ORIGINAL RESEARCH

Comparative study of Shoulder Hydrodilatation with Suprascapular Nerve Block versus Hydrodilatation in Stage 2 Frozen Shoulder: A Retrospective Analysis

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ABSTRACT

Background: Frozen shoulder (FS) is usually a self-limiting but debilitating condition, with pain and limitation in range of motion of the involved shoulder which may peak at 3-6 months. Early shoulder exercises are painful but important to achieve full range of motion. So early interventions like hydrodilatation (HD)with suprascapular nerve blocks (SSNB) when performed prior to physical therapy can alleviate the severe pain, inflammation and make rehabilitation easy. This study aims to know the effect of SSNB on shoulder hydrodilatation, procedural comfort, and effect on pain and disability scores at 12 weeks follow up. **Methods:** Our study was a retrospective observational study which included 30-60 years old patients, diagnosed with stage 2 of FS who had underwent intervention. Group SSN+HD received suprascapular nerve block with local anesthetic, followed by hydrodilatation whereas Group HD no nerve block was given. The functional outcome was evaluated by Shoulder Pain and Disability Index (SPADI) score and shoulder active range of motion (ROM) measured at 2 weeks, 6 weeks and 12 weeks. Intraprocedure VAS score was measured. **Result:** The results of this study show that SSN block provides better intraprocedure VAS (3.8 vs 8.3 $p< 0.001$) and ease of HD and manipulation than HD alone .At the end of 12 weeks, both the groups improved significantly from the baseline SPADI score but SSN+HD group had significantly less scores ($p < 0.001$). The ROM for active abduction ($p< 0.008$) and forward flexion ($p < 0.001$) was also improved significantly in SSN+HD group. **Conclusion:** Both SSNB+HD and HD are effective in reducing pain and improving shoulder function. However, augmentation with SSNB has significantly better results.

Keywords: Frozen shoulder, hydrodilatation, SPADI, suprascapular nerve block, range of movement

INTRODUCTION

Frozen shoulder (FS) is usually a self-limiting condition, with pain and limitation of motion of the involved shoulder and with recovery within 2 to 3 years for most of the patients[1].

FS typically goes through three overlapping clinical stages based on severity of limitation of shoulder range of motion (ROM) and the patients' pain level. Stage I (freezing) is the inflammatory stage and includes worsening pain but limited effect on the ROM of joint. Stage II (frozen) involves some decrease in pain but increased stiffness resulting in considerable loss of shoulder function and affects patients' daily routine activities. Stage III (thawing) is characterized by reduced pain, and a gradual improvement in stiffness over a few months to years. Although symptoms of stiffness and mild to moderate pain have been reported in 27–50% of patients once the long term was done[2] . Thus, the clinical course of the condition can comprise of an extended period of pain, and functional limitations.

The exact evidence based model for the management of FS is yet to be defined. Management strategies depend upon the stage of the disease and include pharmacological therapy, associated physiotherapy, HD of the shoulder capsule with or without a SSNB, arthroscopic capsular release etc[3].

Currently there's no gold standard therapeutic regimen which is universally acceptable as the most effective treatment for restoration of range of motion in Stage 2 frozen shoulder and reducing pain in these patients[4].It has been widely accepted that

hydrodilatation (HD) combined with physical therapy is useful in management of adhesive capsulitis, and leads to improved function and better joint mobility [5-6].

In late freezing or early frozen stage, shoulder capsular distension done with steroid, saline, local anaesthetic agent is supposed help in reducing inflammation and break the 'early intracapsular fibrosis' which may help in improving range of movement (ROM)[7-9]. However, such interventions are painful, which can have a negative effect on patient compliance in the rehabilitation program. Therefore, a suprascapular nerve block (SSNB) when given in conjunction with hydrodilatation (HD) might be a more beneficial approach prior to beginning of physical therapy[10-12].

Use of steroids, as used in many studies with SSNB can be detrimental to the patients especially diabetics due to systemic absorption[13], so in our practice , patients were given only local anesthetic (LA) at the SSNB site and the interventions were done with the purpose of better passive stretching intraprocedure aiming at early and comfortable rehabilitation.

Thus, the study aims to understand the effect of HD with or without SSNB with LA only in patients of second stage of frozen shoulder. The literature regarding the same is not present in our knowledge.

METHODS

We retrospectively assessed medical records of patients aged 30- 60 yrs old, presenting to the pain clinic OPD with stage 2 of FS and treated with Ultrasound (USG) guided shoulder hydrodilatation procedure with or without suprascapular nerve block (SSNB) at the spinoglenoid notch, at the pain clinic of a tertiary care medical college, between November 2021 and December 2023.The patients undergoing these procedures were informed that the their outcomes and follow-ups might be used for publication purposes in the future, and informed consent was obtained regarding the same.

Patients of age 30-60 years with pain and stiffness in predominantly one shoulder for more than 3 months, and restriction of passive motion more than 30° in 2 or more planes, when measured with a goniometer; were included in our study. A shoulder ultrasound was performed in all the patients, along with an AP view shoulder X-ray was done and reviewed by a trained pain physician .

Patients having evidence of a complete rotator cuff tear, systemic inflammatory disease an allergy to any agent used, pregnancy and any previous surgery in the shoulder in the last 12 months, were excluded from the study.

Sample collection – The samples were divided into two groups. Group SSN+HD patients had received SSN at the spinoglenoid notch followed by glenohumeral joint HD and steroid injection . Group HD patients had received joint HD without nerve block (Figure 1).

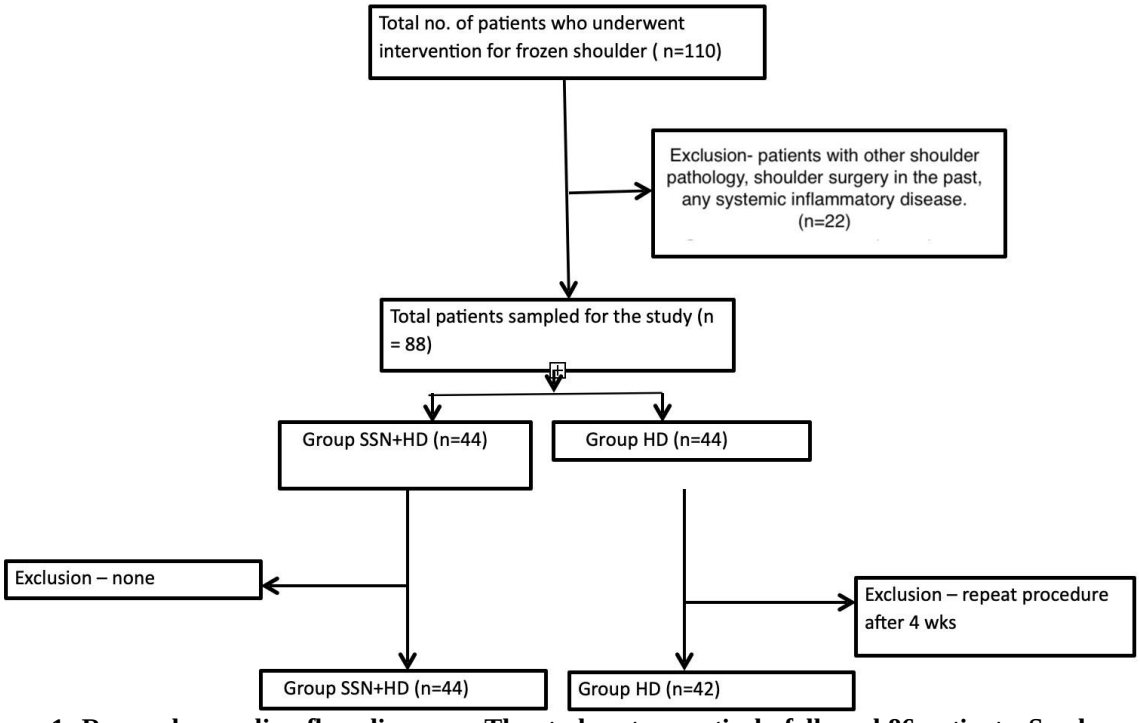

Figure 1- Research sampling flow diagram : The study retrospectively followed 86 patients. Samles were divided into two groups.Group SSN+HD patients had received SSNB at the spinoglenoid notch followed by glenohumeral joint HD and steroid injection . Group HD patients had received joint HD without nerve block. Group SSN +HD and Group HD comprised of 44 and 42 patients respectively.

All procedures were done by the same pain physician in the out patient procedure room of the pain clinic. A 20 G i.v.cannula was inserted. Under full aseptic precautions USG guided block procedure were performed.

In Group SSN+HD, the patient was positioned in lateral decubitus position with the symptomatic side in a non- dependent position and the patient facing the clinician. The USG machine (GE LOGIQ V2 Colour Portable ultrasound machine) was placed on the opposite side of the table. The non dependent arm was placed across the chest. SSNB was performed at the spinoglenoid notch under USG guidance using a 5–13 Hz linear transducer. Spinoglenoid notch was identified by scanning the inferior aspect of the spine of scapula from medial to lateral side. A 23-gauge short-beveled 8 cm quincke spinal needle was inserted out of plane, in contact with the bone. After negative aspiration, 4 ml of 2 % lignocaine and 4 ml of 0.5% bupivacaine was injected. (Figure 2 and 3).

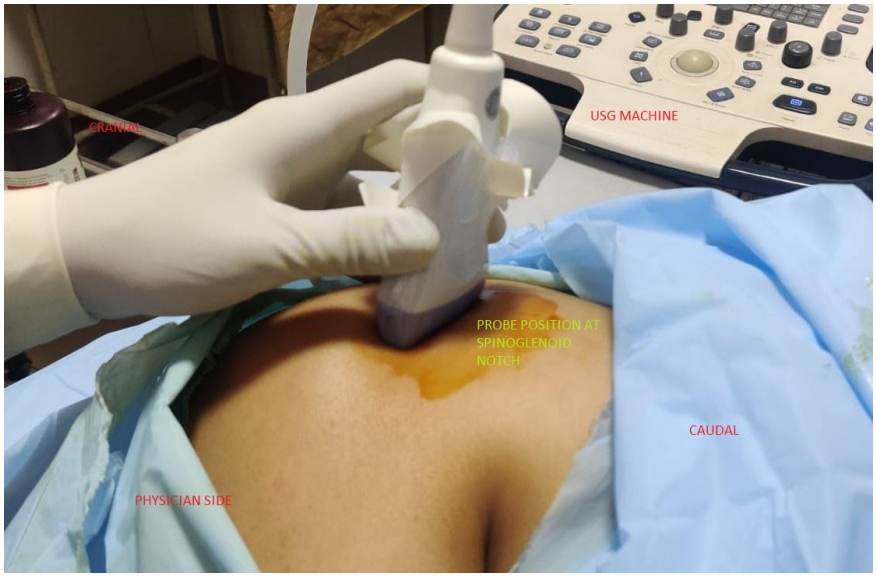

Figure 2 - The identification of suprascapular nerve at the spinoglenoid notch. The patient was in lateral decubitus position with the symptomatic side up and the patient facing the clinician. The USG machine placed on the opposite side of the table. SSNB was performed at the spinoglenoid notch under USG guidance using a 5–13 Hz linear array transducer. Spinoglenoid notch was identified by scanning the inferior aspect of the spine of scapula from medial to lateral side.

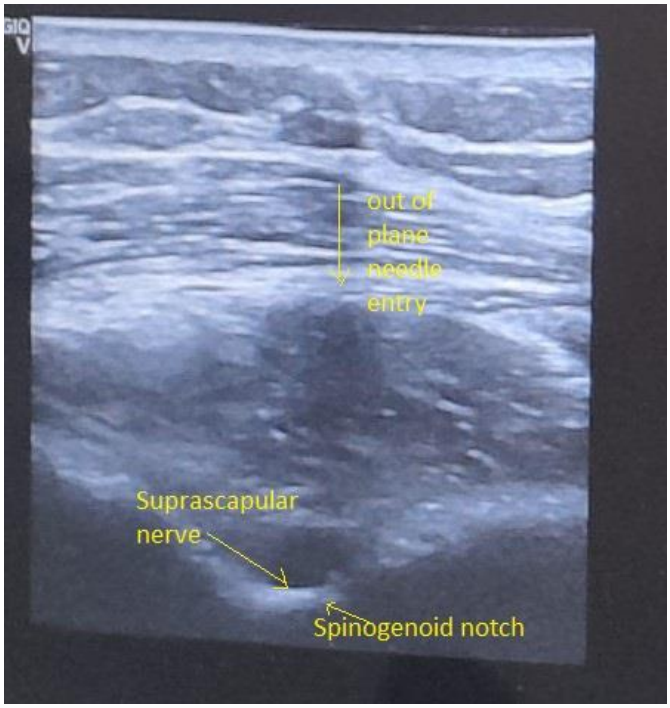

Figure 3 - A 23-G(3.5 inch) quincke spinal needle was inserted out of plane, in contact with the bone. After negative aspiration, 4 ml of lignocaine 2% and 4 ml of bupivacaine 0.5% was injected.

After that, the posterior glenohumeral joint was identified by sliding the tranducer laterally and after 10 min of SSNB, 23-G spinal needle was inserted in the joint in plane and 6 ml of lignocaine 2% given. Five minutes later, hydrodilatation was started and 30-40 ml of normal saline was injected slowly. It was stopped once the patient was not able to tolerate the procedure. Then 40 mg of triamcinolone acetonide mixed in 6 ml of 0.5 % bupivacaine was administered slowly (Figure 4 and 5).

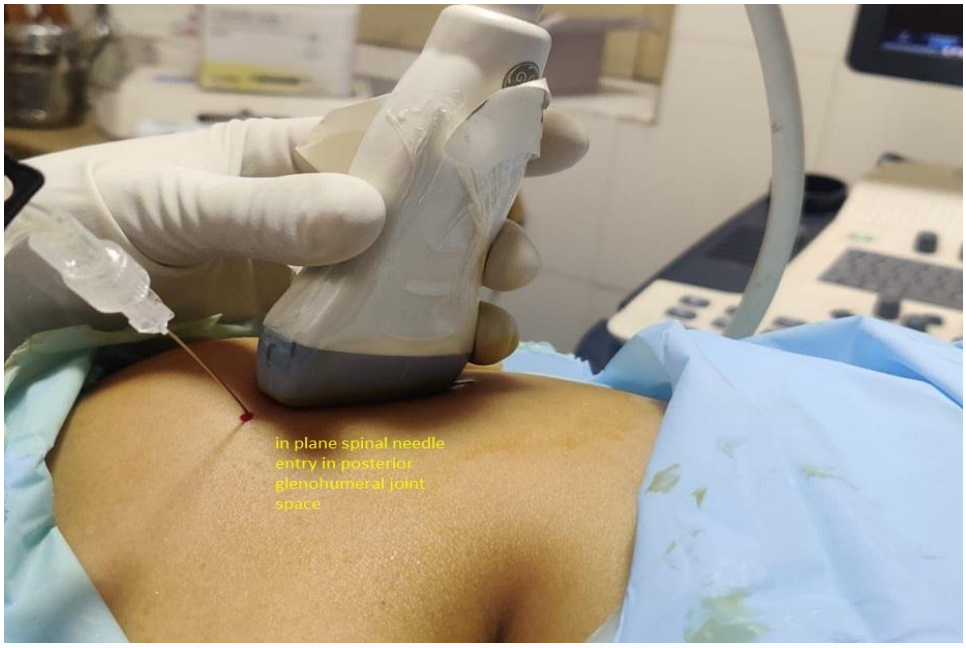

Figure 4 - Glenohumeral joint hydrodilatation by posterior approach . The posterior glenohumeral joint was identified by sliding the tranducer laterally from the position of spinoglenoidnotch .

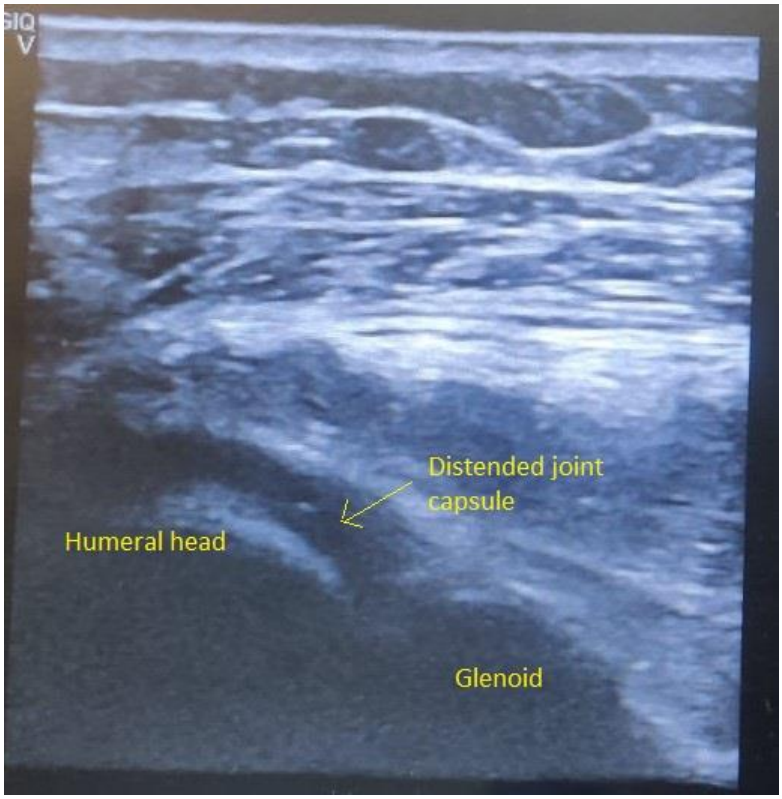

Figure 5 -After 10 min of SSNB, 23-G spinal needle was inserted in the joint space , in- plane and 6 ml of lignocaine 2% given. Five minutes later, hydrodilation was started and 30-40 ml of normal saline was injected slowly. It was stopped once the patient was unable to tolerate the procedure. Then 40 mg of triamcinolone acetonide mixed in 6 ml of 0.5 % bupivacaine was administered slowly

Intra-procedure VAS score (0-10) was measured and documented. Following the procedure, after 10 minutes, the clinician did passive stretching of the shoulder joint with support to humerus head and scapula by their one hand and stretching into external rotation, flexion and abduction by another hand. Post procedure an exercise protocol was needed to be followed by the patients that had been taught before the procedure.

In Group HD, Shoulder Hydrodilatation was done in a similar manner as group SSN+HD but without the SSNB.

If at the completion of 4 weeks, the pain VAS was more than 6, patients were adviced repeat procedure and those patients were excluded from the analysis.

For comparing the efficacy of treatment, Shoulder Pain and Disability Index (SPADI) score was used. The SPADI is a self-reported questionnaire consisting of 13 items on two domains: pain-5 items and disability-8 items, and it uses a 11-point numerical rating scale of difficulty from 0 to 10. The scale produces a total score out of 130 and is subdivided for pain parameters (maximum score of 50) and disability parameters (maximum score of 80). A higher score on the SPADI is indicative of higher perceived pain and/or disability. The minimal clinically important differences(MCID) for this tool has been reported to range between 8 and 13 points[14].

SPADI scores were collected at baseline and at 2, 6 and 12 weeks followup procedure. Participants' range of lateral abduction, active forward flexion and combined extension and internal rotation were assessed at each of these visits. This was done by a goniometer. Combined extension and internal rotation were assessed using the back scratch test and thumb position was used to interpret data by an eight point Likert scale. 1 was thumb reaching ipsilateral greater trochanter, 2 is reaching ipsilateral buttock , 3 is ipsilateral sacroiliac joint, 4 is lumbosacral junction, 5 is lower lumbar spine (up to L3), 6 is upper lumbar spine (up to L1), 7 is lower thoracic spine (up to T9), 8 is middle thoracic spine (up to T5). To simplify for statistical purposes, the internal rotation positions 1–3 were graded as severe restriction; 4–6 as a moderate restriction; and 7–8 as a mild restriction.

Statistical analysis was performed with the use of SPSS Statistics v 29.0. The quantitative data are reported as mean ±SD and was analyzed using independent sample student's T-test and paired sample T-test. The nonparametric data were analyzed using Mann-Whitney test.

Qualitative data are reported as frequency and percentage and Chi-square test was used to find the association between qualitative variables. A P value less than 0.05 was considered significant. Figure 1 depicts the methodology of our study.

RESULTS

The groups were comparable with respect to the baseline characters of age, sex, duration of symptoms, baseline active abduction and forward flexion. $p<0.05$ is statistically significant. Table 1 depicts the baseline characteristics of our study.

Table 1- Baseline characteristics of study groups.

		Group SSD+HD (n= 44)	Group HD (n=42)	p value
Age in years (mean±SD)		45.48 ± 8.42	46.45 ± 7.53	0.573* [NS]
Sex	Female n(%)	28(63.6)	22(52.4)	0.290* [NS]
	Male n(%)	16(36.4)	20(47.6)	
Duration of symptoms (in months) (mean±SD)		5.59 ± 1.72	6.12 ± 1.89	0.178* [NS]
Baseline active lateral abduction in degrees (mean ± SD)		67 ± 15	70 ± 12	0.310* [NS]
Baseline active forward flexion in degrees (mean ±SD)		83 ± 7	80 ± 10	0.110* [NS]

*=independent sample t test, #=chi-square test, [NS]=not significant, $p < 0.05$ is statistically significant

At the beginning of the study, both groups were comparable regarding the SPADI scores (72.8±6.5 for SSN+HD and 72.6±6.7 for HD) (Mean±SD). The difference between the two means was not statistically significant ($p = 0.936$). After two weeks, there was a notable difference between the groups. The SSN+HD group had a substantially lower score (22.4±3.2) compared to the HD group (40.0±7.9) ($p < 0.001$), indicating that the SSN+HD intervention had a significant impact within this short timeframe. Similar to this trend, the SSN+HD group continued to have a lower score (30.3±3.4) compared to the HD group (39.7±3.4) at 6 weeks, and even at 12 weeks, the SSN+HD group maintained a lower SPADI score (19.7±3.9) compared to the HD group (25.9±4.1), with a statistically significant difference ($p< 0.001$) (Figure 6).

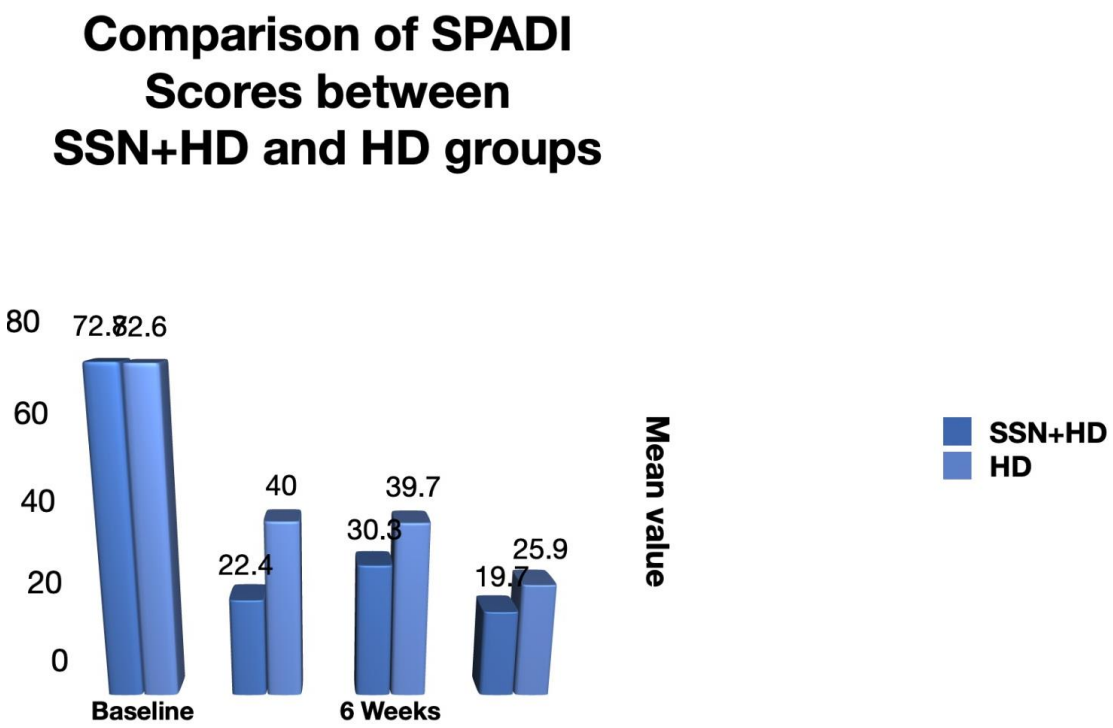

Figure 6 - The trend of SPADI over the duration of 2, 6 and 12 weeks in SSN+HD and HD groups.

The intra-procedural VAS scores also showed a significant difference between the groups. The SSN+HD group had a substantially lower VAS (3.8±0.9) compared to the HD group (8.3±0.9), with a highly significant difference ($p < 0.001$), indicating better outcome in the SSN+HD group (Figure 7).

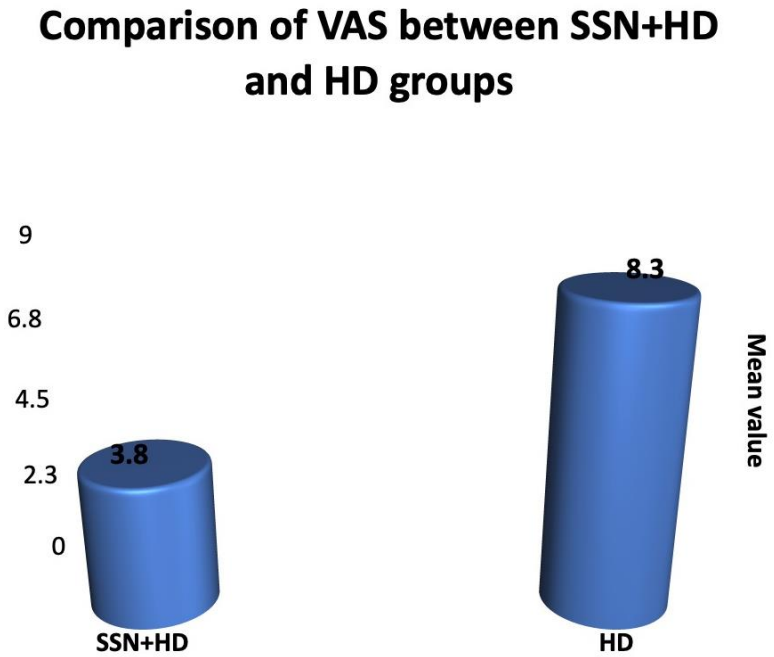

Figure 7 – The intraprocedure VAS score difference between the two groups.

The active range of motion were represented as mean ±SD and measured in degree. The active lateral abduction for the HD group was 70 ± 12, while for the SSN+HD group, it was slightly lower at 67 ± 15. At the end of 12 weeks, the SSN+HD group (115 ± 12) showed a significantly higher mean for lateral abduction compared to the HD group (108 ± 12) and the difference was statistically significant ($p = 0.008$). Active Forward Flexion at baseline for the HD group was 80 ± 10, whereas for the SSN+HD group, it was slightly higher at 83 ± 7, which were comparable.

At the end of 12 weeks, the SSN+HD group (180 ± 10) showed a significantly higher mean value for

forward flexion compared to the HD group (122 ± 14) $p < 0.0001$).
Overall, the SSN+HD group showed greater improvements in both active lateral abduction and active forward flexion compared to the HD group as shown in Table 2.

Table 2- Comparison of Active lateral abduction & Active forward flexion in HD group with SSN+HD group at the end of 12 weeks

		Baseline Mean ±SD	12 wks Mean ±SD
Active lateral abduction (degree)	HD	70 ± 12	108 ± 12
	SSN+HD	67 ± 15	115 ± 12
p* value		0.303	**0.008**
Active forward flexion (degree)	HD	80 ± 10	122 ± 14
	SSN+HD	83 ± 7	180 ± 10
p* value		0.110	**0.0001**

The frequency distribution of movements of combined extension and internal rotation was as per the 8-point Likert scale. Most of the patients had mild (43.2% in SSN+HD and 42.9% in HD) to moderate (43.2% in SSN+HD and 45.2% in HD) restriction of movement in both the groups at the end of 12 weeks. A minor proportion (13.6% in SSN+HD and 11.9% in HD) of the patients had severe restriction of movement (Figure 8).

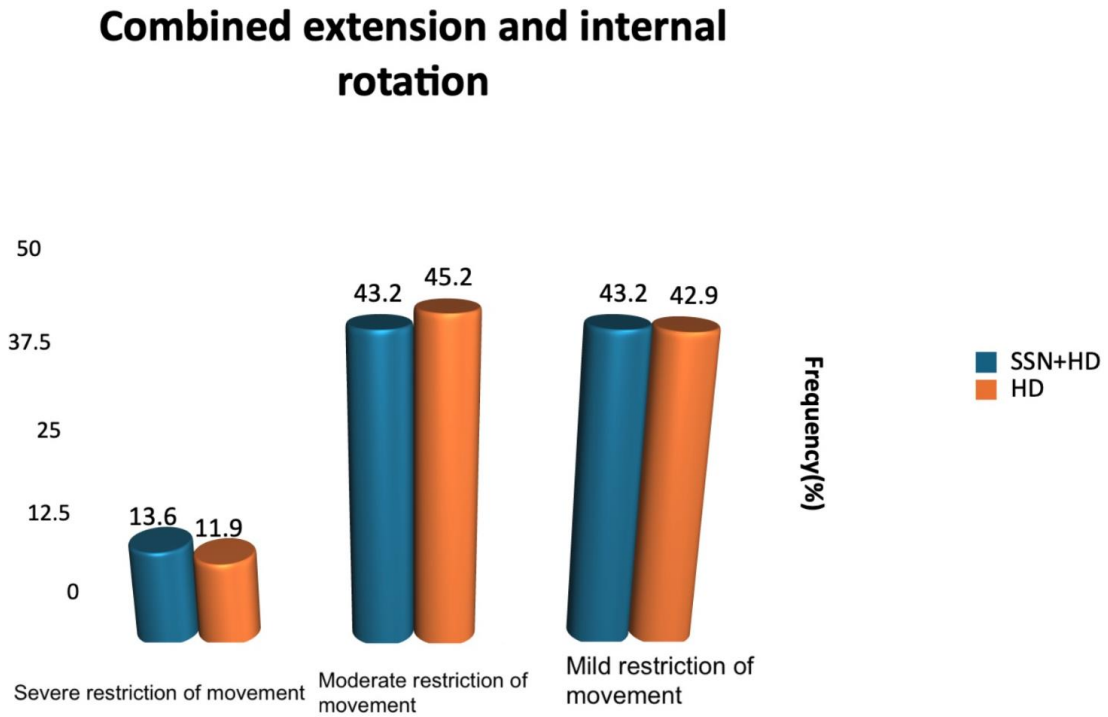

Figure 8- Frequency distribution of combined external and internal rotation movements on the basis of Likert scale in SSN+HD and HD groups.

DISCUSSION

Frozen shoulder (FS) is usually a self-limiting but debilitating condition, with pain and limitation in range of motion of the involved shoulder which may peak at 3-6 months [15-17]. Early shoulder exercises are painful but important to achieve full range of motion. Hence, early interventions like HD with SSNB when performed prior to physical therapy can alleviate the severe pain, make rehabilitation much easier and patients will be more complaint towards the physical therapy[18-20]. Our study has retrospectively tried to investigate whether addition of SSNB prior to HD, improves intra-procedure pain scores and 12 week pain and functionality among stage 2 frozen shoulder patients. Based on our findings, both HD and the groups resulted in improved outcome on the basis of

SPADI scores at 2, 6 and 12 weeks follow-ups, but the group with nerve block was better.

Moreover, during the injection, the VAS scores of SSN+HD group were much lower as compared to HD alone, implying that patients had less pain intraprocedure with a prior nerve block. More effective passive joint stretching could be done in such patients just postprocedure. The range of active abduction and forward flexion was significantly better in the nerve block group. One of the contributing factor could be better passive joint stretching just post procedure and better capsular stretching during hydrodilatation due to less pain . Though in combined extension and internal rotation, there was not much difference between the 2 groups .As per the results of this series, a combination of SSNB with HD seems to reduce the disability and pain in cases of stage 2 frozen shoulder patients. In spite of the small sample size, the statistical methods have proven to give significant results.

However, there are a few limitations to our study. First, being a retrospective observational study, the allocation bias is a concern. A randomized controlled trial in a prospective manner would have been more appropriate. Furthermore, the post-procedure physical therapy was same in both groups in order to decrease the impact of various confounding variables. Secondly, some studies have depicted that diabetics fair worse in the post-treatment period [20-21]but we were unable to do such an analysis because of the retrospective nature of our study and the relatively small sample size. Also, the results or our study may not be generalizable in all stages of adhesive capsulitis as we have only included patients in stage 2 of the disease. Another limitation is the short follow-up duration of our study, a longer follow-up is needed to assess better treatment.

Many studies have been performed that have compared the efficacy of SSNB with that of intra-articular injections in the management of frozen shoulder. Hydrodilatation has demonstrated transient improvement in shoulder pain and disability during the early follow-up duration [20].

A systematic review and meta-analysis compared the pooled effects of HD vs intra-articular corticosteroids and concluded that HD leads to transient but more marked improvements in shoulder disability and ROM. They also mentioned thatgood mobilization after HD is a promising and effective adjuvant treatment option for patients suffering from a FS[22].Hai V Le et al could not conclude on any single treatment protocol to be universally effective[23]. Wang JC et al concluded that HD once done with 40 and 10 mg steroid, had similar improvements in shoulder parameters at 3 months [13].

HD works by stretching the joint capsule. Around 43% of the patients have described HD to be very painful[9].

A study by Yoon et al. [24] showed that HD yields a rapid improvement in pain and mobility after 3 months. However, 6 months post treatment, they did not observe any significant differences between intra-articular or subacromial steroid injections and hydrodilatation. Debeer P et al [25] observed similar findings after hydrodilatation in patients of depression, kinesiophobia and anxiety having frozen shoulder.

Many authors have used SSN with steroids and compared it with hydrodilatation[26,27], most likely to decrease pain for physical therapy but the results cannot be exactly correlated whether the improvement in ROM was because of the nerve block or due to the immediate anti-inflammatory effects of the corticosteroids given along with the nerve block . Hence, we have eliminated the steroid component at the SSN and only given local anesthetic in our, in order to correctly correlate the efficacy of this treatment modality.

The ASES (American Shoulder and Elbow Surgeons Standardized Shoulder Assessment) and intra-procedure VAS scores at, 1 month and 6 months were assessed by Albana et al, in 2 groups of HD and SSN+HD with extra 20 mg steroid injections at the SSN, in SSN+HD group and they concluded that though intraprocedure VAS score was decreased in the nerve block group but functional scores significantly higher only in the first month but not at 6 months[28].

Although both SSNB and HD have been researched on individually in various studies[12,19,21,29,30] ,we could not find any study that has compared SSNB without any steroid for such procedure.

CONCLUSION

SSNB at the spinoglenoid notch with local anesthetic pre procedure in conjunction with hydrodilatation in stage 2 frozen shoulder patients, shows better outcomes at 12 weeks of follow up in terms of pain and functionality and better patient compliance towards physical rehabilitation in the postprocedural period. Hence, this combination can be a better treatment choice for these patients.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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