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PEDIATRIC SPINAL ANESTHESIA : A PROSPECTIVE STUDY DONE IN PEDIATRIC CASES UNDERGOING LOWER LIMB SURGERY

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ABSTRACT

Pediatric spinal anaesthesia as a primary anesthetic technique is less common technique done at our part of world. It is mainly limited to specialized pediatric centre. The misconceptions regarding its safety and feasibility can be better known with greater use, experience and research. Spinal anesthesia in children is a relatively safe technique with few complications and may be considered an alternative for general anesthesia, especially in for surgery of lower limb and lower abdomen. Despite its popularity for newborns and infants in last two decades, there are still unanswered questions with this technique. The objective of this study is to evaluate the successes rate, complications and hemodynamic stability related to pediatric spinal anesthesia.

Materials and method: It is a prospective study done at Western Hospital Nepalgunj from January 2018 to December 2018. Nepalgunj is situated in Banke district, a part of province 5 Total 76 American Society of Anaesthesiologist (ASA) I and II patients aged 5-15 years were selected for the study.

Results: Spinal anesthesia was successful in 74 children out of 76 children (97.36%), while in 2 childrens General Anaesthesia was performed. No significant hemodynamic changes occurred before and after anaesthesia, mean change in systolic Blood Pressure was 14mmhg and diastolic Blood Pressure was 9.3mmhg. Except shivering in four (5.4%) patients no other complications occurred.

Conclusion: Spinal anesthesia with hyperbaric bupivacaine is a feasible anesthetic for lower limb surgery.

KEYWORDS: Bupivacaine, Lower limb surgery, Paediatric spinal anesthesia.

INTRODUCTION

Spinal anesthesia, first introduced in children at beginning of the 20th century, offers adequate intraoperative anesthetic conditions (analgesia and muscle relaxation). The technique is easy to perform even if lumbar puncture is difficult when child is smaller. Regional anesthesia in children was first studied by August Bier in 1899.[1] He performed the first spinal anesthesia and two of his patients were children. Spinal anesthesia is an uncomplicated and effective technique that produces a rapid onset and exceedingly effective analgesia sympathetic and motor block in lower part of the body.

Pediatric spinal anesthesia is not only a safe alternative to general anesthesia but also anesthesia of choice. It is performed in the pediatric age group as much preferred technique especially in day care surgeries. In children, spinal anesthesia produces a dense intra-operative analgesia when combined with general anesthesia, it reduces the requirements for anesthetic agents and opioids intra-operatively. As lower limb orthopedic surgery is done in orthopedic table in difficult position, it requires maintenance of airway and vascular access in remote position which is difficult in intubated child.

Post blockade cardiovascular stability and relatively low heart rate and blood pressure changes may be due to relative immaturity of sympathetic nervous system would make children's vasomotor tone less dependent on this system and that capacitance vein in lower extremities are small and send little blood flow for this region. Complications in children are lower than adult, some rare respiratory failure were described with the need for ventilator assistance especially in spinal blocks close to T_1. Post dural puncture headache may be present in children. Kokki et al[2] have shown that this adverse effects can be detected in younger children though rare in children under 10 years age.

Lower limb fractures are the common injury in pediatric age group, in most of the cases cause of injury is fall from height and they require good anesthesia with muscle relaxation for operation. Airway manipulation

with endotracheal tube during positioning in orthotable may lead to kinking and displacement, in this situation the spinal anesthetic technique provides reliable airway management without endotracheal intubation and use of muscle relaxant. Spinal anesthesia is suitable in children with a full stomach who need emergency surgery such as acute trauma patients where the risk of aspiration is less than general anesthesia because airway reflexes are protected during general anaesthesia. Nausea and vomiting is also less likely.

The objective of this study was to evaluate the characteristics of spinal block like ease of performance, efficacy, adverse effect and complication in children 5-15 years undergoing lower limb surgery.

MATERIAL AND METHOD

It is a prospective study done to evaluate the successes rate, complications and hemodynamic stability related to pediatric spinal anesthesia. The study was done at Western Hospital, Nepalgunj situated in Banke district which is part of province no. 5. Western Hospital is the study was conducted over a period of 12 months from January 2018 to December 2018. All the pediatric age group patients (5 to 14 years) with unilateral lower limb fracture undergoing surgery during the study period were 76 and were included in the study.

The inclusion criteria were –

1. Patients undergoing unilateral lower limb surgery
2. Age 5 year to 15 years
3. Those willing to participate in the study

The exclusion criteria were -

1. Refusal of the parents
2. Progressive neurological diseases
3. Infection of skin or subcutaneous tissue locally at puncture site
4. Coagulation defects
5. Allergy to local anesthetics
6. Severe hypovolemia
7. With contraindications to Lumbar Puncture

The variables under study included
Age of the patients – As mentioned by the parents
Demography – was divided into terai and hilly region as per place of residence as mentioned by the parets
Type of fracture – femur, tibia, fibula, foreign body and cut injury of foot
Hemodynamic stability - Blood Pressure and Pulse before and after induction
Attempt in which lumbar puncture was successful
Ketamine requirement
Duration of anesthesia.
Complication rate

All the patients under study were subjected to detailed preanesthetic evaluation and were not allowed to take solid food for 6 hours and clear fluids for two hours before anesthesia. After establishment of intravenous access, all were preloaded with crystalloid solution (Ringer's lactate) 10 ml/Kg. Heart rate, Blood pressure and oxygen saturation were measured and recorded before giving spinal anaesthesia. All patients except those who were cooperative and calm were sedated on operating table before spinal with Ketamin 1-2 mg /kg mixed with Atropine 0.6 mg in 10 ml for immobility of patient for lumber puncture. During spinal if sadation was insufficient, additional intravenous ketamine in 0.25mg/kg was given and noted. All patients received spinal anesthesia via mid line approach with patient in lateral position (with fracture site down ward) with aseptic precaution. Lumbar puncture was performed in $L_{4,5}$ inter space using 25 gauze spinal needles. After getting free flow of cerebro spinal fluid hyperbaric bupivacaine 0.5% in a dose of 0.25 mg /kg was injected, to avoid cephaloid spread of drug a pillow was kept below child's head. Two minutes after spinal anesthesia patients were turned supine and level of sensory and level of motor blockade were assessed at every 2 minutes interval for 10 minutes. The onset of block meant either sensory loss at any dermatome or sudden fall of leg. The hemodynamic parameters were monitored throughout the surgery. Sensory level was assessed by the lack of response to firm pin-prick to the dermatome level. Motor blockade was assessed using modified Bromage score[3] as follows.

1. Free movements of leg and feet
2. Just able to flex knee with free movement of feet
3. Unable to flex, but with free movement of feet
4. Unable to move legs or feet

After 10 minutes of SAB if peak sensory level was at least T_{10} and Bromage score was more than 3, surgeon was allowed to start surgery.Due to restricted movement of injured limb motor test was done in non injured limb. If there was no response to surgical stimuli it was considered successful spinal block. After finishing operation patient was transferred to post operative ward and maintained on i.v.fluid for four hours after that oral feeding started.

RESULTS

Spinal anesthesia was attempted in 76 children (58 boys, 18 girls) with the mean age 9.35 ±2.9 years (range 5 -15 years) and mean weight 23.54±5.8 Kg (range 12 to 31 kg). Most of the patients 46 (60.52%) were from hilly areas remaining 30 (39.47%) were from terai. and placement of SA was successful in 74/76 children (97.36 %). In 2 patients GA was administered. Lumbar puncture was successful in first attempt in 61 (82.4%) patients and in second attempt in 13 (17.6 %) patients.

Table 1: Characteristic of Blockade.

Onset of block	**3.43 ±2.2 minutes**
Attempt	
I	82.4% (61 patients)
II	17.6% (13 patients)
Duration of Block	1.8 ±0.74 minutes

Table 2: Hemodynamic evaluation before and after spinal anesthesia.

Haemodynamic Changes	**Before Spinal Anaesthesia (Mean±SD)**	**10 minutes after Spinal Anaesthesia (Mean ± SD)**
Systolic Blood Pressure	106± 11.5 mmhg	92±10.9 mmhg
Diastolic Blood Pressure	66.8±8.7mmhg	57.49±9.78 mmhg

The study shows that the change in systolic BP before and after anaesthesia was 14.07mmhg and change diastolic BP was 9.31mmhg.

Types of injury

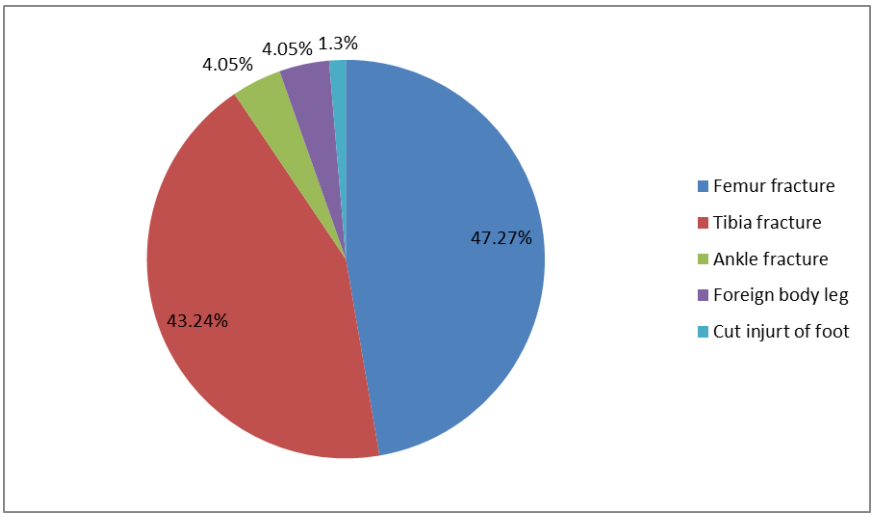
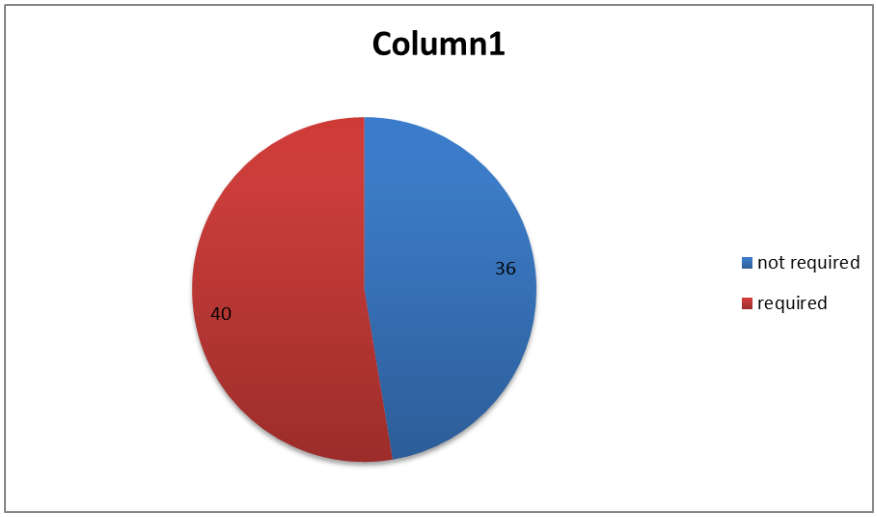


Figure 1: Pie chart showing type of injury.

Above figure shows the type of injury in patients under study. The commonest type of fracture was femur fracture which was present in 35 (47.27%) patients, followed by fracture tibia in 32 (43.24%) patients. 3(4.05%) patients had ankle fracture and 3 (4.05%) had foreign body leg.

KETAMINE REQUIREMENT

Out of 76 patients, 40 required ketamine where as 36 did not**.**



COMPLICATIONS

Except shivering in four (5.26%) patients, no other complications occurred.

DISCUSSION

Spinal anesthesia is a useful technique for infraumbilical and lower limb orthopedic surgeries.[4] In healthy children most of the procedure is performed as a day case surgeries like herniotomy, circumcision, minor urological and orthopedic procedures. Spinal anesthesia is a very good alternative for such cases where the child can be returned to the family hence alot of stress to the parents is avoided. Since less general anesthetic drug including parental opioids are used, the risk of postoperative respiratory depression and vomiting is minimal. The stress response to surgery is also limited and recovery is fast. In 1904, the British surgeon Tyrell Gray has published the results of a series of 300 pediatric spinal anesthesia for procedure below the diaphragm.[5] The author was impressed with the low incidence of postoperative nausea and vomiting. Several author reports on the spinal anesthesia were published by Junkin(1933)[6], Robson (1936)[7] and Berkowithzet al (1951).[8]

Leigh et al[9], in 1948 observed that all pediatric anesthesias in Vancouver Hospital were spinal. There is even a report on spinal anesthesia for more complex surgical procedures such as lobectomies and pneumatomies.

In our study we found spinal anesthesia is a safe technique in pediatric lower limb surgery. Spinal anesthesia has been found to be more cost effective in comparison to general anesthesia. The drugs and equipments required are much less and cheaper besideslength of hospital which is also usually shorter.[10] Before spinal anesthesia, ketamine mixed with atropine was given forsadation and to decrease secretion. Ketamine induces dissociative anesthesia causing functional dissociation between cortical and limbic system. Protective airway reflexes are maintained during sedation. Ketamin having a high therapeutic index is a suitable drug for sedation in the pediatric population.[11] Spinal anesthesia produces a reliable, profound and uniformly distributed sensory block with rapid and good muscle relaxation and it results in more complete control of cardiovascular and stress responses then epidural or opioid anesthesia.[12]

Limitation of study

Period of anaesthesia and analgesia is less than two and half hours so not ideal for prolong surgery.

Uncooperative children need extra supplement ketamine despite successful block during surgery.

Due to unavailablity of pediatric spinal needle study was limited to older children above 5 years age,

Complications

Complications in children are lower than adults.[13] several authors have referred a relative cardiovascular stability, even with blockade at t_4. In children above 8 years of age, there is a decrease in blood pressure and bradycardia as in adults. In our study systolic blood pressure drop was 14.07 and diastolic blood pressure drop was 9. 31 for which no extra medication was used and they were treated with intravenous fluid infusion.In four (5.4%) patients there was shivering and was treated with tramadol 2mg/kg. No other complications such as bradycardia, nausea, vomiting and post dural puncture headache and urinary retention was noted.

Ahmed et al[14] conducted a study to evaluate characteristic 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 brdycardia was seen in one patient, which was treated with atropine.

CONCLUSION

Pediatric spinal anesthesia is a safe, cost effective and single-shot technique for lower limb surgery and good alternative to general anesthesia. This technique of anaesthesia is ideal for rural area of under developed country where there is shortage of modern anaesthetic equipments.

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REFERENCES

1. Bier A. Experiments on the cocainization of the spinal cord. Survey of Anaesthesiology, June 1, 1962; 6(3): 352-8.
2. Kokki H, Hendolin H, Turunen M. Post dural puncture headache and transient neurological symptom in children after spinal anaesthesia using cutting and pencil point paediateic spinal needles. Acta Anaesthesiologicascandinavica, 1998; 42(9): 1076-82.
3. Bromage PR. A comparison of the hydrochloride and carbondioxidesalts of lidocaine and prilocaine in epidural analgesia. ActaAnaesthesiologicaScandinavica, 1965; 9: 55-69.
4. Somri M, Gaitini LA, Vaida SJ, Malatzkey S, Sabo E. Yudashkin M et al. The effectiveness and safety of the spinal in the pyloromyotomy procedure. Paediatr Anaesth, 2003; 13: 32-73.
5. Tyell-Gray HT. A study of spinal anesthesia in children and infants. Lancet, 1909; 3: 913-17.
6. Junkin C. Spinal anesthesia in children. Can Med Assoc J., 1933; 28: 51-53.

7. Robson CH. Anesthesia in children. Am J Surg, 1936; 34: 468-73.
8. Berkowitz S, Greene BA. Spinal anesthesia in children: report based on 350 patients under13 years of age. Anesthesiology, 1951; 12: 376-87.
9. Leigh MD, Beiton MK. Pediatric anesthesia. AnesthAnalg, 1956; 3: 1-17.
10. Carlos C, Melvin E. First 300 cases of pediatric regional anesthesia in Venezula (Caudal, spinal and peridural). The internet journal of Anesthesiology, 2000; 4: 4-10.
11. Miqdady MI, Hayajneh WA, Abedelhadi R, Gilger MA. Ketamin and midazolam sedation for pediatric gastrointestinal endoscopy in the Arab world.World Journal of Gastroenterology. WJG., 2011; 17(31): 3630.
12. Wolf A, Doyle E, Thomas E. Modifying infant stress response to major surgery ; spinal vs opioid analgesia. PediatrAnesh, 1998; 8(4): 305-11.
13. Giaufre E, Dalens B, Gombert A. Epidemiology and morbidity of regional anesthesia in children: a one year prospective survey of the French Language Society of Pediatric Anesthesiologist. Anesth Analg, 1996; 83(5): 904-12.
14. Ahmed M, Ali NP, Kabir SM. Nessa M. Spinal Anesthesia: Is it safe in younger children? JAFMC Bangladesh, 2010; 6(1): 25-8.