IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 21, Issue 10 Ser.9 (October. 2022), PP 09-15
www.iosrjournals.org

Comparison of Outcome of Intra Articular Depot Steroid Combined With Suprascapular Nerve Block Versus Intra Articular Depot Steroid Only In Periarthritis Shoulder: A Randomized Controlled Study

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Abstract:
Objective*: Periarthritis shoulder or adhesive capsulitis is a common health condition resulting in pain with progressive loss of movement and function hampering quality of life. Both intraarticular steroid and Suprascapular nerve block (SSNB) are simple and safe techniques for providing relief from shoulder pain and improving functional outcome. We hypothesize that addition of SSNB with intraarticular steroid will be more efficacious in providing analgesic relief and improving quality of life.*
Materials and methods*: A randomized controlled study was carried out for a total of 147 cases of periarthritis shoulder, out of which (n=72) patients were given intraarticular depot steroid combined with suprascapular nerve block and (n=75) patients were given intraarticular depot steroid only. All the cases were followed up for a period of three months.*
Results*: At presentation in SSNB+steroid group, Visual Analogue Scale (VAS) score was 7.39±1.015 and Shoulder Pain and Disability Index (SPADI) score was 80.30±6.109 and in steroid group VAS score was 7.35 ±1.084 and SPADI score was 80.98±5.981. At 12 weeks in SSNB +steroid group VAS score was 1.57±0.499 and SPADI score was 5.854±1.604 and in steroid group VAS score was 2.48± 0.891 and SPADI score was 18.86±5.011. Also (ROM) range of motion (flexion, abduction, internal and external rotation) improved more in steroid+ SSNB group than steroid group.*
Conclusion*: In our study it was found that there was a significant difference between intraarticular steroid only group and SSNB plus steroid group in terms of final outcome as SSNB plus steroid group has better ROM, SPADI and VAS scores than only steroid group.(p< 0.001)*
Key words: *Periarthritis shoulder; adhesive capsulitis; intraarticular steroid injection; suprascapular nerve block; SPADI score, VAS score, Range of movement of shoulder*
Level of evidence: *Level II : Randomized Controlled study*

Date of Submission: 15-10-2022 Date of Acceptance: 31-10-2022

I. Introduction

Periarthritis Shoulder is a common and debilitating condition characterized by painful, gradual loss of both active and passive glenohumeral motion in all planes which results from progressive fibrosis and contracture of the capsule of the glenohumeral joint.[(19)] 'Periarthritis' describes a painful shoulder syndrome that is distinct from arthritis with general radiographic preservation of the joint.[(14)] Simon Emmanuel Duplay first coined the term "scapulo humeral periarthritis" and described its pathology[(14)]. Later in 1934, Earnest Codman coined the term "frozen shoulder"[(5)] and which was later called "adhesive capsulitis" by Neviaser in 1945 as he noted that the shoulder joint was the site where the pathology occurs.[(20)] Adhesive capsulitis of shoulder can be divided into primary idiopathic or secondary adhesive capsulitis shoulder.[(16)] It passes through four stages described as inflammatory, freezing, frozen, and thawing.[(21)] Rather than discrete and well-defined stages adhesive capsulitis represents a continuum of disease. While many treatment options available for adhesive capsulitis have been described only few have been proven in randomized controlled trials such as simple analgesia, NSAIDs, intra-articular steroid injection and surgery.[(17)] Among various nerve block techniques that have been described, Suprascapular nerve block (SSNB) has proven to be an effective and simple method for the management of shoulder pain. It can be performed in the outpatient department (OPD) using anatomical landmarks to determine the site of needle placement. This technique was first described in 1941 and its main aim was blocking the nerves to the glenohumeral joint as the scapular notch has the suprascapular nerve from which branching takes place. [(25)] Intra-articular steroid and local anaesthetic injection is effective in decreasing

pain and improving functional performance and range of motion.[3] But unfortunately, the effects are not long lasting and repeated injections are frequently needed. We hypothesize that addition of SSNB with intraarticular steroid will be more efficacious in providing analgesic relief and improving quality of life. Therefore we have designed this prospective randomised study which seeks to compare the outcomes of intra articular depot steroid combined with Suprascapular nerve block (SSNB) with only intraarticular depot steroid injection in the treatment of adhesive capsulitis.

II. Material And Methods

This was a randomized, prospective controlled study. The reporting of data from this trial complies with the consolidated standard of reporting trials **(CONSORT)** statement.

A total of 192 consecutive patients with adhesive capsulitis were prospectively enrolled between April 2020 to August 2020. Patients were diagnosed with adhesive capsulitis if they had limitation of both active and passive shoulder motion , pain of shoulder joint and if finding on radiography of their shoulder were normal[23]. Patients in the age group of 20 to 70 years, patients of both sex having symptoms (pain or discomfort) for 6 months to 1 year[1]and if they remained unresponsive to conservative treatment consisting of medications or physical therapy for at least 6 months were eligible for the study. All patients had a limited range of motion (ROM) of shoulder joint. (ROM losses of 25 percent or greater compared with the non involved shoulder in atleast 2 of the following motions: glenohumeral flexion, abduction, internal and external rotation. All patients underwent simple radiography. Patients with rotator cuff tear (n=2), those with glenohumeral arthritis (n=1), those with history of surgery on the same shoulder (n=3), those with history of steroid injection within 6 months before enrolment (n=11), and those who refused to give consent (n=15) to participate in the study were excluded. Thus a total (n= 32) patients were excluded in the study. The remaining (n= 160) patients after randomization were allocated into 2 groups of 80 patients each Group A and Group B. Patients were randomized using computer generated block randomization sequence (**www.randomizer.org)** by an independent researcher and group assignment was disclosed to the physician at the time of intended treatment. **Group A** received intervention in the form of **SSNB+ intraarticular steroid** injection and **Group B** received **intraarticular steroid** injection only. Among these 160 patients, 13 (8 from Group A and 5 from Group B) were lost in follow up and therefore not included in the evaluation of results. Total patients thus analyzed were (n=72) in **Group A (SSNB +steroid)** and (n = 75) in **Group B steroid** only group. Thus total patients analysed were 147 (Figure 1).

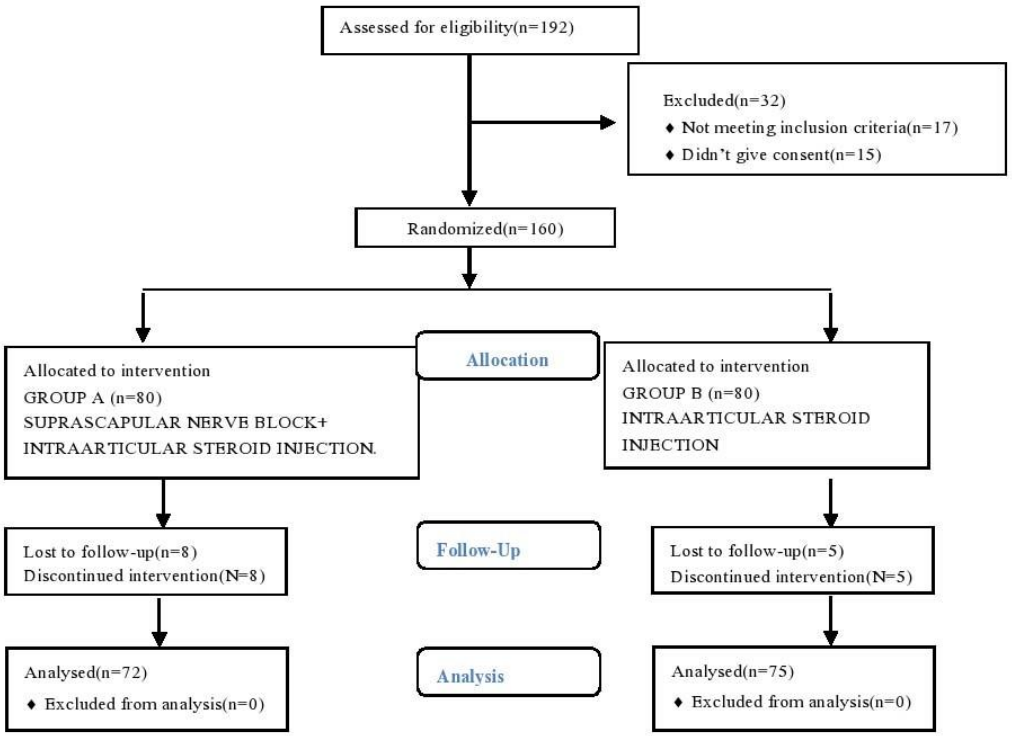

Fig no 1: The flow chart

During the study period all patients underwent conventional conservative treatment, including medications and home based physical therapy. The medications included a NSAID and a muscle relaxant which was administered for approximately 1 week. For physical therapy, active assisted shoulder range of motion (ROM) exercises including finger ladder exercises were performed for approximately 12 weeks, depending on the recovery of ROM.

All data were prospectively collected by a clinical researcher who was blinded to the study design. The patients demographic data and other characteristics including age, sex, dominant shoulder, duration, underlying disease (diabetes mellitus, hypertension, thyroid disease) and work level were recorded. The work level was recorded as high, medium or low depending on whether the work involved heavy manual labour, manual labour with less physical activity or sedentary activity.[(4)] The demographic data and clinical data are summarized in **(Table 1)**.

Treatment procedure is as follows .The patients of **Group A** received SSNB with 10 ml of 0.25 % of bupivacaine along with 1 ml of 40 mg triamcinolone with 4 ml of 2 percent lidocaine.The patients of **Group B** received only 1 ml of 40 mg triamcinolone with 4 ml of 2 percent lidocaine. Irrespective of group allocation all the patients received similar adhesive plaster. An observer who is blinded to the group allocation will collect data on demography, laboratory and radiological findings, **SPADI, VAS, ROM** and any other observation. The procedure followed in **Group A (SSNB+STEROID group)** is as follows. STEP 1 (SSNB) :We have used the Meier technique[(24)] . Patient was placed in sitting position with both arms in full adduction. The spine of the scapula was identified between the lateral end of acromion and the medial end of the spine of scapula .The line is halved. A point 2 cm above and medial was identified. This constitutes the entry point. The 10 ml of 0.25% bupivacaine loaded needle was inserted in inferolateral direction making 45 º angles to the skin surface. The needle was advanced until the floor of the spine of the scapula is reached. After attempted aspiration the agent was injected slowly to produce suprascapular nerve block. Step 2 .(Intra articular steroid)The needle should be inserted 2 to 3 cm inferior to the posterolateral corner of the acromion and directed anteriorly in the direction of the coracoid process. 1 ml of 40 mg triamcinolone with 4 ml of 2 percent lidocaine is injected. As with any injection; aspiration should be done to ensure that there has not been needle placement in the blood vessel. The injection should be performed slowly, but with consistent pressure.

The procedure followed in **Group B (The steroid only group**)is as follows. The needle should be inserted 2 to 3 cm inferior to the posterolateral corner of the acromion and directed anteriorly in the direction of the coracoid process.

Table no 1:Patients clinico-demographic variables by injection group.

VARIABLE	SSNB+STEROID	STEROID	P VALUE
NUMBER	72	75	
AGE	45.30 (10.1035)	44.80 (10.997)	0.7714 (T Test)
SEX (M:F)	27:45	32:43	0.638 0.221#
SYMPTOM DURATION (MONTHS)	17.79 (4.596)	16.57(4.205)	0.158$
DOMINANT SHOULDER (YES:NO)	29:41	32:43	0.8800 0.02277#
DIABETES (YES:NO)	11:61	10:65	0.915 0.010#
HYPERTENSION (YES:NO)	23:49	21:54	0.7324 0.116#
THYROID DISEASE (YES:NO)	4:68	3:72	0.715
WORK LEVEL (HIGH :MEDIUM : LOW)	10:24:38	13:29:33	0.5615 1.154#

Values in parentheses are standard deviation.
SSNB :Suprascapular Nerve Block
-Chisquare test was used.
$ -Mann Whitney test was used.

Post injection patients of both group A and group B remained seated or placed in supine position for a few minutes after the injection. The joint was then put through passive range of motion for patients of both the groups and they remained in the hospital to be monitored for 30 minutes . All patients in the 2 groups received the same NSAID for pain relief after injection. A stretching exercise program as described previously was started from the 1st day after injection. Clinical symptoms were evaluated at 4 time points for all patients before treatment, 1 week, 4 weeks and 12 weeks after treatment. The clinical outcome was evaluated using the following:-

1. The Shoulder Pain and Disability Index (SPADI) score. It is the patient completed questionnaire with 13 items assuming pain and extent of difficulty with activity of daily living (ADL) requiring the use of upper extremity.
2. Visual analogue scale (VAS) score for pain (range 0-10, with 10 indicating worst pain)
3. Range of motion (ROM): we included four shoulder movements viz FLEXION, ABDUCTION, INTERNAL ROTATION AND EXTERNAL ROTATION. (Abduction, External rotation and Flexion in degrees measured with the help of a goniometer; Internal rotation in cm, distance from C7 spine to the tip of thumb hand placed behind back). Passive shoulder range of motion (ROM) was measured using a goniometer by a clinical researcher who was blinded to the study.

Patients were followed up in the out-patient department on 1st, 4th and 12th week and the above 3 parameters were recorded to analyze the functional outcome of our intervention for each patient. Outcome measures were assessed at baseline and 1, 4, and 12 weeks post injection. Statistical analysis was performed using SPSS 22.0 software (IBM ,Armonk,NY,USA). I way analysis of variance (ANOVA) was used to identify significant differences in continuous variables among the groups ; the Chi square test or the Fisher exact test was used to identify any significant difference in the categorical variables. The Mann Whitney test was also used while comparing if any significant difference existed between groups. Values of $P< 0.05$ were considered statistically significant.

III. Result

At initial presentation no intergroup difference were observed in the VAS score, SPADI score and any ROM (flexion, abduction, internal rotation and external rotation) among the 2 groups .There was significant improvement from baseline to 12 weeks of follow up ($P<0.001$) for each of the 2 groups.

When compared within each of the 2 groups the VAS and SPADI scores decreased in each of the 2 groups at 1, 4, and 12 weeks ($P<0.001$). Also the range of motion (flexion, abduction, internal rotation and external rotation) improved in each of the 2 groups ($P<0.001$). [Table 2]

When the comparison was made between Group A (SSNB+ Steroid) and Group B (Steroid only) , it was noted that for baseline i.e. at presentation P values for VAS was ($P= 0.7789$) and SPADI was ($P=0.5186$) respectively. The P values at presentation for range of motion are as follows. Flexion ($P=0.6265$), Abduction ($P=0.9428$), Internal rotation (0.0553) and External rotation (0.5961).Thus at presentation all the P values are statistically insignificant. However at 1, 4 and 12 weeks the reduction in VAS ($P<0.001$) and SPADI scores ($P<0.001$) in Group A (SSNB+Steroid) was statistically significant when compared to the Steroid group only. Also at 1, 4 and 12 weeks, Group A (SSNB +Steroid) was observed to have a greater improvement in Flexion ($P<0.001$), Abduction ($P<0.001$), Internal rotation ($P<0.001$) and External rotation ($P<0.001$) than Group B (Steroid only) and it was statistically significant also. [Table 3]

PARAMETERS (values are in weeks)	**SSNB+STEROID (GROUP A)**		**STEROID (GROUP B)**	
	MEAN	**P VALUE**	**MEAN**	**P VALUE**
VAS 0 (Preinjection)	7.39 (1.015) *	-	7.35 (1.084) *	-
VAS 1	4.54 (0.73)*	<0.001	5.45 (1.094)*	<0.001
VAS 4	2.82 (0.738) *	<0.001	3.67 (1.031) *	<0.001
VA S 12	1.57 (0.499) *	<0.001	2.48 (0.891)*	<0.001
SPADI 0 (Preinjection)	80.30 (6.109)*	-	80.98 (5.981) *	-
SPADI 1	53.29 (4.245) *	<0.001	65.04 (6.067) *	<0.001
SPADI 4	31.00 (3.477)*	<0.001	40.72 (5.113) *	<0.001
SPADI 12	5.854 (1.604) *	<0.001	18.86 (5.011) *	<0.001
FLEXION 0 (Preinjection)	76.51 (10.581) *	-	76.69 (10.478) *	-
FLEXION 1	114.74 (5.686) *	<0.001	95.69(4.220) *	<0.001
FLEXION 4	130.33 (4.648) *	<0.001	111.61 (3.823) *	<0.001
FLEXION 12	144.49 (6.158) *	<0.001	121.95 (4.013) *	<0.001
ABDUCTION 0 (Preinjection)	76.29 (9.814) *	-	76.75 (9.122) *	-

ABDUCTION 1	123.96 (5.406) *	<0.001	98.91 (11.083) *	<0.001
ABDUCTION 4	142.93 (6.613) *	<0.001	116.25 (11.962) *	<0.001
ABDUCTION 12	152.22 (6.795) *	<0.001	134.76 (9.902) *	<0.001
INTERNAL ROTATION 0 (Preinjection)	29.19 (3.892) #	-	27.84 (2.433) #	-
INTERNAL ROTATION 1	20.02 (2.907) #	<0.001	21.90 (2.927) #	<0.001
INTERNAL ROTATION 4	12.97 (1.846) #	<0.001	17.50 (1.905) #	<0.001
INTERNAL ROTATION 12	7.15 (1.218)#	<0.001	13.29 (1.722) #	<0.001
EXTERNAL ROTATION 0 (Preinjection)	18.46 (3.369)*	-	18.14 (3.532) *	-
EXTERNAL ROTATION 1	44.11 (3.156) *	<0.001	31.42 (5.286) *	<0.001
EXTERNAL ROTATION 4	51.14 (4.495) *	<0.001	42.17 (3.647) *	<0.001
EXTERNAL ROTATION 12	66.82 (3.195) *	<0.001	52.13 (3.717) *	<0.001

Table no 2:Comparison of clinical scores and range of motion (ROM) within the injection groups whereby each clinical outcome at 1, 4, and 12 weeks was compared to pre-injection values.

Values in parentheses are standard deviation.
SSNB :Suprascapular Nerve Block
* Values are in degrees.
# Values are in centimeter.

Table no 3:Comparison of clinical scores and range of motion (ROM) between the groups whereby each clinical outcome in one group was compared with the corresponding clinical outcome of another group at pre-injection, 1 , 4 and 12 weeks respectively.

PARAMETERS (values are in weeks)	**SSNB+STEROID(GROUP A) MEAN**	**STEROID(GROUP B) MEAN**	**P VALUE**
VAS 0 (Pre injection)	7.39 (1.015)*	7.35 (1.084)*	**0.7789**
VAS 1	4.54 (0.730)*	5.45 (1.094)*	<0.0001
VAS 4	2.82(0.738)*	3.67 (1.031)*	<0.0001
VA S 12	1.57 (0.499)*	2.48 (0.891)*	<0.0001
SPADI 0 (Pre injection)	80.30 (6.109)*	80.98 (5.981)*	**0.5186**
SPADI 1	53.29 (4.245)*	65.04 (6.067)*	<0.0001
SPADI 4	31.00 (3.477)*	40.72 (5.113)*	<0.0001
SPADI 12	5.854 (1.604)*	18.86(5.011)*	<0.0001
FLEXION 0 (Pre injection)	76.51 (10.581)*	76.69 (10.478)*	**0.6265**
FLEXION 1	114.74 (5.686)*	95.69(4.220)*	<0.0001
FLEXION 4	130.33 (4.648)*	111.61(3.823)*	<0.0001
FLEXION 12	144.49 (6.158)*	121.95(4.013)*	<0.0001
ABDUCTION 0 (Pre injection)	76.29 (9.814)*	76.75 (9.122)*	**0.9428**
ABDUCTION 1	123.96 (5.406)*	98.91 (11.083)*	<0.0001
ABDUCTION 4	142.93 (6.613)*	116.25 (11.962)*	<0.0001
ABDUCTION 12	152.22 (6.795)*	134.76 (9.902)*	<0.0001
INTERNAL ROTATION 0 (Pre injection)	29.19 (3.892)#	27.84(2.433)#	**0.0553**
INTERNAL ROTATION 1	20.02 (2.907)#	21.90(2.927)#	<0.0001
INTERNAL ROTATION 4	12.97 (1.846)#	17.50(1.905)#	<0.0001
INTERNAL ROTATION 12	7.15 (1.218)#	13.29(1.722)#	<0.0001
EXTERNAL ROTATION 0 (Pre injection)	18.46 (3.369)*	18.14(3.532)*	**0.5961**
EXTERNAL ROTATION 1	44.11 (3.156)*	31.42 (5.286)*	<0.0001
EXTERNAL ROTATION 4	51.14 (4.495)*	42.17 (3.647)*	<0.0001
EXTERNAL ROTATION 12	66.82 (3.195)*	52.13(3.717)*	<0.0001

Values in parentheses are standard deviation.
SSNB :Suprascapular Nerve Block

* Values are in degrees.
\# Values are in centimeter.

IV. Discussion

The management of adhesive capsulitis ranges from watchful neglect to even advanced surgical procedures viz arthroscopic capsular release remains controversial. Most patients with this condition doesn't require operative treatment.[15] Also NSAIDS are ineffective in treating adhesive capsulitis.[8]

In 2014, **Ozken et al**[22] reported an improvement in shouder pain following surascapular nerve block. However their study is different from ours as they included only (N=10) patients of frozen shoulder with diabetes mellitus thereby decreasing the disease spectrum. There was no control group and also the shoulder disability was not assessed. Yet the results of Ozkan and colleagues support our results and provide evidence of pain relief in adhesive capsulitis .

In the study of **Mitra et al**[18] a total of 28 patients were taken and SSNB followed by intra articular steroid and finally hydrodilation under fluoroscopy guidance and then manipulation was performed in only flexion and abduction movements. The results of our study are in accordance with Mitra and colleagues although we included a relatively large number of subjects (n= 147) and assessed movements in flexion, abduction, internal rotation and external rotation and also did a disability assessment in contrast to study of Mitra where only flexion abduction showed improvement.

In the study of **Dahan et al**[6] a series of indirect SSNB were given at an interval of 7 day. Total study subjects were (N=34) and follow up assessment were done by MPQ (McGill Pain Questionnaire). In contrast our study had (n= 147) subjects and we used VAS and SPADI as pain and disability assessment tool. Also our study had a follow up of upto 12 weeks a relatively longer duration.

In 2002 **Karatas et al**[12] conducted a single-blinded, randomized, comparative clinical trial for evaluation of the clinical effectiveness of 2 suprascapular nerve block techniques in adhesive capsulitis. In their study they found suprascapular nerve block given by near-nerve electromyography technique to be effective in treatment of adhesive capsulitis of shoulder. However in our study we employed the anatomical landmarks and expertise of the treating physician for the SSNB. This is a fairly accurate method[24] in turn saves valuable treatment time and made it a outpatient procedure.

In the study of **Jones et al**[11] a randomised trial is done to compare a single SSNB injection with a course of (average 2.2) of steroid injection alone in a group of 30 patients where they found benefit of SSNB over steroid in the treatment of adhesive capsulitis. The results of our study are in accordance with Jones and colleagues. However our sample size is relatively larger (n=147). Also Jones et al included 20 mg of 0.5 ml triamcinolone acetonide along with 9.5 ml of 0.5 % bupivacaine for SSNB in contrast to our study where we refrained from using steroid to the SSNB injection , as there is no evidence of additional benefit and infact questionable safety concerns[13]

The present study suggests that after 1 , 4 , 12 weeks post injection with SSNB+STEROID , the VAS and SPADI scores were significantly decreased ($P < 0.05$) and the ROM was significantly increased ($P < 0.05$) as compared to post injection with only STEROID. The above findings are also echoed in the studies done by **El-Badawy et al [7] and Simon Carette et al[2].** We also observed that the reduction in pain post procedure lasted more than 12 weeks, which exceeds the pharmacological effect of the drugs. This may be due to decrease in central sensitization of dorsal horn nociceptive neurons. In addition, depletion of substance P and nerve growth factor in the synovium and afferent C fibers of the glenohumeral joint. And because of this the patient's ability to perform a adequate exercise program also increases which in turn causes further decrease in disability and increase in ROM.

A low incidence of adverse affects have been reported in literature. Pneumothorax, complete plexus blockade and injury to suprascapular vessels have been reported as complications of this procedure[10] . We did not experience any such complication, however we did encounter one patient in the SSNB+STEROID group who suffered from transient hypotensive syncope /vasovagal attack immediately after injection. The patient however recovered spontaneously .Our safety record is comparable to that of the studies conducted by **El – Badawy and colleagues [7]**

A few **limitation**s should be noted in interpreting our findings. First, no nerve stimulator / imaging technique was used to locate the suprascapular nerve. The SSNB was given solely on the basis of anatomical landmarks. Second although the diagnosis of frozen shoulder was based on physical exam and radiographs, those with small rotator cuff tear or labral lesion could have been missed as we didn't perform MRI to confirm its presence. Third all patients were instructed to perform home based physical therapy, exercise program, compliance of same was not confirmed individually.

V. Conclusion

From the results of our study we observed the patients getting suprascapular nerve block along with intra articular steroid injection were observed to have an increased functional outcome, increased ROM and decreased pain as compared to the patients who received only intra articular steroid in the management of adhesive capsulitis. On reviewing previous literatures, we found comparable results. Also we observed that the combined approach of suprascapular nerve block along with intra articular steroid injection followed by home exercises accelerates the recovery. This combined approach is effective and safe to be administered in out patient clinic by well trained physicians. Its extensive use could drastically save medical time and also have economic benefit as patients can return to work sooner without the need for hospitalization and extensive physiotherapy sessions. However these factors may be carefully assessed in a future study.

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