JOINTS (Journal Orthopaedi and Traumatology Surabaya)
October 2025; 14(2): 99-104, DOI: 10.20473/joints.v14i2.2025.99-104
Received: 02 September 2025 / Revised: 11 October 2025
Accepted: 20 October 2025 / Published: 30 October 2025

Original Article

Hypertonic Dextrose Prolotherapy Injection Improves Clinical Outcomes in Shoulder Impingement Syndrome with Diabetes Mellitus: A Quasi-Experimental Study

Rita Vivera Pane[1,2], Aufar Zimamuz Zaman Al Hajiri[3]

[1]Department of Physical Medicine and Rehabilitation, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia
[2]Department of Physical Medicine and Rehabilitation, Hajj Regional Hospital, Surabaya, Indonesia
[3]Faculty of Medicine, Universitas Nahdlatul Ulama Surabaya, Surabaya, Indonesia

Correspondence should be addressed to Rita Vivera Pane, Department of Physical Medicine and Rehabilitation, Universitas Nahdlatul Ulama Surabaya, Raya Jemursari No. 51-57, Jemur Wonosari, Wonocolo, Surabaya 60237, Indonesia e-mail: dr.rita@unusa.ac.id

ABSTRACT

Background: Shoulder impingement syndrome (SIS) is the most common cause of shoulder pain. Current conservative management approaches often require years for patients to achieve pain relief. This study aimed to identify the effects of hypertonic dextrose prolotherapy (HDP) injections on pain levels and shoulder functionality in SIS patients with diabetes mellitus.
Methods: A quasi-experimental study was conducted recruiting SIS patients at Hajj Regional Hospital, Surabaya, Indonesia, from January 2022 to December 2023. The study group was divided into two: the HDP group, which received a 5 mL injection of HDP at a concentration of 20%, and the control group, which received pharmacotherapy and regular rehabilitation therapy. While the control group received regular pharmacotherapy and rehabilitation therapy only. The study outcomes assessed were the Numeric Rating Scale (NRS) and shoulder Active Range of Motion (AROM). The evaluation was conducted three times: before the intervention, immediately after the intervention, and two weeks after the intervention.
Results: A total of 20 study participants were divided into two groups: 10 in the HDP group and 10 in the control group. Inter- and intragroup analyses showed significant differences in NRS mean values between the HDP and control groups ($p < 0.05$). Similarly, AROM analysis showed significant differences in mean values between the HDP and control groups, both inter- and intra-group ($p < 0.05$).
Conclusions: HDP injection reduces pain intensity and improves shoulder AROM within two weeks after injection.

Keywords: Active range of motion; Diabetes mellitus; Hypertonic dextrose prolotherapy; Numeric rating scale; Shoulder impingement syndrome

INTRODUCTION

Shoulder impingement syndrome (SIS) is one of the most common causes of shoulder pain.[1] SIS is a commonly used term referring to patients with shoulder pain. In patients with SIS, there is soft tissue impingement that triggers pain every time they raise their arms. The suspected pathological mechanism is structural narrowing of the subacromial space.[2] However, there are many potential etiologies underlying SIS, making diagnosis more difficult. It is a complex condition involving a combination of intrinsic and extrinsic factors.[3] As a first step, a comprehensive medical history and focused physical examination can be key indicators for establishing a diagnosis of SIS. For further evaluation and accurate diagnosis, investigations including X-rays, ultrasound (US), and magnetic resonance imaging (MRI) may be recommended.[1,2]

Management that can be considered at the beginning of the visit is conservative therapy, including physical therapy and anti-inflammatory

drugs.[1] However, conservative treatment only provides satisfactory results within 2 years in 60% of cases. This significantly impairs productivity in most patients. If symptoms persist after conservative therapy, other alternatives may be considered, including invasive and non-invasive procedures. Invasive procedures may involve surgery, but patients often refuse due to fear of surgery. Therefore, non-invasive procedures are more commonly considered, including injections with regenerative agents.[2]

A randomized controlled trial (RCT) involving 31 patients with chronic supraspinatus tendinopathy evaluated the effects of hypertonic dextrose prolotherapy (HDP). The intervention group received 20% HDP injections at the supraspinatus enthesis under ultrasound guidance, while the control group received 5% normal saline. The results showed that HDP injections reduced pain, prevented disability, and improved shoulder function based on active range of motion (AROM).[4] Another RCT study also evaluated the effect of HDP injection on pain levels and disability in 57 patients with chronic supraspinatus tendinosis. The study group was divided into two, with 29 patients allocated to the intervention group (receiving 20% HDP injection) and 28 patients allocated to the control group (receiving 5% normal saline injection). The study concluded that HDP injections alleviated short-term pain and disability in patients with chronic supraspinatus tendinosis.[5]

This study aimed to evaluate the effect of HDP injection in patients with SIS and diabetes mellitus on pain intensity and shoulder function.

MATERIAL AND METHODS

Study Design

This study used a quasi-experimental, non-randomized design and included patients diagnosed with SIS and diabetes mellitus at Hajj Regional Hospital, Surabaya, Indonesia. Participants were recruited from the Physical Medicine and Rehabilitation Outpatient Clinic between January 2022 and December 2023. A consecutive non-probability sampling method was applied. All patients who visited the clinic during the study period and met the inclusion criteria were invited to participate until the target sample size was achieved.

Inclusion and exclusion criteria

Participants included adults aged 30–70 years who had chronic shoulder pain lasting more than three months, were clinically diagnosed with SIS, and had diabetes mellitus. Patients were excluded if they had a history of shoulder or cervical spine surgery, post-traumatic shoulder injury, or full-thickness rotator cuff tears.

Intervention

All participants assigned to the HDP group received a 5 ml injection of HDP at a concentration of 20% into the supraspinatus tendon and subacromial-subdeltoid bursa (SASD) under aseptic conditions with US guidance. The US device used was a Canon Xario 100 model. The probe used was an 18L7 linear transducer with a frequency of 7.2–14 MHz. HDP injections were administered by physiatrists certified in interventional pain management. In addition to receiving HDP injections, the HDP group also received non-interventional therapy, including pharmacotherapy and regular rehabilitation management: ultrasound diathermy (USD), transcutaneous electrical nerve stimulation (TENS), and shoulder AROM exercises. Meanwhile, the control group received the same pharmacotherapy and regular rehabilitation therapy as the HDP group without HDP injections.

Study Outcome

The outcomes defined in this study were divided into two categories: patient pain levels and patient shoulder functionality. Patient pain levels were determined using a numeric rating scale (NRS). NRS is a tool for measuring the level of pain experienced by each individual. NRS measurements are taken by a doctor or examiner by directly asking

the patient about the level of pain they are currently experiencing. There are a total of 11 pain levels, ranging from level 0, which indicates no pain at all, to level 10 (the maximum level), which indicates severe pain. The patient responds with a single number (on a scale of 0 to 10) indicating the level of pain they are currently experiencing, which is the NRS score assigned.[6]

The shoulder AROM assessed in this study included flexion, abduction, external rotation, and internal rotation. These measurements were performed using a standard two-arm goniometer. Shoulder flexion and abduction were evaluated in the standing position, shoulder extension was measured with the elbow flexed at 90° in the prone position, shoulder internal rotation was measured with the shoulder abducted at 90° and the elbow flexed at 90° in the prone position, and external rotation of the shoulder is measured with the shoulder abducted 90° and the elbow flexed 90° in the supine position.[7] These two outcomes were assessed three times each, including: before receiving the intervention, immediately after receiving the intervention, and two weeks after receiving the intervention.

Data Analysis

General data, including age and sex, were collected and analyzed descriptively. It's presented as mean and standard deviation (SD) or number (*n*) and percent (%). Main data, including NRS and shoulder AROM, were presented as mean and SD for each group. The statistical analyses included intergroup and intragroup comparisons. Intergroup differences between the HDP and NS groups were assessed using an independent sample t-test, while intragroup changes across the three evaluation points were analyzed using repeated -measures ANOVA. The significance level was set at $p < 0.05$. Data were entered using Microsoft Excel, and statistical analysis was performed using IBM SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA).

RESULTS

Data from twenty participants were analyzed. The mean ages in the HDP and control groups were 55.1 ± 5.7 and 57.6 ± 4.9 years, respectively. Female participants were more common in both groups, comprising 70% in the HDP group and 90% in the control group, as shown in Table 1.

We assessed the patient's pain complaint used NRS. There was a significant difference in the mean values between the HDP and control groups before intervention and two weeks after intervention evaluation ($p = 0.000$), as shown in Table 2. Within-group comparison, there was a

Table 1. Participants data.

Participants Data	HDP Group (10)	Control Group (10)
Age, mean ± SD	55.1 ± 5.7	57.6 ± 4.9
Gender, *n* (%)		
Male	3 (30%)	1 (10%)
Female	7 (70%)	9 (90%)

Table 2. The NRS before intervention, immediately after intervention, and two weeks after intervention.

NRS	HDP Group (10)	Control Group (10)	*p*-value[a]
Before intervention	5.9 ± 0.99	6 ± 0.66	0.795
Immediately after the intervention	2.8 ± 0.91	5 ± 0.81	0.000
Two weeks after the intervention	0.9 ± 0.73	4.1 ± 0.56	0.000
p-value[b]	0.000	0.000	

[a]Intergroup analysis using an independent samples t-test
[b]Intragroup analysis using repeated-measures ANOVA

Table 3. The shoulder AROM before intervention, immediately after intervention, and two weeks after intervention.

	HDP Group (10)	Control Group (10)	*p*-value[a]
Shoulder abduction AROM (mean ± SD)			
Before intervention	81 ± 20.24	70.5 ± 29.19	0.362
Immediately after the intervention	145 ± 23.68	83.5 ± 38.30	0.000
Two weeks after the intervention	170 ± 19.43	112 ± 24.40	0.000
p-value[b]	0.000	0.000	
Shoulder flexion AROM (mean ± SD)			
Before intervention	92.5 ± 17.83	75.5 ± 31.83	0.158
Immediately after the intervention	155 ± 19.43	93.5 ± 19.43	0.000
Two weeks after the intervention	176 ± 8.43	115 ± 29.90	0.000
p-value[b]	0.000	0.000	
Shoulder internal rotation AROM (mean ± SD)			
Before intervention	22.5 ± 15.85	13 ± 10.32	0.130
Immediately after the intervention	60 ± 23.45	18.5 ± 14.34	0.000
Two weeks after the intervention	84 ± 12.64	25.5 ± 25.21	0.000
p-value[b]	0.000	0.002	
Shoulder external rotation AROM (mean ± SD)			
Before intervention	20.5 ± 13.21	11 ± 11,00	0.098
Immediately after the intervention	55.5 ± 25.54	17.5 ± 14.95	0.001
Two weeks after the intervention	81 ± 14.49	23.5 ± 17.48	0.000
p-value[b]	0.000	0.000	

[a]Intergroup analysis using an independent samples t-test
[b]Intragroup analysis using repeated-measures ANOVA

significant NRS reduction after intervention between both groups ($p = 0.000$). At all three time points — before, immediately after, and two weeks after the intervention — the HDP injection group demonstrated higher values than the control group.

Shoulder AROM (abduction, flexion, internal rotation, and external rotation) was examined three times. The mean AROM was observed, as shown in Table 3. This study showed a significant difference in the mean AROM values in both inter- and intra-group comparisons before the intervention, immediately after the intervention, and two weeks after the intervention, especially in the HDP group, with a significance value of $p < 0.05$.

DISCUSSION

HDP injection is a regenerative therapy that has been widely used as a treatment for chronic pain caused by musculoskeletal disorders. Regenerative therapy with HDP injection works by stimulating tissue proliferation through triggering an inflammatory response. The beneficial effects of HDP injection are thought to restore structural or anatomical integrity that has been compromised.[8–10]

We had difficulty finding previous studies on HDP injections specifically targeting SIS patients with diabetes mellitus. However, we found several references from other articles discussing HDP injections in cases of shoulder pain. A

case report that administered HDP injections for chronic shoulder pain aimed to evaluate the use of HDP injections as a management option for shoulder pain. The findings of the case report indicated that HDP injections are a fairly effective management option for chronic shoulder pain. Additionally, HDP injections also serve as an alternative option for some patients who refuse surgery.[9] Other studies have also reported that patients experienced significant improvements in pain and joint stability.[8]

An RCT evaluating the effects of HDP injections in patients with chronic supraspinatus tendinopathy demonstrated reduced shoulder pain and improved active range of motion.[4] Another RCT study also compared the effects of HDP injections versus a control group in cases of rotator cuff tendinopathy with severe pain. The study stated that participants in the HDP injection group (who also received physical therapy) experienced longer -lasting pain relief compared to the control group, who received saline injections.[11] In addition, another RCT study also reported similar results. The study examined the effect of HDP injections on pain levels and shoulder disability in cases of chronic supraspinatus tendinosis. The study concluded that HDP injections improved pain and disability in the short term in patients with chronic supraspinatus tendinosis. Additionally, ultrasound scans revealed morphological changes in the tendon that were recorded by the sixth week.[5]

According to several studies, HDP has a longer-term effect in reducing musculoskeletal complaints. Another study concluded that HDP provides longer-lasting efficacy benefits in cases of knee osteoarthritis.[12–14] An article proposes an explanation for the mechanism behind HDP's consistent and sustained efficacy over the long term. HDP is suggested to stimulate fibroblast proliferation and enhance collagen and extracellular matrix production in the affected tendon.[15]

Although this study showed a significant reduction in pain and improvement in shoulder function after HDP injection in patients with SIS and diabetes mellitus, it is important to interpret these findings with caution due to its non-randomized design. The lack of randomisation may have introduced selection bias and potentially influenced comparisons between groups, despite similar baseline NRS scores. Future randomised controlled study is needed to confirm these findings.

This study has several limitations. First, limited participants due to specific target population (SIS patients with diabetes mellitus). Second, the non-randomized sampling method used in this quasi-experimental study may limit the generalizability of the findings; however, this approach was appropriate to the clinical setting and design. Third, this study focused only on evaluating clinical changes and did not evaluate morphological changes through ultrasound scanning.

CONCLUSION

In this study, HDP injection showed significant benefits for patients with shoulder impingement syndrome and diabetes mellitus. It effectively reduced pain intensity based on NRS evaluation and improved shoulder function based on shoulder AROM assessment within two weeks after injection. Further studies are needed to assess its long-term effectiveness.

ACKNOWLEDGMENTS

Thanks to all the study participants, Hajj Regional Hospital, Surabaya, and Universitas Nahdlatul Ulama Surabaya.

FUNDING

This study did not receive financial support from any source.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

ETHICAL APPROVAL

The ethical clearance was approved by the Research Ethics Committee at the Hajj Regional Hospital, Surabaya, Indonesia (Approval No. 073/21/KOM. ETIK/2021). Prior to participation, all eligible patients received detailed information on the purpose, procedures, potential risks, and benefits of the study. Informed consent was obtained from each participant. Participant confidentiality was strictly maintained throughout the study.

DATA AVAILABILITY STATEMENT

The study data is available by request to the corresponding authors.

REFERENCES

1. Horowitz EH and Aibinder WR. Shoulder impingement syndrome. Phys Med Rehabil Clin N Am. 2023;34:311–34.
2. Garving C, Jakob S, Bauer I, Nadjar R, Brunner UH. Impingement syndrome of the shoulder. Dtsch Arzteblatt Int. 2017;114:765–76.
3. Braman JP, Zhao KD, Lawrence RL, Harrison AK, Ludewig PM. Shoulder impingement revisited: evolution of diagnostic understanding in orthopedic surgery and physical therapy. Med Biol Eng Comput. 2014;52:211–9.
4. Lin CL, Huang CC, Huang SW. Effects of hypertonic dextrose injection in chronic supraspinatus tendinopathy of the shoulder: a randomized placebo -controlled trial. Eur J Phys Rehabil Med. 2019;55:480–7.
5. Lin CL, Chen YW, Wu CW, Liou TH, Huang SW. Effect of hypertonic dextrose injection on pain and shoulder disability in patients with chronic supraspinatus tendinosis: a randomized double-blind controlled study. Arch Phys Med Rehabil. 2022;103:237–44.
6. Bielewicz J, Daniluk B, Kamieniak P. VAS and NRS, same or different? Are visual analog scale values and numerical rating scale equally viable tools for assessing patients after microdiscectomy? Pain Res Manag. 2022;2022:5337483.
7. Wang L, Yu G, Zhang R, Wu G, He L, Chen Y. Positive effects of neuromuscular exercises on pain and active range of motion in idiopathic frozen shoulder: a randomized controlled trial. BMC Musculoskelet Disord 2023;24:50.
8. Michalak N, Banks D, Kane L, Siefferman J. Dextrose prolotherapy for the treatment of chronic shoulder pain in patients with joint hypermobility: a case series. Clin Med Insights Arthritis Musculoskelet Disord. 2024;17:11795441241264821.
9. Seenauth C, Inouye V, Langland JO. Dextrose prolotherapy for chronic shoulder pain: a case report. Altern Ther Health Med. 2018;24:56–60.
10. Zhu M, Rabago D, Chung VC-H, Reeves KD, Wong SYS, Sit RWS. Effects of hypertonic dextrose injection (prolotherapy) in lateral elbow tendinosis: a systematic review and meta-analysis. Arch Phys Med Rehabil. 2022;103:2209–18.
11. Bertrand H, Reeves KD, Bennett CJ, Bicknell S, Cheng AL. Dextrose prolotherapy versus control injections in painful rotator cuff tendinopathy. Arch Phys Med Rehabil. 2016;97:17–25.
12. Teymouri A, Birang N, Fakheri M, Nasiri A. Comparison of the efficacy of ultrasound-guided dextrose 25% hypertonic prolotherapy and intra-articular normal saline injection on pain, functional limitation, and range of motion in patients with knee osteoarthritis; a randomized controlled trial. BMC Musculoskelet Disord. 2025;26:313.
13. Vomer RP, Larick RS, Milon R, York E. The effect of intra-articular hypertonic dextrose prolotherapy on pain, quality of life, and functional outcome scores in patients with knee osteoarthritis. Cureus. 2023;15:e48096.
14. Salsabil JR, Pane RV, Hasan H, Al Hajiri AZZ. Hypertonic dextrose prolotherapy injection in grade IV knee osteoarthritis with obesity: a case report. Acta Medica Indones. 2024;56:349–55.
15. Arias-Vázquez PI, Tovilla-Zárate CA, González-Graniel K, Burad-Fonz W, González-Castro TB, López-Narváez ML, et al. Efficacy of hypertonic dextrose infiltrations for pain control in rotator cuff tendinopathy: systematic review and meta-analysis. Acta Reumatol Port. 2021;46(2):156–70.