Fluoroscopic Stellate Ganglion Block for Postmastectomy Pain: A Comparison of the Classic Anterior Approach and the Oblique Approach

Dina Nabil Abbas, MD, Ekramy M. Abd el Ghafar, MD, Wael A. Ibrahim, MD, and Azza F. Omran, MD

Objective: Stellate ganglion block is usually performed with the classic anterior paratracheal approach. The anatomy of the stellate ganglion being in close proximity to various critical structures renders a number of complications, which are potentially associated with its blockade. The aim of this study was to assess the analgesic efficacy and safety of a new approach of the stellate ganglion block using an oblique fluoroscopic view.

Methods: Fifty patients with postmastectomy pain syndrome were randomly allocated into 1 of 2 groups: the anterior paratracheal stellate block group and the oblique fluoroscopic stellate block group. Four blocks were performed for each patient using the same approach each time. The results were evaluated in terms of pain intensity as assessed by the visual analog scale score, morphine consumption, and allodynia surface area (in cm²). Patient satisfaction score (PSS), skin temperature, side effects, and complications were recorded and compared between the 2 studied groups after each block had been performed.

Results: The mean visual analog scale score, daily morphine consumption, and areas of allodynia were significantly decreased and the PSS was significantly increased after each block and for up to 3 months after the last block in both the groups. However, there were no statistically significant differences between the 2 groups at the same study period apart from PSS, which was statistically more significant in group oblique at certain times. The incidences of side effects were significantly more in group classic than in group oblique.

Conclusions: The oblique fluoroscopic approach of the stellate ganglion block is as effective as the anterior paratracheal approach but is safer and more satisfactory to the patients.

Key Words: stellate ganglion block, techniques of stellate ganglion block, postmastectomy pain

( Clin J Pain 2010;00:000–000)

S tellate ganglion block (SGB) has been commonly performed, both for diagnostic and therapeutic purposes, for the upper extremity complex regional pain syndromes, which may be because of lesions or dysfunction of the neural system.¹ Postmastectomy pain syndrome (PMPS) is a neuropathic pain condition, which follows surgical treatment for breast cancer.²,³ This syndrome consists of persistent pain in the anterior chest, the axilla, and the medial and posterior parts of the arm after breast surgery and is characterized by hyperalgesia, allodynia, and spontaneous pain.⁴ Pain usually begins in the immediate postoperative period but may be delayed for 6 or more months after surgery. The pain characteristically persists beyond the normal healing period.⁵ PMPS can develop from surgical damage to the intercostobrachial nerve, the lateral cutaneous branch of the second intercostal nerve that is often resected at mastectomy.⁶ As it is believed that this nerve is injured in 80% to 100% of mastectomy patients who undergo an axillary dissection⁷ SGB can be a therapeutic way for treating PMPS.

The stellate ganglion is formed by the union of the inferior cervical ganglion with the first thoracic ganglion (SG). Its size is variable. It is situated on the anterolateral aspect of the seventh cervical and first thoracic vertebrae, mostly in a groove between the vertebral body and the transverse process.⁸

However, it should be noted that there is considerable variation. The cervical sympathetic chain is variable and may also be included in the sheath of the carotid artery.⁹ Near the SG, the vertebral artery originates from the subclavian artery and is commonly found anterior to the SG. The nerve roots of the brachial plexus, including C6, C7, C8, and T1, lie posterior to the respective tubercles.¹⁰ The SG provides sympathetic innervations to the upper extremity through the gray communicating rami of C7, C8, T1 and sometimes C5 and C6.¹¹ Inconstant pathways (Kuntz nerves) contribute to occasional innervations to the upper extremity from the T2 and T3 gray communicatings rami. These fibers do not pass through the SG; instead, they join the brachial plexus and ultimately innervate the distal structures of the upper extremity.¹² These fibers may be the cause of inadequate pain relief in patients with sympathetically mediated pain despite evidence of a satisfactory block.¹³

The most commonly used approach is the anterior paratracheal approach with¹⁴ or without fluoroscopy,¹⁵ or with computed tomography,¹⁶ magnetic resonance imagining,¹⁷ or ultrasound guidance¹⁸ to position a needle at C6 or C7 levels but the nonfluoroscopic radiologic guidance techniques (MRI, CT, and ultrasound) can be expensive, time consuming, and impractical for most interventional pain physicians.

The anatomy of the SG, being in close proximity to various critical structures, renders a number of complications potentially associated with its blockade, some of which are serious and potentially fatal.¹⁹ Many of these complications are not serious, but are associated with patient discomfort. Side effects such as the Horner syndrome that includes ptosis, myosis, enophthalmos, anhydrosis of the neck and face, conjunctival injection, unilateral flushing, and nasal congestion are expected reactions to the blockade of the SG.²⁰ Most complications...
from SGB occur after diffusion of the local anesthetic (LA) solution onto nearby nerve structures or because of injury to important structures owing to misplacement of the needle. For these reasons, and in an attempt to avoid these technical difficulties and to improve the safety and efficacy of the block, Abdi et al developed a new oblique technique for stellate block, which can be performed at C6 or C7.

This technique may overcome many of the technical issues that confound needle placement by the classic technique. Introducing the needle at the base of the uncinate process of the C7 vertebrae (Fig. 1) through an oblique fluoroscopic approach increases the likelihood of encountering the cervical sympathetic ganglion and allows the use of lesser volumes of LAs than those used by the anterior paratracheal approach. This study was therefore carried out to evaluate this new technique and to assess the efficacy and safety in comparison with the classic anterior paratracheal technique (Fig. 2).

PATIENTS AND METHODS

After approval from the institutional ethics committee of the National Cancer Institute, Cairo University, 50 female patients, aged between 25 and 70 years, with PMPS after modified radical mastectomy with prominent sympathetic pain were included in this randomized, prospective, controlled, clinical study. Inclusion criteria were pain of less than 8-week duration with any of the following symptoms: allodynia, burning pain, shooting pain, hyperalgesia, and uncontrolled visual analog scale (VAS) score > 6 despite nonsteroidal anti-inflammatory drug administration, oral morphine sustained release tablets (MST > 120 mg), and the addition of coanalgesic adjuvants (gabapentin 400 mg/8 h and amitriptyline 25 mg/12 h).

All the patients were informed about the procedure and its possible consequences, and written informed consent was obtained before the procedure. All the patients were evaluated with regard to their systemic diseases, general condition, and coagulation status. Patients were excluded if they had any contraindication to the procedure (coagulation disorders, local infection, sepsis, or mental disorders) or to sympathetic blockade (decompensated cardiopulmonary or hemodynamic disorders). Repeated SGBs have been reported to aggravate glaucoma. Thus, they were considered as a contraindication.

Groups

Fifty patients were randomly allocated to 1 of the 2 groups using the envelop method. In group O (n = 25), the oblique fluoroscopic technique for SGB was performed, whereas in group C (n = 25), the classic anterior paratracheal fluoroscopic approach was performed. For each patient, the procedure was performed and was repeated with the same approach each time. The second block was performed after 1 week, the third block was performed again after another week, and the fourth block was performed after 1 month. Thus, 4 blocks were performed for each patient. Thus 200 stellate blocks were intended to be performed, 100 with the classic anterior paratracheal technique and the other 100 with the oblique fluoroscopic technique.

Preparation of the Patients

With each block, the patients had an intravenous catheter inserted in a large vein that was securely anchored. All suitable resuscitation equipment and drugs were available. All vital signs were monitored throughout to measure heart rate, blood pressure, and oxygen saturation for up to 1 hour after the block performance. Skin temperatures were recorded in the distal portion of both the upper extremities at identical locations. Fentanyl (11 µg/kg) and midazolam (0.02 µg/kg) were administered intravenously for conscious sedation as required, taking into account the physical status of the patient.
**Technique**

The patients were positioned on their back (supine) with a small pillow under the shoulders to open up the neck area. The neck was prepared and draped in a standard sterile manner using iodine antiseptic solution, and circumferentially draped with sterile towels.

In group C, the fluoroscope was directed in an anterior-to-posterior direction to visualize the C7 vertebral body, the T1 transverse process, and the first rib as landmarks. The skin over the target point, that is, the junction of the C7 transverse process with its corresponding vertebral body was marked. The entry site was anesthetized with 1% lidocaine and a 2.5-inch, 25-gauge spinal needle was advanced toward the target point until the bone was encountered. The block needle should be placed between the carotid artery and the trachea (both are identified with palpation); the carotid artery was gently pulled away from the midline. Once the bone was encountered, 1 mm of the needle was withdrawn and 1 mL of radio-opaque dye was injected with real-time fluoroscopic imaging. After confirming the needle position and the contrast dye distribution, after a negative aspiration for blood and cerebrospinal fluid, 0.5 mL of 0.25% bupivacaine was injected. The patient was observed for any untoward reaction for a few seconds, and then 4.5 mL of 0.25% bupivacaine was injected.

In group O, the fluoroscopic beam was directed in an anteroposterior direction with caudocranial angulations of the C-arm until the C6-C7 disc was well visualized. Then, the C-arm was rotated obliquely, ipsilateral to the side to be blocked to allow adequate visualization of the neural foramina. The skin over the target point, that is, the junction of the uncinate process and the vertebral body, was seen on the fluoroscope and was marked (Fig. 3).

The entry site was anesthetized with 1% lidocaine and a skin wheal was raised at the surface point. Under real-time imaging, a single pass was made with a 25-gauge 2.5-inch spinal needle to contact the bone at this point with caution to avoid passage of the needle toward the neural foramina and the thecal sac, which are located posteriorly; the disc located at the cephalad; and the esophagus, which resides medial to the ultimate target point. Finally, the needle tip should be at the junction between the uncinate process and the vertebral body (Fig. 4). The stylet was removed, and 1 mL of radio-opaque dye was injected with real-time fluoroscopic imaging (Fig. 5). The syringe containing the contrast dye was exchanged with the one that contained the LA. After ensuring that negative aspiration was performed, a 0.5 mL test dose was injected and the patient was observed for any untoward reaction for a few seconds, and then 3 mL of 0.25% bupivacaine was injected.

**Evaluation Parameters**

The results were evaluated in terms of pain intensity as assessed by the linear VAS score (where 0 = no pain and 10 = worst pain imaginable), total morphine consumption, and allodynia surface area in cm\(^2\) using a cotton bud, and their upper extremities were examined for skin temperature. Patient satisfaction score (PSS) was assessed using a linear scale (where 0 = very dissatisfied; 10 = very satisfied). These evaluations were made before the block and 2 hours after each block and monthly for 3 months after the last block. The skin temperatures were recorded by a temperature probe in the distal portion of both the upper extremities were examined for skin temperature.
extremities that were to be compared with each other and Horner syndrome was observed for documentation of the block. Side effects and complications were documented and compared after each block was performed in the 2 groups.

**Statistical Analysis**

Descriptive tables and statistical analysis were made with SPSS (7.5) statistical program. Parametric data were represented as means and standard deviation, whereas nonparametric data were represented as numbers and proportions. Comparison between the groups for parametric data was made by the t test whereas the paired t test was used for comparisons between intragroups. The Mann-Whitney U test was used for intergroup comparison and the Wilcoxon test for intragroup comparison for nonparametric data. Proportions were analyzed using the χ² analysis or the Fisher exact test as appropriate. P values < 0.05 were considered statistically significant.

**RESULTS**

All the patients that had enrolled in the study had completed it between April 2008 and May 2009, apart from 3 patients who underwent 1 block and did not complete the study. Two patients were randomized in the C group and 1 patient in the O group, and their data were excluded from statistical analysis. Patients’ characteristics were comparable in both the groups and are presented in Table 1. There were no statistically significant differences between the groups.

Apart from 2 patients in group C and 1 patient in group O, who did not develop pain relief after the first block and did not complete the study, all the other patients in both the groups had statistically significant pain relief immediately after the block as shown in Figure 6. With regard to morphine consumption, there was a significant reduction in the mean daily morphine consumption at each time point compared with the preblock consumption in both the groups (P < 0.05). However, there were no statistically significant differences between both the groups before the procedure and all through the study period (Table 2).

The results concerning areas of allodynia are shown in Table 3. There was a significant increase in skin temperature (2.3 ± 0.8°C) compared with the other extremity (P < 0.05), after 80 stellate blocks of 98 blocks in group C and after 78 stellate blocks of 97 blocks in group O immediately after the block procedure (P < 0.05). There were no statistically significant differences between the 2 groups.

Compared with the scores before block performance (baseline), PSS was significantly increased after block performance at different times all through the study period (P < 0.05) in both the groups. Despite comparable scores before block performance in both the groups, the mean PSS at T1, T2, T3, and T4 were more statistically significant in group O than in group C (P < 0.05). However, there were no statistically significant differences between both the groups at T5, T6, and T7 (Table 4).

**Side Effects and Complications**

Side effects were recorded for the 191 stellate blocks that were performed in 50 patients (Table 5). The Horner syndrome occurred 90 times after stellate blocks were performed by the classic approach and 94 times after

---

**TABLE 1. Patients’ Characteristics and Duration of the Procedure in Both the Studied Groups**

<table>
<thead>
<tr>
<th></th>
<th>Group C (n = 25)</th>
<th>Group O (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>50.4 ± 9.7</td>
<td>53.4 ± 10.5</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td>78.4 ± 8.6</td>
<td>76.6 ± 9.6</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>155.6 ± 7.8</td>
<td>158 ± 8.5</td>
</tr>
<tr>
<td>Duration of the procedure (min)</td>
<td>4.8 ± 1.7</td>
<td>4.3 ± 1.5</td>
</tr>
</tbody>
</table>

Data are expressed as means and standard deviation. n changed to 23 in group C and 24 in group O after the first block.

---

FIGURE 4. Final needle placement at the base of the C7 uncinate process on the right side.

FIGURE 5. Stellate ganglion block with a contrast injection.

FIGURE 6. VAS at measured times in the studied groups. VAS indicates visual analog scale.
Mean Patient Satisfaction Score in the Studied Groups at Each Time Point

<table>
<thead>
<tr>
<th>Group C (n = 25)</th>
<th>Group O (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>163 ± 21.2</td>
</tr>
<tr>
<td>T1</td>
<td>90.6 ± 12.5*</td>
</tr>
<tr>
<td>T2</td>
<td>79.6 ± 13.6*</td>
</tr>
<tr>
<td>T3</td>
<td>70.6 ± 11.5*</td>
</tr>
<tr>
<td>T4</td>
<td>66.5 ± 12.7*</td>
</tr>
<tr>
<td>T5</td>
<td>62.6 ± 9.6*</td>
</tr>
<tr>
<td>T6</td>
<td>59.8 ± 10.5*</td>
</tr>
<tr>
<td>T7</td>
<td>58.6 ± 9.7*</td>
</tr>
</tbody>
</table>

T0 before block, T1 after first block, T2 after second block, T3 after third block, T4 after fourth block, T5 one month after last block, T6 two months after last block, T7 three months after last block.

n changed to 23 in group C and 24 in group O after the first block.

Data are expressed as means and standard deviation.

*P value < 0.05 compared with the other group at the same time point.

T0 before block, T1 after first block, T2 after second block, T3 after third block, T4 after fourth block, T5 one month after last block, T6 two months after last block, T7 three months after last block.

n changed to 23 in group C and 24 in group O after the first block.

Data are expressed as means and standard deviation.

*P value < 0.05 compared with before block performance in the same studied group.

**P < 0.05 compared with the other group at the same time point.

TABLE 3. Areas of Allodynia (cm²) in the Studied Groups at Different Time Points

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Group C (n = 25)</th>
<th>Group O (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>31.14 ± 5</td>
<td>29 ± 6.3</td>
</tr>
<tr>
<td>T1</td>
<td>15 ± 3.5*</td>
<td>13.8 ± 3.7*</td>
</tr>
<tr>
<td>T2</td>
<td>8.5 ± 2.6*</td>
<td>7.4 ± 2.3*</td>
</tr>
<tr>
<td>T3</td>
<td>7.5 ± 2.2*</td>
<td>7.1 ± 2.1*</td>
</tr>
<tr>
<td>T4</td>
<td>5.2 ± 1.4*</td>
<td>4.8 ± 1.5*</td>
</tr>
<tr>
<td>T5</td>
<td>4.8 ± 1.2*</td>
<td>4.3 ± 1.5*</td>
</tr>
<tr>
<td>T6</td>
<td>4.2 ± 1.8*</td>
<td>4.3 ± 1.6*</td>
</tr>
<tr>
<td>T7</td>
<td>4.7 ± 1.5*</td>
<td>3.5 ± 1.2*</td>
</tr>
</tbody>
</table>

T0 before block, T1 after first block, T2 after second block, T3 after third block, T4 after fourth block, T5 one month after last block, T6 two months after last block, T7 three months after last block.

n changed to 23 in group C and 24 in group O after the first block.

Data are expressed as means (standard deviation).

*P value < 0.05 compared with before block performance in the same studied groups.

TABLE 4. Mean Patient Satisfaction Score in the Studied Groups at Each Time Point

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Group C (n = 25)</th>
<th>Group O (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0</td>
<td>2.8 ± 1.2</td>
<td>3.1 ± 1.6</td>
</tr>
<tr>
<td>T1</td>
<td>4.6 ± 1.4*</td>
<td>6.7 ± 1.5*</td>
</tr>
<tr>
<td>T2</td>
<td>4.3 ± 1.5*</td>
<td>7.8 ± 1.9*</td>
</tr>
<tr>
<td>T3</td>
<td>3.8 ± 1.1*</td>
<td>7.5 ± 1.5*</td>
</tr>
<tr>
<td>T4</td>
<td>4.9 ± 1.7*</td>
<td>8.2 ± 0.9*</td>
</tr>
<tr>
<td>T5</td>
<td>7.5 ± 0.9*</td>
<td>7.6 ± 1.2*</td>
</tr>
<tr>
<td>T6</td>
<td>8.5 ± 1.2*</td>
<td>8.5 ± 1.2*</td>
</tr>
<tr>
<td>T7</td>
<td>8.1 ± 1.1*</td>
<td>8.2 ± 0.9*</td>
</tr>
</tbody>
</table>

T0 before block, T1 after first block, T2 after second block, T3 after third block, T4 after fourth block, T5 one month after last block, T6 two months after last block, T7 three months after last block.

Data are expressed as means and standard deviation.

*P < 0.05 compared with before block performance in the same studied group.

**P < 0.05 compared with the other group at the same time point.

TABLE 5. Side Effects and Complications

<table>
<thead>
<tr>
<th>Group C (F1 = 94)</th>
<th>Group O (F2 = 97)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horner syndrome</td>
<td>90 94</td>
</tr>
<tr>
<td>Pain, discomfort</td>
<td>35* 0</td>
</tr>
<tr>
<td>Hoarseness of voice</td>
<td>8* 0</td>
</tr>
<tr>
<td>Lump sensation</td>
<td>8 0</td>
</tr>
<tr>
<td>Cough</td>
<td>1 0</td>
</tr>
<tr>
<td>Respiratory</td>
<td>0 0</td>
</tr>
<tr>
<td>Asymptomatic hematoma</td>
<td>17* 0</td>
</tr>
<tr>
<td>Convulsion</td>
<td>0 0</td>
</tr>
<tr>
<td>Brachial plexus block</td>
<td>9* 0</td>
</tr>
</tbody>
</table>

F1 is the number of stellate block done by the classic anterior paratracheal technique.

F2 is the number of stellate block done by the oblique fluoroscopic technique.

Data are number of occurrence of the event.

*P < 0.05 compared with the other group at the same time point.
is short lived and is replaced by PSS by pain relief, so there were no significant differences in PSS between both the groups thereafter.

In 2007, Ackerman and Zhang26 studied the efficacy of SGB in 25 patients with the complex regional pain syndrome type I of their hands and, they found out a positive correlation between SGB efficacy and how soon SGB therapy was initiated. They reported that 40% of the patients had complete symptomatic relief, 36% had partial relief, and 24% had no relief. They found that the duration of symptoms until SGB therapy was 4.6 ± 1.8 weeks in patients who reported complete symptomatic relief, 11.9 ± 1.6 weeks in patients who had partial relief, and 35.8 ± 27 weeks in patients who had no relief. In 2009, Yucel et al,27 also found that SGB had successfully decreased VAS from 8 ± 1 to 1 ± 1 and also increased the range of movement of the wrist joints in patients with complex regional pain syndrome type I. Furthermore, they concluded that the duration between symptom onset and therapy initiation was a major factor affecting blockade success. In our study, the duration of symptoms until SGB therapy was less than 4 weeks in all the patients.

There was a statistically significant increase in skin temperature on the ipsilateral side of the block. The increase in skin temperature denotes successful SGB, but unfortunately, this method is ineffective if the skin is warm at the onset of the block.28,29

No serious complications occurred in the study in both the groups. The Horner syndrome is considered as a side effect and not a complication and it also denotes successful stellate block. The incidence of pain and discomfort during the procedure was much higher and statistically significant in the classic approach. It occurred during 35 blocks performed by the classic anterior paratracheal approach and it did not occur in any of the blocks performed by the oblique fluoroscopic approach. As with the classic anterior paratracheal approach, we pull the carotid artery laterally away from the needle; this may cause pain and discomfort to the patient and also paresthesia. As nerve root compression may occur during this procedure, we do not have to do so in oblique fluoroscopic approach as the pathway of the needle is away from the carotid sheath.

Hoarseness of voice and lump sensation occurred after 8 blocks were performed by the conventional classic approach to stellate block. This was most probably because of the spread of the LA to the recurrent laryngeal nerve (RLN). This does not occur in any case in the oblique fluoroscopic approach. However, Hardy and Wells23 reported an incidence of 10% with 10 mL LA solution and up to 80% with 20 mL solution in the classic approach. Kapral et al18 reported RLN palsy in only 1 patient (N = 12) in whom ultrasonography showed the spread of the LA between the carotid sheath, thyroid gland, and the esophagus (the anatomic site of the RLN), which is why bilateral stellate block is not advisable at the same setting. Spread of LA to the opposite side was recorded leading to bilateral RLN block.30,31 Thus, careful placement of the needle in close proximity to the ganglia with the oblique technique allows the use of a smaller volume of the LA agent, and diminishes the risk of RLN block. Persistent cough was noticed once after SGB done by the classic approach while starting injection of the dye and was relieved spontaneously with reposision of the needle. This may be due to tracheal puncture.

No respiratory embarrassment occurred in our study. It was mentioned that patients may have severe respiratory distress because of temporary paralysis of the vocal cords.32 Respiratory embarrassment and possible mechanical ventilation were recorded after the injection into either the epidural or the intrathecal space.33,34

In patients whose respiratory reserve is already compromised severely, blockade of the nearby phrenic nerve can produce temporary paralysis of the diaphragm.35 Severe airway obstruction, secondary to acute and delayed retropharyngeal or cervicomediastinal hematoma, after SGB may occur.36,37

The frequency of retropharyngeal hematoma after SGB was reported in a large retrospective review done by Higa et al,38 who carried out Medline and Japanese database literature searches over a 40-year period on the topic of SGBs to establish the incidence of retropharyngeal hematoma. The overall incidence was approximated at 1 per 100,000 SGBs. The researchers found a total of 27 instances in which complications of hematoma and airway compromise had occurred. They also mentioned the possibility that other vessels from the thyrocervical trunk or the inferior thyroid artery might possibly be implicated, as the vertebral artery had no apparent damage noted at either autopsy or surgery in those cases in which autopsy was performed. In another recent study of 300 vertebral arteries, the researchers found that in only 93% of cases, did the vertebral artery enter the transverse foramen at C6.39

However, Kapral et al18 reported a much higher incidence of asymptomatic hematoma especially with the blind technique. In our study, there was no hematoma in the oblique approach but asymptomatic superficial hematoma occurred on 17 occasions in the classic technique and was resolved spontaneously. In a cadaveric study, it was found that arterial vessels other than the vertebral artery, which also supply the anterior spinal cord and brain stem, pass directly anterior to the transverse processes at the site of the conventional anterior paratracheal approach.40 It is concluded that it is anatomically possible. Therefore, the accidental injection or induced spasm of these vessels, and not the vertebral arteries, is responsible for some cases of seizure, hematoma, or other vascular complications during the conventional SGB. Therefore, the oblique fluoroscopically guided approach is technically easy and may better avoid vascular injury as it is more medial than the classic technique and it avoids contact with the jugular and carotid vessels and minimizes the chance of intravascular injection and eliminates the need of pushing the great vessels out of the way of the needle.

Brachial plexus block occurred on 9 occasions in the classic technique in the form of some motor weakness, which improved spontaneously after 6 hours of the block; this does not occur in the oblique technique as only small volumes of LA are used.

The earlier findings suggest that both the techniques of stellate block are effective in the management of neuropathic pain of the upper limb but the oblique fluoroscopic technique is more advantageous as it avoids inadvertent insertion into the thecal sac, the esophagus, the disc, or the neural tissue, as these structures cannot be adequately visualized during 35 blocks performed by the classic anterior paratracheal approach. Therefore, the oblique fluoroscopically guided approach is technically easy and may better avoid vascular injury as it is more medial than the classic technique and it avoids contact with the jugular and carotid vessels and minimizes the chance of intravascular injection and eliminates the need of pushing the great vessels out of the way of the needle.

The pneumothorax should not be an issue, as with the oblique technique, the needle is medially placed, and it avoids contact with the pleura, the diaphragm, or the pneumothorax, which improved spontaneously after 6 hours of the block; this does not occur in the oblique technique as only small volumes of LA are used. The earlier findings suggest that both the techniques of stellate block are effective in the management of neuropathic pain of the upper limb but the oblique fluoroscopic technique is more advantageous as it avoids inadvertent insertion into the thecal sac, the esophagus, the disc, or the neural tissue, as these structures cannot be adequately defined with the straight anteroposterior fluoroscopic view. The pneumothorax should not be an issue, as with the review of the computed tomographic scan of the pleural dome, with the oblique technique in nonemphysematous
individuals carried out by Abdi et al suggest that the pleura is usually avoided. It is technically easier and more comfortable for the patient as it avoids pressing or pushing the vascular system out of the way and eliminates the need for palpation of the C6 tubercle in a perpendicular manner until the C6 or C7 tubercle is contacted. This can be painful and uncomfortable to the patient and may lead to paresthesia, as the nerve root may be encountered. It minimizes the chance of intravascular injection. It allows the use of smaller volumes of LAs, thus decreasing the chance of spread of LA to the adjacent structures, as RLN and cervical nerve root brachial plexus and it can be easily learned. Thus decreasing the chance of spread of local anesthetics to adjacent structures such as RLN and brachial plexus. This technique can easily be learned by trainees.

REFERENCES