"A COMPARATIVE STUDY IN ADHESIVE CAPSULITIS BETWEEN MANIPULATION UNDER GENERAL ANAESTHESIA WITH STEROID INJECTION VS USG GUIDED HYDRODISTENTION WITH STEROID INJECTION."

INTRODUCTION

Adhesive capsulitis, commonly known as frozen shoulder, is a clinical syndrome characterized bypain and progressiveloss of both activeand passiveshouldermotion which is due to inflammation and fibrosis of glenohumeral joint capsule . This condition typicallyevolves through three stages: the painful stage, the frozen stage, and the thawing stage. The exact etiology remains unclear, but it is often associated with diabetes mellitus, thyroid disorders, and prolonged immobility of the shoulder joint.

TYPESOFFROZENSHOULDER

1. PrimaryFrozenShoulder(IdiopathicAdhesive Capsulitis)

It occurs without any identifiable cause or underlying systemic condition. It is the most common form and often appears spontaneously.

Characteristics:

Onset:Gradual onset without anypriorshoulder trauma orknown precipitatingfactors.

- **Progression**:Followstheclassicthree-stageprogression—freezing,frozen,and thawing.
- **RiskFactors**:Commonlyseeninindividualsaged40-60years,moreprevalentin women, and has a higher incidence in people with diabetes mellitus [1].

2. SecondaryFrozenShoulder

Post Traumatic Secondary frozenshoulder occursasaresultofanunderlyingconditionor shoulderinjury.Itissecondarytootherdiseasesormechanicalproblems

Types of Secondary Frozen Shoulder**:**

- Adhesive Capsulitis
- **SystemicDiseases**:

AIM

The aim of this study is to **compare the efficacy and safety of Manipulation Under General Anesthesia (MUGA) with Steroid Injection versus Ultrasound-Guided (USG) Hydro distension with Steroid Injection in the treatment of Primary adhesive capsulitis (frozen shoulder).** The goal is to determine which treatment provides better outcomes in terms of pain relief, range of motion improvement, and safety, as well as to evaluate patient satisfaction and long-term effectiveness.

REVIEWOFLITERATURE

ANATOMY

The shoulder is a highly intricate joint both structurally and functionally, renowned for its

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exceptional mobility facilitated by the glenohumeral joint. It includes the shoulder girdle, which links the upper limb to the axial skeleton through the sternoclavicular joint.

STRUCTUREAND FUNCTION

The shoulder girdle consists of the clavicle and the scapula, which connect with the proximal humerus of the upper limb. There are four joints in the shoulder: the sternoclavicular (SC), acromioclavicular (AC), scapulothoracic, and glenohumeral joints.

Thesternoclavicularjointisasnovialsaddlejointandthe only connection between the upper limb and the axial skeleton. .

The glenohumeral joint is a highly mobile ball-and-socket synovial joint, stabilized by the rotator cuff muscles attaching to the joint capsule, as well as the tendons of the biceps and triceps brachii.

THE GLENOHUMERAL JOINT

The glenohumeral joint is encapsulated by a fibrous joint capsule that extends from the anatomical neck of the humerus to the rim of the glenoid fossa. This capsule is part of the larger capsulolabral complex, which includes thickened bands known as the glenohumeral ligaments. These ligaments, become taut at various positions of abduction and rotation of the humerus.The inner surface of the joint capsule is lined with a synovial membrane that produces synovial fluid to minimize friction between the articular surfaces.The shoulder joint is surrounded by several bursae, which are fluid-filled sacs that reduce friction between tissues, such as tendons, muscles, and bones. These bursae help facilitate smooth movement of the shoulder joint. The main bursae around the shoulder joint are Subacromial bursa**,subscapular bursae,subarachnoid bursae,subdeltoid bursae and infraspinatus bursae**

RANGE OF MOTION IN THE GLENOHUMERAL JOINT -The glenohumeral joint allows for an extensive range of motion across multiple planes:

1. **Flexion and extension**
2. Abduction and Adduction
3. **Internal Rotation** and external rotation

ADHESIVECAPSULITIS

Adhesive capsulitis, commonly known as frozen shoulder, affects 2 to 5% of the population, predominantly females over the age of 55. . Adhesive capsulitis is strongly linked to endocrine disorders such as diabetes and hypothyroidism. Treatment typically involves conservative measures, with many cases resolving on their own. Surgicalintervention is considered for persistent cases and entails releasing the fibrotic capsule.

PATHOPHYSIOLOGY

Frozenshoulderistypicallycharacterizedasafibrotic,inflammatorycontractureinvolving the rotator interval, capsule, and ligaments. The pathology involves cytokine-mediated inflammation of the synovium, leading to fibroblasticproliferation as observed through arthroscopic studies. .

Initially, the coracohumeral ligament, positioned over the rotator cuff interval, is often thefirst structure affected. Contraction of this ligament restricts external rotation of the arm, typically the initial motion limited in early adhesive capsulitis. As the condition progresses, the glenohumeral joint capsule thickens and contracts, further reducing the range of motion in all directions.

HISTOPATHOLOGY

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Histopathological studies of the glenohumeral capsule have demonstrated a notable increasein fibroblasts, myofibroblasts, and various inflammatorycells, including B-lymphocytes, mast cells, and macrophages

HISTORYANDPHYSICALEXAMINATION

Patients experiencing early adhesive capsulitis (AC) typically present with sudden onset of unilateral anterior shoulder pain. Common symptoms include limitations in both passive and active range of motion, initiallyaffecting external rotation and laterabduction ofthe shoulder. The condition can vary in severity and stages but tends to be self-limiting over time,impacting daily activities, work, and leisure pursuits. Functional impairments associated with frozen shoulder include difficulty reaching overhead (e.g., hanging clothes) or to the side(e.g., fastening a seat belt), as well as challenges with shoulder rotations necessary forpersonal hygiene tasks like dressing and hair brushing.

Physical examination is crucial for diagnosing frozen shoulder, despite the discomfort and stiffness that may hinder patients from fully participating. Two common diagnosticmaneuvers involve combined motion tests, such as reaching the scapula from behind the neck and from behind the back. However, the hallmark feature for diagnosing AC is the loss of passive range of motion. When passive range of motion is significantly limited, examination of active motion may be unnecessary. .

EVALUATION

Frozen shoulder, or adhesive capsulitis (AC), is primarily diagnosed through clinical evaluation, medical history, and imaging studies aimed at ruling out other possible conditions rather than confirming AC itself. No single laboratory test or imaging modality can definitively confirm AC.

Diagnostic imaging for AC can be challenging because conventional methods such as radiographs, ultrasound, plain MRI, and CT scans often show normal findings. These imaging modalities are typically used to exclude concurrent pathologies like rotator cuff tears or osteoarthritis of the glenohumeral joint. High-resolution musculoskeletal ultrasound (MUS) is frequently employed as the initial imaging tool for evaluating shoulder pathology,

MRI may show thickening of the coracohumeral ligament and capsule of the glenohumeral joint, while MRI arthrography can reveal a reduction in joint space volume.

The "lidocaine test" involves injecting lidocaine into the subacromial space to differentiate between AC and subacromial conditions like impingement syndrome. In AC, passive range of motion remains limited after the injection, whereas patients with subacromial impingement typically experience improved motion. This test can be guided by ultrasound to ensure accurate placement of the injection.

MANAGEMENT: The current treatment options available:

1. **NSAIDs**:Nonsteroidalanti-inflammatorydrugs
2. **PhysicalTherapy**:
3. **OralCorticosteroids**:
4. **Intra-articularSteroidInjections**:
5. **Hydrodilstension**:Thisinvolvesinjectingacombinationofsalineandsteroidintothe glenohumeralcapsuletostretchit,whichcanreducepainandimprove Range of movement[ROM]. Its effectiveness is comparable to intra-articular steroid injections.

HYDRODISTENSION of the shoulder joint is a medical procedure used primarily to treat adhesivecapsulitis,commonlyknownasfrozenshoulder.Here'sadetailedoverviewof what it involves:

. The procedure involves injecting a fluid mixture, usually containing saline and sometimes

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corticosteroids, into the shoulder joint to stretchand expand the joint capsule. This process can help to alleviate pain and improve range of motion.

1. **Hydrodistension Procedure**:

- **Injection of Fluid**: During hydrodistension, a needle is inserted into the shoulder joint, and a fluid mixture is injected. The fluid typically contains saline and may include corticosteroids.
- **Capsular Stretching**: The injected fluid exerts pressure on the joint capsule, stretching and expanding it. This process aims to break up adhesions and reduce the thickness of the fibrotic capsule.
- **Pain Relief and Improved Mobility**: By stretching the capsule, the procedure helps to alleviate pain and increase the range of motion in the shoulder. The corticosteroids can reduce inflammation, further aiding in symptom relief.

2. **Biological Effects**:

- **Decompression**:Thefluidinjectioncanhelptodecompressthejoint,whichmayalso relieve pressure on nearby nerves and structures.
- **Breaking Adhesions**: The stretching effect of the fluid can help to break down adhesions and scar tissue within the joint capsule.
- **EnhancedSynovialFluidDistribution**:Increasedfluidvolumehelpsindistributing synovial fluid more evenly, potentially improving lubrication within the joint.

3. **Post-Procedure**:

- **PainManagement**:Patientsmay experiencetemporary discomfortaftertheprocedure, but this is generally managed with pain relief medications.
- **Rehabilitation**: Physicaltherapy isoften recommendedpost-procedure and enhance the improvements in shoulder function and range of motion.

The main goal of hydrodistension is to stretch the capsule of the shoulder joint and break up adhesions (scar tissue) that limit movement and cause pain in patients with frozen shoulder.

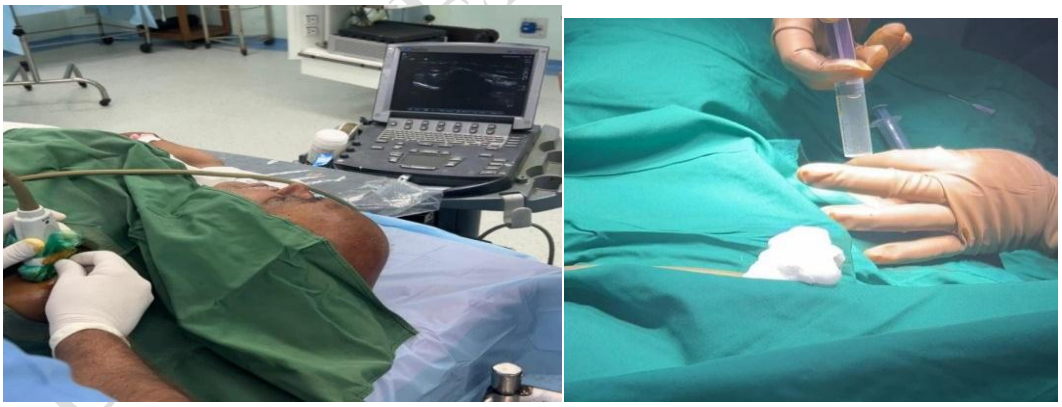

Fig. 6: Operative theatre setup for Hydrodistension Around 15-30mlof Normal Saline is injected to into the thickened and fibrosed shoulder capsule break the adhesions and improve the Range of motion

Patient kept supine on the ot table with the surgeon on the effected side and the USG machine on the opposite side.

Post-ProcedureCare:

- After the procedure, patients are usually monitored for a short period to ensure there are no

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immediate complications..

Prognosis

Short-TermOutcomes:

- **Positive Response**: Many patients experience significant relief of symptoms and improvement in shoulder mobility within a few weeks of the procedure.

- **Sustained Improvement**: Studies suggest that hydrodistension can provide lasting relief from symptoms for several months to years. However, individual responses vary, and some patients may need additional treatments or physical therapy to maintain improvements.

- **Physical Therapy**: Engaging in a structured physical therapy program post-procedure is crucial for maximizing outcomes and ensuring sustained recovery.

2. **Overall Effectiveness**:

- **SuccessfulTreatment**:Hydrodistensionisgenerallyeffectiveformanypatientswithadhesive capsulitis, particularly when combined with other therapeutic modalities.

Follow-Up:

- Follow-upappointmentsaretypicallyscheduledtomonitorprogressanddetermineifadditional treatments or therapies are needed.

Conclusion:

Hydrodistensionof theshoulderjointisavaluabletreatmentoption for patients sufferingfrom frozen shoulder, helping to alleviate pain and restore range of motion by stretching the joint capsule and breaking up adhesions. It is important for patients to discuss the procedure thoroughly with their healthcare provider to understand its potential benefits and risks in their specific case.

1. **ManualManipulation**:[MUGA]

- **Technique**: The physician applies controlled, forceful movements to the shoulder joint. These movements are designed to stretch and break down adhesions within the joint capsule and surrounding tissues.
- Common techniques include external and internal rotations, abduction, and flexion/extension of the shoulder. The exact movements depend on the individual's range of motion and the severity of the adhesive capsulitis.

StretchingoftheJointCapsule:

- **Capsular Distension**: The procedure helps to disrupt the fibrous adhesions and contractures within the capsule which can relieve restrictions in shoulder movement'

IncreasedRangeof Motion:

- **Immediate Effect**: By breaking up adhesions and stretching the joint capsule, MUA often results in an immediate increase in the range of motion. This is due to the physical disruption of the restrictive tissue and the restoration of joint mobility.

- **Physical Therapy**: After the manipulation, patients typically undergo a rehabilitation program that includes physical therapy. This helps to maintain and improve the range of

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motion achieved during the procedure and to strengthen the shoulder muscles.

Prevention of Recurrence: Rehabilitation is crucial to prevent the recurrence of adhesions and to support the healing of the joint capsule.

Fig 3 - Intra OPImagesofMUGA

Effectivenessand Risks:

- **Effectiveness**: MUA can be highly effective in improving shoulder mobility and reducing painassociatedwithfrozenshoulder.Manypatientsexperiencesignificantimprovementin range of motion immediately after the procedure.
- .

Follow-Up:

- Follow-upappointmentsarecrucialtomonitorprogress and adjust thetreatmentplanas needed.

Conclusion:

Manipulation under general anesthesia is a well-established procedure for treating frozen shoulder by breaking up adhesions and scar tissue that limit shoulder mobility. It offers significant potential benefits in restoring function and reducing pain, THE choice of treatment depends on the severity and stage of the condition, as well as individualpatientfactors.Eachoptioncarriesrisksandbenefits,anddecisionsshouldbe taken accordingly.

Indications for Surgery:

Failure of Conservative Treatment: .

- **NoResponsetoInjections**.
- **InadequateResponsetoPhysicalTherapy**

Complications :- Complications associated with adhesive capsulitis and its treatments include: Residual Shoulder Painand Stiffness:.Humeral Fracture. Tendon Ruptures:.

- **Labral Tears**: **Glenohumeral Joint Dislocation**&**RotatorCuff Tears**:.

The Shoulder Pain and Disability Index (SPADI) The Shoulder Pain and Disability Index (SPADI) is a self-report questionnaire designed to assess the severity of shoulder pain and its

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impacton daily activities. It is widely used in clinical practice and research settings to measure shoulder pain and disability.

Componentsofthe SPADI:

1. **Pain subscale**: This part of the questionnaire assesses the intensity of shoulder pain. It typically consists of 5 items where the respondent rates their pain severity during various activities (e.g., lying, lifting, at night) on a scale from 0 (no pain) to 10 (worst pain imaginable).
2. **Disability subscale**: This section evaluates the extent to which shoulder pain interferes with dailyactivitiesandfunctionaltasks.Italsoincludes8itemswheretherespondentratesthe difficulty they experience in performing different activities (e.g., washing back, dressing, carrying a bag) on a scale from 0 (no difficulty) to 10 (unable to do).

Howit is used:

- **Scoring**: Scores for each subscale are calculated by summing the responses. The total SPADIscoreis derived fromthesum ofthepain and disabilitysubscalescores. Each subscale score can range from 0 to 50, with higher scores indicating more severe pain and disability.
- **Interpretation**:AhigherSPADIscoreindicatesgreatershoulderpainanddisability. Clinically,changesinSPADIscoresovertimecanhelpmonitortreatmentprogressor effectiveness.
- **Utility**: The SPADI isuseful for assessing awide range of shoulderconditions, includingrotator cuff tears, shoulder impingement syndrome, osteoarthritis, and shoulder instability. **Advantages:**
- **Patient-reported**
- **Sensitivetochange**: It is sensitiveto changes in pain and functional status, makingit useful for evaluating treatment outcomes.
- **Easytoadminister**:Itisrelativelyquickandstraightforwardtoadminister,makingit practical for routine clinical use.

Overall, the SPADI provides valuable information about the impact of shoulder pain on daily life and helps guide treatment decisions and outcomes assessment in clinical practice

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Shoulder Pain and Disability Index (SPADI)

Please place a mark on the line that best represents your experience during the last week attributable to your shoulder problem.

Pain scale

How severe is your pain?

Circle the number that best describes your pain where: 0 = no pain and 10 = the worst pain imaginable.

At its worst?	0	1	2	3	4	5	6	7	8	9	10
When lying on the involved side?	0	1	2	3	4	5	6	7	8	9	10
Reaching for something on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Touching the back of your neck?	0	1	2	3	4	5	6	7	8	9	10
Pushing with the involved arm?	0	1	2	3	4	5	6	7	8	9	10

Disability scale

How much difficulty do you have?

Circle the number that best describes your experience where: 0 = no difficulty and 10 = so difficult it requires help.

Washing your hair?	0	1	2	3	4	5	6	7	8	9	10
Washing your back?	0	1	2	3	4	5	6	7	8	9	10
Putting on an undershirt or jumper?	0	1	2	3	4	5	6	7	8	9	10
Putting on a shirt that buttons down the front?	0	1	2	3	4	5	6	7	8	9	10
Putting on your pants?	0	1	2	3	4	5	6	7	8	9	10
Placing an object on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Carrying a heavy object of 10 pounds (4.5 kilograms)	0	1	2	3	4	5	6	7	8	9	10
Removing something from your back pocket?	0	1	2	3	4	5	6	7	8	9	10

TableshowingShoulderPainandDisabilityIndex(SPADI)

POST-OPERATIVE PHYSIOTHERAPY

Post-operative physiotherapy plays a crucial role in the recovery and rehabilitation process following both manipulation under general anesthesia (MUA) with steroid injection and ultrasound-guided hydrodistention (UGHD) with steroid injection for adhesive capsulitis. apy

In conclusion, post-operative physiotherapy is integral to the success of both MUGA with steroid injection and UGHD with steroid injection for adhesive capsulitis. It plays a vital role in facilitating recovery, restoring function, managing pain, and empowering patients to achieve optimal outcomes following these procedures. Patients undergoing UGHD had less recurrence rate as compared to those undergoing MUGA. They also had less post op disability and significantly higher return to normal activity

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MATERIALANDMETHODS

It is a Comparative,prospective,randomized controlled trial. Spanning over one month period including Adults aged30-75years diagnosed with adhesive capsulitis, confirmed by clinical evaluation and who have not responded adequately to conservative treatments such as physical therapy and medications.

- Patiiients are divided into two groups :
  - **GroupA**:ManipulationUnderGeneralAnersthesia(MUA) withSteroidInjection.
  - **GroupB**:Ultrasound-Guided(USG)HydodistensionwithSteroidInjection.

1. Statistical tests will be used to compare pain relief and range ofmotion improvements

- The study will be conducted following approval from an appropriate ethics review board. This methodology aims to rigorously evaluate and compare the two treatment modalities for adhesive capsulitis, providing valuable insights into their relative effectiveness, safety, and long-term outcomes.

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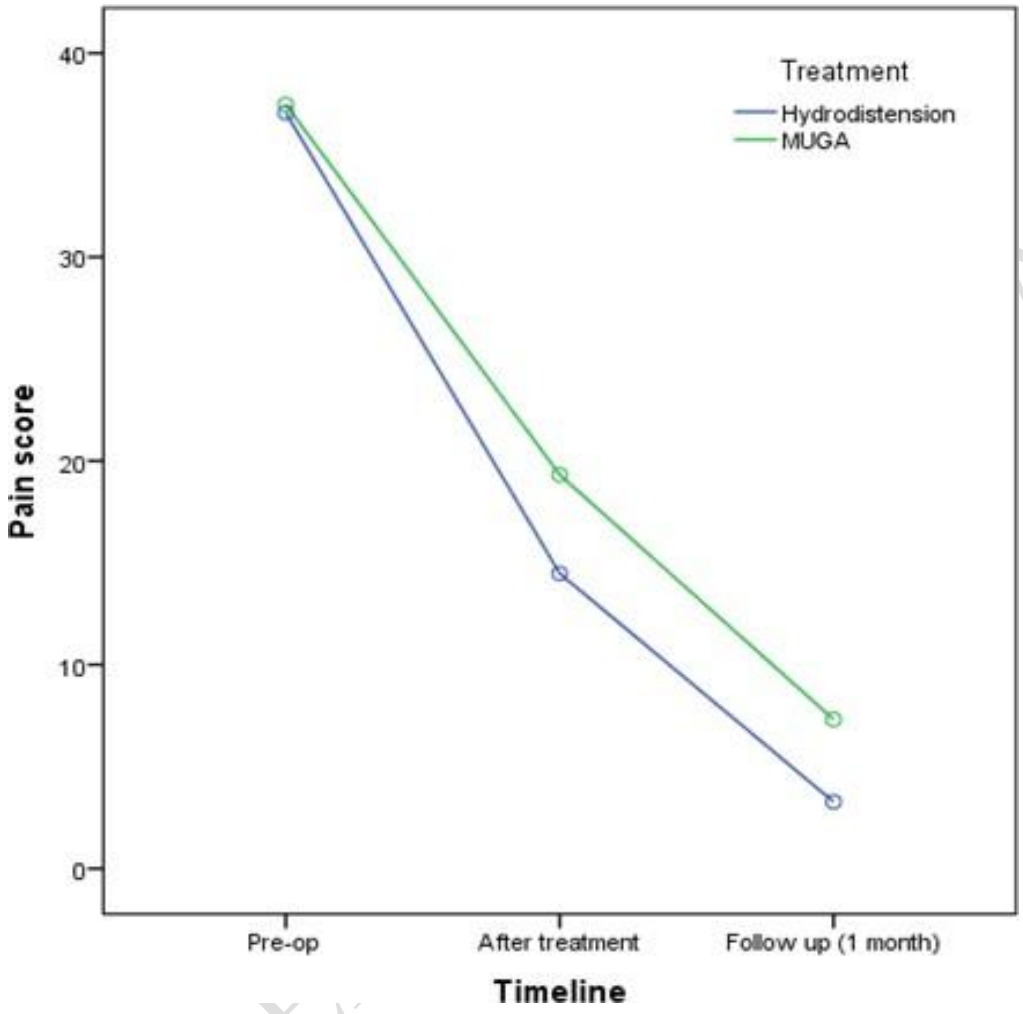
OBSERVATIONSANDRESULTS

1) Tableshowingpainscoreamongstudy subjects



In this study, pain scores for patients with shoulder adhesive capsulitis were analyzed pre-operatively, post-operatively, and one month post-operation. Patients underwent either manipulation under general anaesthesia (MUGA) or ultrasound-guided Hydrodistension. Pre-operatively, the mean pain scores were similar: 37.08 (Hydrodistension) and 37.48 (MUGA). Post-operatively, Hydrodistension patients had a mean pain score of 14.48, whereas MUGA patients had a mean of 19.32. At one month follow-up, Hydrodistension patients had a significantly lower mean pain score of 3.28 compared to 7.32 for MUGA. Tests of between-subjectseffectsshowedsignificantdifferences.Treatmenttypehadasignificanteffectonpain reduction ($F = 30.076$, $p < .001$, partial eta squared = .385). Overall, ultrasound-guided Hydrodistension resulted in more substantial pain relief than MUGA.

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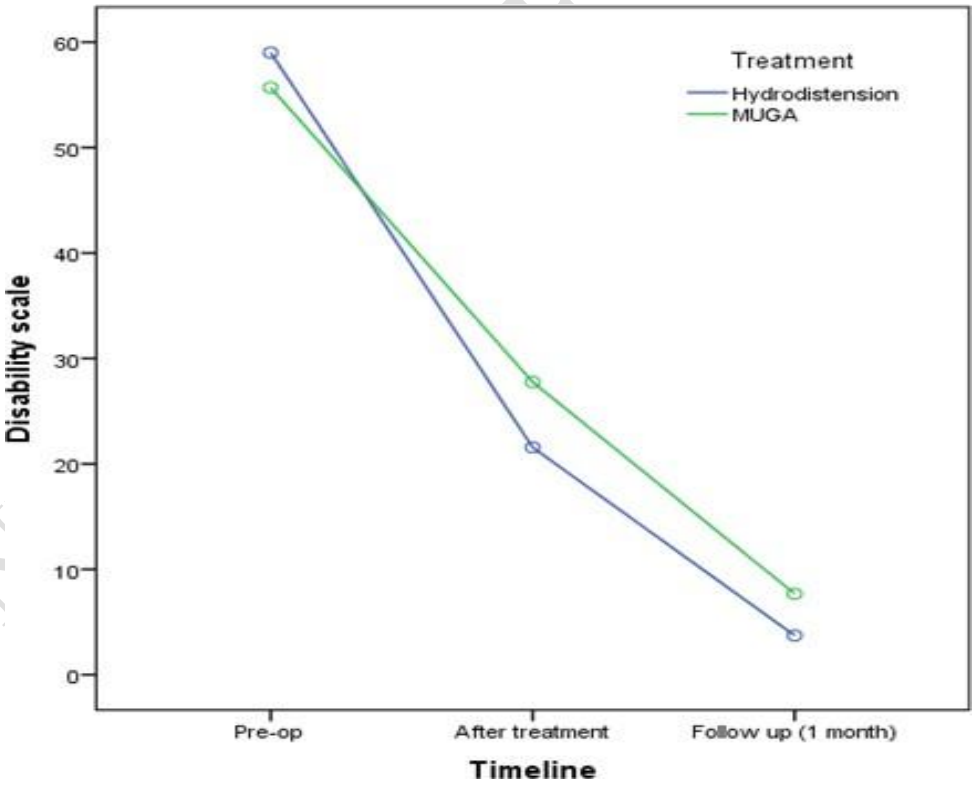
2) Tableshowingdisabilityscaleamongstudysubjects

DescriptiveStatistics

Disabilityscale	Treatment	Mean	Std. Deviation
DS (PRE OP)/80	Hydrodistension	59.00	2.398
	MUGA	55.68	5.375
	Total	57.34	4.447
DS (POST OP)/80	Hydrodistension	21.56	5.148
	MUGA	27.76	6.098
	Total	24.66	6.403
DS(F/U 1MONTH)/80	Hydrodistension	3.72	1.100
	MUGA	7.68	2.594
	Total	5.70	2.809



In this study, disability scores for shoulder adhesive capsulitis patients were evaluated before surgery, after surgery, and one month post-operation. Patients underwent either manipulation under general anaesthesia (MUGA) or ultrasound-guided Hydrodistension.

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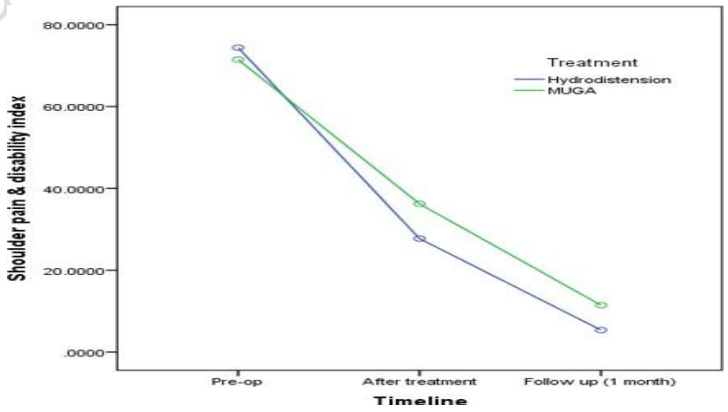
Beforesurgery,themeandisabilityscoreswere59.00fortheHydrodistensiongroupand 55.68 for the MUGA group. After surgery, the mean scores decreased to 21.56 for the Hydrodistension group and 27.76 for the MUGA group. At the one-month follow-up, themean scores further reduced to 3.72 for the Hydrodistension group and 7.68 for the MUGA group. The analysis of between-subjects effects showed that the type of treatment had a significantimpactonreducingdisabilityscores(F=13.511,p=.001,partialetasquared= .220). Overall, both treatments significantly reduced disability scores, but ultrasound-guided Hydrodistension led to greater improvement compared to MUGA.

3) Tableshowingshoulderpain &disabilityindexamongstudysubjects

DescriptiveStatistics			
SPADI	Treatment	Mean	Std. Deviation
SPADI(PRE OP)	Hydrodistension	74.396800	2.7586254
	MUGA	71.474800	4.2806767
	Total	72.935800	3.8575318
SPADI(POST OP)	Hydrodistension	27.720800	6.0261513
	MUGA	36.215200	7.8242961
	Total	31.968000	8.1350263
SPADI(F/U 1MONTH)	Hydrodistension	5.380400	1.0183012
	MUGA	11.446400	3.7174116
	Total	8.413400	4.0820676



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DISCUSSION

Andren and Lundberg originally introduced the concept of hydrodistension (HD) in 1965 as a treatment method for adhesive glenohumeral joints, which involves expanding the joint capsule [1]. .

Manipulation under Anesthesia (MUA) entails the passive tearing of the thickened, inflamed capsule and contracted ligaments (Fig. 2).

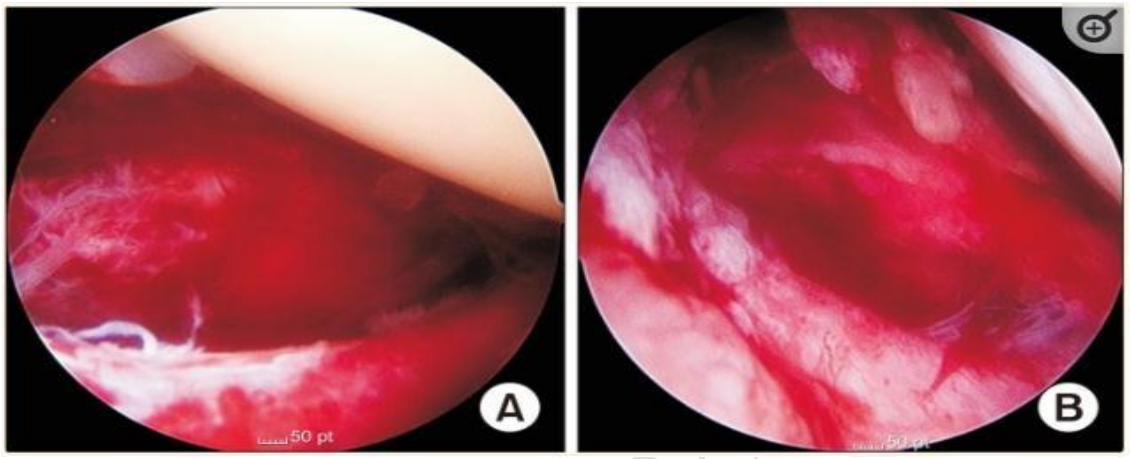

Fig.13:capsulartearingaftermanipulationundergeneral anaesthesia

MUA was primarily conducted under general anesthesia; however, advancements in ultrasound technology made it feasible using brachial plexus or cervical nerve root block[6,7].

In the context of treatment approaches, the combination of hydrodilatation (HD) and corticosteroids has been widely studied, though the direct impact of HD alone has been challenging to ascertain [19-23]. In their study, they aimed to compare outcomes between groups receiving HD with steroids versus steroids alone, assessing the added benefit of HD to intra-articularsteroid injections. .

US-guided hydrodistention (HD) has been employed using both anterior and posterior approaches in clinical practice. Evidence suggests that the anterior approach may offer superior efficacy compared to the traditional posterior method. This approach is believed to facilitate more effective distribution of the injected mixture into affected areas, potentially enhancing distention and addressing concurrent conditions like biceps tenosynovitis, which commonly co-occurs [24]. Additionally, the anterior approach is noted for its technical advantages in obese patients,

CONCLUSION

Adhesive capsulitis, commonly known as frozen shoulder, presents a challenging clinical scenario characterized bypain, stiffness, and functional impairment of the shoulder joint. This study undertook a comparative study to evaluate the efficacy of two treatment modalities: manipulation under general anesthesia (MUA) with steroid injection versus ultrasound-guided

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(USG) hydrodistention with steroid injection, using the Shoulder Pain and Disability Index (SPADI) scale as a primary outcome measure.

The findings of this study provide valuable insights into the management of adhesive capsulitis. Both MUA with steroid injection and USG-guided hydrodistention with steroid injection demonstrated significant improvements in pain relief and functional outcomes, as measured by the SPADI scale. .

Conversely, USG-guided hydrodistention with steroid injection offered a minimally invasive alternative that leverages the mechanical effect of fluid injection to stretch the capsule and break down adhesions. .

In conclusion, this comparative study underscores the efficacy of both the procedures. The SPADI scale serves as a reliable tool for assessing treatment outcomes and guiding evidence-based clinical decision-making, ultimately enhancing the quality of care for patients suffering from this debilitating condition.

In this study, both ultrasound-guided Hydrodistension and manipulation under general anesthesia (MUGA) significantly reduced pain, disability, and shoulder pain and disability index (SPADI) scores in patients with adhesive capsulitis.

. The analysis of between-subjects effects confirmed that Hydrodistension had a significantly greater impact on reducing these scores. Overall, thestudyconcludedthatwhilebothtreatments wereeffective, ultrasound-guidedHydrodistension provided more substantial improvements in pain relief and functional recovery for patients with adhesive capsulitis.

REFERENCES

1. Hubbard MJ, Hildebrand BA, Battafarano MM, Battafarano DF. Common Soft Tissue Musculoskeletal Pain Disorders. Prim Care. 2018 Jun;45(2):289-303.

2. Xiao RC, DeAngelis JP, Smith CC, Ramappa AJ. Evaluating Nonoperative Treatments for Adhesive Capsulitis. 2017 WINTERJ Surg Orthop Adv. 26(4):193-199.

3. Murakami AM, Kompel AJ, Engebretsen L, Li X, Forster BB, Crema MD, Hayashi D, Jarraya M, Roemer FW, Guermazi A. The epidemiology of MRI detected shoulder injuries in athletes participating in the Rio de Janeiro 2016 Summer Olympics. BMC Musculoskelet Disord. 2018 Aug 17;19(1):296.

4. Kingston K, Curry EJ, Galvin JW, Li X. Shoulder adhesive capsulitis: epidemiology and predictors of surgery. J Shoulder Elbow Surg. 2018 Aug;27(8):1437-1443.

5. Oderuth E, Ali M, Atchia I, Malviya A. A double blind randomised control trial investigating the efficacy of platelet rich plasma versus placebo for the treatment of greater trochanteric pain syndrome (the HIPPO trial): a protocol for a randomised clinical trial. Trials. 2018 Sep 21;19(1):517. [PMC free article]

6. WongCK,StrangBL,SchramGA,MercerEA,KestingRS,Deo KS.Apragmaticregional interdependence approachtoprimaryfrozenshoulder:aretrospective case series.J ManManip Ther. 2018 May;26(2):109-118.

7. Chen Y, Yang J, Wang L, Wu Y, Qu J. [Explanation on Evidence-based Guidelines of Clinical Practice with Acupuncture and Moxibustion: Periarthritis of Shoulder]. Zhongguo Zhen Jiu. 2017 Sep 12;37(9):991-4.

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8. JavedO,MaldonadoKA,AshmyanR. StatPearls[Internet].StatPearlsPublishing; Treasure Island (FL): Jul 24, 2023. Anatomy, Shoulder and Upper Limb, Muscles.

9. McCausland C, Sawyer E, Eovaldi BJ, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Aug 8, 2023. Anatomy, Shoulder and Upper Limb, Shoulder Muscles.

10. Cowan PT, Mudreac A, Varacallo M. StatPearls [Internet]. StatPearls Publishing; Treasure Island (FL): Aug 8, 2023. Anatomy, Back, Scapula.

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