) did not show any clinically significant change compared to baseline preoperative values . Nausea was found in 6% (3 patients) and was associated with high level of block. Urinary retention is seen in 2%(1 Patient), PDPH occurred in 2% (1 patient) in school aged children.

DISCUSSION

The present study was under taken to evaluate the safety and efficacy of spinal anaesthesia in paediatric group of patients in respect to intraoperative and post operative parameters, in view of duration and quality of analgesia and anaesthesia along with the effect of local anaesthetic drugs on vital parameters and to study the side effects and complications.

Our study was an open, noncomparative prospective observational study comprised of 50 patients aged 2-14 years of ASA grade I and II. A sample size of 50 children was considered sufficient to provide necessary background information to evaluate the safety and efficacy of spinal anaesthesia and on the performance of intrathecal bupivacaine.

As our study is an open, non-comparative prospective observational study, without control group, no statistical analysis was performed for descriptive results. Therefore these descriptive results were presented as mean(SD), range or number (percentage) of cases as appropriate Our study was observational study, in view of duration and quality of analgesia and anaesthesia like degree and duration of motor block, level of sensory block, time to first resque analgesic and incidence of side effects and complications.

Thus advantage of spinal anaesthesia like early post-operative analgesia is evident by our study.Our study results suggests early ambulation of the patients and shows that patient can be discharged on the day of surgery.

FLACC SCORE(objective evaluation) in age group of 1-4 years while VAS SCORE(subjective evaluation) in 5-14yrs age group. In < 4years, we choose the FLACC scale to evaluate pain post-operatively as it is easy to use, validated, gives us an objective evaluation, and the VAS score was not well understood by them. The necessity for rescue medicine was decided by the pain score.

H Kokki K Tuovinen et al did a study on Spinal anaesthesia for paediatric day-case surgery.It was a double-blind, randomized, parallel group, prospective comparison of isobaric and hyperbaric bupivacaine. They compared bupivacaine 5 mg ml-1, either isobaric in saline 0.9% or hyperbaric in 8% glucose, for spinal anaesthesia in 100 children,. The success rate of the block was greater with hyperbaric bupivacaine (96%) compared with isobaric bupivacaine (82%) (P = 0.025,)The highest median level of sensory block was T4 (10-90th percentiles T1 to T7) in 0.9% glucose group and T4 (T1-T5) in 8% glucose group.In above study is similar distribution of sensory block was present as in our study.[6]

Goyal R, Kavitha Jirtjil, BB Bajet al reviewed spinal anaesthesia in paediatric patient and concluded that spinal anaesthesia produces a reliable, profound and uniformly distributed sensory block with rapid onset and good muscle relaxation, and it results in more complete control of cardiovascular and stress responses than epidural or opioid anaesthesia.Data of our study was similar to that in above study.[7]

M Ahmed, NP Ali, SMH Kabir et al in their study showed that time to two segment regression of block was 74 minutes (range 30-190 minutes).Kokki H, Hendolin H. et al in 1996 conducted prospective study in 7-18 years old school age children showed that the time to two segment regression of block was 83(50-143) minutes in 0.9% glucose and 85(53-150) minutes in 8% glucose group. Results of M Ahmed et al ,Kokki H, Hendolin H. et al were comparable to our study.[6,8]

M Ahmed, NP Ali, SMH Kabir, M Nessa Mean time of giving rescue analgesic after spinal block was 118 minutes (range 59-240 minutes)Imbelloni LE, Vieira EM et al conducted a study in 40

children aged 1 to 5 years scheduled for outpatient surgeries ,showed duration of analgesia was 4.13 ± 0.89 hrs(248+54minutes). The result of Ahmed M et al were comparable to our present study whereas Imbelloni LE et al study results showed variation.[8,9]

Goyal R, Jirtjil K in their article reviewed the fact the physiological impact of sympathectomy is minimal or none in smaller age groups. The fall in blood pressure and a drop in the heart rate are practically not seen in children less than five years. This may be due to the immature sympathetic nervous system in children younger than five-eight years system resulting in less dependence on vasomotor tone to maintain BP. The relatively smaller fraction of total blood volume in the lower extremities and splanchnic system limiting venous pooling and relatively vasodilated peripheral blood vessels. The change in heart rate are related more to the development of arterial hypotension than to cardiac accelator denervation..[7]

Franco Puncuh Hannu Kokki et al gave spinal anaesthesia in paediatric patients and did study on a single centre experience with 1132 cases Efficacy, safety and ease of performance of the spinal block were shown to be satisfactory in most children. Only 27 of the 1132 children needed any supplementation. The incidence and severity of complications was low. They concluded that spinal anaesthesia with hyperbaric bupivacaine is a feasible anaesthetic method in children for surgery in the lower part of the body.[2]

Memon N.G et al demonstrated that children less than 5-year old tolerate high thoracic spinal with minimal changes in heart rate and arterial pressures, but in contrast among school-age children high levels of sensory block are associated with some alterations BP & HR remained stable throughout the procedures .There is no need to preload the children for spinal under 7 years of age.[10]

Imbelloni LE, Vieira EM et al concluded that no patient developed oxygen desaturation or arterial hypotension. Bradycardia was observed in one patient.Our present study as reveals that intraoperative and postoperative values of the hemodynamic parameters (heart rate HR, systolic blood pressure SBP, diastolic blood pressure DBP, and oxygen saturation SpO_2) did not show any clinically significant change compared to baseline preoperative values .The haemodynamic pattern and respiratory function were stable during spinal anaesthesia. Brief periods of hypotension were seen but responded well iv fluid administration alone (Ringer lactate). None of the patient needed vasopressors.On futher analysis, impression was that, preschool aged childen,<6yrs showed more hemodynamic stability minimal changes in heart rate and arterial pressures throughout the procedures.[9]

Katherine Kirkpatrick Rita Vashisht did their work on anesthesia for Pediatric UrologyMany urogenital conditions are unique to children. An overview of some of the conditions that necessitate a carefully considered anesthetic approach with techniques to anticipate and prevent complications .[11]

Dermot J. Kelly Mahmood Ahmad in their study summarized the current knowledge of physiological mechanisms, pharmacological modalities and controversial issues surrounding preemptive analgesia. The variable patient characteristics and timing of preemptive analgesia in relation to surgical noxious input require individualization of the technique(s) chosen. Multi-modal analgesic techniques appear more effective.[12]

S. M. Walker studied pain in children and concluded that significant advances in theassessment and management of acute pain in children have been made, and are supported by an increase in the availability and accessibility of evidence-based data. However, methodological and practical issues in the design and performance of clinical paediatric trials limit the quantity, and may influence the quality, of current data, which lags behind that available for adult practice. Collaborations within research networks, which incorporate both preclinical and clinical studies, may increase the feasibility and specificity of future trials. There is a major need for further clinical research, training of health-care providers, and increased resources, to improve management and outcomes for children with chronic pain.[13]

Finally, our study demonstrated adequate surgical anaesthesia with good intraoperative and postoperative analgesia with marked haemodynamic stability with minimal complications.The advantages of spinal anaesthesia like profound muscle relaxation with early ambulation and early feeding are evident from our study also.Thus showing that spinal anaesthesia is safe for lower limb and lower abdominal especially infraumblical extraperitoneal surgeries in paediatric patients .Our observation and results are consistent and comparable with those reported by above studies and literature.

CONCLUTION

It can be concluded that spinal anaesthesia is safe for lower limb and lower abdominal mainly infraumblical extraperitoneal surgeries in paediatric patients.Paediatric spinal anesthesia is not only a safe alternative to general anaesthesia but often the anaesthesic technique of choice in many lower abdominal and lower limb surgeries in children. There is no requirement of any additional expensive equipment either and this procedure can be easily performed in peripheral centers. Its analgesic effect contributes for postoperative pain relief and decrease the need for supplemental analgesics in the post operative phase.

Paediatric spinal anaesthesia may have been conceptualized a century ago but its golden years are yet to come. Overall patient safety, feasibility and reliability are the key features of this technique which will only become better with greater use, experience and research However, greater acceptance and experience is yet desired for this technique to become popular.

REFERENCES

1. Abajian JC, Mellish RVP, Brown AF, et al :Spinal anaesthesia for surgeries in the high risk infant: Anaesth Analg 1984; 63:359–362.
2. Puncuh F, Lampugnani E, Kokki H. Use of spinal anaesthesia in paediatric patients: a single centre experience with 1132 cases. Pediatric Anesthesia. 2004 Jul 1;14(7):564-7.
3. Hocking G , Wild Smith JAW. intrathecal drug spread . Br J Anaesth 2004;93(4):568-578
4. Corning J.L : Spinal anaesthesia and local medication of the cord. New York journal of medicine 1885; 42: 483-5
5. Bainbridge WS. A report of twelve operations on infants and young children during spinal anesthesia. Arch, Pediatr 1901; 18:570-574.
6. Kokki H, Tuovinen K, Hendolin H. Spinal anaesthesia for paediatric day-case surgery: a double-blind, randomized, parallel group, prospective comparison of isobaric and hyperbaric bupivacaine. British journal of anaesthesia. 1998 Oct 1;81(4):502-6.
7. Goyal R, Jirtjil K, Baj BB, Singh S, Kumar S. Paediatric spinal anesthesia. Indian Journal of Anaesthesia. 2008 May 1;52(3):264.
8. Ahmed M, Ali NP, Kabir SM, Nessa M. Spinal Anaesthesia: Is it Safe in Younger Children?. Journal of Armed Forces Medical College, Bangladesh. 2010;6(1):25-8.a
9. Imbelloni LE, VIEIRA E, Sperni F, Guizellini RH, Tolentino AP. Spinal anesthesia in children with isobaric local anesthetics: Report on 307 patients under 13 years of age. Pediatric Anesthesia. 2006 Jan 1;16(1):43-8.
10. Memon Gn, Wagan F, Wagan Ma, Laghari Gm. Safety And Efficacy Of Pediatric Spinal Anaesthesia, Sharing Experience. Medical Channel. 2011 Oct 1;17(4).
11. Kirkpatrick K, Vashisht R. Anesthesia for Pediatric Urology. InAnesthesia for Urologic Surgery 2014 (pp. 177-196). Springer New York.
12. Kelly DJ, Ahmad M, Brull SJ. Preemptive analgesia II: recent advances and current trends. Canadian Journal of Anesthesia. 2001 Dec 1;48(11):1091.
13. Walker SM. Pain in children: recent advances and ongoing challenges. British journal of anaesthesia. 2008 Apr 21;101(1):101-10.