ORIGINAL RESEARCH PAPER

Volume - 12 | Issue - 04 | April - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

COMPARISON OF ULTRASOUND GUIDED PULSED RADIOFREQUENCY ABLATION AND BUPIVACAINE BLOCK OF SUPRASCAPULAR NERVE FOLLOWED BY MANIPULATION IN REDUCTION OF PAIN AND FUNCTIONAL DISABILITY IN ADHESIVE CAPSULITIS OF SHOULDER A RANDOMIZED CONTROLLED STUDY

Physical Medicine & Rehabilitation

Prashant Kami PGT.

Akoijam Joy Singh* Professor and Head, Department of PMR, RIMS, Imphal, Manipur, India. *Corresponding Author

Longjam Nilachandra Singh Associate Professor, Department of PMR, RIMS, Imphal, Manipur, India.

Monica Moirangthem Senior Resident, Department of PMR, RIMS, Imphal, Manipur, India.

Khwairakpam Selina Devi PGT, Department of PMR, RIMS, Imphal, Manipur, India.

Shruti Pandey PGT, Department of PMR, RIMS, Imphal, Manipur, India.

ABSTRACT

Objective:- To compare the efficacy of ultrasound guided pulsed radiofrequency ablation and bupivacaine block of suprascapular nerve followed by manipulation for reduction of pain and functional disability in adhesive capsulitis of shoulder **Methods:-** Forty eight patients with adhesive capsulitis of shoulder were included in a prospective, randomised controlled trial, which were distributed in two group. The study group received ultrasound guided pulse radiofrequency ablation(PRFA) of suprascapular nerve,while the control group received 10 ml of 0.5% of bupivacaine block .Outcome measures used were VAS,SPADI (shoulder pain and disability index) and passive range of motion (PROM) assessment were done at baseline, 1 week, 4 weeks and 12 weeks follow ups. **Results:-** All outcome measures in the study group and in the control group showed significant improvement from the baseline ($P < 0.05$). A comparison of the 2 groups indicated significantly greater improvement in the study group at all times in VAS and shoulder pain and disability index scores (all $P < 0.05$), and for PROM ($P < 0.05$). **Conclusions:** The present study found that ultrasound guided pulsed radiofrequency ablation and bupivaciane block of suprascapular nerve rendered improvement in pain and disability till 12 weeks. However, in terms of faster onset and greater pain relief with disability reduction, pulsed radiofrequency ablation of suprascapular nerve showed statistically significant improvement in almost all outcome measures. Therefore, it is suggested that it might be the treatment of choice in future for managing pain and disability in patients with adhesive capsulitis of shoulder.

KEYWORDS

Adhesive capsulitis,Ultrasound guided Pulse RFA, suprascapular nerve

INTRODUCTION

Adhesive capsulitis is a common condition characterized by spontaneous onset of pain, progressive loss of both active and passive range of motion in all planes of glenohumeral joint especially external rotation.[1]Neviaser JS in 1945 described adhesive capsulitis as a contracted, thickened joint capsule that seemed to be drawn tightly around the humeral head with a relative absence of synovial fluid and chronic inflammatory changes within the subsynovial layer of the capsule.[2] It can have a variable duration but usually last between 1-3 years without intervention thereby negatively affecting patient's activities of daily living (ADL) and reduces the quality of life.[3] The incidence of adhesive capsulitis in the general population is approximately 2% but several conditions are associated with an increased incidence.Individuals between the ages of 40 and 70 are more commonly affected. Approximately 70% of patients are women and 20 to 30% of affected individuals develop adhesive capsulitis in the opposite shoulder.[4]This study was carried out by taking into consideration that the suprascapular nerve supply about 70% of the sensory nerves in the shoulder joint and rest is supplied through the axillary nerve branches.[5]

SSNB is a safe and effective option for the management of adhesive capsulitis and it can be easily performed at outpatient basis.[6]Ultrasound guided pulsed radiofrequency ablation of suprascapular nerve in adhesive capsulitis of shoulder has shown positive results in reduction of pain and functional disability of adhesive capsulitis of shoulder. Pulsed radiofrequency (PRF) ablation can reduce chronic pain by delivering an electrical field and heat bursts (temperature of <42°C, in contrast to conventional radiofrequency applications, which deliver a constant temperature of 60°C–80°C) to neural tissue without causing neural injury. PRF ablation of the suprascapular nerve was effective in treating chronic shoulder pain, including adhesive capsulitis, and it facilitated functional recovery without risking paralysis of the supraspinatus or infraspinatus muscles.[7] Considering the significant side effects of other therapies such as steroids and surgery, patients with adhesive capsulitis of shoulder can take advantage of ultrasound guided radiofrequency ablation of suprascapular nerve because it is safe, cost effective, and has no need for hospitalization, fewer hospital visits and the lack of significant adverse events during the treatment. Although it shows potential advantage for the treatment of adhesive capsulitis, very few studies were available at present. Moreover there is no comparison study between ultrasound guided pulsed radiofrequency ablation and bupivacaine block of suprascapular nerve block followed by manipulation in adhesive capsulitis of shoulder available in literature at present

METHODS:

Study design:

This is prospective, randomised controlled study conducted in Department of Physical Medical and Rehabilitation, Regional Institute of Medical Sciences, Imphal. During the period between august 2020 to September 2022.

Study population:

Patients with shoulder pain with stiffness attending the out-patient department (OPD) of Physical Medicine and Rehabilitation, Regional Institute of Medical Sciences, Imphal during the study period

Inclusion criteria

1. Age group 35-60 years
2. Diagnosed case of stage II and stage III adhesive capsulitis
3. Patient who are willing to comply with the study and follow up assessments

Exclusion criteria

1. Any recent febrile or infectious disease (systemic & local).
2. Patients with osteoporosis
3. Patients with a history of fracture or dislocations of shoulder joints
4. Malignancy (including hematologic and non-hematologic malignancies)
5. Autoimmune and hematological disorders
6. Impaired cognition
7. Pregnancy

8. Degenerative changes at the glenohumeral joint as shown by a standard antero-posterior radiograph
9. Patients with cardiac pacemaker or Cardiac arrhythmia
10. Allergic to local anaesthetics (lidocaine and bupivacaine)
11. Concomitant neurological complaints or abnormalities originating from the cervical spine

Sample size:
Sample size is calculated by using the formula $N = (u + v)^2 (S_1^2 + S_2^2)/(m_1 - m_2)^2$ Where,u=0.84 at 80% power v=1.96 at 5% level of significance. Taking into consideration the study conducted by Wu YT et al[8] in 2014.Hence, 22 participants were needed to be studied per group giving a total of 44 patients.However, taking into consideration a dropout rate of 10%, the final calculated sample comes to 24 participants per group, giving a total sample size of 48.

Randomization:
It was done through computer generated table. Single blinding was done in which the assessor was blinded

Ethics approval:
The approval of the Research Ethics Board, Regional Institute of Medical Sciences, Imphal was taken for this clinical study. Patients were informed about the nature of the study and willing participants were asked to sign the informed consent form. Patients could withdraw from the study at any time.

Outcome Measures :
The outcome measure was the reduction of pain intensity as quantified by the visual Analogue Scale(VAS), with a scale ranging from 0 (no pain) to 10 (extremely severe pain).Outcome measures were the score of shoulder pain and disability index (SPADI), a validated, self-reported questionnaire that is used to measure pain (5 items) and disability (8 items) associated with a shoulder disorder. The pain subscale ranges from 0 to 50, the disability subscale ranges from 0 to 80, with the total scale ranging from 0 to 130.Another outcome measure was the PROM, which was evaluated by using a universal goniometer.

Pre-procedure:
All patients were subjected to complete history taking followed by physical examination and routine laboratory investigations. Visual analog score (VAS),SPADI and were assessed before the procedure in all cases.

Intervention:
Group A (Study group):Pulsed Radiofrequency ablation of the suprascapular nerve (PRFA): Ultrasound guided pulsed radio frequency ablation of suprascapular nerve after injecting 2 ml of 2% Lignocaine for local skin infiltration. Group B (Control group):Suprascapular Nerve Block (SSNB): Ultrasound guided single injection of 10 ml 0.5% Bupivacaine near the suprascapular nerve

Pulsed Radio-frequency ablation (PRFA) of the Suprascapular Nerve:
In sitting position with the affected shoulder in full adduction, ultrasound machine was positioned on the right side in front of the patient and injection site was approached from behind the patient. The skin cleaned with 10% betadine and spirit solution. A thin layer of sterile gel was placed between the draped ultrasound transducer and the skin. The linear transducer was placed vertically over the fossa, then locating the spine of the scapula along its long axis.The point at which the spine of the scapula becomes discontinuous due to the suprascapular notch was identified. Bridging the notch in its base is the superior transverse scapular ligament.

The suprascapular nerve was found under the superior transverse scapular ligament**.** Overlying the ligament is the suprascapular artery, and that was avoided during the needle insertion. Covering the notch is the supraspinatus and the trapezius muscle. The needle was advanced in plane into its final position in the notch and a 100 mm long radiofrequency needle with 10 mm active tip was then advanced under ultrasound guidance toward the scapular notch. After appropriate positioning of the needle into the suprascapular notch, RF probe was inserted and checked for stimulation. Gentle adjustment of needle with sensory stimulation at 50Hz, 0.2 millisecond pulse width was used to elicit reproducible paraesthesias in the shoulder joint between 0.3-0.5volts. Motor stimulation at 2Hz frequency and 0.2 millisecond pulse width which triggers contractions of the infraspinatus and supraspinatus muscles between 0.3-0.5volt was done.

Three cycles of 120 seconds pulsed mode radio-frequency lesioning was performed keeping the temperature constant at 42˚C, at a frequency of 2Hz and pulse width of 20 milliseconds. At 30 minutes after the pulsed radiofrequency ablation procedure, VAS score was measured by using numerical scale and shoulder was manipulated using a short arm lever and a fixed scapula in supine position with the sequence of flexion, extension, abduction and adduction, external and internal rotation of shoulder joint. All the participants received exercise therapy after the completion of intervention. Rescue drug 500 mg of paracetamol was given as and when required.Participants were discharged if there were no significant complications, such as pain, bleeding, or pneumothorax.

Suprascapular Nerve Block:
As described above, suprascapular fossa was identified by using ultrasound and then, suprascapular nerve and suprascapular artery was identified as a pulsatile structure in the region of suprascapular notch. A 22-G spinal needle was inserted along the longitudinal axis of the ultrasound beam. The needle was visualized in its full course. The point for injection was an ultrasound image demonstrating the needle tip in proximity to the suprascapular nerve in the suprascapular notch then 10 ml of 0.5% Bupivacaine was injected. The injection and spread of local anesthetic was visualized. After 30 minutes of procedure,VAS score was measured by using numerical scale and shoulder was manipulated using a short arm lever and a fixed scapula in supine a position with the sequence of flexion, extension, abduction and adduction, external and internal rotation of shoulder joint All the participants received exercise therapy after the completion of intervention. Rescue drug 500 mg of paracetamol was given as and when required. Participants were discharged and there were no significant complications, such as pain, bleeding, or pneumothorax.

Statistical Analysis
Data were collected in a pre-tested proforma and entered in excel sheet. Data analysis was done by using IBM- Statistical Package for the Social Sciences (IBM-SPSS) 21 version (IBM.Armonk, NY,Inc). For descriptive statistics mean, frequency, percentage and standard deviation were used. Characteristics of the study participants for the continuous variable were analysed by student's t-test and categorical variables by chi-square test. ANOVA and paired t-test was used for within the group comparison and student's test for between the group comparison p value <0.05 was taken as significant.

RESULTS
The total numbers of participants in the study were 48, distributed in two groups. The study group received ultrasound guided pulsed radio-frequency ablation of the suprascapular nerve, while the control group received ultrasound guided suprascapular nerve block with bupivacaine followed by manipulation of shoulder joint in both the groups. Assessments were done at baseline, 1 week, 4 weeks and 12 weeks post procedure.Out of total 48 patients, 17 patients were males which constituted 35.41% of total patients and 31 were females constituting 64.58% of total sample size. The study group consists of 7 males and 17 females with the mean age group of 47.25 ±7.7 years, while the control group consists of 8 males and 16 females with a mean age group of 46.58±7.2 years.

Table 1 shows the baseline characteristics of the two groups. There were no significant differences between the groups in any of the measured baseline characteristics, VAS, SPADI scores, and passive range of motion (PROM) of shoulder joint (p>0.05).

Table 1: Comparison of baseline characteristics between the study and control group (N=48)

Characteristics	Groups		p-value
	PRFA (n=24, %)	Bupivacaine(n=24, %)	
Age(years) Mean(SD)	47.25± 7.702	46.58 ±7.223	
30-40	5 (20.8)	7 (29.2)	0.633*
41-50	10 (41.6)	7 (29.2)	
51-60	9 (37.6)	10 (41.6)	
Gender			0.547*
Male	7 (29.2)	8 (33.3)	
Female	17 (70.8)	16 (66.7)	

Duration			1.00*
3-9 months	13(54.2)	12(50.0)	
10-15 months	11(45.8)	12(50.0)	
Side of affection			1.00*
Right	7 (29.2)	9 (37.5)	
Left	17 (70.8)	15 (62.5)	
VAS Score	7.33 (0.761)	7.38 (0.711)	0.846#
PAIN SPADI	74.08 (4.736)	71.067 (5.647)	0.115#
DISABILITY SPADI	`50.83 (7.755)	47.50 (7.372)	0.134#
Total SPADI	75.83 (5.0)	72.92 (6.903)	0.101#
Passive Flexion	85.42 (22.646)	82.92 (20.104)	0.688#
Passive Abduction	77.08 (18.761)	77.9 (18.414)	0.877#
Passive Internal Rotation	27.08 (9.991)	27.50 (12.247)	0.898#
Passive External Rotation	20 (9.325)	20.83 (9.743)	0.763#

*Chi Square test
#Independent 't' test

Table 2: Comparison of VAS and SPADI between the study and control group (N=48)

Outcome measure	PRFA (n=24)	Bupivacaine(n=24)	p-value*
Passive Flexion			0.000*
Baseline	85.42(22.646)	82.92(20.104)	
1 week	135.42(11.413)	101.25(13.929)	
4 weeks	144.17(7.755)	102.50(13.592)	
12weeks	168.33(3.807)	110.00(15.036)	
Passive Abduction			0.000*
Baseline	77.08(18.751)	77.92(18.411)	
1 week	130.42(9.991)	91.67(17.362)	
4 weeks	138.75(9.470)	93.33(19.708)	
12weeks	165.83(10.598)	145.42(20.868)	
Passive Internal Rotation			0.000*
Baseline	27.08(9.991)	27.50(12.247)	
1 week	44.17(14.116)	45.83(12.482)	
4 weeks	45.42(15.317)	50.83(12.129)	
12weeks	51.67(15.511)	62.08(12.847)	
Passive External Rotation			0.004*
Baseline	20.00(9.325)	20.83(9.743)	
1 week	54.58(6.580)	31.25(9.470)	
4 weeks	66.25(5.758)	36.25(9.696)	
12 weeks	89.17(2.823)	45.00(8.847)	

Table 3: Comparison of passive ROM between the study and control group (N=48)

Outcome measure	Groups Mean(SD)		p-value*
	PRFA (n=24)	Bupivacaine (n=24)	0.001*
VAS scores			
Baseline	7.33 (0.761)	7.38(0.711)	
1 week	3.46(0.588)	5.79(0.658)	
4 weeks	2.50(0.780)	5.21(0.833)	
12weeks	1.08(0.282)	4.29(0.751)	
SPADI Pain			0.001*
Baseline	74.46(4.836)	71.67(5.647)	
1 week	35.83(5.836)	50.42(6.241)	
4 weeks	20.83(2.823)	40.42(5.500)	
12weeks	10.83(4.082)	29.58(6.241)	
SPADI Disability			0.000*
Baseline	50.83(7.755)	47.50(7.372)	
1 week	30.83(7.755)	40.00(9.780)	
4 weeks	21.67(4.815)	28.75(5.124)	
12weeks	11.25(4.484)	25.00(6.594)	
Total SPADI			0.000*
Baseline	75.83(5.036)	72.92(6.903)	
1 week	37.92(7.211)	57.92(7.790)	
4 weeks	25.42(7.2110	50.42(8.065)	
12weeks	12.08(4.149)	43.33(9.168)	

*Repeated measures ANOVA
*Repeated measures ANOVA

DISCUSSION:

This study showed that both bupivacaine block and pulsed RFA of SSN followed by manipulation of shoulder are effective for treating adhesive capsulitis of shoulder, but pulsed RFA was better than bupivacaine block in terms of faster as well as longer period of pain relief along with disability improvement.To the best of our knowledge, there is no study available for ultrasound guided pulsed radiofrequency ablation of suprascapular nerve followed by manipulation in reduction of pain and functional disability for adhesive capsulitis of shoulder to compare the efficacy with bupivacaine block of suprascapular. In the present study, there was significant improvement in the mean score of all the outcome measures, VAS, SPADI and passive range of motion scores in both the groups at 1 week ,4 weeks and 12 weeks follow up ($p<0.05$) and statistically significant in terms of pain relief at 1 week, 4 weeks and 12 weeks between the two groups ($p<0.05$). Similarly Shah RV et al[9] conducted a case report of fluroscopy-guided pulsed mode radio-frequency lesioning of the Suprascapular nerve in a patient with chronic shoulder pain and found improvement in pain and range of motion and was sustained for 15 weeks. The improvement in VAS score and PROM showed a parallel pattern at follow-up in both groups. This is attributable to improvement in pain, as the pain improved patients were able to achieve more range of motions. In this study, as procedure was followed by manipulation of shoulder, there was significant improvement in all shoulder ROMs noted except for passive internal rotation.The rapid onset of pain relief was also noted after the procedure in study group. Similar to results study conducted by Wu et al[8] found that at 30 minutes after the PRF lesioning procedure, the patients reported a decrease in pain using a visual analog scale (VAS). Although the mechanism of PRF lesioning is not yet clear, one study indicated that it may modify neuronal membranes.[10] Degree of pain was significantly decreased a week after intervention. However, pain was always decreased compared to that of previous follow up visit.The study published by Liliang PC et al[11] concluded that mean Shoulder Pain and Disability Index scores (SPADI) at 6-month follow-up showed a significant decrease compared with preradiofrequency ablation of suprascapular nerve in chronic shoulder pain ($p < 0.001$). The pain relief persists for 5 months after PRFA application in the intervention group. Similar study conducted by Gurbet et al[12] also reported improved shoulder function and pain relief for at least 12 weeks after each PRF procedure. Several other studies also reported that this procedure provided relief from pain and improved the ROM for 12 weeks to 6 months[13,14,15] Previous study was conducted on comparing the effect of physical therapy alone with physical therapy and PRFA of the suprascapular nerve using a ultrasound guided technique. Our study is the first randomized controlled study to investigate the effect of PRFA of the suprascapular nerve comparing with one of the standard treatment followed by manipulation of shoulder joint in adhesive capsulitis. One of the most frequently used methods is Bupivacine block injection with a steroid. However, one review concluded that an intraarticular steroid injection before rehabilitation provided only a short-term benefit.[16] Similar to the results of Abdelshafi et al[17] found that this method provided long-term relief from pain as well as improved the SPADI scores and range of motion of shoulder joint. The rapid onset of pain relief after PRFA of the suprascapular nerve apparently makes it easier for patients to tolerate rehabilitation therapy.

The Study conducted by Shanahan EM et al[18] concluded that there may be a reduction in central sensitisation secondary to diminished nociceptive stimulus as a potential effect of SSNB. This is in keeping with recent study, which have identified the presence of peripheral and central sensitization in patients with chronic shoulder pain.[19] As PRFA applied to the suprascapular nerve is an invasive procedure, it may certainly not be the first treatment option. However, it may be considered as an option in patients who do not respond to conservative treatment. Moreover, in light of the observation that conservative treatment for adhesive capsulitis may take a long time to improve pain and thus hinders in rehabilitation, PRFA of suprascapular nerve following manipulation of shoulder joint is a treatment option may considered in clinical practice for its repeatability, more comfortable process of rehabilitation, rapid relief of pain and shorter duration of treatment. Further studies are needed to support this hypothesis.This is considered to be helpful in improving the efficacy and compliance for rehabilitation therapy for patients with adhesive capsulitis of shoulder. However, more research is needed before we can recommend widespread adoption of this procedure as a treatment for adhesive capsulitis of shoulder.Thus, PRFA of the suprascapular nerve followed by manipulation might be proposed as a treatment option in adhesive

capsulitis of shoulder to relief pain and facilitate shoulder mobilization in patients with adhesive capsulitis of shoulder.

CONCLUSION:

Ultrasound guided suprascapular nerve block is a safe and effective method to treat pain and functional disability in adhesive capsulitis of shoulder. In this study we found that ultrasound guided pulsed radiofrequency ablation and bupivaciane block of suprascapular nerve rendered improvement in pain and disability till 12 weeks. However, in terms of faster onset and greater pain relief with disability reduction, pulsed radiofrequency ablation of suprascapular nerve showed statistically significant improvement in all outcome measures. Therefore, it is suggested that it might be the treatment of choice in future for managing pain and disability in patients with adhesive capsulitis of shoulder.Nevertheless, a large sample size and longer follow up period are recommended.

REFERENCES

1. Calis M, Demir H, Ulker S, Kirnap M, Duygulu F, Calis HT. Is intraarticular sodium hyaluronate injection an alternative treatment in patients with adhesive capsulitis? Rheumatol Int.2006;26(6):536-40.
2. Neviaser JS. Adhesive capsulitis of the shoulder. J Bone Joint Surg Am. 2011; 19(9):53642.
3. Dias R, Cutts S, Massoud S. Frozen shoulder. BMJ. 2005 Dec; 331(7530):1453-6.
4. Miller III RH, Azar FM, Throckmorton TW. Shoulder and elbow injuries. In: Terry CS, Beaty JH, editors. Campbell's operative orthopaedics.12th ed. Missouri:Mosby; 2013.p.2235-36.
5. Teasell RW, Foley NC, Bhogal SK, Speechley MR. An evidence-based of stroke rehabilitation. Top Stroke Rehabil.2003;10(1):29-58.
6. Abdelshafi ME, Yosry M, Elmulla AF, Al-Shahawy EA, Adou MA, Eliewa EA. Relief of chronic shoulder pain: A comparative study of three approaches. Middle East J Anaesthesiol.2011;21(1):83-92.
7. Cosman ER. A comment on the history of the pulsed radiofrequency technique for pain therapy. Anesthesiology.2005;103:1312.
8. Wu YT, Ho CW, Chen YL, Li TY, Lee KC, Chen LC. Ultrasound-guided pulsed radiofrequency stimulation of the suprascapular nerve for adhesive capsulitis. a prospective, randomized, controlled trial. Anesth Analg.2014;119(3):686-92.
9. Shah RV, Racz GB. Pulsed mode radiofrequency lesioning of the suprascapular nerve for the treatment of chronic shoulder pain. Pain Physician.2003;6(4):503-6.
10. Cosman Jr ER, Cosman Sr ER. Electric and thermal field effects in tissue around radiofrequency electrodes. Pain Med.2005;6(6):405-24.
11. Liliang PC, Lu K, Liang CL, Tsai YD, Hsieh CH, Chen HJ. Pulsed radiofrequency lesioning of the suprascapular nerve for chronic shoulder pain. Pain Med.2009; 10(1):70-5.
12. Gurbet A, Turker G, Bozkurt M, Keskin E, Uçkunkaya N, Sahin S. Efficacy of pulsed mode radiofrequency lesioning of the suprascapular nerve in chronic shoulder pain secondary to rotator cuff rupture. Agri.2005;17(1):48–2.
13. Keskinbora K, Aydinli I. Long-term results of suprascapular pulsed radiofrequency in chronic shoulder pain. Agri.2009;21(1):16-21.
14. Huang CC, Tsao SL, Cheng CC, Hsin MT, Chen CC. Treating Frozen Shoulder with Ultrasound-Guided Pulsed Mode Radiofrequency Lesioning of the Suprascapular Nerve. Pain Med.2010;12(11):1837-40.
15. Kane TP, Rogers P, Hazelgrove J, Wimsey S, Harper GD. Pulsed radiofrequency applied to the suprascapular nerve in painful cuff tear arthropathy. J Shoulder Elbow Surg.2008;17(3):436-40.
16. Blanchard V, Barr S, Cerisola FL. The effectiveness of corticosteroid injections compared with physiotherapeutic interventions for adhesive capsulitis.Physiotherapy. 2010;96(2):95-107.
17. Abdelshafi ME, Yosry M, Elmulla AF, Al-Shahawy EA, Adou MA, Eliewa EA. Relief of chronic shoulder pain: a comparative. Middle East J Anesthesiol.2011;21(1):83-92.
18. Shanahan EM, Ahern M, Smith M, Wetherall M, Bresnihan B, FitzGerald O. Suprascapular nerve block (using bupivacaine and methylprednisolone acetate) in chronic shoulder pain. Ann Rheum Dis.2003;62(5):400-6.
19. Dabholkar A, Mehta M, Yardi S.Central and Peripheral Sensitization in Patients with Chronic Shoulder Pain. IJSR.2013;4(4):466-8.