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Original Research Article

A Prospective Study To Evaluate The Effect Of Subacromial Triamcinolone Injection In Cases Of Subacromial Impingement Syndrome

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ABSTRACT

Background: Subacromial Impingement Syndrome is the common cause for shoulder pain caused due to pathology in one or more of the structures present in the Subacromial area. The discomfort is linked to a loss of shoulder function and difficulty performing regular everyday activities. The pathophysiology is not entirely understood. The Subacromial injection was developed to reach a high drug concentration at the site of pathology while using a less overall drug to avoid systemic side effects. Triamcinolone Acetonide produces both anti-inflammatory and direct analgesic benefits in the shoulder.

Material and Methods: This study included 55 patients with Age more than 20 and Pain during Shoulder Arc of Motion, Positive Neer's Sign and Hawkin's Test. Pain during Shoulder Arc of motion, Visual Analogue Scale Score and Shoulder Pain and Disability Index was calculated pre injection and post injection at 2,6 and 12 weeks. Data was collected and analyzed statistically.

Results: 55 cases were worked up on OPD Basis. Mean age was 50.69, Male dominance. Pain during Shoulder Arc of Motion which was initially present in all 55 patients decreased over the follow-ups and at the end of 12 weeks only 3 patients had persistent pain. Visual Analogue Scale Median at 0 weeks was 9 which decreased to 0 at 12 weeks, Shoulder Pain and Disability Index Median at 0 weeks was 82.3 which decreased to 3.07 at 12 weeks. All these changes were significant with p value < 0.001.

Conclusion: We conclude that in our patients suffering from Subacromial Impingement Syndrome post subacromial injection under C-ARM guidance with Triamcinolone Acetonide, the results measured by Pain during Shoulder Arc of Motion, VAS Score and SPADI showed significant improvement. Thus, We support that Subacromial injection of Triamcinolone Acetonide is safe, economical and effective in the treatment of patients suffering from Subacromial Impingement Syndrome

Keywords: Shoulder Pain and Disability index, Visual Analogue Scale, Pain during Shoulder Arc of Motion, Neer's sign, Hawkin's test

ISSN 2515-8260 Volume 10, Issue 02, 2023

Introduction

The Shoulder complaints' estimated prevalence is 7% to 34%, often with Subacromial Impingement Syndrome as the underlying cause [1]. Since it was first described in 1852, the most common cause of shoulder pain is Subacromial Impingement Syndrome, accounting for 44% to 65% of all shoulder complaints [2].
Dr. Charles Neer was the first to describe Subacromial Impingement Syndrome (SIS). Neer claims that Impingement is a mechanical compression of the Supraspinatus tendon, the Long head of the Biceps Tendon, and the Subacromial Bursa, which are all situated in the Subacromial region [3]. (Figure 1)

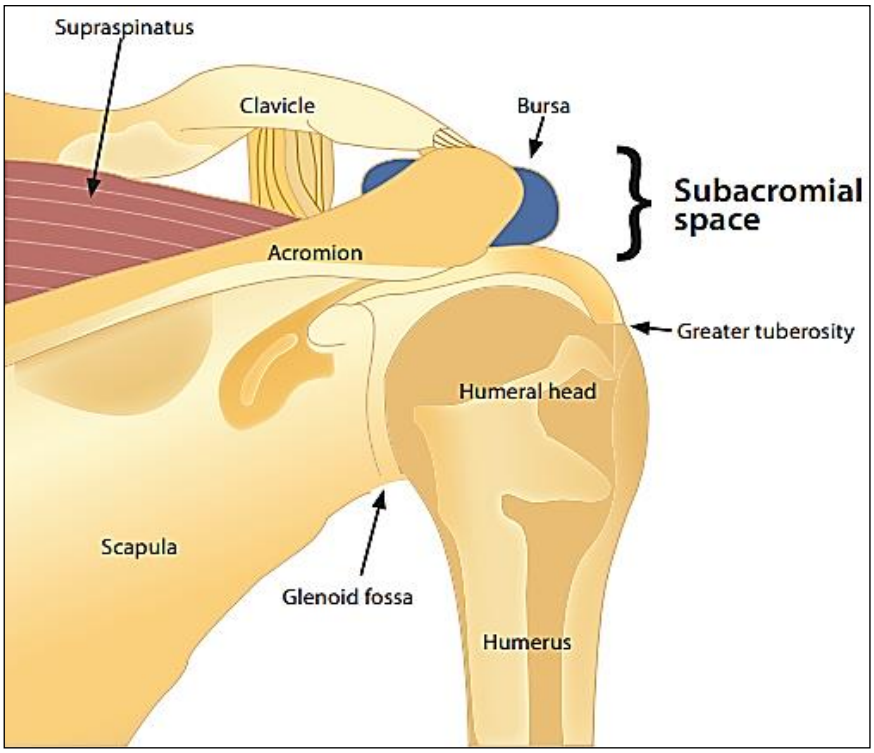


Fig 1: Structures Located Within Subacromial Space [4]

Pathology in one or more of the structures present in the Subacromial area is the cause of Subacromial Impingement Syndrome (SIS). The discomfort is linked to a loss of shoulder function, particularly during overhead movements, whether work, sports or regular everyday activities [5].

Epidemiology

Sports and occupations requiring repetitive overhead motions, such as handball, volleyball, swimming, carpentry, painting and hairdressing are the ones where Shoulder Impingement Syndrome is most frequently observed [2]. Sixth decade of life witnesses the highest incidence of Subacromial Impingement Syndrome [2].

Glenohumeral Joint Kinematics

The Acromion and Coracoacromial Ligament give the anterior boundary, the humeral head provides the inferior border and the Acromioclavicular (AC) joint provides the superior border [2]. The Subacromial area changes in breadth as the arm is rotated or abducted, bringing the humerus closer to the anteroinferior margin of the acromion. The Humeral head

ISSN 2515-8260 Volume 10, Issue 02, 2023

migrates superiorly, the bursa guarding the rotator cuff thins out and the cuff itself becomes more compressed if the equilibrium controlling shoulder kinematics is upset.

In the first 30-60 degrees of active glenohumeral elevation, the humeral head moves by 1-3 mm in the superior direction. The Glenohumeral joint demonstrates essentially ball and socket kinematics above approximately 60º of glenohumeral elevation [6]. Superior humeral translation that occurs during the initial phase of elevation appears to be due to the cranially directed pull on the Head of the humerus by the deltoid muscle [5]. During passive glenohumeral flexion, anterior humeral head translations measuring 2 to 5 mm have been seen [6]. Theoretically, an increase in the usual superior and anterior humeral head translation would emphasize these alterations in the subacromial region, causing mechanical compression of the tissues in the subacromial area during glenohumeral motion [6]. According to the Impingement's position, which is classified as Extrinsic or Intrinsic and the impingement's underlying etiology, which is referred to as Primary or Secondary impingement, Shoulder Impingement Syndrome can be described [2].

Extrinsic mechanism

First, it appears that the Acromion's anatomical shape plays a significant role in the emergence of Shoulder Impingement Syndrome.

In 1983, Neer stated that the Acromion's shape best explains why Rotator cuff tears and SIS arise in some people but not in others [7].

Bigliani *et al*. in 1986 investigated the acromion shapes and concluded that there were three different shapes [8] (Figure 2)

Type 1: Flat.
Type 2: Curved.
Type 3: Hooked.

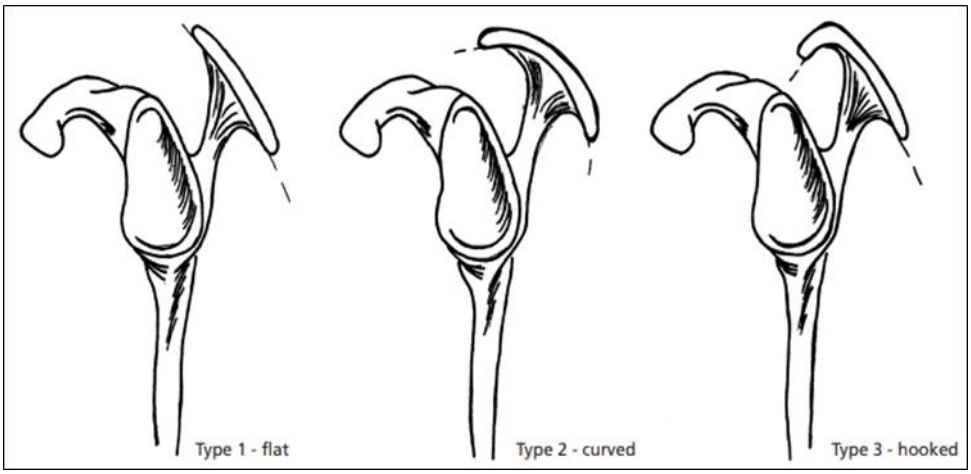


Fig 2: Shapes of Acromion [8]

As stated by Neer's model the mechanical compression caused by the Acromion and Coracoacromial arch is the etiology of impingement [9] therefore Decompressive Acromioplasty should result in a halt to the illness process but later it was found that patients experienced Rotator cuff tears even after the operation and it was then implied that mechanisms other than the Acromion contribute to the genesis of SIS and Rotator Cuff tears [10].

A further potential cause is the Acromioclavicular joint (AC). Osteophytes frequently form in this joint (AC arthritis). Patients with an Oblique AC joint are more likely to experience Shoulder Impingement Syndrome [11].

ISSN 2515-8260 Volume 10, Issue 02, 2023

Shoulder Impingement Syndrome is aided by the Coracoacromial Ligament (CAL). The Rotator Cuff Tendon and CAL both experience deterioration as a result of constant contact [11]. The CAL's collagen fibers subsequently stiffen as a result. As CAL becomes more rigid, the pressure between it and the rotator cuff tendon increases, potentially leading to tendon degeneration [11]. Moreover, the Subacromial area shrinks and Rotator Cuff impingement takes place.

Intrinsic mechanism

All the elements that lead to the degeneration of the Rotator Cuff Tendon are part of the intrinsic process. Some of the contributing variables are ageing, poor vascularity, altered biology, genetic component, overuse, overload, and trauma [11]. The tendon degenerates, stiffens, loses its flexibility and fibrosis may develop as the human body ages.

Primary vs. Secondary Impingement

The Subacromial space structurally narrows during primary impingement. Examples of primary Shoulder Impingement Syndrome include those caused by swelling of the soft tissues or aberrant acromion morphology, such as a hooked class III acromion.
Normal anatomy at rest and the start of impingement during shoulder motion are the hallmarks of secondary Shoulder Impingement Syndrome, which is probably caused by rotator cuff weakness and results in uncontrolled cranial translation of the humeral head [2].

Neer's Classification

Neer classified shoulder impingement into three severity levels or groups [12]. (Figure 3)
Stage I: Impingement is typically associated with overuse-type processes and primarily results from edema, bleeding or both.
Stage II: Is characterized by greater fibrosis and irreversible tendon alterations.
Stage III: Shoulder Impingement Syndrome, a rupture or tear of the tendon may be caused by chronic, long-term fibrosis.

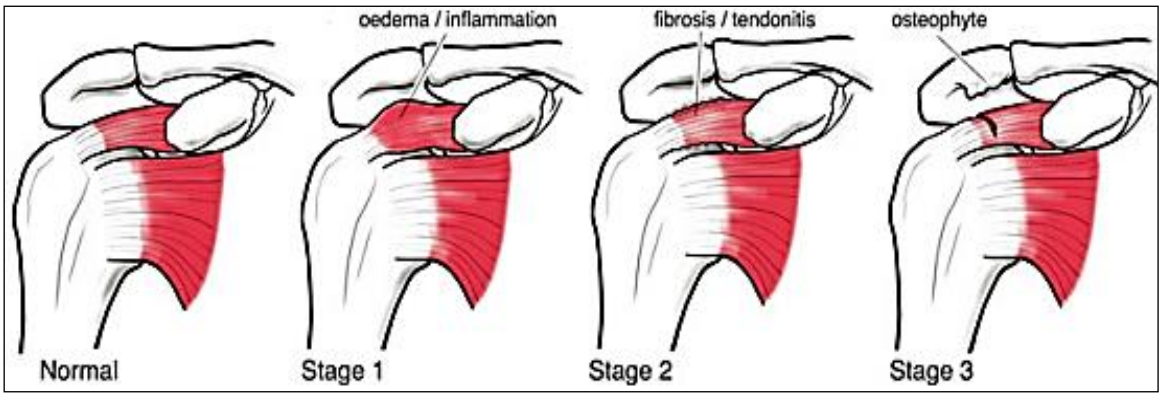


Fig 3: Diagramatic Representation of Neer's Classification [12]

History and Physical Examination

The diagnosis depends on a comprehensive history and physical examination. The main reason people come in for an evaluation may be due to a loss of motion or nighttime pain keeping them awake. Pain frequently leads to weakness and stiffness [13]. Key elements of the physical examination include special tests [14]. The Hawkin's test, Neer's sign and a Painful

ISSN 2515-8260 Volume 10, Issue 02, 2023

arc of motion are tests specific to Shoulder Impingement Syndrome [15].

Treatment

The purpose of treatment in SIS is to stop the inflammatory process, reduce pain, prevent progressive degenerative changes, provide an improved joint range of motion, Increase muscle strength and perform daily life activities. The physiological effects of local corticosteroids are numerous. Through their binding to cytoplasmic glucocorticoid receptors, they regulate the transcription of many pros and anti-inflammatory proteins [16]. Therapeutic benefits of corticosteroid injection in impingement are due to anti-inflammatory activity, relaxation of reflex muscle spasm, pain relief and mechanical improvement [17].
The Subacromial injection was developed to reach a high drug concentration at the site of pathology while using a less overall drug to avoid systemic side effects [18]. Currently, a combination of corticosteroid solution and local anesthetics is injected into a local soft tissue inflammatory site in clinical practice. Triamcinolone Acetonide is a kind of corticosteroid that is commonly used in Orthopaedic procedures.

Aim and Objectives: To assess pain after giving Subacromial injection of Triamcinolone in cases of Subacromial Impingement Syndrome during follow ups at 2 weeks, 6 weeks and 12 weeks using Pain during Arc of motion, Visual Analogue Scale and Shoulder Pain and Disability Index.

Material and Methods

This Prospective Observational study was conducted on patients diagnosed with Subacromial Impingement Syndrome above the age of 20 years presenting to the Orthopaedics Outpatient Department, Sri Guru Ramdas Charitable Hospital attached to Sri Guru Ramdas University of Health Sciences, Vallah, Amritsar. Single Subacromial Corticosteroid Injection of Triamcinolone Acetonide (40 mg) was administered to Patients presenting to Orthopaedics Outpatient Department from 1 April 2021 to 31 July 2022.
Patients with Pain on Shoulder Abduction from 60-120 degrees and Positive Neer's Sign and Hawkin's Test were included in the study.

Painful Arc of motion: Painful Shoulder Arc of Motion was the Inclusion Criteria. In this pain was appreciated with the Abduction of the affected side arm between 60 and 120 degrees and forced overhead movement by the patient [19].

Neer's sign: This test was performed by maximally forward flexing the patient's arm while holding the scapula in a depressed position. Internal Impingement was indicated by localized shoulder pain on the posterior shoulder [20].

Hawkin's test: The patient's arm was passively internally rotated while the shoulder was in a 90-degree forward flexion position and the elbow in flexion. Pain over the acromion indicated Subacromial Impingement [20].

Exclusion criteria

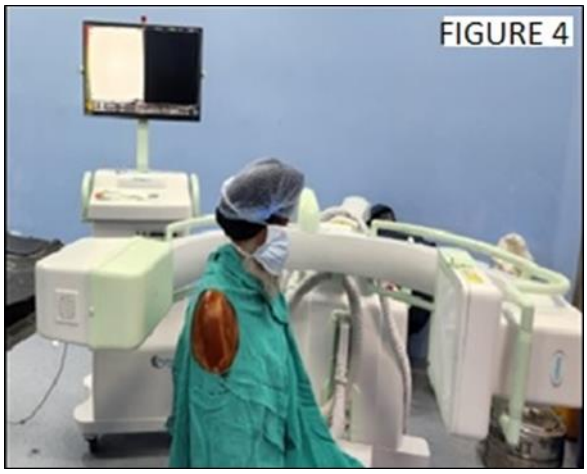
1. Patient who underwent Spinal or Shoulder surgery in recent 6 months.
2. Current spinal or upper limb fractures.
3. Previous Triamcinolone injection in last 4 weeks.
4. Patients with history of Shoulder dislocation.
5. Patients with Random blood sugars levels more than 130 mg/dl, pregnant women, breast feeding mothers.

ISSN 2515-8260 Volume 10, Issue 02, 2023

6. Referred pain from Cervical Spine.
7. Skin infection at site for Subacromial injection.
8. Contraindication to Triamcinolone injection such as sepsis, Fracture sites, Prosthetic joint.

Procedure: Informed written consent of each patient was taken, detailed clinical history was recorded and general physical, local examination was done. Participants were assessed by checking Pain during Arc of Motion, calculating Visual Analogue Scale score and Shoulder Pain and Disability Index at the time of administering Subacromial corticosteroid Injection. The affected side of the patient was confirmed and marked. Vital parameters of the patient were monitored. The affected side was painted and draped as the patient sits on a Stool with the arm by the side of the body. (Figure 4) Injection was administered via a Dorsolateral approach through the interval just beneath the dorsal acromial edge. [21]The skin at the site of injection was anesthetized with 2% lignocaine using a 26 Gauge needle. 18 Gauge needle was inserted at the anesthetized skin site.

Under C-ARM guidance proper positioning of the needle was confirmed. (Figure 5) 1mL of Triamcinolone Acetonide (40 mg) and 1 ml of 2% Lignocaine without Adrenaline was mixed in a 5 ml syringe and administered through 18 Gauge needle. (Figure 6) The Injection administration was performed by Orthopaedic Surgeon under C-ARM guidance. (Figure 7)



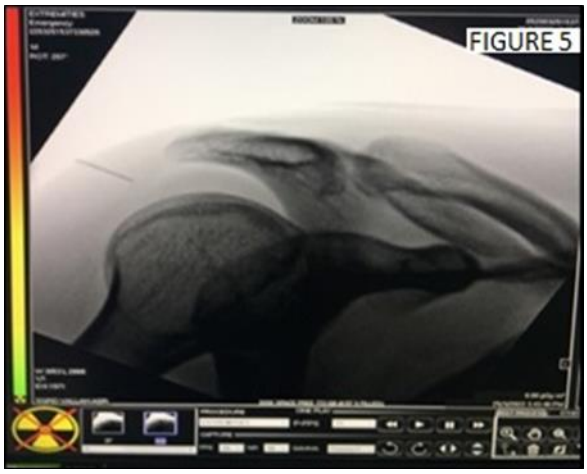
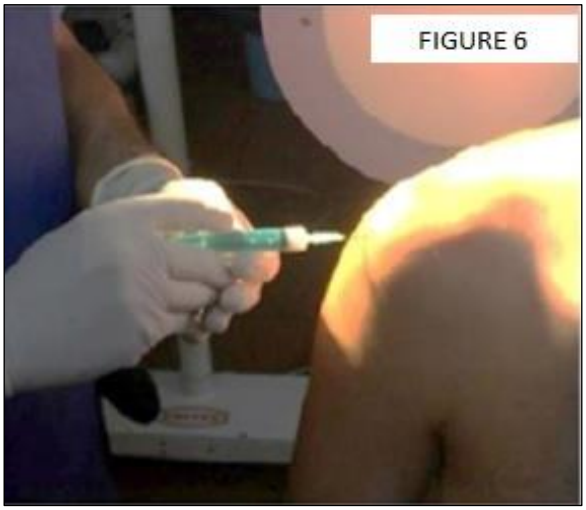


Fig 4: OT Setup along with Positioning of C Arm **Fig 5:** Needle Positioning under C-Arm Guidance



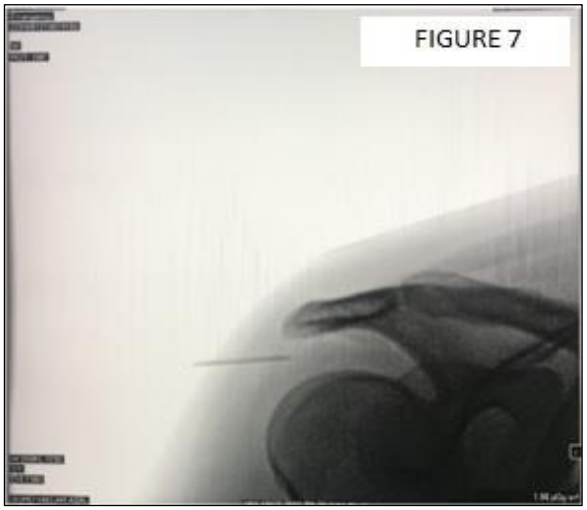


Fig 6: Clinical Picture While Administering Subacromial Corticosteroid Injection

Fig 7: C-Arm Picture of Drug Administration

Follow UP: Patients were followed up at 2 weeks, 6 weeks and 12 weeks post-injection on an

ISSN 2515-8260 Volume 10, Issue 02, 2023

OPD basis.
The Results were evaluated by checking Pain during Arc of Motion and calculating Visual Analogue Scale Score and Shoulder Pain and Disability Index during follow-ups.

Statistics: At the end of the study, data from the present study was systematically collected, compiled in Microsoft Excel and statistically analyzed using Statistical Package of Social Sciences (SPSS) version 26 to draw relevant conclusions. The observations were tabulated in the form of number and percentages and Median and Interquartile range. Paired comparison of SPADI and VAS at each time interval was performed using the Wilcoxon Signed Ranks Test. Categorical data was analyzed using the Chi-square test. The level of significance was determined as its, $p \leq 0.05$ as significant and $p \leq 0.001$ as highly significant.

Results

Table 1 and 2 depicts the distribution of 55 patients suffering from Subacromial Impingement Syndrome fulfilling Inclusion criteria who were considered for the study. Baseline VAS, SPADI, Pain during Shoulder Arc of Motion were noted. Post-injection Patients were followed up at 2, 6, and 12 weeks. VAS, SPADI and Pain during Shoulder Arc of Motion were noted. Results were derived from the data and were represented in a tabular and graphical manner.
At 0 weeks all patients had Pain during Shoulder Arc of Motion which decreased significantly and at 2 weeks 21 patients and 6 weeks only 9 patients had persistent pain. At 12 weeks of follow up only 3 patients still complained of the pain as depicted in Figure 8. These differences from the baseline till 12 weeks were found to be statistically significant with a p-value<0.001.
The VAS Score Median at 0 weeks was 9 and At 2 weeks was 5 which when compared At 6 weeks was 2. At 12 weeks VAS Score Median was 0. This change throughout from baseline till 12 weeks was statistically significant with a p-value<0.001 as depicted in Figure 9.
The Median of SPADI at Zero weeks was found to be 82.3 which on follow up at 2 weeks turned out to be 36.15; at 6 weeks 6.92 and at 12 weeks it was 3.07 as shown in Figure 10. All these differences were statistically significant with a p -value <0.001 .

Table 1: Age Distribution of Patients in the Study

Age (Years)	Number	Percent
≤30	4	7.3
31-40	9	16.4
41-50	14	25.5
51-60	16	29.1
61-70	11	20.0
>70	1	1.8
Total	55	100.0

Table 2: Demographic Data of the Patients

Age (Mean ± SD)	50.69±12.80years
Gender (Female/Male)	22/33

ISSN 2515-8260 Volume 10, Issue 02, 2023

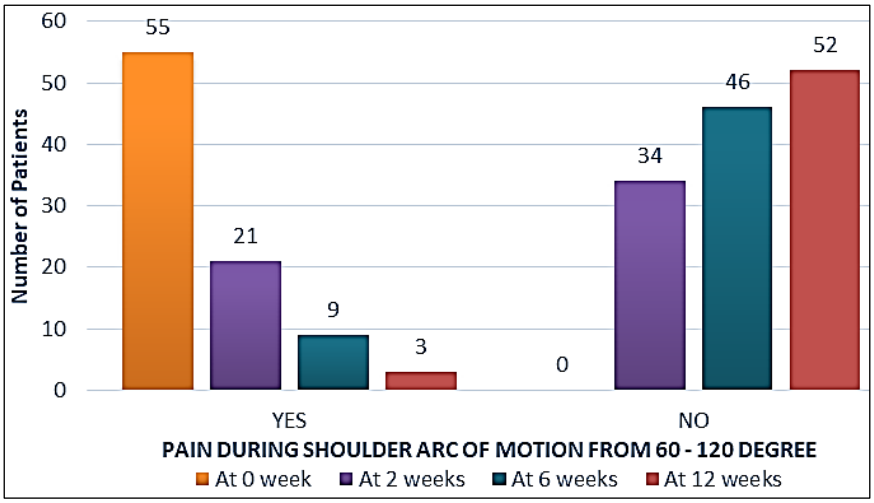


Fig 8: Pain during Shoulder Arc of Motion from 60-120 Degrees at Different Follow-Ups during the Study

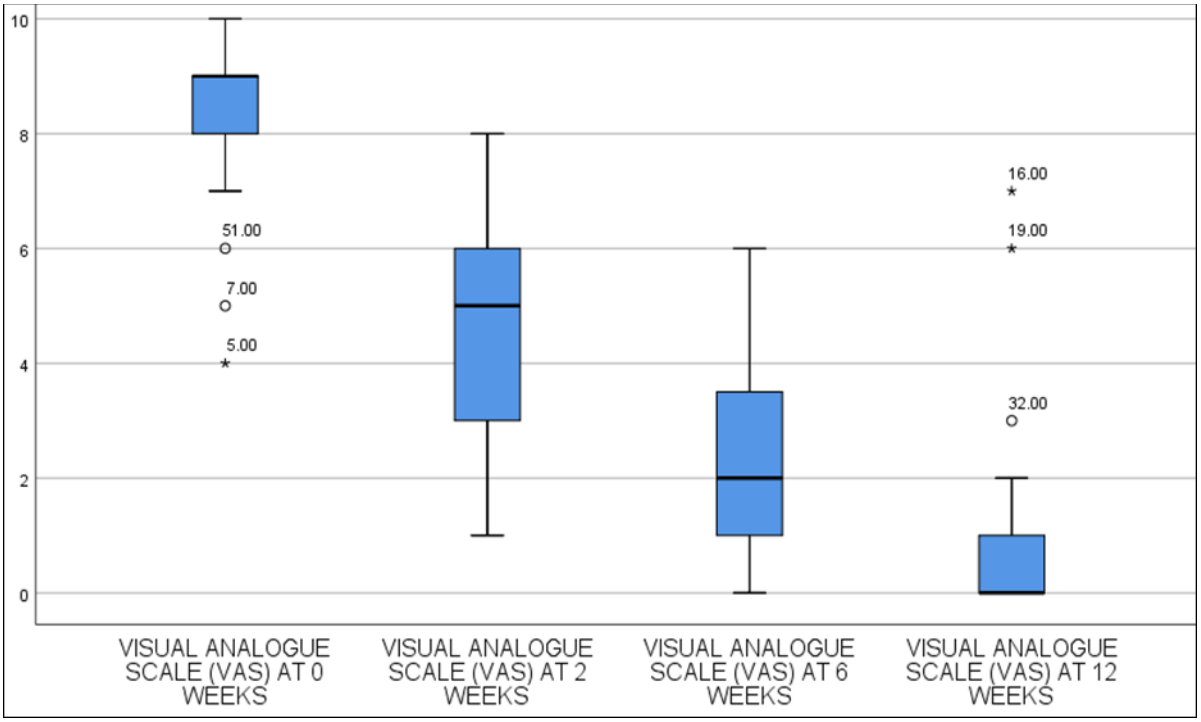


Fig 9: Comparison of VAS Score at Different Follow-Ups during the Study

ISSN 2515-8260 Volume 10, Issue 02, 2023

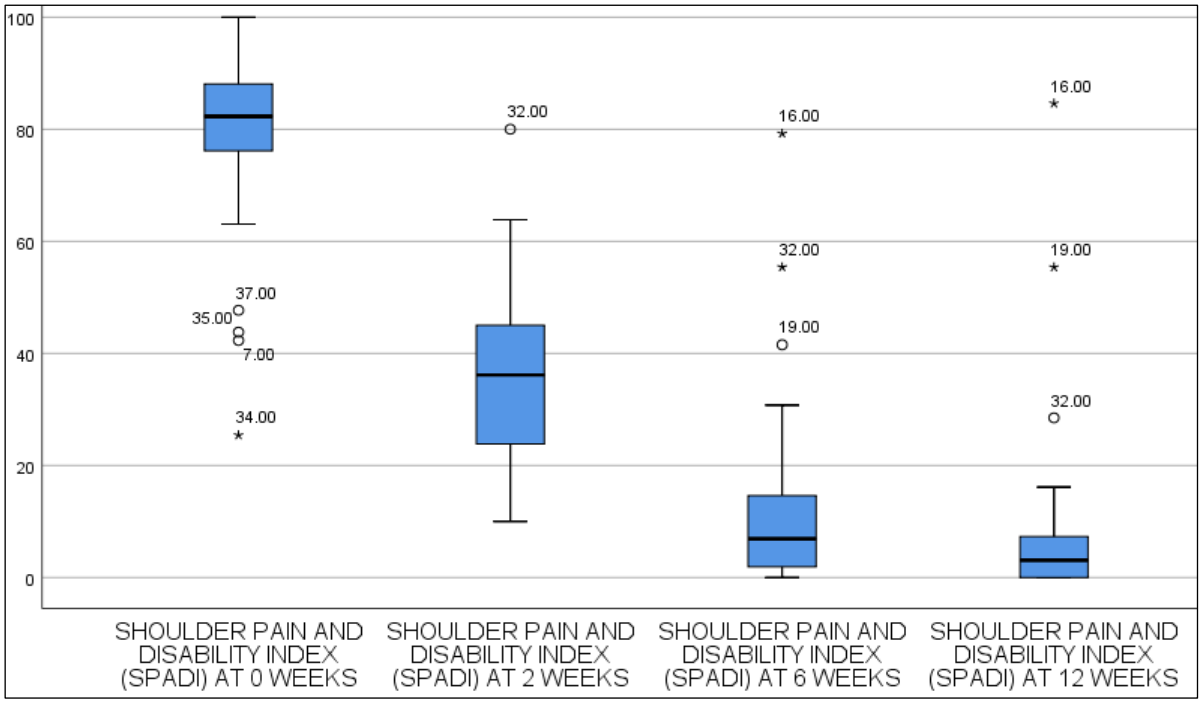


Fig 10: Comparison of SPADI at Different Follow-Ups during the Study

Discussion

Our patient population had mean age of 50.69±12.80. A similar study was done by Huu MN *et al*. and they found the mean age as 52.3 [22] and Kanatli U *et al*. found mean age of the patients to be 50.1 years [23]. In our study males represented 60 percent of the study population. Anwer S *et al*. found that 76.6 percent of the study population were males [24]. But Garvey KD *et al*. however had 85.3 percent of females with Subacromial Impingement Syndrome [25]. Differences may be because of the higher proportion of men involved in activities involving repetitive overhead motion such as carrying heavy loads in Indian subcontinent.

Positive Neer's Sign and Hawkin's Test were the Inclusion criteria. As stated in the SUPPORT trial accurate diagnosis of Subacromial Impingement Syndrome is challenging but combination of the patients' history and response to Neer's and Hawkin's Tests and Pain on shoulder abduction provides optimal sensitivity and specificity [26]. Calis M *et al*. found that the most sensitive diagnostic tests for Subacromial Impingement syndrome were Hawkins' Test (92.1%), Neer test (88.7%) [27].

In our study Pain during Shoulder Arc of Motion was the first parameter and all 55 patients suffered pain during the Shoulder Arc of Motion during 60 to 120 degrees. This 60-120 degree pain is the characteristic pain arc seen in patients of Subacromial Impingement Syndrome [19]. Two weeks after administering the injection 34 patients were relieved of the pain during Shoulder Arc of Motion. 21 patients still had symptoms of pain. At the next follow-up at 6 weeks, 46 patients out of the 55 were relieved of their symptoms of pain during the Shoulder Arc of Motion, remaining 9 patients still complained of pain. At 12 weeks only 3 patients had persistent pain during Shoulder Arc of Motion rest 52 patients were relieved of pain. These differences were statistically significant with a $p<0.001$.

Various studies have however considered the change in Active range of motion after administration of injection and not the effect on Pain during the Arc of Motion exclusively. Nihal B *et al.* [28] stated that shoulder ROM in supine position, improved significantly at three month compared to before-injection and the improvement continued 1-year period. Also Bashir F *et al*. [29] found out significant improvement in VAS and active range of motion and

ISSN 2515-8260 Volume 10, Issue 02, 2023

effect persisted 8 weeks post-injection. Similarly increase in active range of motion was also observed by Chung-Ming yu *et al*. [30] in a four week follow up in 90% of the study population. VAS Score was the second evaluating parameter. VAS Score Median was 9 at zero weeks. On follow-up at 2 weeks the VAS Median has decreased significantly from pre-injection value of 9 to the value of 5. The VAS Score median at 6 weeks was 2. VAS Score Median at 12 weeks was 0. This difference between the VAS scoring at 0 weeks and at all further follow-ups were statistically significant with $p<0.001$.

Comparing our study with the literature Garvey KD *et al*. [25] in a similar study followed up 34 patients after administering Triamcinolone Acetonide injection and found that baseline mean VAS Score was 5.96 +/- 2.28 which decreased to 2.51 +/- 2.44 at 3 months and this was statistically significant and with p-value of 0.0001. Huu MN *et al*. [31] have used Methylprednisolone Acetate subacromially and found pre intervention baseline mean VAS was 8.4+/- 1.25 which decreased significantly to mean VAS of 2.6 +/- 1.12 over 3 months. A study done by Say F *et al*. [32] had a mean VAS of 7.8+/- 1.1 which decreased to 2.1 +/- 1.1 over 6 months.

The third and final parameter for effect evaluation was Shoulder Pain and Disability Index and in the study SPADI Median before administering injection was 82.3. 2 weeks post-injection the SPADI Median decreased to 36.15. SPADI at six weeks decreased further and the Median was 6.92. At the final follow-up at 12 weeks the SPADI Median was 3.07 and this change between 0 weeks and further follow-ups was statistically significant with $p<0.001$.

Three patients persistently had positive Shoulder arc of motion. SPADI and VAS Score in these patients increased again after an initial fall indicating loss of the effect of injection. 1 patient lost to follow up after 12 weeks. The other two patients underwent MRI and were diagnosed with Rotator cuff tear and Type III acromion causing impingement for which they were operated. This gives a clue that there might be a need for other investigations apart from clinical tests in order to better treat the outliers.

Comparing our study with that of Garvey KD *et al*. [25] similar results of a decrease in the SPADI were observed when compared over 3 months. Also study done by Haghighat S *et al*. [33] found a similar trend of decrease in SPADI both when administered blindly and ultrasound-guided. Similar were the results in the study done by Hsieh LF *et al*. [34] eliciting a significant decrease in SPADI. Although the last two studies used a different corticosteroid but there is a significant decreasing trend in SPADI value post corticosteroid injection administration thereby improving pain and decreasing the disabilities of the patient suffering from subacromial impingement syndrome. Our study as well as the study done by other authors have a similar $p<0.001$ denoting its high significance.

Our study had an advantage of using a C-ARM along with palpation of bony landmarks while administering injection Subacromially thereby providing extra precision while drug administration. Also our study has compared the effect of Triamcinolone Injection to the pain during Shoulder Arc of Motion which exclusively has not been compared previously. We felt the drawback of the study was to keep follow-up of patients for a longer time span to check the Triamcinolone Acetonide effect getting withered away which may aid in patient management and to decide for repeat injections if needed.

Conclusion

We conclude that in our patients suffering from Subacromial Impingement Syndrome post subacromial injection under C-ARM guidance with Triamcinolone Acetonide, the results measured by Pain during Shoulder Arc of Motion, VAS Score and SPADI showed significant improvement. Thus, We support that Subacromial injection of Triamcinolone Acetonide is safe, economical and effective in the treatment of patients suffering from Subacromial Impingement Syndrome

ISSN 2515-8260 Volume 10, Issue 02, 2023

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