RESEARCH PAPER

Treatment Of Periarthritis Shoulder With Intra-Articular Steroid Injection By Ultrasound Guided Versus Palpatory Techniques.

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Abstract

Background- Periarthritis (PA) shoulder, adhesive capsulitis or frozen shoulder is a common cause of shoulder pain leading to limitation of daily activity.

Objectives- To prospectively compare the effectiveness of intra-articular steroid injection by ultrasound-guided technique versus palpatory technique in periarthritis of the shoulder.

Method- Two groups (A and B) containing 40 patients in each group, allocated by computerised block randomization were given the interventions: Group A: Intra-articular corticosteroid injection by palpatory method, Group B: Intra-articular corticosteroid injection by ultrasonographic guidance method. Each patient was assessed before intervention and 1, 4 and 12 weeks after intervention using predefined assessment tools like the 0-10 Numeric Pain Intensity Scale, Active and passive Range of motion using a handheld goniometer, Quick Disability of Arm, Shoulder and Hand (DASH) score, Shoulder Pain and Disability Index (SPADI) index.

Results- In Group A, there were 23 females (57.50%) and 17 males (42.50%) with a ratio of 1.35:1 (F: M). In Group B, there were 16 females (40%) and 24 males (60%) with a ratio of 0.66:1 (F: M). In both groups, statistically significant improvement in pain, active and passive range of motion in all directions and function was observed at each follow-up interval when compared to baseline. On comparison between the two groups, no statistically significant difference was found. The improvement in terms of active and passive abduction, flexion, extension, internal rotation, external rotation, numerical pain intensity scale, quick DASH scores and SPADI scores were comparable in both groups.

Conclusions- Although USG guidance provides us with the advantage of real-time visualisation with increased accuracy of needle placement in the target area, this may not translate into a better outcome. In cases where the accuracy of drug or contrast delivery is required, as in cases of sodium hyaluronate or contrast agents, the USG-guided technique is a better choice. It is recommended that further studies be conducted for more insight into the issue.

Keywords- Periarthritis, Shoulder Pain, Ultrasonography, Interventional, Pain Measurement

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Introduction:

Periarthritis (PA) of the shoulder, adhesive capsulitis or frozen shoulder is a common cause of shoulder pain leading to limitation of daily activity. It is characterised by painful, restricted shoulder range of motion (ROM) in patients with normal radiographs. Neviaser in 1945, coined the term 'adhesive capsulitis' for painful stiffening of the shoulder [1]. Codman in 1934 used the term 'frozen shoulder' to describe a painful shoulder condition of insidious onset with stiffness and difficulty sleeping on the affected side. He stated that most cases resolved in about two years without treatment [2]. However, this entity was first identified by Duplay in 1872, and he labelled this condition as 'periarthritis scapulohumeral' [3]. Zuckerman and Cuomo (1993) defined it as a condition of uncertain aetiology characterised by substantial restriction of both active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder [4].

Periarthritis of the shoulder occurs in approximately 2% to 5% of the general population, is slightly more common in women than men, and is most frequently seen in the 5th and 6th decades of life [5]. It is usually an idiopathic condition, but can be associated with diabetes mellitus, inflammatory arthritis, trauma, prolonged immobilisation, thyroid disease, cerebrovascular accident, myocardial infarction, or autoimmune disease. Periarthritis of the shoulder has been divided into four stages [6]. Stage 1 occurs for the first 1 to 3 months and involves pain with shoulder movements but no significant glenohumeral joint ROM restriction when examined under anaesthesia. In stage 2, the 'freezing stage', symptoms have been present for 3 to 9 months and are characterised by pain with shoulder motion and progressive glenohumeral joint ROM restriction in

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forward flexion, abduction, and internal and external rotation. During stage 3, or the 'frozen stage', symptoms have been present for 9 to 15 months and include a significant reduction in pain but maintenance of the restricted glenohumeral joint ROM. In stage 4, frequently referred to as the 'thawing stage', symptoms have been present for approximately 15 to 24 months, and ROM gradually improves. Routine radiographic evaluation is usually normal, but glenohumeral joint arthrography typically shows a significant reduction in the capsular volume.

Exercises play an important role in the treatment of periarthritis of the shoulder [7,8]. Passive joint glides and non-painful ROM exercises are started first. Early scapular stability exercises and rotator cuff exercises can be added. As symptoms improve, active assisted and active ROM exercises can be added along with open-chain and proprioceptive exercises.

Corticosteroid therapy was suggested in 1955 by Crisp and Kendall [9]. The use of intra-articular corticosteroid injections to treat shoulder pain has remained one of the most common procedures. Corticosteroids have an anti-inflammatory property of reducing pro-inflammatory derivatives such as bradykinin, histamine, prostaglandins, leukotrienes and may have anti-nociceptive effects (A direct stabilising effect on neural membranes and inhibits C fiber transmission) [10,11].

Traditionally, intra-articular injection of the shoulder joint is performed by applying knowledge of anatomical landmarks. However, the injections can also be performed with ultrasound guidance with visualisation of the needle tip at the target site. Ultrasound imaging has the advantage of being able to visualise the target area, offering the facility of optimal needle positioning and deposition of the proper amount of drug.

Through this prospective study, we attempted to compare the efficacy of intra-articular steroid injection by ultrasound-guided versus palpatory techniques in the treatment of periarthritis of the shoulder in terms of pain, range of motion, and functional index.

Material & Methods:

Hypotheses:

Better visualisation of the joint space improves the accuracy of steroid deposition; therefore, ultrasound-guided injections are more effective than injections given by the palpatory method in periarthritis of the shoulder.

Objectives:

To prospectively compare the effectiveness of intra-articular steroid injection by ultrasound-guided technique versus palpatory technique in periarthritis of the shoulder. To assess the effectiveness of intra-articular steroid injection by ultrasound-guided technique and palpatory technique in the treatment of periarthritis of the shoulder in terms of:

- Change in pain intensity
- Change in the limitation of the range of
- Change in functional index

Type of Study- Randomised Controlled Study
Period of Study- 18 months.
Allocation- Computerised Block Randomisation
Study population- Patients visiting the department and diagnosed with Periarthritis of the shoulder.
Sample Size- A total of eighty (80) patients, with Forty (40) patients in each group.

Inclusion Criteria:

- Age 35 years and above.
- Shoulder pain and stiffness in one or both shoulders for at least 4 weeks.
- Failed conservative management taken for at least 2 weeks.

Exclusion Criteria:

- History of shoulder trauma, surgery.
- History of injection in the involved shoulder during the preceding 6 months.
- History of chronic diseases: rheumatoid arthritis, peripheral vascular disease, gout, clotting disorders, uncontrolled diabetes mellitus.

Methodology:

Informed, written consent was taken from all patients willing to participate in this study. Selected patients were assigned to two groups (A and B) containing 40 patients in each group by Computerised Block Randomisation. Interventions: -

- **Group A: -Intra-articular corticosteroid injection by palpatory method**

The patient was seated with the arm internally rotated and resting on the lap. Internal rotation of the arm helps to open up the posterior joint line to allow easier needle entry into the joint. After preparing the skin and with aseptic precautions, a 21G needle was inserted from the point that is opposite to the coracoid process and two fingers below the spine of the scapula. The needle was aimed towards the coracoid process. After confirmation of the placement of the needle tip in the joint space, which was characterised by a loss of soft tissue resistance, aspiration was done to check if any vessels were injured. Once aspiration for blood was found to be negative, 2 ml of (40mg/ml) Methyl prednisolone acetate was injected.

- **Group B: - Intra-articular corticosteroid injection by ultrasonographic guidance method**

The posterior approach was performed using a Sonosite Micromaxx Ultra Sonography machine with a 6–13MHz linear array transducer. The patient was lying obliquely prone on the contralateral shoulder. After aseptic preparation of skin and transducer, a 21G needle was inserted, from lateral to medial, parallel to the long axis of the transducer and advanced under ultrasonographic control in the joint between the humeral head and the posterior glenoid labrum. 2 ml of (40mg/ml) Methyl

prednisolone acetate was injected, after negative aspiration for blood.

Rescue Medication: -Only Paracetamol tablets (maximum 3 tablets a day) of 500 mg strength were given to the patient after injection for a maximum period of 1 week, and that too, if there was any need.

The **endpoints** of the study were any of the following

1. Completion of 3 months of follow-up treatment.
2. Patient not willing to continue on the study.
3. Increase in pain by 3 levels on the pain intensity scale.
4. If the patient had to take Paracetamol more than 1.5 gm/day for more than 1 week.

Assessment:

Each patient was assessed before intervention and 1, 4 and 12 weeks after intervention using predefined assessment tools.

Tools of assessment:

1. 0-10 Numeric Pain Intensity Scale.
2. Active and passive Range of motion using a handheld goniometer.
3. Quick Disability of Arm, Shoulder and Hand (DASH) score.
4. Shoulder Pain and Disability Index (SPADI) index.

Statistical Analysis

Categorical variables were presented in numbers and percentages (%), and continuous variables will be presented as mean ± SD and median. Normality of data was tested by the Kolmogorov-Smirnov test. If the normality was rejected, then a non-parametric test was used.

Statistical tests will be applied as follows-

1. Quantitative variables were compared using the unpaired t-test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups and paired T test/ Wilcoxon signed rank test within group across follow-up.
2. Qualitative variables will be compared using the Chi-Square test /Fisher's exact test.

A p-value of <0.05 was considered statistically significant.

The data were entered in an MS EXCEL spreadsheet, and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

Results

The follow-up in the study was for 3 months. Demographic profile of all patients (n=80) was noted and compared. Out of 80 patients included in the study, there were 39 females (48.75%) and 41 males (51.25%) with a ratio of 0.95:1 (F: M). In Group A, there were 23 females (57.50%) and 17 males (42.50%) with a ratio of 1.35:1 (F: M). In Group B, there were 16 females (40%) and 24 males (60%) with a ratio of 0.66:1 (F: M). The duration of symptoms in the patients ranged from 2 to 12 months in our study.

Table 01 - Comparison of age (in years) in two groups

	Group A	**Group B**	**p value**
Mean ± SD	51.55 ± 7.25	51.4 ± 7.56	0.928
Min-Max	38-65	40-68	

Range of Motion

The degree of active as well as passive movements of abduction, flexion, extension, internal rotation and external rotation of the shoulder was recorded at the entry into the study and at each follow-up. Both intra-group and inter-group comparisons were done for statistically significant differences, if any.

Table 02 - Comparison of The Mean Range of Active & Passive Abduction Between the Two Groups

Active Abduction	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	106.25 ± 25.69		105.25 ± 26.02		0.906
1 week	120.5 ± 25.94	.0001	116.5 ± 27.74	.0008	0.380
4 weeks	123.75 ± 26.88	.001	121.38 ± 27.17	.0002	0.680
12 weeks	140.38 ± 20.77	<.0001	142.88 ± 22.39	<.0001	0.431
Passive Abduction	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	110.75 ± 25.66		110.25 ± 25.47		0.930

1 week	124.88 ± 22.52	<.0001	121 ± 25.53	.0002	0.396
4 weeks	126.88 ± 25.89	0.001	123.62 ± 27.83	0.001	0.568
12 weeks	143.38 ± 18.79	<.0001	145.88 ± 22.41	<.0001	0.356

Table 03 - Comparison of the mean range of active flexion & passive flexion between the two groups

Active Flexion	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	116.88 ± 24.46		116.5 ± 23.59		0.926
1 week	135.38 ± 21.41	.029	135.88 ± 20.22	0.033	0.934
4 weeks	140.38 ± 19.59	<.0001	139.38 ± 20.13	<.0001	0.957
12 weeks	150.75 ± 15.95	.010	149.75 ± 18.4	0.002	0.796
Passive Flexion	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	122.38 ± 23.2		122.12 ± 23.39		0.961
1 week	140.75 ± 18.76	.0001	141 ± 17.91	0.0001	0.965
4 weeks	143 ±18.56	.0001	144.12 ± 18.5	<.0001	0.787
12 weeks	154.75 ± 14.85	<.0001	153 ± 16.44	<.0001	0.767

Table 04 - Comparison of Mean Range of Active Extension & Passive Extension Between the Two Groups

Active Extension	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	41.12 ± 12.88		40.88 ± 12.7		0.885
1 week	48.62 ± 11.15	.001	48 ± 12.44	0.002	0.960
4 weeks	50 ± 9.81	.0004	49.88 ± 10.71	0.0003	0.811
12 weeks	60.25 ± 6.69	<.0001	59.12 ± 9.19	<.0001	0.940
Passive Extension	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	43.5 ± 12.31		43.25 ± 12.07		0.919
1 week	50.62 ± 9.21	.001	49.25 ± 11.85	0.002	0.847
4 weeks	52.62 ± 8.24	.0001	50.88 ± 10.68	0.001	0.842
12 weeks	60.75 ± 6.26	<.0001	60.38 ± 8.35	<.0001	0.635

Internal Rotation

Table 05 - Comparison of the Mean Range of Active Internal Rotation & Passive Internal Rotation Between the Two Groups

Active Internal Rotation	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	23.75 ± 8.68		23.88 ± 8.66		0.907
1 week	29.62 ± 12.93	.003	30.12 ± 12.93	0.001	0.820
4 weeks	39.88 ± 13.47	<.0001	41.75 ± 12.53	<.0001	0.482
12 weeks	61 ± 6.91	<.0001	60.88 ± 8.46	<.0001	0.829
Passive Internal Rotation	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	26.5 ± 8.64		26.62 ± 8.73		0.950
1 week	30.75 ± 13.85	.032	31.5 ± 13.26	0.008	0.719
4 weeks	44.12 ± 12.85	<.0001	46.38 ± 12.25	<.0001	0.432
12 weeks	62.75 ± 7.33	<.0001	61.88 ± 9.11	<.0001	0.784

External Rotation

Table 06 - Comparison of the Mean Range of Active External Rotation & Passive External Rotation Between the Two Groups

Active External Rotation	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	28 ± 9.92		28.62 ± 10.06		0.762
1 week	39.38 ± 13.21	.0001	38.62 ± 12.91	<.0001	0.822
4 weeks	53.62 ± 11.82	<.0001	50.75 ± 11.01	<.0001	0.229
12 weeks	63.38 ± 7.63	<.0001	62.75 ± 8.32	<.0001	0.739
Passive External Rotation	**Group A**		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	30.75 ± 10.71		31.38 ± 10.8		0.762

1 week	43.62 ± 13.06	<.0001	43.75 ± 11.86	<.0001	0.887
4 weeks	55.25 ± 11.09	<.0001	53.38 ± 11.84	<.0001	0.456
12 weeks	66.38 ± 8.09	<.0001	65.38 ± 9.9	<.0001	0.621

NUMERICAL PAIN INTENSITY SCALE

Pain assessed using the Numerical Pain Intensity Scale showed significant improvement in both groups at all three follow-ups as compared to baseline. No significant difference was seen in the outcomes in Group A at 1week, 4weeks and 12 weeks follow-up as compared to Group B.

Table 07 - Comparison of Mean Range Numerical Pain Intensity Scale Values Between the Two Groups

	Group A		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	7.35 ± 1.35		7.32 ± 1.51		0.840
1 week	4.32 ± 1.25	<.0001	4.62 ± 1.63	<.0001	0.740
4 weeks	4.28 ± 1.32	<.0001	4.58 ± 1.78	<.0001	0.511
12 weeks	2.72 ± 1.18	<.0001	2.9 ± 1.37	<.0001	0.642

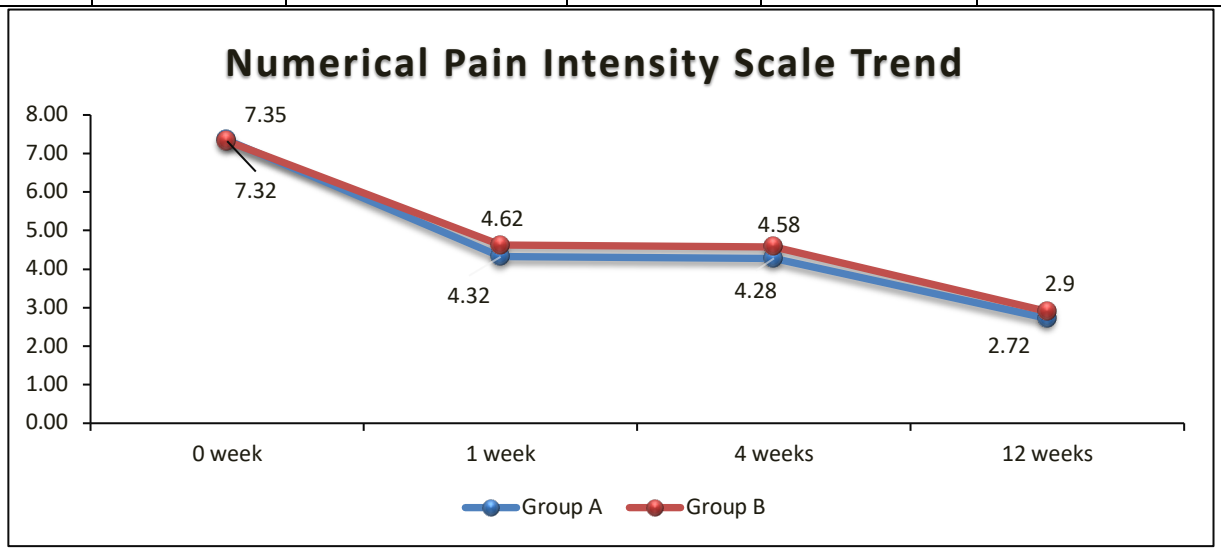

Figure 01 - Comparison of Mean Range Numerical Pain Intensity Scale Values Between the Two Groups

QUICK DASH Scores

Quick DASH Scores were found to improve significantly at each follow-up in both groups when compared to the baseline. No significant difference was seen in Group A in the Quick DASH Scores at 1week, 4weeks and 12 weeks follow-up as compared to Group B.

Table 08 - Comparison of Mean Range Quick Dash Scores between the Two Groups

	Group A		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	33.99 ± 13.15		34.82 ± 14.04		0.786
1 week	24.59 ± 12.59	<.0001	27.43 ± 13.86	<.0001	0.340

4 weeks	22.78 ± 11.96	<.0001	24.31 ± 10.65	<.0001	0.903
12 weeks	17.09 ± 10.66	<.0001	18.57 ± 9.15	<.0001	0.234

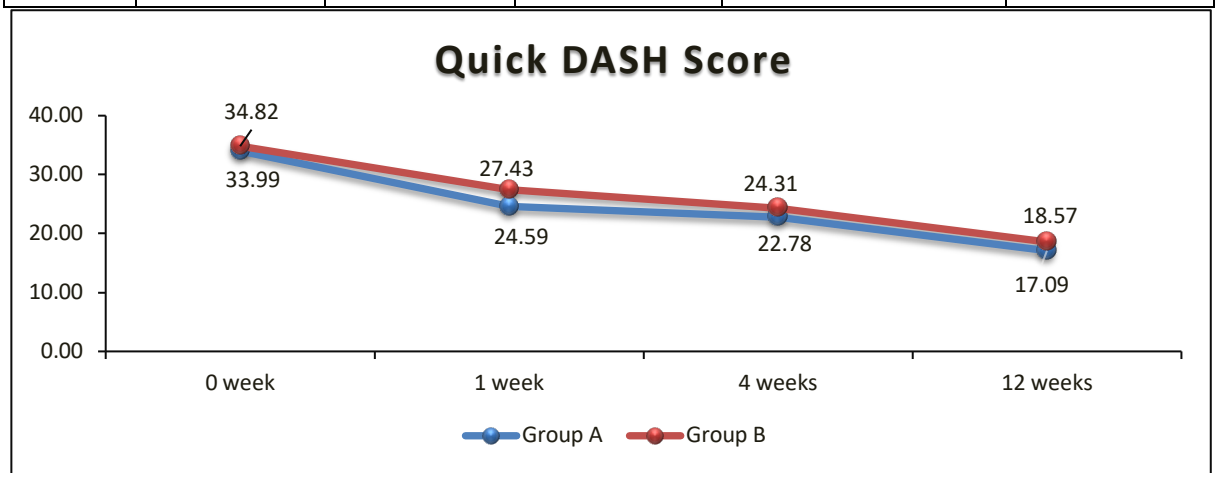

Figure 02 - Comparison of mean range quick DASH scores between the two groups

SPADI Scores

There was improvement in the SPADI Scores at each follow-up interval in both groups when compared to the baseline. No significant difference was seen between the two groups at all three follow-ups.

Table 09 - Comparison of Mean Range SPADI Scores Between the Two Groups

	Group A		**Group B**		**p-value** (comparison between two groups)
	Mean ± SD	p-value (compared to baseline)	Mean ± SD	p-value (compared to baseline)	
0 week	56.63 ± 13.45		57.32 ± 13.77		0.823
1 week	45.7 ± 13.56	<.0001	47.2 ± 13.9	<.0001	0.627
4 weeks	44.2 ± 13.12	<.0001	44.01 ± 13.55	<.0001	0.949
12 weeks	33.49 ± 12.92	<.0001	33.82 ± 10.82	<.0001	0.903

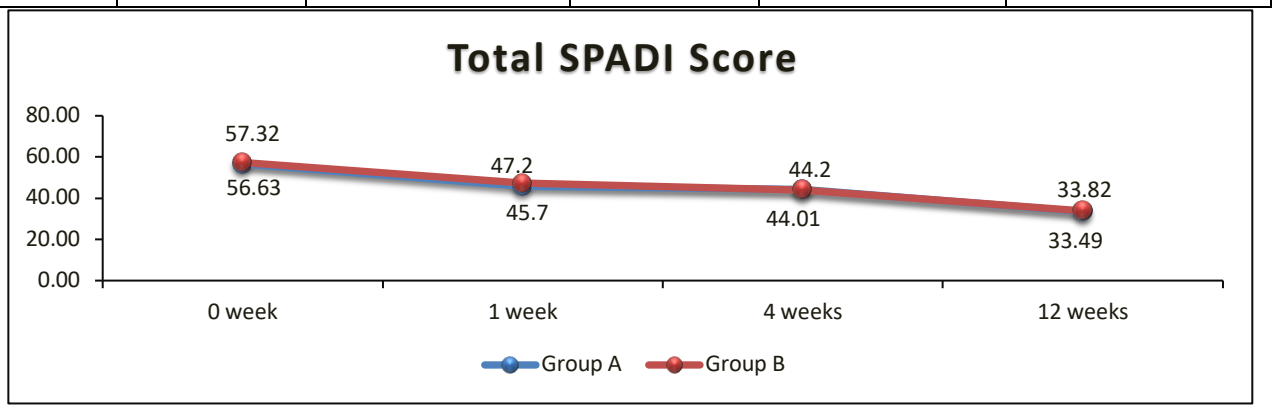

Figure 03 - Comparison of mean range SPADI scores between the two groups

Discussion:

The efficacy of intra-articular corticosteroid injection in the treatment of periarthritis of the shoulder has already been well documented in the literature [12,13]. Evidence confirms an active process of hyperplastic fibroplasia and excessive type III collagen secretion that leads to soft-tissue contractures of the coracohumeral ligament, soft tissues in the rotator interval, the subscapularis muscle, and the subacromial bursa.[14] Corticosteroids have an anti-inflammatory property and reduce pro-inflammatory derivatives and are used intra-articularly to decrease inflammation and pain [10,11].It is found that USG guidance increases the accuracy of needle placement in the gleno-humeral joint of the shoulder [15]. We hypothesised that USG-guided steroid injection, which allows us to visualise the drug deposition in the target area, would yield a better outcome than steroid injection by the palpatory method in periarthritis of the shoulder. In both groups, statistically significant improvement in pain, active and

passive range of motion in all directions and function was observed at each follow-up interval when compared to baseline. On comparison between the two groups, no statistically significant difference was found. The improvement in terms of active and passive abduction, flexion, extension, internal rotation, external rotation, numerical pain intensity scale, quick DASH scores and SPADI scores were comparable in both groups. Thus, both the methods we assessed showed similar effectiveness in the treatment of PA shoulder. These findings are conflicting with the report in a similar study by Lee *et al.* [16]. However, they observed similar efficacy of the two methods beyond the third week. We noted a few differences between the present study and one reported by Lee et al., which may be attributed to the differences in the outcome. In our study, a single intra-articular injection of 2ml methylprednisolone (40mg) was given to each patient in either group of 40 patients (sample size 80) each and assessed in terms of improvement in range of motion, numerical pain intensity scale, quick DASH scores and SPADI scores. On the other hand, in the study by Lee et al., they used intra-articular injection of 0.5ml triamcinolone (20mg) mixed with 1.5 ml of 2% lidocaine and 3ml of normal saline, followed by 2.5ml low molecular weight sodium hyaluronate (25mg) in the second week and weekly for the next four weeks. They evaluated the patients in terms of improvement in range of motion and the numerical pain intensity scale only. The observations made in our study are comparable to those reported by Bloom *et al.* [12]. There were a few limitations of this study. Neither the investigator nor the patients were blinded. The amount and frequency of rescue medication were not analysed.

Conclusion:

This study was done to assess and compare the efficacy of intra-articular steroids injection by the palpatory method to that by the USG guided method in the treatment of Periarthritis shoulder.Patients of one group were given an intra-articular steroid injection by palpatory method, while patients of the other group received an intra-articular steroid injection under USG guidance. Pre-intervention and post-intervention assessment of these patients was done using the Numerical Pain Intensity Scale, SPADI, quick DASH scores and active and passive range of motion. The patients were followed up at regular intervals of 1-, 4- and 12-weeks following intervention. Most of the subjects included in the study were males (51.25%). Patients were in the age group 38 to 65 years, with the maximum number of patients in the age group of 40 – 50 years, and an evenly distributed demographic profile over the two groups.This also indicates that although USG guidance provides us with the advantage of real-time visualisation with increased accuracy of needle placement in the target area, this may not translate into a better outcome. Moreover, the USG-guided procedure requires expertise in musculoskeletal ultrasonography.From the experience through this study, it can be concluded that the palpatory or landmark guided method of intra-articular injection of steroid should be followed. However, in cases where the accuracy of drug or contrast delivery is required, as in cases of sodium hyaluronate or contrast agents, the USG-guided technique is a better choice. It is recommended that further studies be conducted for more insight into the issue.

Author role statement:

Nirmalya Mohapatra[1] (conceptualisation, methodology, supervision, writing- original draft, software, validation, formal analysis)
Satish Kumar Nanda[2] (data curation, validation, supervision, project administration)
Rabisankar Sahu[3] (resources, software, validation, resources investigation, formal analysis)
Sushil Kumar Nayak[4] (visualisation, writing- review & editing, project administration, software)

Conflict of interest: No potential conflict of interest relevant to this article was reported.

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