Comparative Study between General Anesthesia and Spinal Anaesthesia in Paediatric Patients

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ABSTRACT

Introduction: Anaesthesia Comprises of analgesia, unconsciousness, relaxation and suppression of reflexes. This state of Anaesthesia can be achieved either by regional or General Anaesthesia (GA). In G.A all the four parameters are fulfilled, where as in regional Anaesthesia the patient need not be unconscious. Study aimed to prove the supremacy of spinal anaesthesia to general anaesthesia.

Material and methods: A Comparative study was done in sixty patients divided into two groups as Group 'S' received spinal anaesthesia with Butivacaine 0.5%, 0.4mg/kg body weight. Group 'G' (General Anaesthesia) consisting thirty patients were given G.A relaxant technique with IPPV.

Results: 'S' group is hemodynamically more stable in the immediate post operative period when compared with the 'G' group. Conscious levels: 100% of S group patients showed no sign of altered consciousness. Where as 9 out of 30 patients i.e 28% G group patients were drowsy in the immediate post operative period and needed observation for a longer period. No notable complications like nausea, vomiting, or urinary retention were noticed in both groups.

Conclusion: No complications were noted in both groups patients were drowsy in 'G' group, but all are awake and co-operative in 'S' group.It can be concluded that the sub-arachnoid block is proved to be a better choice for the below the umbilical level surgeries in pediatric patients as it is having no complications and will be accepted by surgical team and parents.

Keywords: General Anesthesia, Spinal Anaesthesia, Paediatric Patients

INTRODUCTION

Spinal anesthesia (SA) has the advantage of providing analgesia and total muscle relaxation in a conscious and compliant patient and an uneventful postoperative recovery. At the same time, it also protects against the potential complications of general anesthesia (GA).[1] Despite these advantages, regional anesthesia is still preferred only for patients who are at high risk for general anesthesia, and the majority of surgeons still prefer doing both procedures under GA. Thus, most of the publications and textbooks on laparoscopic surgery cite GA as the anesthetic option for abdominal laparoscopic surgery. But, lately, occasional reports of laparoscopic surgery being performed under regional anesthesia (spinal or epidural) in selected patients have started coming in.[2]

Of the advantages of spinal anesthesia over general anesthesia is that the patient is awake and oriented at the end of the procedure. Second, the absence of general anesthetic side effects (e.g., nausea and vomiting) and less pain experienced due to the effect of neuraxial analgesia. Third, patients that have received spinal anesthesia tend to ambulate earlier than patients receiving general anesthesia. Finally, complications related to intubation and/or extubation is avoided in spinal anesthesia for patients undergoing laparoscopic interventions. Combining a minimally invasive surgical procedure with a less invasive anesthetic technique appears, theoretically, to further enhance the advantages of the operation.[3]

Anaesthesia Comprises of analgesia, unconsciousness, relaxation and suppression of reflexes. This state of Anaesthesia can be achieved either by regional or General Anaesthesia (GA). In G.A all the four parameters are fulfilled, where as in regional Anaesthesia the patient need not be unconscious. Pediatric patients are a special group in that their requirements cannot be expressed by themselves. The Anesthesiologist concerned must pay more attention towards their paediatric patients. The commonly adopted method of Anaesthesia in children is G.A as per the traditional standards. In G.A, the patients are kept in an unconscious state that will have its own complications.[4]

Spinal Anaesthesia (S.A), a form of regional anaesthesia, may be "a suitable type for surgeries below the level of umbilicus", was investigated in the present study.

Study aimed to compare the efficacy, safety, advantages and disadvantages of the techniques of S.A and G.A spinal anaesthesia in pediatric age group undergoing surgeries below umbilicus.

MATERIAL AND METHODS

The study comprised of sixty patients of either sex with ASA Grade I and II and age varying between 1 and 5 years. They were posted for elective below umbilical general surgery.

The patients were divided randomly into two groups.

Group 'S' received spinal anaesthesia with Butivacaine 0.5%, 0.4mg/kg body weight. These patient were kept immobile with inhalational anaesthesia using Sevoflurane.

Group 'G' (General Anaesthesia) consisting thirty patients

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were given G.A relaxant technique with IPPV.

Routine pre-anesthetic checkup, including examination of spine and laboratory investigations, BT, CT were done. A written consent was obtained according to hospital ethical committee. Patients were prepared, without food or drink for 4-6 hours prior to surgery. Apart from the usual contents, the spinal set included a 26 gauge disposable spinal needle, two ml disposable syringe and 0.5% Bupivacaine heavy 4 ml ampoule. All emergency drugs like atropine, Mephenteramine, Adrenaline and Endotracheal tubes and working Laryngoscopes were kept ready. Boyle anaesthetic was checked and kept ready. A pulse oximeter and a NIBP monitor were connected to the patient.

Technique in Group 'S' patients

Prior to spinal anesthesia, patients were made immobile for better conditions. The patient was induced with Sevoflurane 7-8% and a tidal volume of 10ml per kg- with a minimum of four litres minute volume. Sevoflurane was cut to 2% as the patient was unconscious and stabilized. Using a 24 guage canula an IV line was started and Atropine (0.01 mg/kg) was given. All the patients were kept in left lateral position, avoiding flexion of the neck with a small towel under the left cheek to lift the head, and the knees were drawn up over the abdomen. After observing a steady O_2 saturation, under sevoflurane analgesia patients were kept immobile during the procedure of spinal anaesthesia.

With aseptic conditions after confirming the free flow of cerebrospinal fluid (CSF) the drug bupivalaine (0.5%) heavy, 4 mg/kg injected intrathecally. After positioning the patient supine, sevoflurane < 1% was administered with the Ayre 'T' piece throughout the surgical procedure. In the study, sevoflurane was selected, as its blood gas solubility is low 0.6 facilitating faster induction and emergency when compared to previous halogenated agents. It causes a dose related decrease in myocardial contractility and mean arterial pressures. It has little effect of catacholamines. It does not cause coronary steal. This agent does not cause epileptiform of EEG activity, and also not much rental impairment. Its excretion is predominantly through the lungs.

Following parameters were observed

The onset of the block was confirmed by relaxation of the abdominal muscles and testing analgesia. For muscle relaxation: observation of the surgeon was taken for assessment.

- Quality of motor block was accessed using Bromage scale:
  - Grade-I Unable to move feet and knee.
  - Grade-II Able to move feet only or big toe.
  - Grade-III Just able to flex the knees
  - Grade - IV Full flexion of the knees and feet .
- Pulse rate and Blood pressure (BP) were noted before the procedure, immediately after the block, then every 5 minutes for 15 minutes and then every 15 minutes till the completion of the surgery.
- Oxygen saturation was recorded using pulse oximeter.
- Duration of motor block was noted as interval between injection drug and the reappearance of toes or limb movements.
- Duration of analgesia was accessed by the behavior of child for feeling of pain.
- Any side effects of spinal anaesthesia were noted.

Postoperatively vital parameters were noted carefully and all the patients were observed for immediate usual post spinal anaesthesia complications like Nausea, vomiting, shivering, restlessness, bradycardia, hypotension due to sympathetic block, respiratory depression, post lumbar puncture headache, urinary retention

Technique in G group patient

Thirty patients belonging to the G group, after routine PAC and investigations, were kept nil by mouth for six hours and anesthetized as per the protocols. Pre oxygenation for three minutes, followed by premedication of 0.01 mg/kg wt atropine IV was given at the start. Pre-operative analgesic and hypnotic drugs were avoided in the premedication, in order to have same basal levels in both groups, before the start of anaesthesia. The patient was induced with Sevoflurane and intubated with un-cuffed oral Endo Tracheal Tube using succinyl-coline 1 mg per kg wt. Sevoflurane 0.5 to 1% was used for intra operative hypnosis. Anaesthesia was maintained with Nitrous oxide and oxygen. Vecuronium 0.08 mg per kg was used for muscle relaxation. At the end of the surgery reversal was given with neostigmine 0.08 mg per kg and atropine 0.04 mg per kg. Pulse rate, blood pressure. Body moments and SPO_2 were recorded at 0, 1, 3, 10, 40, 60 minute- time intervals, until the surgery was completed.

RESULTS

Age group involved in study are 1-5 yrs are with weight 11.83 kgs in group-G and 12.06 yrs in group-S. At starting of the case to 1, 3, 10, 40, 60 minutes the mean pulse rate in 1 to 3 years and at 3-5 years were significant in between 2 groups (table-1). In all time intervals systolic blood pressure is significant between 2 groups (table-2).

In all time intervals diastolic blood pressure is significant between 2 groups.

Except at zero minute of diastolic BP in 3-5 yrs age group it is insignificant (table-3).

There was a significant change in all time intervals of study in between 2 groups (table-4).

DISCUSSION

The present study comprising 60 patients of age group 1 to 5 years posted for below umbilical surgeries, were divided into two groups- 'S' and 'G'. Routine anaesthesia was given to G group and spinal anaesthesia with 0.5% bupivacaine to 'S' group.

Demography

The average age of G group is 3.624 years. Among the G group the weight ranged from 8 to 15 Kgs and the mean weight calculated was 11.83 Kgs. Among the S group the weight ranged from 8 to 15 Kgs and the mean weight calculated was 3.633 Kgs. On observation, the ages of both group are very similar and weights are comparable. Male

Age group (in Years)	G group patients		S group patients		P value	Result
Zero minutes	Mean	SD	Mean	**SD**		
1-3	117.5	4.99	126.22	4.84	<0.01	S
3-5	110.57	23.28	88.33	12.56	<0.001	S
One minutes						
1-3	121.25	1.04	125.78	5.78	<0.05	S
3-5	112.9	21.73	86.86	11.22	<0.001	S
3 minutes						
1-3	119	1.85	125.78	4.18	<0.001	S
3-5	110.29	19.09	86.83	10.75	<0.001	S
10 minutes						
1-3	121.5	0.93	126.22	6.04	<0.05	
3-5	120.86	17.79	85.95	12.18	<0.001	
40 minutes						
1-3	125	5.13	80.00	8.00	<0.001	
3-5	128.29	14.33	86.81	10.39	<0.001	
60 minutes						
1-3	126.75	5.65	80.00	8.00	<0.001	
3-5	131.52	14.67	83.67	20.18	<0.001	

Table-1: Changes in intra operative pulse rate

Age Group (in Years)	G group patients		S group patients		P value	Result
	Mean	**SD**	**Mean**	**SD**		
Zero minutes						
1-3	105	7.56	92.44	4.25	<0.001	S
3-5	101.36	7.59	94.38	7.28	<0.001	S
1 minutes						
1-3	120	0	91.67	4.15	<0.001	
3-5	101.82	10.30	91.00	8.82	<0.001	
3 minutes						
1-3	108.75	6.41	91.56	3.50	<0.001	
3-5	105.23	7.63	91.2381	8.263805	<0.001	
10 minutes						
1-3	109.38	9.43	92.33	4.18	<0.001	
3-5	101.86	6.60	92.05	8.46	<0.001	
40 minutes						
1-3	113.25	4.53	91.44	4.10	<0.001	
3-5	104.14	7.80	93.33	7.05	<0.001	
60 minutes						
1-3	115.00	5.35	91.67	4.36	<0.001	
3-5	103.55	7.95	93.76	7.63	<0.001	

Table-2: Changes of systolic blood pressure in groups

children are more in 'S' group because of the nature of surgery like, Orchepexy, Urethroplasty and inguinal hernia.

Hemodynamic changes intra-operatively

A) The pulse rate: The pulse rate was observed from 0,1,3,5,10,40 and 60 minutes. In G group, the basal pulse rate is 117.5 + 4.99 and it is 126.22 ± 4.84 in S group (1 to 3 years age). G group (3 to 5 years age) has 110.57 ± 23.28 and S group has 88.33 ± 12.56.

At One minute: In G group, the pulse rate rose rate from 121.25± 1.04 in 1 to 3 years sub group. In 3 to 5 years age group, G group patients have 112.9 ± 21.7. This shows there is an increase in pulse rate from basal level.

S group has shown slight fall in Pulse rate from 125.78 ± 5.78(sub group 1 to 3 years) and 86.86 ± 11.22(3 to 5 years sub group). The S group has shown slight fall in Pulse rate after initiation of anaesthesia.

3 and 10 minutes: At the end of 3rd and 10th minutes, the pulse rate has gradually increased in G group 119 ± 1.85(1 to 3 years sub group) and 110.29 ± 1.909(3 to 5 age sub group) and 121.5 ± 0.93(1 to 3 years sub group) 120.86 + 17.79 (3 to 5 age). This result shows that the pulse rate is gradually increasing from initial level in G group. In S group, the PR is stable and did not vary much from the basal level.

B) Systolic Blood Pressure: The systolic blood Pressure was observed from 0,1,3,5,10,40 and 60 minutes.

In G group, the 'Zero' systolic blood pressure is 105 ± 7.56

Age group (in Years)	G group patients		S group patients		P value	Result
	Mean	SD	Mean	SD		
Zero minutes						
1-3	61.25	2.31	52.22	4.41	<0.001	S
3-5	57.82	4.36	59.52	7.57	>0.05	NS
1 minutes						
1-3	65.625	3.20	50.67	4.72	<0.001	S
3-5	60.45	6.53	57.33	8.13	<0.001	S
3 minutes						
1-3	61.875	2.59	51.78	5.14	<0.001	S
3-5	55.68	6.42	56.81	9.36	<0.05	NS
10. minutes						
1-3	64.875	5.64	52.11	5.06	<0.001	S
3-5	57.32	6.31	56.71	8.88	<0.05	NS
40 minutes						
1-3	67.25	6.227818	51.56	4.88	<0.001	S
3-5	60.64	7.64	57.76	7.70	<0.001	NS
60 minutes						
1-3	65.25	4.773438	52.22	4.41	<0.001	S
3-5	59.27	5.43	58.57	7.56	<0.05	NS

Table-3: Changes in intra operative diastolic pressures

S Group	PR	SBP	DBP	RR
Mean	102.17	93.52	57.24	25.72
SD	19.68	7.41	7.63	5.38
G Group				
Mean	113.06	111.41	66.06	30.12
SD	14.75	13.73	8.53	5.77
P-value	<0.01	<0.01	<0.01	<0.01

Table-4: Post operative monitoring (Immediate)

in sub group G**1** and 101.36 ± 7.59 in G**2** sub-group.

At one minute, the same systolic blood pressure in G**1** rose from basal 105 ± 7.56 and in G**2** systolic blood pressure rose from 101.36 ± 7.59. The 'S' group has shown statistically insignificant fall from basal to one minute intra operative.

3 and 10 minutes: At the end of 3rd and 10th minute, the systolic blood pressure fluctuations are less in G group. But relatively they are more in 'G' group. 'S' group showed almost an insignificant fall of systolic blood pressure.

40 and 60 minutes 'G' group shows more fluctuations of systolic blood pressure whereas the 'S' group which showed nearly no change in systolic blood pressures.

C) Diastolic blood pressures: From basal level in 'G' group the increase was More than the 'S' group, which showed a very little fall in both sub Groups from the basal level. 3 and 10 minutes: 'G' group showed a very slight increase in diastolic blood pressures. 'S' group also showed an increase which is lesser in magnitude than in 'G' group. 40 and 60 minutes: 'G' group showed slight fall and "S' group no change at all in the systolic blood pressure.

Postoperative monitoring

1. The mean values of pulse rate, systolic blood pressure diastolic blood pressure and respiratory rate in 'S' group are less than those of the 'G' group. This shows that the 'S' group is hemodynamically more stable in the immediate post operative period when compared with the 'G' group.
2. Conscious levels: 100% of S group patients showed no sign of altered consciousness. Where as 9 out of 30 patients i.e 28% G group patients were drowsy in the immediate post operative period and needed observation for a longer period.
3. Complications: No notable complications like nausea, vomiting, or urinary retention were noticed in both groups.

In our study of the spinal group (S) of patients showed decreased pulse, which was similar to Gurudatta and Arif in their study of spinal anesthesia in lower abdominal surgeries found that of the patients had bradycardia[5], while Mehta et al. compared general and spinal anesthesia in laparoscopic cholecystectomy and found no evidence of bradycardia.[11] 5% of group (S) patients had hypotension (>20% fall in BP) in our study, while it was 24% in Gurudatta and Arif study[5], 30% in Mehta et al. (>30% fall in BP) 18.21% in Sinha et al. study discussing laparoscopic surgeries under spinal anesthesia.[6]

Carlos C, and et al,[7] studied 300cases of pediatric cases of anaesthesia consisting of caudal, spinal and perineural techniques. The study group of children consisted age 12 years posted for abdominal and lower limb surgeries. He concluded that regional anaesthesia in children results

in minimal haemodynamic and respiratory changes, and recommended it as easy, safe and cost effective allowing early mobilization with a wide margin of safety.

H. Kokki and Hendolin[8] studied about hyperbaric bupivacaine for spinal anaestesia in 7 to 18 year old children comparison of bupivacaine 5 mg per ml in 0.9% and 8% glucose solutions" with diazepam pre-medication. They studied both groups using bupivacaine with varied concentrations of glucose. Success rate, spread and duration of sensory block were similar but the level of block was better in 0.9% glucose group.

Franco Puncuh studied use of S.A. in Pediatric patients in single centre experience with 1132 cases, they have included 6 months to 4 years children for surgery in the lower part of the body. All the patients were sedated with Midazolam, Propofol, Thiopentone maintaining spontaneous ventilation before inducing spinal block. Purposefully, they have avoided inhalational agents.

Ahmed *et al.,* (2010)[10] conducted a study to evaluate characteristics of spinal anesthesia on 78 children aged between 2 and 6 years and reported that shivering occurred in five patients and vomiting occurred in one patient. Two patients suffered from hypotension, which was treated with ephedrine and bradycardia was seen in one patient, which was treated with atropine.

CONCLUSION

The present prospective study was conducted in pediatric patients between the ages of 1 and 5 years, divided into two groups - 'S' and 'G', each consisting of 30 children posted for below umbilical surgeries. The study is undertaken in the pediatric patients of 1 to 5 years age to prove the supremacy of spinal anaesthesia over General Anaesthesia in surgeries below the umbilicus.

In the 'S' group the patients were made immobile with the help of inhalation of sevoflurane, bupivacaine (0.4 mg/per kg weight) was used for induction of subarachnoid block. In 'G' group sevoflurane induction, intubation with scolin and maintained with vercuronium. All the patience in 'S' group have shown know raise in pulse rate or blood pressure all the patience in 'G' group have recorded a raise of blood pressure and pulse rate in all the slots. Muscle relaxation was more satisfactory in 'S' group than the 'G' group, as expressed by the surgeon. No complications were noted in both groups patients were drowsy in 'G' group, but all are awake and co-operative in 'S' group.It can be concluded that the sub-arachnoid block is proved to be a better choice for the below the umbilical level surgeries in pediatric patients as it is having no complications and will be accepted by surgical team and parents.

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