INTRODUCTION

Interscalene brachial plexus block is indicated for shoulder and clavicle surgeries but usually C3 and C4 supplementation is needed for complete surgical analgesia for shoulder and clavicle procedures. Landmark techniques using peripheral nerve stimulator required larger volumes and resulted in increased incidence of adverse effects like vascular puncture, Horner's syndrome, diaphragmatic paresis due to phrenic nerve palsy. After the introduction of ultrasound for regional anaesthesia, the volume needed for adequate analgesia was reduced.
reduced. The incidence of adverse effects due to block was also reduced.

This study aims to compare the quality of analgesia and incidence of adverse effects using two different volumes of 0.5% bupivacaine for clavicular surgeries by ultrasound guided combined interscalene and superficial cervical plexus block.

Subjects and Methods:

After institutional ethical committee clearance, 60 patients of age group 20 – 65 yrs of ASA physical status I,II and weighing 50 kg and above who underwent elective internal fixation for clavicle fractures were selected and randomly allocated into two groups through lots after written informed consent. Patients were divided into 2 groups, group L(n=30) comprised of patients who were put on 15 ml of 0.5% bupivacaine and group H(n=30) were put on 25 ml of 0.5% bupivacaine. Patients with respiratory disease, coagulopathy, psychiatric disease, neck infection, obesity (BMI> 35 Kg/m2) and history of allergy to bupivacaine were excluded from the study.

After inclusion in the study, the patient was explained about the procedure. Routine monitoring included ECG, saturation, etco2 and non invasive blood pressure. Patients were given oxygen 6 litres/min through facemask. Intravenous midazolam 30 g/kg was given for sedation after the block. The ultrasound guided interscalene and superficial cervical plexus block was done by an experienced anaesthesiologist having experience in ultrasound guided nerve blocks using sonosite and peripheral nerve stimulator(lifetech eztim2) with a 50 mm 22 G echogenic needle(pajunk inc.). With the patient in the supine position with the head turned to the opposite side. After painting with betadine solution on the area of injection, 1 ml of 2% lignocaine was infiltrated. Using ultrasound, brachial plexus was visualized. Root and trunks were identified between the anterior and middle scalene muscles at C6 level. Peripheral nerve stimulation was done (frequency 2 Hz, pulse width 0.1 ms) and after obtaining a deltoid muscle response, the current was reduced from 1.5 mA to 0.4 mA and 15 ml or 25 ml of 0.5% bupivacaine was given with respect to the corresponding group. After the injection, superficial cervical plexus was visualized with ultrasound and 10 ml of 0.25% bupivacaine was given.

A blinded assistant unaware of the patient group was asked to assess the quality of block in terms of thermal sensation, pin prick and motor function. The block was considered to be adequate when there was absence of pain to pin prick and absence of thermal sensation and modified bromage scale of 0. Motor function was assessed by modified bromage scale.

Modified bromage scale definition

4 – full power in relevant muscle group
3 – reduced power but able to move muscle group against resistance
2 – able to move relevant muscle group against gravity but inability to move against resistance
1 – flicker of movement in relevant muscle group
0 – no movement in relevant muscle group

The movement of diaphragm was assessed 1 hour before and 15 min, 30 min, 1 hour and 4 hours after the block using ultrasound on the ipsilateral side of interscalene block for the involvement of phrenic nerve. Adequate post operative analgesia was defined as complete absence of pain and rating of 0 in numerical rating scale. Duration of post operative pain relief was assessed based on the time of intravenous fentanyl given for breakthrough pain after surgery. For 95% confidence interval and 80% of power assuming 0% outcome in group L and 24% outcome in group H, the sample size was calculated as 28 for each arm.

Mean and standard deviation were used to analyse parametric data. Continuous variables were analysed by using student’s t-test. Qualitative data were analysed using fisher’s exact test. Statistics were done using SPSS version 15.0.
RESULTS:

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>GROUP L</th>
<th>GROUP H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>34.06 ± 6.3</td>
<td>32.86 ± 7.79</td>
</tr>
<tr>
<td>Gender (n)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Female</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>ASA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I / II</td>
<td>27 / 2</td>
<td>27 / 2</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>62.5 ± 6.2</td>
<td>64.8 ± 7.5</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>163.8 ± 8.6</td>
<td>163.3 ± 7.3</td>
</tr>
<tr>
<td>Duration of surgery (minutes)</td>
<td>118.1 ± 18.3</td>
<td>114.4 ± 19.1</td>
</tr>
<tr>
<td>Failed block (n)</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1 – Demographic characteristics

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>GROUP L</th>
<th>GROUP H</th>
<th>P- VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phrenic nerve palsy(n)</td>
<td>0</td>
<td>6</td>
<td>0.023*</td>
</tr>
<tr>
<td>Adequate Intra op anaesthesia and analgesia(n)</td>
<td>28</td>
<td>28</td>
<td>1.00</td>
</tr>
<tr>
<td>Duration of post op analgesia (hours)</td>
<td>5.78 ± 0.4</td>
<td>5.7 ± 0.4</td>
<td>0.459</td>
</tr>
</tbody>
</table>

Table 2 – Primary and Secondary outcome statistics

* p value < 0.05 (significant)

60 patients completed the study protocol, 29 in the high volume (group H) and 29 in the low volume (group L). There were failed block in 2 patients (one patient in each group) due to technical reasons, they were excluded from the study. There were no significant differences in age, gender, weight, height, ASA physical status, duration of surgery in both the groups. Patient’s demographic characteristics are presented in table 1. 1 patient in group H developed horner’s syndrome. There were no incidence of local anaesthetic toxicity or hemodynamic instability.

Adequacy of intraoperative anesthesia and analgesia was comparable in both the groups (p – 1.00). Phrenic nerve palsy was present in 6 patients of group H whereas none of the patients of group L developed phrenic nerve palsy. The incidence of phrenic nerve palsy was statistically significant (p – 0.023).

There were no requirement of supplementation of analgesics in both the groups intraoperatively. The duration of postoperative analgesia was 5.78 ± 0.4 in group L and 5.7 ± 0.4 in group H (p -0.459). The statistical parameters of primary and secondary outcomes are given in table 2.

DISCUSSION

The results of our study demonstrate that ultrasound guided combined interscalene and superficial cervical plexus block provides comparable quality of analgesia and reduced incidence of phrenic nerve palsy. One patient in group H (high volume) developed horner’s syndrome. Therefore 15 ml (low
volume) of 0.5 % bupivacaine given by ultrasound guidance for interscalene brachial plexus block gives comparable quality of intraoperative and postoperative analgesia with reduced incidence of adverse effects.

Combined interscalene and superficial cervical plexus block can be used for clavicular fractures for intraoperative and postoperative analgesia\(^5\). Not only can it be used for postoperative analgesia but can be used as a sole anaesthetic for clavicular surgeries too according to recent studies\(^4\). since clavicular innervation is poorly defined in literature, supplementation with superficial cervical plexus is required for adequate analgesia for clavicle surgeries\(^5\).

McNaught et al. conducted a study comparing ultrasound and nerve stimulation and determined the minimum effective volume required for effective interscalene block\(^3\) and Falcao et al. also determined the minimum volume required for adequate postoperative analgesia with 0.5 % bupivacaine as 2.34 to 4.29 ml\(^2\) which is very comparable to the results in our study.

We had hemidiaphragmatic paresis in 6 patients of group H(high volume) whereas none of the patients in group L(low volume) developed nerve palsy. Earlier studies comparing high vs low volume of local anaesthetic showed increased incidence of hemidiaphragmatic paresis in high volume group\(^2,8,9\). Ultrasound is a reliable non invasive technique of diagnosing hemidiaphragmatic paresis in patients who have been performed interscalene block\(^10,11\).

In our present study, the average duration of post operative pain relief in both the groups were comparable and the mean duration of post operative analgesia in both the groups were 5.5 hours. Further studies are needed to confirm the lower volume required to produce adequate quality of analgesia and reduced incidence of hemidiaphragmatic paresis.

To summarize, combined interscalene and superficial cervical plexus block with 0.5 % bupivacaine gives adequate intraoperative and postoperative analgesia with reduced incidence of hemidiaphragmatic paresis.

**CONCLUSION**

Comparable quality of intraoperative and postoperative analgesia and reduced incidence of hemidiaphragmatic paresis can be obtained with 15 ml of 0.5 % bupivacaine compared to 25 ml of 0.5 % bupivacaine given by ultrasound guided combined interscalene and superficial cervical plexus block for clavicular surgeries.

**REFERENCES**


anaesthetic volume compared with peripheral nerve stimulation for interscalene block. Br J Anaesth 2011 Jan;106(1): 124-130


