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RESEARCH ARTICLE
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COMPARISON OF SINGLE SHOT SUPRA SCAPULAR NERVE BLOCK AND INTRA-ARTICULAR STEROID INJECTION IN ADDITION TO PHYSICAL THERAPY FOR THE MANAGEMENT OF FROZEN SHOULDER PATIENTS PRESENTING TO DHQ HOSPITAL RAWALPINDI; A RANDOMIZED CONTROL TRIAL

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Abstract:
Background: A frozen shoulder is a condition characterized by pain and limitation of movement in the shoulder joint. Physical therapy is one form of treatment that can be used but combining it with a suprascapular nerve block or steroid injection can speed up recovery. This study compares the effectiveness of these two treatments for the condition.
Methods: A double-blinded randomized control trial was run for 12 months at DHQ Teaching Hospital Rawalpindi, Pakistan compared the effectiveness of SSNB and IAS for frozen shoulder in 40 patients, with 20 in each group. Patients were advised physiotherapy afterward. Moreover, pain and disability scores were calculated by SPADI at 2,4,8 and 12 weeks after administering the respective therapy.
Results: Pain score in the SSNB group improved from 28.45 to 11.65 at 12-week intervals against an improvement from 29.2 to 16.85 in the IAS group. Moreover, the disability score improved from 40.35 to 14.6 at 12 weeks in the SSNB group against an improvement from 41.55 to 21.85 in the IAS group. Compared to the IAS group, the SSNB group had a lower mean of pain and disability scores at weeks 2,4,8 and 12 ($p<0.05$). Age and gender showed no significant correlations ($p>0.05$).
Conclusion: Suprascapular nerve block in conjunct with physiotherapy is more effective than intra-articular steroid injection for pain and disability in frozen shoulder, regardless of age and gender. Long-term effectiveness remains to be studied.

Introduction:
Pain in the shoulder joint and restricted range of motion are the hallmarks of a frozen shoulder. It is a syndrome of unknown etiology that arises without a known intrinsic shoulder pathology and is

characterized by severe limitation of both passive and active shoulder mobility, as reported by the American Academy of Orthopaedic Surgeons (1,2). It is more prevalent in middle-aged, elderly, and diabetic individuals. This disorder was first described by Codman in 1934. It was characterized by limitations in range of motion in both active and passive shoulders, as well as slow-onset pain (3). The disorder's pathogenesis is poorly understood, but it is thought that the shoulder capsule thickens and becomes stiff and there is proliferative synovitis (4). Macroscopic signs include thickness and capsular congestion, as well as an inflammatory look of the coracohumeral and middle glenohumeral ligaments, notably around the rotator interval (5). Under a microscope, however, the affected capsule shows a greater quantity of T cells, mast cells, fibroblasts, and macrophages. This inflammation is associated with elevated levels of growth factors that promote fibrosis, cytokines associated with inflammatory process, and interleukins (6). The disease is associated with four stages: first comes the stage of painful inflammation, then the second stage is freezing, third is frozen, and finally the thawing stage (7). Reeves et al., however, have divided the progression of this disease into three distinctive phases. According to Reeves et al, thawing is the first stage that involves gradual improvement of the range of motion and a gradual recovery from the symptoms. The second stage is freezing, which involves a gradual onset of shoulder pain along with progressive loss of motion. The last stage is called frozen, in which pain subsides gradually, and the severity of stiffness plateaus (8). The stiffness that is caused leads to limitations in the functional shoulder joint movement, although the pain generally improves in these patients. The clinical course of the disorder results in lengthened spells of pain and functional disability.

Most patients with adhesive capsulitis wait before contacting a healthcare professional, especially until their stiffness and discomfort have persisted for several weeks or months (1). Because the condition generally manifests itself gradually rather than suddenly, people will not seek medical attention until their daily activities are severely restricted (1,9). To differentiate between a shoulder that is painful and stiff and one that has adhesive capsulitis, it is important to get comprehensive history as well as perform detailed physical examination (9). Upon examination, the patient may feel severe discomfort whilst palpating the anterior and posterior capsules of the joint, as well as the insertion site of the deltoid muscle. (9). The evaluation of the passive range of motion is the most important aspect of the patient's physical examination (9). Adhesive capsulitis is generally diagnosed clinically. Radiographic examinations rule out alternative etiologies of shoulder discomfort and can have a beneficial role in diagnosis (10). Currently, MRI and MR arthrography can provide strong imaging indicators of adhesive capsulitis, and it has been demonstrated that these MRI abnormalities correlate well with the outcome of surgery (11).

The mainstay of treatment for frozen shoulder depends on which phase of disease the patient is currently suffering. Conservative treatment is successful in up to 90 percent of the patients and should be the first line of treatment (12). Limiting inflammation by the use of NSAIDs and physiotherapy to expand the range of motion of the joint, oral steroids are among the first-line treatments employed to counter frozen shoulders (13). Positive outcomes have been documented using physiotherapy alone or in comparison to other conservative treatments (14). NSAIDs are more beneficial when taken in conjunction with physiotherapy than when used alone. Similarly, steroid injection combined with physiotherapy produced higher results than injection alone (15). In patients who don’t respond adequately to treatment, manipulation under anesthesia, intra-articular steroid injection, supra-scapular nerve block, and surgical capsular release are some methods employed to achieve pain relief and improve movement limitation (3).

In a meta-analysis, the addition of a suprascapular nerve block or an intra-articular steroid injection accelerated the functional recovery of the patients. These findings were especially significant in the inflammatory stage (16). Although corticosteroid injection is an intrusive therapy with dangers like septic arthritis, it is beneficial in reducing pain and impairment in patients during uncomfortable or frozen periods. Numerous clinical trials have been conducted across the world to investigate the early effectiveness of steroid injections (17). In comparison to a series of intra-articular injections, suprascapular nerve block provided quicker, more thorough pain relief and restored ranges of motion in a study by Jones et al. Consequently, they concluded that in primary care, a suprascapular nerve block is a well-tolerated and successful treatment for a frozen shoulder (18). This study aims to evaluate and determine the effectiveness of intra-articular shoulder joint steroid injection and supra-scapular nerve block in treating frozen shoulder, along with whether one approach is better than the other.

Materials and methods:

This double-blinded randomized control trial was conducted over 12 months at the Anesthesia, Intensive care, and Pain department of DHQ Teaching Hospital Rawalpindi. 40 patients in total presenting with Frozen Shoulders were included in the study and followed over 12 weeks, with 20 in both groups. Patients aged 30-60 years, irrespective of gender were included in the study. The patients included were those who presented with pain symptoms for over 4 weeks but less than 6 months. Patients presenting with extreme degeneration of the shoulder joint confirmed by CT and X-ray findings, those with a history of prior physiotherapy or intra-articular injections to the shoulders in the last 6 months, bilateral frozen shoulder, cervical radiculopathy, rotator cuff tears, trauma, history of allergy to injectables, and pregnant patients were excluded from the study.

The samples were randomized by a computer program into two groups: Group A and Group B receiving Suprascapular Nerve block (SSNB) and Intraarticular Shot (IAS) respectively. Physical treatment was started at home for both groups, and they were each provided an exercise program. Patients were reassessed at 2, 4, 8, and 12 weeks. Both groups received 6ml of 0.5% isobaric bupivacaine combined with 40mg depomedrol and were referred to physiotherapy afterward.

Intraarticular steroid injection:

The posterior route was used to administer the injection. The needle was positioned anteriorly towards the coracoid process and 2-3 cm below and medial to the posterolateral aspect of the acromion. The glenohumeral joint was reached when there was no more resistance to the advancement of the needle.

Suprascapular nerve block:

The Meier technique was used (19). The middle point of the scapular spine was marked while the patient was seated. A nerve stimulator needle was placed at an angle of 45 degrees coronal and 30 degrees caudal inclination to strike the suprascapular nerve. This was at a position that was selected to be 2 cm above and 2 cm medial to this midpoint. An ideal block was defined as when 0.5mA elicited external rotational movement.

The follow-up assessment of pain scores was performed via the Shoulder Pain and Disability Index (SPADI) score (20), with the evaluator also blinded to the exposure of treatment to the patient. The score was taken bi-weekly from weeks 0 to 12. There are a total of 5 questions in the SPADI score for the pain domain and 8 questions in the disability domain. The physiotherapist explained to the patients what to do after the injection. They were to take analgesics for three days, and at night, they were advised to put an ice pack on their shoulders and perform Codman pendulum movements.

Data analysis was performed on SPSS version 23. The Shapiro-Wilk test was initially used for checking the normalcy of the quantitative date, and the results were presented as the mean along with the standard deviation (SD). Categorical data were expressed by frequency and percentage. The independent t-test was used to compare the means of the two groups. The Fisher’s exact test was used to compare categorical data. Statistical significance was determined when the p-value was less than 0.05.

Ethical Review was obtained from the Institutional Review Board of Rawalpindi Medical University.

Results:

The mean (SD) age in the SSNB group was 44.60 (7.70) years and that of the IAS group was 45.40 (6.46) years. Normal distribution of data was confirmed by the Shapiro-Wilk test which showed the p values of 0.953 and 0.757 respectively confirming that the data was normally distributed. There were 10 males (50%) in the SSNB group and there were 12 males (60%) in the IAS group.

The mean score of pain in SPADI in the SSNB group was 28.45 (7.0) before the treatment. It later on improved to 21.75, 18.70, 16.65, and 11.65 at weeks 2, 4, 8, and 12 after treatment. The mean score of pain in SPADI in the IAS group was 29.2 (2.70) before treatment, it later improved to 25.5, 22.45, 18.65, and 16.85 at weeks 2, 4, 8, and 12 after treatment. The trends in the reduction of the score of pain with time are shown in **Figure 1**

The mean score of disability in SPADI in the SSNB group was 40.35 (11.39) before the treatment. Later, it improved to 27.9, 25.65, 19.85, and 14.6 at weeks 2, 4, 8, and 12 after treatment. Moreover, the mean score of disability in SPADI in the IAS group was 41.55 (5.52) before the treatment, it was improved to 34.65, 30.55, 25.7, and 22.85 at weeks 2, 4, 8, and 12 after treatment. Shapiro-Wilk test showed all the data was distributed normally (p>0.05). The trend of the reduction of the score of disability with time are shown in **Figure 2.**

The T-test was employed to compare the means of scores of pain in both groups at week 0 and it was insignificant (p=0.51). However, when the scores at different weeks after the treatment were compared, it was shown that the SSNB group had significantly lower scores at intervals of weeks 2, 4, and 12, (p= 0.01, 0.02, and 0.007). Moreover, the scores of disability showed no significant difference at week 0 amongst the groups (p=0.47). However, when comparing scores at different weeks after the treatment, the SSNB group had significantly lower scores in all intervals of weeks 2, 4, 8, and 12. (p= 0.001, p= 0.02, p= 0.007, and p< 0.001). The average decrease in mean score per week for pain was 1.41 in the SSNB group and it was 1.02 in the IAS group. Whereas, the average decrease in mean score per week for disability was 2.14 for the SSNB group, and in the IAS group it was 1.55. This information has been summarized in **Table 1.** The comparison with age and gender revealed no significant data (p>0.05).

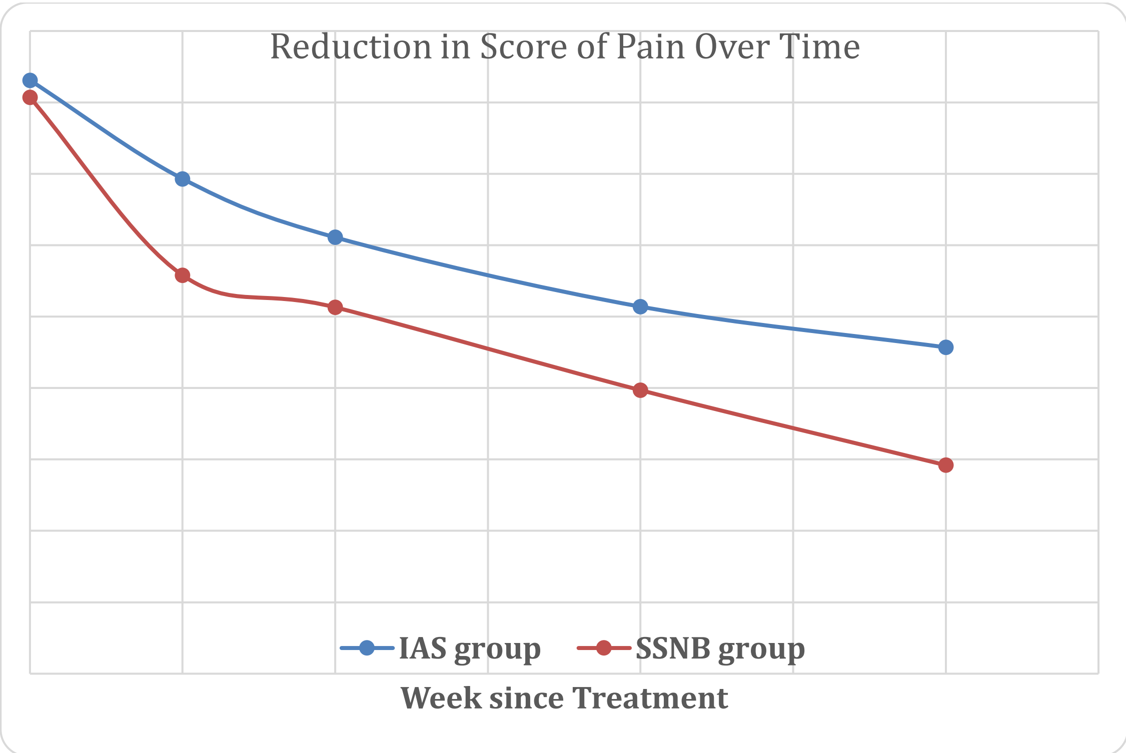

Figure 1: Trends in Reduction of Pain scores over time

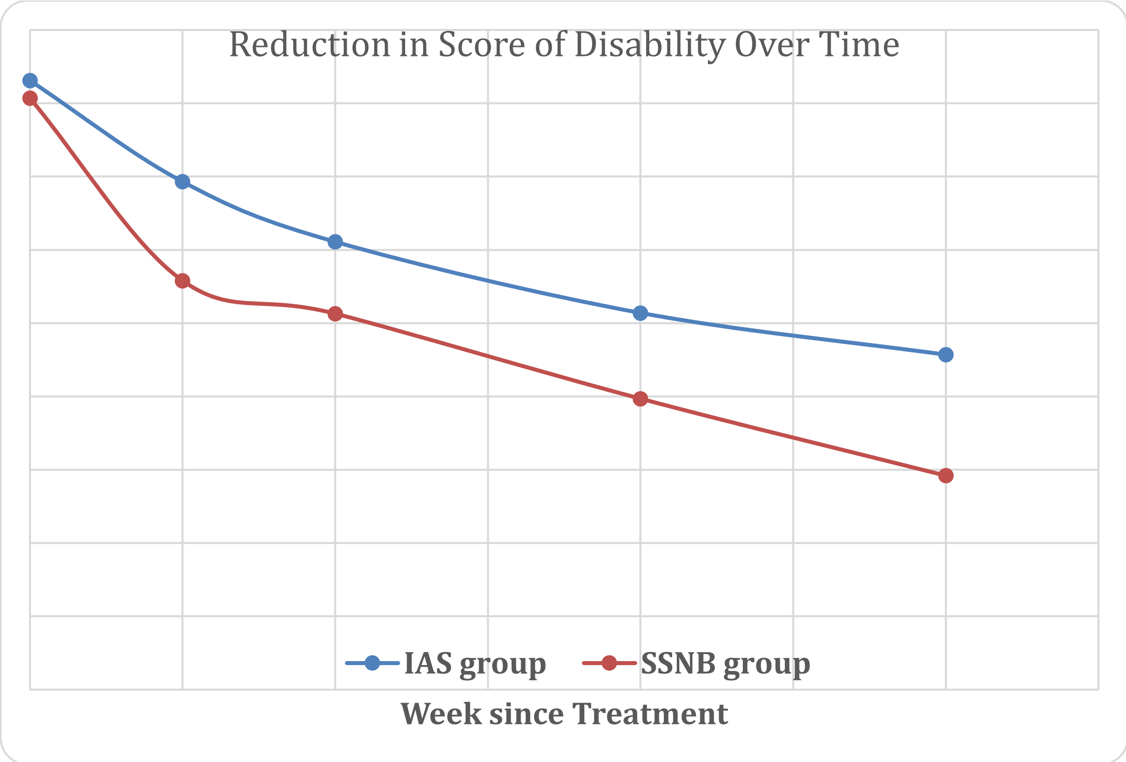

Figure 2: Reduction in Score of Disability over time

	SSNB Group	IAS Group
Reduction in mean score per week for pain	1.41	1.02
Reduction in mean score per week for disability	2.14	1.55

Table 1: Showing the average decrease in mean score of pain and disability per week in both groups

Discussion:

A frozen shoulder is a serious and excruciating shoulder condition caused by inflammation of the joint that results in soft-tissue stiffness of the capsulosynovium. For patients to engage in the physiotherapy program, pain management is essential. The goal of both, a suprascapular nerve block and an intraarticular steroid injection is to reduce the patient's pain so that exercises involving capsular stretching may be carried out (21). To improve adherence to the physiotherapy schedule and control pain, it is customary to provide a suprascapular nerve block or an intraarticular steroid injection before starting physical therapy.

Several studies have found that either of these methods can be used as adjuncts to physical therapy. Klc et al. (22) compared patients in one group who obtained only physical rehabilitation to a separate group that was given suprascapular nerve block before undergoing physical therapy in an RCT including 41 participants. They found that suprascapular nerve block is more effective than physical therapy alone in improving function and relieving pain. It is also safe and well-tolerated. Sun et al. (23) showed that in a meta-analysis of nine RCTs, intraarticular steroids before physical therapy reduced external rotation range and SPADI score among individuals with frozen shoulders when compared to physical rehabilitation alone. Intraarticular steroids have also been shown to yield favorable results by Lee et al. (24) and Bulgen et al. (25). There have been some other studies comparing physiotherapy alone with physiotherapy in addition to an IAS injection or SSNB. A study by Abdelshafi et al showed that an intra-articular corticosteroid shot with physiotherapy was more effective than physiotherapy alone in the management of pain in frozen shoulder (26). However, a clinical trial by Taskaynatan et al. did not achieve a statistically significant difference (27). Green et al stated that physiotherapy alone is not effective at all in the treatment of a frozen shoulder (28). Bulgen et al (25) showed none of the treatment regimens had a long-term benefit. However, it was reported in these studies that these steroid shots can have a beneficial outcome in decreasing discomfort and increasing range of motion, especially in the early stages.

A study by Mardani-Kivi M et al. found that the VAS and SPADI scores, in addition to the amount of movement the joint could undergo (ROM), significantly improved in the SSNB group as compared to the other two groups (p0.001), which included the IAS group and physiotherapy alone (PT) group. In the other two groups, it was shown that the IAS group outperformed the PT group (29). These results are essentially similar to our study as our RCT also states that significantly better outcomes in the SSNB group were achieved compared to the IAS group. Similar to ours, an RCT conducted by Parashar et al. (30) showed that when comparing the IAS group to the SSNB group , improvements in most of the parameters examined were observed; these improvements were statistically significant in internal rotation, pain score, and disability score, but not in total range of motion or exterior rotation. It was determined that SSNB in conjunction with non-invasive rehabilitation (NIR) was a safe and successful treatment option for idiopathic frozen shoulder. (30). Additionally, the current study demonstrates that SSNB plus NIR is a more successful treatment for unexplained frozen shoulder than either NIR by itself or NIR plus IAI. The suprascapular nerve block provided quicker and more thorough relief from pain and flexibility in the range of motion recovery than several rounds of intra-articular injections, according to a study conducted by Jones et al (18). He also suggested that suprascapular nerve block can be used effectively and safely in a primary healthcare facility and suggested that larger multicenter trials should be conducted (18). Our study concludes that there is not a significant correlation between age and pain or disability of frozen shoulder. Moreover, gender also did not impact the scores of pain and disability. Similar results have been shown in literature published before (3,30).

Numerous theories have been put forth in an attempt to explain the precise mechanism of pain relief in SSNB. These include a "wind down" phenomenon that results in a decrease in the central sensitization of dorsal horn nociceptive neurons (following a reduced peripheral nociceptive input), a reduction in pain-producing substances in the synovial fluid, and infiltration into the supraspinatus muscle during the block (31). Our study has demonstrated that SSNB is superior to intraarticular injection. This may be explained by the sensory supply provided by the suprascapular nerve to about 70% of the shoulder joint, which includes the acromioclavicular joint, the superior and posterosuperior regions of the glenohumeral joint and capsule, as well as motor branches to the supraspinatus and infraspinatus muscles (32). In blindly attempted intraarticular injection, there is a chance of the drug seeping into the surrounding tissues. Previous research has found that blind intraarticular injections had a lower success rate than ultrasound-guided injections (33). Since the anatomical landmark strategy is the most widely used technique globally, we employed it for our study as well. Some of the SSNB issues that have been previously reported, including pneumothorax (34), were not seen in our study. With SSNB, no long-term risk of accidental septic arthritis or cartilage atrophy is present in contrast to intraarticular corticosteroid injection.

Our study has certain limitations. Firstly, due to a limited sample size, the power of the study is limited, and a larger sample size would not only increase the power but also yield more robust results. Moreover, for diagnosing frozen shoulder, only clinical assessment and no MRI imaging was used.

Conclusion:

In conclusion, our study showed that SSNB in addition to physiotherapy is a superior method of pain and disability control than intra-articular steroid injection in patients with frozen shoulders. Moreover, our study also showed that there is no significant relation between pain and disability in the frozen shoulder with age and gender. Further research should focus on the long-term effectiveness of these therapies.

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Conflicts of Interest:
The authors have no conflicts of interest.

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