Comparative Study of Fluoroscopy vs Ultrasound Guided Stellate Ganglion Block

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ABSTRACT

Introduction: Stellate ganglion block (SGB) is used for the treatment of many vascular disorders and sympathetically mediated pain including pain of head, neck, cancer, phantom, postherpetic neuralgia, cardiac arrythmia, orofacial pain, and vascular headache. Various modalities to localize stellate ganglion use of fluoroscopy, computerized tomography, magnetic resonance imaging, and radionucleotide tracers. Ultrasound imaging is a best tool for SGB due to its clarity, low cost, lack of radiation and portability. In this study we aimed to compare the efficacy of fluoroscopy vs ultrasound guided stellate ganglion block in lowering the pain using numeric rating scale (NRS).

Material and Methods: Study was perform in 40 patients suffering from upper limb and head and neck, neuropathic pain. The first group (Group I) received stellate ganglion block under ultrasound guidance while the second group (Group II) received stellate ganglion block under fluoroscopy guidance. The *t*-test and Man Whitney test were perform to analyses the data.

Results: The requirement of different analgesia were comparable in both group I and group II patients. Change in pain score was maximum at immediate post-block, 1 h post-block, 6 h post block (65.84% of baseline) while change was minimum at 48 h post-block (48.45% of baseline). The pain was significantly lower in group I from baseline as compared to group II at all periods. Range of Ease rating score were also lower in group I. Block was statistically achieved earlier in Group I (4.55±0.69 min) as compared to Group II (12.60±2.56 min).

Conclusion: USG and fluoroscopy are both good techniques for stellate ganglion block, but due to less complication, early blocking effect time, more precise placement of medication ultrasound guided block is preferred over fluoroscopy method.

Keywords: Stellate Ganglion Block, Fluoroscopy, Ultrasound, Pain, Block

INTRODUCTION

Stellate ganglion block (SGB) is a sympathetic block of cervicothoracic ganglion for the management of sympathetically mediated pain and vascular insufficiency of the upper extremities, head, and neck. This block has also been used for the treatment of phantom pain, postherpetic, neuralgia, cancer pain, cardiac arrhythmia, orofacial pain, and vascular headache.[1]

The stellate ganglion is formed by the fusion of the first thoracic ganglion and inferior cervical as they meet anterior to the vertebral body of C7, measuring 2.5 cmx 0.5 cm and lies over the neck of 1st rib, between C7 and T1. It lies medial to the scalene muscles, lateral to longus colli muscle, esophagus, trachea, and recurrent laryngeal nerve, anterior to C7 transverse process and prevertebral fascia, superior to the subclavian artery, and posterior to the vertebral vessels.[1-3] Image guided nerve block has changed the practice of stellate ganglion block and increased safety and accuracy compared with the blind injections.[4]

Various modalities to localize stellate ganglion use of fluoroscopy, computerized tomography, magnetic resonance imaging, and radionucleotide tracers. However, these techniques may not be practical in clinical practice as they are time-consuming, costly, involve radiation exposure, and may cause damage to the important structures situated near the stellate ganglion.[3-5] The use of ultrasound improves safety of procedure by direct visualization of the related anatomical structures minimizing the risk of injury to neighboring structures. It helps in the deposition of drug subfascially with real-time imaging.[1] There are so many approaches in USG guided stellate ganglion block, out of these we are using anterior paratracheal approach in our study. In anterior approach, the transducer is placed at the level of C6 or C7 to visualize important structures and then gently pressed between the carotid artery and the trachea to retract the carotid artery laterally and to position the transducer close to longus colli, but is associated with more risk of injury to inferior thyroid artery, vertebral artery, and esophagus.[1]

Ultrasound (USG) is a technique to view the structures and guide the needle advancing in real time, confirm the injection, distribution of the medication and avoiding the exposure to radiation.[6] Fluoroscopic and ultrasound guided blocks are easy to use and safe methods for stellate ganglion block.[7] In this study we aim to evaluate the efficacy of reduction in pain using numeric rating scale (NRS), when stellate ganglion block is performed using ultrasound or fluoroscopy.

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MATERIAL AND METHODS

This single blinded randomized prospective parallel arm study was performed after institutional ethical committee approval. Total 40 patients with suffering from upper limb and head and neck, neuropathic pain was included in this study. Sample size was calculated on the basis of 80% power and 0.05 alpha error with 95% confidence interval. A written informed consent was taken from all the patients. Patients were distributed into two groups (n=20 in each group) by "chit method". In Group I patients received stellate ganglion block under ultrasound guidance and Group II patients received stellate ganglion block under fluoroscopy guidance. Patients with sympathetically mediated pain involving of upper extremities, and head and neck region were included in this study. Whereas, patients associated with any comorbidity, history of allergy to local anaesthetic, skin lesion at the site of blockade and central or peripheral neuropathies or coagulopathy were excluded from study.

All the blocks were performed in the operating room where all resuscitation equipment available. The patient in supine position with the neck slightly extended (a pillow may be placed beneath the shoulders), and the head rotated slightly to the opposite side to be blocked. Patients are monitored with ECG, pulse-oximetry, and blood pressure throughout the procedure. The skin temperatures are recorded in the distal portion of both the upper extremities. The procedure is performed with a sterile technique

Ultrasound guidance C7 anterior paratracheal approach

The patient is first positioned as described above. USG linear probe (high frequency 8-12 MHz) placed at cricoid level and shifted laterally to the block side viewing the thyroid, internal jugular vein and carotid artery then locating the anterior tubercle of the C6 transverse process, the probe is brought one level down and the needle is then inserted laterally towards the transverse process of C7. Needle is placed above the longus colli muscle between the carotid fascia and prevertebral fascia. After negative aspiration bupivacaine 0.25%, 5 mL and 1ml (40mg) triamcinolone (steroid) drug is deposited and after withdrawal of needle neck is compressed 2cm above the site of needle insertion to dissipate the drug downwards. A successful block is seen by the extremity temperature increase (typically seen within 3 min). After the procedure, the patient should be allowed to recover in the department for approximately 1 hour.

Fluoroscopic technique

Using the fluoroscopic technique for stellate ganglion blockade encompasses many of the landmarks and patient positioning used for the ultrasound-guided technique. Fluoroscopy provides exceptional bony delineation compared with that of ultrasound. Both the C6 transverse process approach and the C7 anterior paratracheal approach can be done under fluoroscopic guidance. An additional procedural step seen with fluoroscopy is the use of Omnipaque contrast to confirm appropriate needle placement on junction of the transverse process of C7 and pedicle to rule out intravascular injection. As discussed earlier, if the needle is located subfascially, one will see local spread of contrast between the tissue planes both cephalad and caudad. Additionally, if intravascular injection occurs, immediate dissipation of contrast dye will be seen. After that, patients were followed after postoperative period, 1 hour, 6 hour, 24 hour and 48 hours and pain on NRS (numeric pain scale) and complications were noted.

STATISTICAL ANALYSIS

The values were represented in number (%) and mean±SD. Parametric continuous variables were compared using *t*-test and Man Whitney test for nonparametric continuous data. The p-value<0.05 was considered significant. All the analysis was carried out using SPSS 16.0 version (Chicago, Inc., USA).

RESULTS

Baseline characteristics (age, gender and diagnosis) of the patients were statistically similar in both groups as shown in Table 1. Age of patients ranged from 30-58 years. Median age of overall, Group I and Group II patients was 48.50 years and 47.00 years respectively. Mean age of patients of Group II (49.70±5.85 years) was found to be higher than that of Group I (47.20±7.82 years) (Table 1).

Out of 40 patients included in the study, only 3 (7.50%) were males and rest 37 (92.50%) were females. In Group I all the patients were females while in Group II, 85.00% patients were female and rests 15% were males. Difference in gender of patients included in the study was not found to be statistically significant.

Majority of overall (87.50%) as well as Group I (90.00%) and Group II (85.00%) patients were diagnosed as cases of Ca breast with unilateral sympathetic pain. Proportion of patients of Group I was higher as compared to Group II who were diagnosed as Raynaud's Upper limb (10.00% vs. 0.00%) while the proportion of patients of Group II was found to be higher than that of Group I who were diagnosed as Phantom thumb (10.00% vs. 0.00%) and Traumatic Brain Injury (5.00% vs. 0.00%). Difference in diagnosis of patients of Group I and Group II was not found to be statistically significant.

Proportion of patients of Group I was higher as compared to Group II who were given Pregabalin + Morphine (30.00% vs. 20.00%) and Pregabalin + (Tramadol + Paracetamol) + Amitriptyline (35.00% vs. 20.00%) while the proportion of patients of Group II was higher as compared to Group I who were given Pregabalin +(Tramadol + Paracetamol) + Amitriptyline (60.00% vs. 35.00%). Difference in analgesia given to patients of Group I and Group II was not found to be statistically significant (p=0.282) as shown in Table 2.

Pain Score (NPS) at different time intervals in between groups are shown in Table 3.Median of Pre-block pain score of patients of both the groups was 8.00 and mean pain score of Group I (8.05±0.89) was found to be higher than that of Group II (7.85±0.75). Difference in pain score of Group I and Group II was not found to be statistically significant (p=0.547).

	Group I (n=20)	Group II (n=20)	p-Value
Age	47.20±7.82	49.70±5.85	0.789
Gender			
Male	20 (100%)	17 (85.0%)	0.072
Female	0.0 (0.0%)	3 (15.0%)	
Diagnosis			
Ca breast with unilateral sympathetic pain	18 (90.00%)	17 (85.00%)	
Raynaud's upper limb	2 (10.00%)	0 (0.00%)	0.342
Phantom thumb	0 (0.00%)	2 (10.00%)	
Traumatic brain injury	0 (0.00%)	1 (5.00%)	
Data are represented as mean, ±SD and n (%). SD=Standard deviation			

Table-1: Baseline characteristics of the patients

	Group I (n=20)	Group II (n=20)	p-Value
Pregabalin + Morphine	6 (30.0%)	4 (20.0%)	0.282
Pregabalin + (Tramadol +Paracetamol)	7 (35.0%)	12 (60.0%)	
Pregabalin + (Tramadol + Paracetamol) + Amitriptyline	7 (35.0%)	4 (20%)	

Table-2: Required of Analgesic in between groups

	Group I (n=20)			Group II (n=20)			Mann-Whitney U test	
	Median	Mean	SD	Median	Mean	SD	Z	'p'
Pre-	8.00	8.05	0.89	8.00	7.85	0.75	0.664	0.547
Post-	3.00	2.75	0.44	4.00	4.40	0.50	5.668	<0.001
1 h post	3.00	2.75	0.44	4.00	4.40	0.50	5.668	<0.001
6h post	3.00	2.75	0.44	4.00	4.35	0.59	5.471	<0.001
24h post	3.00	2.95	0.60	5.00	5.30	0.57	5.562	<0.001
48h post	4.00	4.15	0.75	6.00	5.60	0.60	4.782	<0.001

Table-3: Pain Score (NPS) at different time intervals in between Groups

Group	Min.	Max.	Median	Mean	S.D.
Group I	4	6	5.00	5.25	0.64
Group II	6	8	7.50	7.45	0.61
Z=5.469; p<0.001 (Mann Whitney U test)					

Table-4: Between Group Comparison of Ease Rating

Group	Min.	Max.	Median	Mean	S.D.
Group I	3	6	5.00	4.55	0.69
Group II	10	18	12.00	12.60	2.56
't'=13.569; p<0.001 (Student 't' test)					

Table-5: Between Group Comparison of Time to achieve Block

	Group I (n=20)	Group II (n=20)
Miosis	9 (45.0%)	6 (30.0%)
Miosis + Hoarseness of voice	0 (0.0%)	7 (35.0%)
Miosis + Nasal congestion	5 (25.0%)	2 (10.0%)
Miosis + Nasal & Eye congestion	6 (30.0%)	1 (5.0%)
Miosis + Nasal & Eye congestion + Voice hoarseness	0 (0.0%)	1 (5.0%)
Miosis + Nasal congestion + Voice hoarseness	0 (0.0%)	3 (15.0%)
χ^2=16.457(df=5); p=0.006		

Table-6: Complications in between Groups

At immediately post-block and 1 h post-block, median pain score of patients of Group II was 4.00 while that of Group I was 3.00. Mean pain score of patients of Group II (4.40±0.50 vs. 2.75±0.44). Difference in pain at immediately post-block and at 1 h post-block were found to be statistically significant.

At 6 h post-block pain score of Group II (4.35±0.59; median 4.00) was found to be higher than that of Group I (5.30±0.57; median 5.00). Difference in pain score of patients of Group I and Group II was found to be statistically significant at 6 h post-block.

At 24 h post-block pain score of Group II (5.30±0.57; median 5.00) was found to be higher than that of Group I (2.95±0.60; median 3.00). Difference in pain score of patients of Group I and Group II was found to be statistically significant at 24 h post-block.

At 48 h post-block pain score of Group II (5.60±0.60; median 6.00) was found to be higher than that of Group I (4.15±0.75; median 4.00). Difference in pain score of patients of Group I and Group II was found to be statistically significant at 48 h post-block.

In Group I change in baseline pain score was 5.30±1.13 (65.84% of baseline) at immediate post-block, 1 h post-block and at 6 h post block. Change in pain score at 24 h and 48 h were 5.10±1.07 (63.35%) and 3.90±1.02 (48.45%). Change in pain score was maximum at immediate post-block, 1 h post-block, 6 h post block (65.84% of baseline) while change was minimum at 48 h post-block (48.45% of baseline) Change in baseline pain score was found to be statistically significant at each of the period of observation

In Group II change in baseline pain score was 3.45±0.76

(43.95% of baseline) at immediate post-block and 1 h post-block and at 6 h post block. Change in pain score at 6h, 24 h and 48 h were 3.50±0.76 (44.59%), 2.55±0.69 (32.48%) and 2.25±0.64 (28.66%). Change in pain score was maximum at 6 h post block (44.59% of baseline) followed by immediate post-block and 1 h post block (43.95% of baseline) while change was minimum at 48 h post-block (28.66% of baseline). Change in baseline pain score was found to be statistically significant at each of the period of observation.

Range of Ease rating score among overall patients, Group I and Group II was 4 to 8 (median 6.00), 4 to 6 (median 5.00), and 6 to 8 (median 7.50) respectively. Mean ease rating score of Group II (7.45±0.61) was found to be higher than that of Group I (5.25±0.64). Difference in ease rating score of Group I and Group II was found to be statistically highly significant ($p<0.001$) as shown in Table 4.

Block was achieved earlier in Group I (4.55±0.69 min) as compared to Group II (12.60±2.56 min). Difference in time to achieve block was found to be statistically significant ($p<0.001$) as shown in Table 5.

Proportion of patients of Group I was higher as compared to Group II who faced Miosis (45.00% vs. 30.00%), Miosis with nasal congestion (25.00% vs. 10.00%), Miosis with nasal &eye congestion (30.00% vs. 5.00%) while the proportion of patients of Group II was higher as compared to Group I who faced Miosis with hoarseness of voice (35.00% vs. 0.00%), Miosis with nasal & eye congestion and voice hoarseness (5.00% vs. 0.00%) and Miosis with nasal congestion and voice hoarseness (15.00% vs. 5.00%). Difference in complications faced by patients of Group I and Group II was found to be statistically significant ($p=0.006$) as shown in Table 6.

DISCUSSION

In our study, the age of patients ranged from 30-58 years. Median age of overall, Group I and Group II patients was 48.50 years and 47.00 years, respectively. Mean age of patients was found to be higher in Group II (49.70±5.85 years as compare to Group I (47.20±7.82 years). Proportion of patients of Group I and Group II was similar in age group 31-40 years (15.00% each) and 51-60 years (35.00% each). It was higher in group I as compared to Group II (5.00% vs. 0.00%) while the proportion of patients of Group II was higher as compared to Group I in age group 41-50 years (50.00% vs. 45.00%). Difference in age of patients of Group I and Group II was not found to be statistically significant. Our study is comparable to study done by Yoo et al. (2012), who reported that median age of patients was 58 years.[8]

In this study, out of 40 patients, only 3 (7.50%) were males and rest 37 (92.50%) were females. In Group I all the patients were females while in Group II, 85.00% patients were female and rests 15% were males. Difference in gender of patients included in the study was not found to be statistically significant. Our study is different from study done by Yoo et al. (2012), in their study, 24 patients were male and 18 were female patients.[8]

In our study, majority of patients were diagnosed as cases of Ca breast with unilateral sympathetic pain group I (90.00%) and group II (85.00%). Raynauds Upper limb was found in group I whereas Phantom thumb and Traumatic Brain Injury were found in group II. Difference in diagnosis of patients was not found to be statistically significant in between group I and group II. Previously, Karaman, (2017) reported that in USG guided block 35% patients were of Raynaud's disease, 35% of hyperhidrosis, and 42% of neuropathic pain, while in fluoroscopy guided block 33% cases were of Raynaud's disease, 34% of hyperhidrosis and 32% of neuropathic pain.[9]

In this study, the proportion of patients was higher in group I as compared to group II who were given Pregabalin + Morphine (30.00% vs. 20.00%) and Pregabalin + (Tramadol + Paracetamol) + Amitriptyline (35.00% vs. 20.00%) while the proportion of patients of group II was higher as compared to group I who were given Pregabalin + (Tramadol+Paracetamol) (60.00% vs. 35.00%). Difference in analgesia given to patients of group I and group II was not found to be statistically significant. Abbas et al. (2010) reported that fluoroscopic stellate ganglion block decrease pain VAS, daily morphine consumption, increased patient safety score.[10]

In our study, mean pain score was found to be higher in group I (8.05±0.89) as compared to group II (7.85±0.75). But difference in pain score was not found to be statistically significant in between group I and group II. Moreover, the mean pain score of patients were found to be statistically significant at immediately post-block, 1 h, 6 h, 24 h and 48 h post-block

In the present study we observed the post-block, pain score was found to be lower than that at pre-block (baseline) in both the groups at all periods. Change in pain score was maximum at immediate post-block, 1 h post-block, 6 h post block (65.84% of baseline) while change was minimum at 48 h post-block (48.45% of baseline) Change in baseline pain score was found to be statistically significant at each of the period of observation in group I and group II. Ola et al. (2014) reported that in USG guided cases pain score was 7.8±0.74 before injection, 2.7±0.85 aft0.85 after first injection, 1.9±0.85 after two weeks, while in fluoroscopy guided pain score was 7.8±0.81 before injection, 0.8±0.76 after first injection and 2.2±0.52 after two weeks.[4]

In this study the mean ease rating score was found to be significantly higher in group II (7.45±0.61) as compared to group I (5.25±0.64). Whereas, the time to achieve block was significantly earlier in group I (4.55±0.69 min) as compared to group II (12.60±2.56 min).

In our study the miosis, miosis with nasal congestion, miosis with nasal and eye congestion were higher in group I, whereas miosis with hoarseness of voice, miosis with nasal & eye congestion and voice hoarseness and Miosis with nasal congestion and voice hoarseness were higher in group II. Difference in complications faced by patients of group I and group II was found to be statistically significant ($p=0.006$). Wei et al. (2014) reported that dysphagia and hoarseness was reported in 13.5% cases and they did not encountered serious complications.[11] Previously a study based on questionnaire,

reported that the number of severe complications to be 1.7 of 1,000 per performed stellate ganglion blocks (0.17%).[12] Wulf et al. (1991), report that the complications was noted in three cases out of 600 stellate ganglion blocks (0.5%).[13] On the other hand, several studies have observed that the severe complications during the puncture were avoided by ultrasound, as it readily establishes soft tissues, such as muscles, vessels, and organs as well as the real-time spread of the local anesthetic.[14-16]

CONCLUSION

Fluoroscopic and ultrasound guided blocks are easy to use and safe methods for SGB. One of the common interventions where the ultrasound guidance is gaining wider acceptance is during the performance of a stellate ganglion block. Our study reported that though USG and fluoroscopy are both good techniques for SGB, but due to less complication, early blocking effect time, more precise placement of medication USG Guided block is preferred over fluoroscopy method.

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