

## Brachial plexus block as a sole anaesthetic technique in upper extremity fracture/dislocation in children: Subclavian perivascular vs parascalene approach

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### Abstract

**Objective:** To compare parascalene approach of brachial plexus block with the classical subclavian perivascular approach as a sole anaesthetic technique in children undergoing closed manipulation for fracture/dislocation around the elbow.

**Materials and methods:** Sixty children (age 6-13 years) undergoing closed manipulation for fracture/dislocation around the elbow were randomly assigned to two groups, Group I (n=30) receiving brachial plexus block using Winnie's classical subclavian perivascular approach and Group II (n=30) receiving brachial plexus block using parascalene approach described by Dalens. Time required for performing the block, onset of analgesia, sensory block to pin prick, adequacy of relaxation, complications and acceptance of the technique to the children, parents and the surgeons were compared.

**Results:** Time required for performing the block (6.3±2.2 min vs. 8.2±2.4 min), onset of subjective analgesia (4.1±1.6 min vs. 5.2±1.4 min) and onset of sensory block to pinprick (6.8±2.1 min vs. 8.6±1.7 min) were significantly shorter in Group I as compared to Group II (p<0.01). Acceptance of the techniques by the children, parents and the surgeons, and the overall success rates were high and comparable between the groups. Complications were minor and the incidence was low in both the groups except Horner's syndrome in 46.7% of patients in Group II.

**Conclusion:** Parascalene approach to brachial plexus block is comparable to classical subclavian perivascular approach in safety, success rate and acceptance in children undergoing closed manipulation and reduction of fracture/dislocation around the elbow.

**Key words:** brachial block, children, parascalene, regional anaesthesia

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In many developing countries including Nepal, more than one third of all surgeries are performed under local or local-regional anaesthesia.<sup>1</sup> Various nerve block techniques are in use for both elective and emergency procedures. However, peripheral nerve blocks are not commonly attempted in children because attempts of locating the nerve can be painful.<sup>2</sup> Brachial plexus block is in use for upper extremity surgical procedures in children both as a supplement to general anaesthesia or as a sole anaesthetic technique though uncommonly. There are various approaches of brachial plexus block that are in use.

The subclavian perivascular or the classical approach of brachial plexus block was described first by Winnie and Collins<sup>3</sup> and has been successfully used as a sole anaesthetic technique in children undergoing upper extremity fracture reduction.<sup>4</sup> The parascalene approach of brachial plexus block was first described

by Dalens and colleagues and has been reported to be devoid of significant complications and claimed to be suitable for the procedures involving arms and elbow.<sup>5</sup> It has been reported to have high success rate in relieving post operative pain in children.<sup>6</sup> But it has not been widely studied as a sole anaesthetic technique in children.

The present study has been carried out to assess the feasibility of parascalene approach of brachial plexus block as a sole anaesthetic technique in children for upper extremity fracture/dislocation reduction and compare it with the classical subclavian perivascular approach.

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## Materials and methods

Sixty children of both sexes undergoing closed manipulation and reduction of fracture or dislocation around the elbow were taken in the study. Children were randomized into two groups using sealed envelope technique after explaining the nature and purpose of the study and obtaining informed consent from the parent. Every attempt was made to obtain the cooperation of the children by explaining and providing comforts to both children and parents. Possibility of early eating was explained if the blocks were accepted and effective. Children not convinced to accept the needle pricks, or having bilateral fractures and systemic diseases were excluded from the study. Children assigned to Group I received classical subclavian perivascular approach and Group II the parascalene approach of brachial plexus block.

Intravenous access was established in all children using 22G cannula on the dorsum of the contra-lateral hand after applying EMLA cream. All the children were kept fasting for solids 6 hours and clear fluids for 2 hours. All the children received oral diazepam 0.2 mg/kg 1 hour before the procedure. No further sedation was used during the procedure. Pulse oximeter was applied to a finger of every child. All the children were positioned supine with a folded towel below the shoulder, the head turned away to the contra-lateral side and the arms extended along the chest wall.

The needle puncture site in Group I was identified by sliding the palpating finger down in the interscalene groove till arterial pulsation of the subclavian artery was felt. After raising a skin weal, a 23G short bevel 1.5 inch needle was inserted in caudad direction till the fascial pop was felt after piercing the neuro-vascular sheath. For injection, 1.5% lignocaine with adrenaline, prepared by mixing three-fourth volume of 2% lignocaine with adrenaline (1:200000) and one-fourth volume of normal saline, was used. The volume used was based on the recommendation by Dalens<sup>7</sup> (10-12.5ml for 15-19kg, 15ml for 20-24kg, 17.5ml for 25-29kg and 20ml for 30-40kg). For children weighing less than 15kg, 1.5% lignocaine with adrenaline in volume equal to 10mg /kg of lignocaine was used.

The needle puncture site in Group II was identified by locating Chassaignac's tubercle and a line drawn from it to the midpoint of the clavicle. The point dividing the upper two thirds and lower one third in the line was identified as the puncture site and a skin weal was raised. The needle (23G, 1.5 inch long and

short beveled) was directed posteriorly at right angle to the skin till paraesthesia was elicited. For achieving the block, 1.5% lignocaine with adrenaline in volume as described above was injected. All the blocks were performed by single investigator. One of the parents was kept in the theatre during the period of performing the block.

The time required to perform the block (the time from positioning of the patient till the last drop of the drug is injected) was recorded by a person unaware about the anaesthetic technique being used. The puncture site was covered with a gauge piece and taped immediately after finishing the injection to mask the observer who was recording the time for analgesia (by asking the patient every minute) and sensory block (by pinpricking every minute). The orthopaedic surgeons performing the manipulation and reduction were kept unaware about the approach of brachial plexus block being used. Continuous verbal contact was maintained with all the children. Pulse rate and SpO<sub>2</sub> were monitored continuously through out. Inability to continue the procedure and need of conversion to general anaesthesia was considered failure. After completing the procedure, the surgeon was asked whether the muscle relaxation was acceptable or not and the child and the parents were asked separately whether they would accept the same technique if required in the future or not.

For post operative analgesia, oral ibuprofen 6mg/kg was prescribed. All the children were observed in the recovery room for at least one hour after the procedure. Discharge criteria included a comfortable child with stable vitals and normal capillary refilling of the affected limb. Patients were discharged with the instruction to report in case of change in the colour of the limb, severe pain or difficulty in breathing immediately to the hospital. If not, they were asked to report to the Orthopaedics out patient department next morning for evaluation and follow up.

Any patient requiring conversion to general anaesthesia was excluded from further comparison. The variables recorded and compared were age, sex, weight, time required to perform the block, time for onset of pain relief, time required for sensory block, acceptance of the technique (to the child, parent and the surgeon), complications and failure rates. Continuous variables were analyzed using two-tailed Student's T test and categorical data were analyzed using Chi-square test. A p-value of less than 0.05 was considered significant.

## Results

All together 60 children, 39 male and 21 female, were enrolled in the study with the age ranging from 6 to 13 years. Fifty one children had supracondylar fracture and 9 had dislocation of the elbow joint (Table 1). Overall success rate was 93.3% in both the groups. Conversion to general anaesthesia was required in four children two in each group while in the rest anaesthesia was complete.

There was no difference in patient characteristics between the groups. Parascalene approach required significantly longer time for performing the block, onset of subjective relief of pain on movement and sensory block to pin pricks (Table 2). Both the techniques had comparable acceptance for the children, parents and the surgeons. No significant complication like pneumothorax was observed in any of the group. Two children in the classical approach developed small haematomas whereas 2 children in Group I and 14 children in Group II developed Horner's syndrome (Table 3).

**Table 1:** Patients characteristics and indications for blocks

	Group I (n=30)	Group II (n=30)
Demographic Data		
Age: mean±SD (years)	8.8±2.4	9.5±2.4
Age range (years)	6-13	6-13
M:F ratio	21:9	18:12
Weight: mean±SD (Kg)	19.5±3.5	18.9±4.1
Indications		
Supracondylar fracture	26 (87%)	25 (83%)
Dislocation of elbow	4 (13%)	5 (17%)

**Table 2:** Time for performing the blocks, subjective pain relief and sensory block

	Group I	Group II
Time required for performing the block (min)	6.3±2.2 (n=30)	8.2±2.4* (n=30)
Onset time for subjective pain relief (min)	4.1±1.6 (n=28)	5.2±1.4* (n=28)
Onset time for sensory block to pinprick (min)	6.8±2.1 (n=28)	8.6±1.7* (n=28)

\*  $p < 0.01$

**Table 3:** Acceptability, failure and complications

	Group I	Group II
Acceptance to children	22 (78.6%) (n=28)	20 (71.4%) (n=28)
Acceptance to parents	26 (92.9%) (n=28)	25 (89.3%) (n=28)
Acceptance to surgeons	26 (92.9%) (n=28)	26 (92.9%) (n=28)
Puncture of vessels (haematomas)	2 (6.7%) (n=30)	0 (n=30)
Horner's syndrome	2 (6.7%) (n=30)	14 (46.7%)* (n=30)
Conversion to GA (failure)	2 (6.7%) (n=30)	2 (6.7%) (n=30)

\*  $p < 0.001$

## Discussion

Difficulty in obtaining cooperation for regional blocks in children has made regional anaesthesia an uncommon sole anaesthetic technique although it has been considered ideal for surgical procedures around the elbow in upper limbs.<sup>8</sup> Supraclavicular approach to brachial plexus block provides ideal operating condition by anaesthetizing entire upper extremity in a shorter time than any other approaches.<sup>9</sup> However, this technique has not been used extensively due to the fear of pneumothorax.<sup>10</sup> But recently this approach has been shown to be feasible and without clinically significant complications.<sup>4</sup> We have experienced that Nepalese children mostly tolerate regional blocks quietly in the presence of their parents.

The relatively new parascalene approach to brachial plexus block has been reported to be suitable for procedures around the elbow and the arm and has been claimed to be without significant complications. However, this technique has not been widely studied as a sole anaesthetic technique and that has prompted us to carry out this study and compare it with the classical technique.

There was no difference in patient characteristics in between the groups. But the time required for performing the block, onset of subjective analgesia and time for objective sensory block were significantly longer in parascalene approach than in the classical perivascular approach. The rapid onset and dense block in the classical approach can be attributed to the fact that the plexus is contracted to

the smallest volume and confined by compact brachial plexus sheath and, having a limited vascular surface area for drug absorption. Moreover, the landmarks for locating the puncture site in classical approach are straight forward and easier compared to the need of identifying multiple landmarks and eliciting paraesthesia in the parascalene approach.

The marginally higher acceptability of the classical technique over parascalene approach may be due to the discomfort of relatively longer performing time and the need of eliciting paraesthesia in the latter technique. There was no difference in acceptance of both the techniques by the parents of the children and the orthopaedic surgeons. Overall, both the techniques were well accepted and this can be partially attributed to the parental presence during the time of performing the block.<sup>11</sup>

Both the groups had high success rate (>90%) with very few patients requiring conversion to general anaesthesia. No serious complications were observed in both the groups. The incidence of minor complication was low and comparable between the groups except significantly higher incidence of Horner's syndrome in parascalene approach. There is a great variation in the reported incidences of Horner's syndrome ranging from less than 4% to more than 70% in the parascalene approach to brachial plexus block<sup>12,13,14</sup> and this is most probably due to lack of uniformity in the techniques used. However, Horner's syndrome has not been reported to be associated with significant clinical

consequences. We did not come across any case of clinical pneumothorax in our study, although incidence of as high as 5% has been reported with the classical approach.<sup>15</sup> Although unconsciousness and apnoea have been reported with suspected subarachnoid block following parascalene approach<sup>16</sup>, it has been claimed that it is unlikely to cause significant complications and avoids damaging pleura, great vessels, the vagus nerve, the phrenic nerve and the spinal canal.<sup>17</sup> In contrary, Greengrass and colleagues<sup>18</sup> have mentioned high possibility of phrenic nerve block (upto50%) with the parascalene approach. But none of our patients showed any grade of respiratory distress indicating that even if phrenic nerve block had taken place, it was not of any clinical relevance when the other phrenic nerve is intact.

It can be concluded that parascalene approach of brachial plexus block is feasible and can be used as an alternative to classical approach as a sole anaesthetic technique in children undergoing closed manipulation and reduction of fractures and dislocations around the elbow.

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