STUDY OF SPINAL ANAESTHESIA IN CHILDREN UNDERGOING LOWER ABDOMINAL AND LOWER LIMB SURGERY WITH 0.5 % BUPIVACAINE(HEAVY)

Dr.D Srinivasalu[1] *Dr. S. Bala Bhaskar*[2] *Dr.A.Srinivasamurthy*[3] *Dr.S S Harsoor*[4]

SUMMARY

Spinal anaesthesia in paediatric patients is becoming popular following better understanding of physiology and reports of its safe use in large number of studies. We administered hyperbaric bupivacaine in paediatric patients posted for lower extremity surgeries and intraoperative parameters and events were recorded. There was no incidence of hypotension and two patients had bradycardia. Average duration of sensory blockade and motor blockade was around one hour. It is concluded that spinal anaesthesia with 0.5% Bupivacaine (heavy) in children is effective in terms of ease of the technique , fast and reliable blockade, stable haemodynamics and lesser incidence of complications but is suitable for surgeries lasting for less than one hour duration.

KEY WORDS :

paediatrics, spinal anaesthesia, bupivacaine heavy, complications

Introduction

Spinal anaesthesia is gaining acceptance in pediatric patients as it is associated with profound and uniformly distributed sensory blockade, rapid onset, good muscle relaxation and more complete control of cardiovascular and stress responses compared to epidural and general anaesthesia. Spinal anaesthesia permits the use of a small dose of local anaesthetic with a low risk of toxicity[1]

Amide local anaesthetics are used regularly for spinal anaesthesia in children. Duration of intrathecally injected lignocaine is too short in some children undergoing surgery. Bupivacaine is an amide local anaesthetic with a moderately rapid onset and a long duration of action[2]. For spinal anaesthesia, Bupivacaine is more commonly used in hyperbaric form prepared by adding Dextrose (8%) with a specific gravity of 1.021 at 37°C.

[1] D.N.B., Professor
[2] D.N.B., Associate Professor
[3] M.D., Professor
[4] M.D., Principal, Professor and Head
Department of Anaesthesiology & Critical Care
Vijayanagar Institute of Medical Sciences (VIMS)
Bellary.
Correspond to :
Dr . Srinivasalu D.

Only limited information is available regarding minor or moderate surgeries done under spinal anaesthesia in preschool and school aged children. Only few of these children are subjected to this technique. Data from different reports regarding technique, dose, duration and complications are still incomplete and not easily comparable .

The aim of this open, non comparative, prospective clinical trial was to evaluate the clinical efficacy of subarachnoid block in children with 0.5% Bupivacaine. The variables studied were ease of lumbar puncture, depth of sub arachnoid space, onset of blockade, duration of blockade, per-operative and post operative complications.

Methods

25 healthy ASA I and II children of either sex, aged between 2 - 8 years, scheduled for elective surgery below umbilicus were selected for the study. The duration of study period was between June and December of 2006. Children with contraindications to subarachnoid block such as local sepsis, bleeding tendency or children with unwilling parents were excluded from the study. The study was approved by

institutional ethics committee. Written and informed consent was obtained from the parents.

A pilot study was done in 10 patients to decide the type of pre and intraoperative sedation and induction.

A thorough preoperative evaluation with recording of basic parameters such as weight , height, heart rate, blood pressure and basic investigations such as haemoglobin, urine (routine) were done.

Standard Nil-Per-Oral guidelines were used prior to surgery. All the children were premedicated with syrup trichlofos 100 mg / kg., one hour before the scheduled time of surgery. Checklist included drugs and equipment necessary for resuscitation, general anaesthesia and monitors. Monitors used were pulse oximeter, NIBP, temperature and ECG monitor. Intravenous access was secured with no. 24 / 22G cannula and infusion of paediatric maintenance solution, according to the rule of 4-2-1 was started.

In children who were anxious or appeared uncomfortable, intravenous access and lumbar puncture was done after inhalational induction with halothane.

In the remaining patients, a sleep dose of IV Thiopentone was given. All the sub arachnoid blocks were performed by staff anaesthesiologists or senior post graduates . Lumbar puncture was done in lateral position in midline with 25 G disposable Quincke needle, with bevel facing laterally, parallel to the longitudinal fibres. Correct placement was confirmed by free flow of CSF. Inj. Bupivacaine at a dose of 0.5 mg / kg for children weighing less than 10 kg, 0.4 mg for children weighing between 11-19 kg and 0.3 mg for children weighing 20 kg and above was injected intrathecally[1].

Data recorded were number of attempts for spinal tap, bloody tap, change of needle, depth of subarachnoid space from skin, time gap between injection of drug and incision, duration of sensory and motor blockade. Heart Rate, SpO2, systolic and diastolic blood pressure and respiratory rate were recorded immediately and once every three minutes till 15 minutes and once in 5 minutes thereafter .

Duration of Sensory blockade was defined as the interval from time of administration of spinal bupivacaine to the time the child first complained of pain at wound site or as score equal to more than 3 (0-5 FACES Scale[2]) in case of younger children.

Duration of motor blockade was defined as the interval from time of administration of spinal bupivacaine to the time of appearance of spontaneous movements of lower extremity or response to mild pinch over the forearm.

If there were signs of inadequate blockade such as response to skin incision, increase in heart rate, BP, increase in respiratory rate, surgeon was asked to wait for further 5 minutes. If these signs persisted, General Anaesthesia was induced. This was recorded and the case was designated as failed block. Incidence of any other side effects such as vomiting, crying, movement , or need for supplemental sedation were noted . All the children were given N_2O and O_2 by Jackson Rees' modification of Ayer's T piece, by mask with spontaneous ventilation.

Bradycardia, defined as a reduction in basal heart rate by 25%, was managed by appropriate dose of IV Atropine. Hypotension, defined as a reduction in basal systolic blood pressure by more than 25%, was managed with appropriate dose of IV Ephedrine

Following surgery, patients were monitored in PACU till sensory and motor recovery. All the patients received Diclofenac suppository for postoperative analgesia after sensory recovery. Patients were checked for any incidence of postdural puncture headache, residual neuromuscular defeicits until the time of discharge from the hospital.

Observations and Results :

TABLE 1. Demographic and Surgical data

Sex	Male	22
	Female	03
Age	2 - 3 years	11
	4 - 5 years	08
	6 - 7 years	04
	8 years	02
Surgery	Hernia repair	13
	Urological	08
	SSG	03

Patient profile and the depth of SA space :

Table 2 (a) : Depth of sub arachnoid space vis a vis weight of patient :

Wt.(Kgs.) (No. of Patients)	7 (3)	8 (2)	9 (2)	10 (1)	11 (1)	14 (2)	15 (4)	16 (1)	18 (2)	19 (1)	20 (4)	25 (2)
Depth (cms)	1.6	2.1	2.4	2	2.4	2.2	2.3	2.5	3	2.4	2.7	2.8

The depth of SA space varied between 1.6 to 3.0 cm between weights of 7 to 25 Kgs.

Table 2 (b): Depth of SA space vis a vis Height

Ht (cms) (No. of patients)	65 (1)	71 - 80 (5)	81 - 90 (6)	100-110 (5)	111-120 (4)	121-130 (4)
Depth (cms)	1.7	2.1	2.3	2.38	3	2.9

The depth of SA space varied between 1.7 to 3.0 cm between heights of 65 to 130 cms.

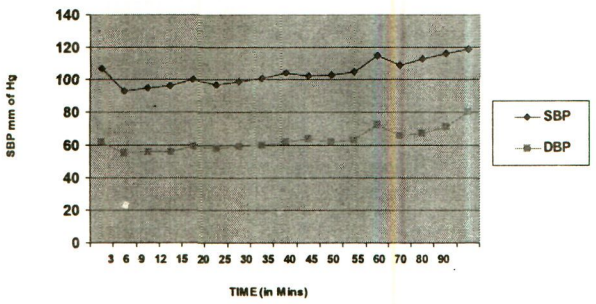
Table 2 (c) : Age vis a vis depth

Age (Years)	2 (8)	3 (3)	4 (4)	5 (4)	6 (4)	8 (2)
Depth (cms)	1.7	2.1	2.3	2.38	3	2.9

Haemodynamic profile:

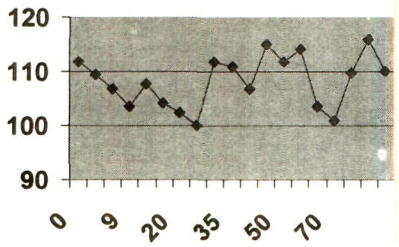
There was an average reduction of 20 % in systolic blood pressure in 6 patients. None of the patients recorded "hypotension" (a fall of more than 25%) requiring treatment.

Chart (1) : SBP and DBP changes



Trend of systolic and diastolic blood pressures is shown in the chart . Maximum fall of systolic blood pressure was about 10 % , seen at 9th minute. The maximum fall in diastolic blood pressure about 20% was seen at 3rd min.

Chart (2) : Heart rate Changes



Six patients had a fall of heart rate by more than 20% ; two patients had a fall of about 25%. Trend of heart rate changes during intraoperative period is shown in the chart (2)

Block Characteristics :

Success of the block : The sub arachnoid block was successful in all the cases. Average duration of sensory blockade was 54 minutes and that of motor blockade was about 56 minutes.

Duration of surgery ranged between 30 min to 90 min. Two patients in whom surgery lasted for more than 65 minutes, required supplementation or conversion to general anaesthesia.

Other Effects :

None of the patients had apnoea or hypoxia.

One patient had vomiting in the immediate post operative period. None of the patients had any incidence of headache or neurological complications in the post operative period.

Discussion:

Over last 100 years, there have been periods of increased interest in the use of spinal anaesthesia in infants and children. Spinal anaesthesia was extensively studied in expremature and normal infants . The advocacy of spinal anaesthesia in older children and adolescents has been recently reviewed by Kokki[3], Tobias[4], Rowney et al[5]

Spinal anaesthesia in children produces a rapid onset of profound and uniformly distributed sensory and motor block and is associated with lesser incidence of untoward haemodynamic events and stress response. Because of these benefits spinal anaesthesia is gaining acceptance in pediatric patients undergoing surgery in lower part of the body.

The present open, noncomparative, prospective study was undertaken to evaluate the clinical efficacy of spinal anaesthesia with bupivacaine 0.5% heavy in children undergoing surgery in lower part of the body

In our study , in 22 out of 25 patients lumbar puncture was successful in the first attempt. Lumbar puncture was successful in all the patients . Success of Lumbar puncture in other studies ranged between 88% - 100% (Robert KW et al)[6].

Average time for completion of spinal technique was 14.8 minutes with a range of a range of 5 - 30 minutes. In 88% of patients, completion of technique was within 20 minutes. This time taken was about 24 minutes in a similar study (Sarihasan et al)[7].

Depth of SA Space and Weight did not correlate with the formula (1 mm x wt in kg) or (weight in kg+ 10) x 0.8 suggested by other studies[8] but showed a constant relationship with height and age.

20% reduction in systolic blood pressure was seen in 6 patients. None of the patients recorded a fall of more than 25% . Maximum fall in systolic blood pressure about 10% was seen at around 9th minute. The maximum fall in distolic blood pressure, about 20% was seen at 3rd minute.

We did not measure the time of onset of blockade as this is technically and clinically difficult in the younger children; instead we measured time interval between the time of intrathecal injection of LA and time of incision. The average time was 5.32 minutes (range 2-10 minutes) which is comparable to 4.33± 2.72 in study by Sarihasan et al[7] ,and is less less compared to 17 minutes in the study by Robert et al[6].

Average duration of sensory blockade was 56 minutes. This was 103 minutes in a study by H. Kokki et.al.,[9] 115 minute in another study by same author[10]. Average duration of motor blockade was 50 minutes in the present study. The duration of motor block has not been found to be studied in other references.

There were no side effects such as apnoea, hypoxia, nausea, vomiting, PDPH or neurological deficit in any of the patients.

Limitations of the study : The size of the study (25 Patients) and non comparative nature prevents us from drawing more statistically based conclusions on the efficacy of spinal anaesthesia in children, especially regarding the physical characteristics in relation to depth of subarachnoid space and the incidence of side effects / complications.

Conclusion :

Spinal anaesthesia with 0.5% Bupivacaine (heavy) in children undergoing lower abdominal or lower limb surgery is effective in terms of ease of the technique , speed of onset, adequacy of blockade, stability of haemodynamics and minimal incidence of complications . The relatively short duration of sensory blockade (less than 1 hour) could, however, can limit its usage in surgeries of longer duration.

References :

1. H.Kokki, K. Tuovinen and H.Hendolin : Spinal anaesthesia for paediatric day case surgery: a double blind, randomised, parallel group, prospective comparison of isobaric and hyperbaric bupivacaine; BJA; 1998; 81: 502-506
2. Etsuro K Motoyama, Peter J Davies : Editors ; Pain Management in infants and children; Smith's Anaesthesia for infants and children; Seventh Edition; 441; Mosby Elsevier
3. H.kokki, Spinal anaesthesia in infants and children Balliere's clinical anaesthesiology 14, 2000, 687-707
4. J.Tobias, Spinal anaesthesia in infants and children. Paediatric Anaesthesia; 10 ; 2000, 5 -16
5. D.A.Rowney and E.Doyle, Epidural and subarachnoid blockade in children. Anaesthesia; 53 1998, 980 - 1001
6. Robert KW, David CA, Joseph MK et al. The safety and efficacyof spinal anaesthesia for surgery in infants :The infant spinal registry, Anaesth.analg. 2006; 102; 67 - 71
7. B.Sarihasan, S Baris, Fyesiltas et al., Spinal anaesthesia in children with rectal premedication with midazolam, Ketamine, and Atropine ; Turkish Journal of medical sciences; 29; 1999, 467-470
8. Hasan MA, Howard RF, Lloyf- Thomas AR: Depth of the epidural space in children: Anaesthesia 49:1085 -1087, 1998
9. H.Kokki, BM Paula, Heikkinen etal Levobupivacaine for pediatric spinal anaesthesia ; Anaesth.Analg.; 98(1) 2004, 64-67
10. H.Kokki and H.Hendolin : Hyperbaric bupivacaine for spinal anaesthesia in 7- 12 yr children; comparison of bupivacaine 5mg/ml in 0.9% and 8% glucose solution: BJA, 84(1) 2000: 59-62