



Supraclavicular Brachial Plexus Block as a Sole Anesthetic Technique in Pediatric Upper Limb Surgeries

KEYWORDS

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ABSTRACT *Background : Peripheral nerve blocks provide an ideal operating condition when used optimally. The adequately administered regional anesthesia can, not only provide very excellent intraoperative pain control but also good post-operative analgesia. Brachial plexus block is been widely used for upper limb surgeries. So the purpose of the study was to assess the usefulness of brachial plexus block for upper limb surgeries in paediatric cases. Method : Fifty patients in the age group 5-12 years belonging to ASA 1 scheduled to undergo Upper limb surgeries were chosen. All the patients were assessed and those with Normal biological, hematological and radiological parameters were selected & assessed the usefulness of brachial plexus block for upper limb surgeries in paediatric cases as the sole anesthetic technique with regards to onset of sensory and motor blockade, duration of sensory blockade, side effects. Result : No significant difference is observed regarding onset & duration of Sensory blockade & minutes between male and female. No significant difference is observed regarding respiratory rate, onset of Motor blockade minutes & age difference between male and female. Conclusion : supraclavicular brachial plexus can be used as a sole anesthetic technique in pediatric patients 0.5% bupivacaine 2mg/kg can be used as a local block provides anesthesia of the upper extremity in a shorter time than any other brachial plexus block. It provides ideal operating conditions with good analgesia, complete muscular relaxation and sympathetic blockade.*

Introduction

Peripheral nerve blocks provide an ideal operating condition when used optimally. They are said to cause least interference with the vital physiological functions of the body with reduced avoiding polypharmacy with an alert, awake and cooperative patient when compared to general anesthesia. The adequately administered regional anesthesia can, not only provide very excellent intraoperative pain control but also good post-operative analgesia.¹ Regional anesthesia traces its origin to Dr Karl Koller, a young Viennese ophthalmologist, who in 1884 employed a solution of cocaine for topical corneal anesthesia in patients undergoing eye surgeries. Most of the local anesthesia agents were developed between 1900-1940 and was basically amino ester compounds. They lost their importance due to shorter duration of action and the associated allergic reactions and systemic toxicity. This paved the way to the synthesis of newer agents namely the amino amide compounds.^{3,4} The advent of long acting drugs has made it possible to carry out prolonged surgeries in the extremities especially for vascular, orthopaedic and plastic procedures and also for relief of chronic pain. The main drawbacks of these agents were the delayed onset of action, varying quality of blockade and the inadequate post-operative analgesia. Application of regional anesthetic techniques to infants and children dates to early days of regional anesthesia. Bainbridge and Gray in 1909 successfully employed cocaine and stovaine for spinal anesthesia in infants and children respectively. In recent years there has been a resurgence of interest in regional anesthetic techniques as they afford excellent post-operative analgesia and there has been increasing interest in pain relief for children.⁵ Peripheral neural blockade has gained much importance in the recent past. The Americans Halsted and Hall described the injection of cocaine into peripheral sites including the ulnar, musculocutaneous, supratrochlear and infraorbital nerves for minor surgical procedures in 1880.

Peripheral blockade remains a well accepted component of comprehensive anesthetic care. Its role has expanded from the operating suite into the arena of postoperative and chronic pain management.⁶ Brachial plexus block is been widely used for upper limb surgeries. There are four approaches to brachial plexus block.⁷ They are supraclavicular, infraclavicular, axillary and interscalene. This study deals about the supraclavicular approach of brachial plexus and its usefulness. So the purpose of the study was to assess the usefulness of brachial plexus block for upper limb surgeries in paediatric cases as the sole anesthetic technique with regards to onset of sensory and motor blockade, duration of sensory blockade, side effects. **Materials & Methods :** This study was carried out in the orthopedic and surgical theatres, madha Medical College and Hospital, after obtaining institutional approval. This is a prospective type of study. Fifty patients in the age group 5-12 years belonging to ASA 1 scheduled to undergo Upper limb surgeries were chosen. All the patients were assessed and those with Normal biological, hematological and radiological parameters were selected. Informed consent was obtained from the parents of all patients. Parents not willing with anticipated difficulty in intubation, neurological disorders, history of allergy to local anesthetics. History of cardiovascular and respiratory disorders were excluded from the study. Patients were assessed pre-operatively and written informed consent was obtained. They were assessed with particular attention to any contradictions. Assessment of pain using verbal rating score intra operatively and visual analogue score post operatively was explained to the patient pre operatively. Patients were not given premedication. On arrival of the patient in the operating room monitors like pulse oximetry, non-invasive blood pressure and electrocardiogram were connected and baseline values of heart rate, blood pressure, respiratory rate and oxygen saturation were recorded. An intravenous access was obtained in the opposite arm. The

patients were administered supraclavicular brachial plexus block by the subclavian perivascular techniques as follows. Patients were positioned supine with a small pillow below the head and neck. The head was turned away from the side to be blocked. The neck was prepared with povidone iodine solution and draped with sterile towels. The following observations were made as vital signs monitoring, non invasive blood pressure and heart rate was measured every minute for the first 10 minutes and every 5 minutes thereafter throughout the intra operative period. Heart rate and rhythm by electrocardiogram and oxygen saturation by pulse oximetry were monitored continuously. Immediately following the administration of the drug patients were evaluated every minute till the onset for sensory and motor blockade. Time of onset of sensory blockade was tested by assessment of pinprick sensation in the C5-T1 dermatomes with a 26G hollow needle. Onset of motor blockade was assessed by loss of shoulder abduction. Failure of the block to appear in 20 minutes was taken as failure and the patients were administered general anesthesia and were excluded from the study. After confirmation that the block has taken up, surgery was started. During the surgical procedures, the degree of pain was assessed with a 3 point verbal rating score; The verbal rating score was utilized if verbal rating score is ≥ 1 , patients were administered general anesthesia to complete the surgery and were excluded from the study. Local anesthetic toxic reactions including subjective and objective manifestations like circumoral numbness, tinnitus, twitching, convulsions, etc., were looked for and appropriate measures were planned. Complications associated with the technique like intravascular injection, intrathecal injection, epidural injection and Pneumothorax were looked for and appropriate measures were planned. Duration of analgesia was tested post operatively using the visual analogue score every ½ hour for the first 6 hours thereafter every 2 hours till 24 hours. Parameters studied were Onset of sensory: - This is the time in minutes from the injection of the drug to the lack of appreciation of pain prick sensation at C5-T1 dermatomes. Onset of motor blockade: - This is the time in minutes from the time of drug injection to the loss of shoulder abduction. Duration of analgesia: - This is the time in hours from the onset of analgesia to the time of administration of rescue analgesia.

Observation & Results

The Mean and SD values for Heart rate related to various time intervals. It is seen that at the time of 5 minutes, the heart rate is increased. From the obtained statistical result that male group got high mean value (97.80) than female (92.00). The statistical result P value is significant $P < 0.01$. Therefore it is observed that there is a significant difference among the various age groups and their heart rate. 5 years age groups have high than other age groups. The table shows the Mean and SD values for SPO2 related to various time intervals SPO2 at 10 minutes is the highest. No significant difference is observed regarding SPO2 between male and female. It is observed that there is no significant difference among the various age groups and SPO2. The Mean and SD values for respiratory rate related to various time intervals. Respiratory rate at the time of 5 minutes is high (17.78). No significant difference is observed regarding respiratory rate between male and female. No significant difference is observed regarding onset of Motor blockade minutes between male and female. It is observed that there is no significant difference among the various age groups and onset of Motor blockade.

Table-1
t-test for onset of Sensory Blockade minutes

Gender	N	Mean	SD	t-value	P value
Male	40	6.23	0.101	1.055	0.312 (NS)
Female	10	6.28	0.125		

No significant difference is observed regarding onset of Sensory blockade minutes between male and female.

Table-2
ANOVA for Onset of Sensory blockade minutes

Age	N	Mean	SD	F-value	P-value
5 years	10	6.30	0.07	5.966	0.001 (0.01)
6 years	10	6.31	0.09		
7 years	10	6.26	0.11		
8 years	10	6.15	0.7		
Above 8years	10	6.20	0.10		
Total	50	6.24	0.11		

It is observed that 5 years and 6 years have high level of sensory blockade.

Table-3
t-test for Duration of Sensory Blockade minutes

Gender	N	Mean	SD	t-value	P value
Male	40	6.47	0.24	1.012	0.327 (NS)
Female	10	6.39	0.21		

No significant difference is observed regarding onset for duration of Sensory blockade hours between male and female.

Table-4
ANOVA for Duration of Sensory blockade hours

Age	N	Mean	SD	F-value	P-value
5 years	10	6.72	0.05	5.966	0.001 (0.01)
6 years	10	6.66	0.08		
7 years	10	6.38	0.21		
8 years	10	6.24	0.09		
Above 8years	10	6.26	0.09		
Total	50	6.45	0.23		

It is observed that there is a significant difference among the various age groups related to sensory blockade 5 and 6 years have high rate.

DISCUSSION

The subclavian perivascular approach to the brachial plexus has gained popularity because of the satisfactory anesthesia and less failure rate with this approach. Lanz in their study on subclavian perivascular brachial plexus block found that the subclavian perivascular block provides an effective block for the surgery on the upper extremity. 8,9,10. They also concluded that at the site of injection with this technique the plexus is reduced to its smallest components and the sheath is reduced to its smallest volume, which explains in greater part the success obtained with this block. In their study on the extent of blockade following various techniques of brachial plexus block demonstrated that the subclavian perivascular approach to the brachial plexus resulted in a homogenous blockade of the nerves of the brachial plexus and prompted us to adopt this technique.

With the supraclavicular approach the injection is made at the level of the trunks. As there are only three components at this level failure rates should be extremely low. With the interscalene approach to the brachial plexus, made at the level of the nerve roots, C8 and T1 are likely to be missed because of the vertical arrangement of the roots. Thus the interscalene approach tends to fail on the ulnar side of the limb in a dermatomal distribution. 11,12,13 In contrast, the axillary approach is made at the level of the terminal

nerves and the musculocutaneous and radial nerves are the most likely nerves to be inadequately blocked resulting in failure within a terminal nerve distribution.

With the supraclavicular technique these complications are not seen. There is a chance of 0.6 – 25% incidence of pneumothorax, which is usually asymptomatic. With the intrascapular approach dangerous and potentially lethal complications like vertebral artery injection and subarachnoid or epidural injection can occur. Therefore, in this study the subclavian perivascular approach to the brachial plexus was used. Stephen Ross demonstrated a proper anatomical approach of the brachial plexus in order to prevent total spinal anesthesia.

Rosemary Hickey recommends using 0.5% concentration of these local anesthetics to provide brachial plexus anesthesia. Therefore, in this study 0.5% bupivacaine is used.

According to Lanz in the subclavian perivascular technique the solution is delivered at a point in which the trunks are compactly arranged. So a volume of 10-15 ml of local anesthetic solution is sufficient for children. According to Pande supraclavicular brachial plexus as a sole anesthetic technique proved to be effective and easy to perform.^{14, 15}

The onset of motor blockade was tested by loss of shoulder abduction. In this study the mean onset time for motor blockade was 3.36 minutes and no significant difference was observed regarding onset of motor blockade between male and female. In this study the mean duration of sensory blockade was found to be 6.4 hours. It is observed that there is a significant difference among the various age groups related to sensory blockade. Those under the age group 5 and 6 years have higher duration of analgesia. None of the patients showed any of the side effects like nausea, vomiting, pruritus, urinary retention, hypotension, headache, sedation or respiratory depression.

In this study there was significant change in the heart rate in the age group 5-6 when compared to other age groups. There was no significant difference in the saturation and respiratory rate of the various age groups.

From this study it is inferred that supraclavicular brachial plexus can be used as a sole anesthetic technique in pediatric patients 0.5% bupivacaine 2mg/kg can be used as a local block provides anesthesia of the upper extremity in a shorter time than any other brachial plexus block. It provides ideal operating conditions with good analgesia, complete muscular relaxation and sympathetic blockade.

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