ISSN No:-2456-2165

Empowering the Path from Stiffness to Recovery in Adhesive Shoulder Capsulitis Complexity

Javed Iqbal[1*]
[1]Department of Physiotherapy, DOW University of Health Sciences (IPM&R), Karachi, Pakistan

Shankar Lal[2]; Heman Lal[2]
[2]Department of Zoology, University of Sindh, Jamshoro. Pakistan

Nand Lal[3]
[3]Department of Physiology, Harbin Medical University, Harbin, Heilongjiang, China

Radheshyam Gupta[4]
[4]Department of Urology Surgery, Harbin Medical University Cancer Hospital, Harbin, Heilongjiang, China

Ghulam Abbas[5]
[5]Department of Zoology, Shah Abdul Latif University, Khairpur, Sindh, Pakistan

Corresponding Author:- Javed Iqbal[1*]

Abstract:- Adhesive shoulder capsulitis, also called arthrofibrosis, is a complex medical condition characterized by excessive scar tissue around the glenohumeral joint, causing stiffness, pain, and reduced functionality. Its historical evolution, from "scapulohumeral periarthritis" to "adhesive capsulitis," traces back to the 20th century. However, the underlying pathology remains unclear, posing diagnostic and treatment challenges. The condition progresses through phases: pain, stiffness, and eventual recovery, each with distinct clinical features. Emerging research shifts the understanding from fibrosis-focused to inflammation and fibrosis combined. Risk factors include age, gender, prior shoulder trauma, and diabetes. It primarily affects older individuals, women, and those with medical comorbidities, particularly diabetes. Diagnosis relies on identifying specific markers like capsule contracture, synovial loss, and adhesions, while differentiation from similar shoulder disorders is crucial. Treatment encompasses non-operative options (physical therapy, medication) and more invasive interventions (manipulation under anesthesia, arthroscopic capsulotomy). This review offers a broad view of adhesive capsulitis, covering its history, causes, risk factors, diagnosis, and various treatments. By exploring its multifaceted dimensions, the aim is to improve understanding and management of this intricate condition, enhancing the lives of those affected.

Keywords:- *Adhesive Shoulder Capsulitis; Arthrofibrosis; Stiffness; Shoulder Trauma; Physical Therapy; Frozen Shoulder.*

I. INTRODUCTION

Adhesive shoulder capsulitis also referred to as arthrofibrosis, presents a complex and distressing medical condition characterized by the excessive formation of scar tissue and adhesions around the glenohumeral joint. This condition results in stiffness, pain, and impaired joint function(A. S. Neviaser & Neviaser, 2011)(Manske & Prohaska, 2008). The resulting stiffness and pain in the shoulder can significantly impede daily activities and diminish the overall quality of life for affected individuals. Historical records of this condition trace back to the early 20th century, with terminology evolving from "scapulohumeral periarthritis" to the more commonly recognized term "adhesive capsulitis" (J. S. Neviaser, 1945). Despite advancements in medical knowledge, the natural progression and underlying pathology of frozen shoulder remain insufficiently understood, posing challenges in both diagnosis and treatment.

The advancement of adhesive capsulitis occurs through distinct phases, progressing from pain to stiffness and eventual recovery (Bunker, 2009). Each phase presents unique clinical characteristics and durations, highlighting the intricate nature of this disorder. Initially, the pathogenesis of adhesive capsulitis was believed to be primarily fibrotic, resembling Dupuytren's disease. However, emerging research indicates that inflammation and fibrosis both play significant roles in its development (Le et al., 2017). This shift in understanding holds implications for potential therapeutic strategies targeting both inflammatory and fibrotic processes.

Several risk factors are associated with adhesive capsulitis, including age, gender, prior shoulder trauma, and underlying medical conditions like diabetes (Harris et al., 2011). The prevalence of adhesive capsulitis increases with age, with a higher occurrence among women and individuals with specific medical comorbidities. Diabetic patients, in particular, face an elevated risk, underscoring the complex interplay between metabolic factors and the development of this condition.

Diagnosing adhesive capsulitis relies on identifying distinctive features such as glenohumeral capsule contracture, synovial loss, and adhesions (Hunt et al., 2007). However, it is crucial to differentiate it from other shoulder disorders with similar symptoms. Treatment approaches encompass a range of options, from non-operative measures like physical therapy and pharmacological interventions to more invasive techniques, including manipulation under anesthesia and surgical procedures like arthroscopic capsulotomy (Neviaser AS & Hannafin JA, 2010) (Le et al., 2017).

This comprehensive review article aims to offer an extensive overview of adhesive capsulitis, encompassing its historical development, underlying causes, risk factors, diagnostic criteria, and the array of available treatment options. Through an in-depth exploration of the multifaceted aspects of adhesive capsulitis, we aspire to contribute to a deeper comprehension of this intricate condition and enhance the capability to manage and improve the lives of affected patients.

- *Natural History:*

Frozen shoulder (FS) progresses through three distinct phases: pain, stiffness, and recovery (Bunker, 2009). The initial painful phase typically lasts between 10 and 36 weeks, with no notable differences between genders or correlation with age. Subsequently, the painful period transitions into the stiff phase, which can persist for a duration of 4 to 12 months without improvement. Following the stiff phase, a spontaneous recovery of mobility occurs, lasting between 5 and 26 months. On average, the entire duration from the onset of FS to recovery is approximately 30 months. Although some objective limitations in movement may continue to exist, functional impairment is generally rare (Bunker, 2009)(Binder et al., 1984)

- *Pathogenesis:*

For a long time, adhesive capsulitis has been viewed as primarily a fibrotic disorder, similar to Dupuytren's disease, as the histology of affected specimens shows fibroblasts mixed with type I and type III collagen (Le et al., 2017). These findings suggest that adhesive capsulitis may arise due to an imbalance between the degradation, remodeling, and regeneration of extracellular matrix tissue. Future therapeutic approaches may involve directly inhibiting fibrogenesis or promoting the remodeling of fibrotic tissue. However, the current understanding now recognizes that adhesive capsulitis development involves both an inflammatory and fibrotic process. Supporting this idea, studies have revealed elevated inflammatory cytokines, such as interleukin (IL)-1a, IL-1b, tumor necrosis factor (TNF)-a, cyclooxygenase (COX)-1, and COX-2 in the capsular and bursal tissues of patients with adhesive capsulitis compared to controls(Lho YM, 2013). This suggests that adhesive capsulitis might be primarily an inflammatory process that eventually leads to fibrotic changes. Samples taken from the rotator interval of patients with adhesive capsulitis typically contain inflammatory cells, including T cells, B cells, macrophages, and mast cells (Hand GC, 2007).

The macroscopic examination has shown thickening and contracture of the capsul(Lundberg, 1969)(J. S. Neviaser, 1945). Histological studies of synovial tissues have indicated increased vascularity and, in some patients, minimal hyperplasia in the sub synovial capsule. Chronic inflammation has been observed, characterized by the infiltration of mononuclear leukocytes, fibrosis, focal degeneration of collagen, and calcification(Lundberg, 1969)(J. S. Neviaser, 1945). However, it is important to note that the inflammatory changes were not consistent, and similar changes were found during autopsies in shoulders that did not exhibit any gross alterations(J. S. Neviaser, 1945).

The available information on the gross and microscopic pathology of Frozen Shoulder (FS) is limited and primarily derived from surgical observations and biopsy samples representing the later stages of the condition. Initial attempts at using arthroscopy to gather new insights have not yielded significant additional information(Cofield, 1983).

- *Patho-Anatomy:*

The primary characteristic of adhesive capsulitis is the contracture of the glenohumeral capsule. This condition is characterized by several findings, including the loss of the synovial layer of the capsule, adhesions between the axillary and itself, as well as adhesions to the anatomical neck of the humerus, leading to an overall decrease in capsular volume (Hunt et al., 2007). Notably, adhesive capsulitis is associated with a thickened and fibrotic rotator interval, which plays a crucial role in maintaining the stability of the glenohumeral joint (Bunker TD and Anthony PP, 1995).

- *Risk Factor:*

Adhesive capsulitis is influenced by several risk factors, including being female, being over 40 years of age, experiencing prior shoulder trauma, testing positive for HLA-B27, and undergoing prolonged immobilization of the glenohumeral joint. Approximately 70% of adhesive capsulitis patients are women, and about 20% to 30% of those affected may develop the condition in the opposite shoulder (Sheridan & Hannafin, 2006). Most individuals diagnosed with adhesive capsulitis (84.4%) are between 40 and 60 years old(Baslund et al., 1990). Moreover, adhesive capsulitis is linked to various medical conditions such as diabetes, thyroid disease, cerebrovascular disease, coronary artery disease, autoimmune disease, and Dupuytren's disease(Harris et al., 2011)(Arkkila et al., 1996). Remarkably, both type I and type II diabetic patients have an elevated risk of developing adhesive capsulitis, with

respective prevalence rates of 10.3% and 22.4%(Griggs et al., 2000). Additionally, diabetic patients with adhesive capsulitis tend to experience worse functional outcomes compared to those without diabetes (A. S. Neviaser & Neviaser, 2011).

➢ *Radiography*:

Throughout the course of FS (Frozen Shoulder), no diagnostic X-ray alterations occur. However, in cases that have been present for a long time, the lack of movement may result in the demineralization of the head of the humerus(Wright & Haq, 1976). Except for this, no other changes have been identified at a frequency that differs from what is commonly observed in individuals without symptoms(Binder et al., 1984)(Wright & Haq, 1976) Nevertheless, in situations where FS needs to be distinguished from other painful shoulder conditions like fractures, arthritis, malignancy, chondrocalcinosis, avascular necrosis, and calcified tendinitis, radiographs may be useful(Rizk & Pinals, 1982).

➢ *Differential Diagnosis:*

Shoulder pain can result from various causes, but not all shoulder disorders lead to a significant limitation of passive motion. The strict definition of Frozen Shoulder (FS) excludes conditions like supraspinatus tendinitis, subacromial bursitis, acute calcinosis of the rotator cuff, and bicipital tendinitis, as these typically do not exhibit the same marked restriction of passive motion. In some cases, injecting local analgesics into the affected area can aid in revealing normal passive motion in these conditions.

To differentiate FS from reflex sympathetic dystrophy, physicians can look for vasomotor and trophic changes, which are characteristics of the latter condition. It may also be necessary to conduct blood tests and radiography (as mentioned in the relevant section) to rule out conditions such as rheumatoid arthritis and bone diseases(Rizk & Pinals, 1982). This comprehensive approach allows clinicians to identify FS more accurately and exclude other potential causes of shoulder pain and limited motion.

II. NON-SURGICAL AND SURGICAL TREATMENT

➢ *Non-Surgical:*

The objective of treating adhesive capsulitis is to achieve a painless and functional shoulder joint(Neviaser AS & Hannafin JA, 2010) (Uppal, 2015). However, since some patients with this condition experience spontaneous improvement, the approach to treatment can vary significantly, ranging from minimal intervention "benign neglect" to more invasive measures like open capsulotomy. Due to the lack of a universal treatment algorithm, the management of adhesive capsulitis should be tailored to each individual patient's specific needs and circumstances.

- *Corticosteroid:*

Corticosteroid shots are commonly used to treat frozen shoulder. These injections can be given in the subacromial bursa, nearby soft tissues, or the shoulder joint itself. However, research findings on their effectiveness have been conflicting. People experiencing severe and persistent pain might find relief from corticosteroid injections, although it's uncertain if these injections can shorten the overall time of disability (Hollingworth et al., 1983) (Rizk et al., 1991).

Intra-articular corticosteroid injections have been observed to provide quicker and more effective relief from symptoms when compared to oral steroid treatment(Widiastuti-Samekto & Sianturi, 2004)(Lorbach et al., 2010). Such injections have the ability to reduce fibromatosis and myofibroblasts in adhesive shoulders(Hettrich et al., 2016). In a study by(Bulgen et al., 1984), intra-articular methylprednisolone injection was found to lead to swifter pain relief and improved range of motion (ROM) compared to physiotherapy, ice therapy, and no treatment. However, no significant differences between the groups were observed after 6 months.

Another study by(D. A. W. M. van der Windt et al., 1998) noted that 77% of patients (40 out of 52) who received one to three intra-articular injections of 40 mg of triamcinolone acetonide experienced improved pain and shoulder disability scores, compared to only 46% (26 out of 56) of patients treated with physiotherapy (twice weekly for 6 weeks). This disparity was sustained even at a 1-year follow-up. Adverse effects, such as facial flushing and irregular menstrual bleeding, were more commonly reported in women(D. A. W. M. van der Windt et al., 1998)

More recently, a randomized controlled trial (RCT) conducted by(Ryans, 2005) demonstrated that a 20 mg intra-articular injection of triamcinolone led to improved self-assessment of global disability at 6 weeks, while physical therapy resulted in enhanced passive external rotation. Interestingly, the group that received both the triamcinolone injection and standardized physical therapy did not experience the combined benefits of either treatment modality or an interaction effect. By the 16-week mark, all groups demonstrated similar improvements in outcome measures(Ryans, 2005).

Sodium hyaluronate, an unbranched polysaccharide with chondroprotective properties, has been investigated as well(Iwata, 1993). It has shown equivalent outcomes to intra-articular corticosteroid injection(Harris et al., 2011). Sodium hyaluronate exhibits metabolic effects on articular cartilage, synovial tissue, and synovial fluid(Iwata, 1993). In a study by(Tamai et al., 2004) that employed dynamic MRI enhanced with Gd-DTPA, it was demonstrated that hyaluronate injection led to a lower coefficient of enhancement (indicative of reduced synovitis) in the synovium of patients with adhesive capsulitis. A systematic review, including four-level I and three-level IV studies, concluded that sodium hyaluronate injection results in improved ROM, constant scores, and pain in the short term, with no reported complications (Harris et al., 2011).

Furthermore, (Rovetta & Monteforte, 1998) reported that a combined injection of 20 mg of sodium hyaluronate and 20 mg of triamcinolone acetonide alongside

physiotherapy yielded better improvements in shoulder pain and joint motion when compared to a triamcinolone injection combined with physiotherapy.

- *Hydro-Dilatation:*

Hydrodilation, also known as distention arthrography or brisement, is a procedure where the contracted capsule is stretched by injecting air or fluid under fluoroscopy and local anesthetic, effectively increasing the intracapsular volume(Sharma et al., 1993)(Watson et al., 2007). In an RCT conducted by(Quraishi et al., 2007), patients in the hydrodilation group showed improved Constant score and visual analog scale (VAS) pain score compared to the group that underwent manipulation under anesthesia (MUA) plus intra-articular triamcinolone. However, there was no significant difference in range of motion (ROM) between the two groups(Quraishi et al., 2007).

The technique involves dilation of the capsule with either saline or steroid and local anesthetic in an attempt to stretch the capsule and break down any adhesions(Quraishi et al., 2007) In a randomized trial of 36 patients, compared hydro-dilatation with manipulation under anesthetic and demonstrated improved functional scores over a six-month period ($p = 0.02$) in the hydro-dilatation group. There was an improvement but no statistical significance in ROM at 6 months in both groups.

Another study using hydrodilation with normal saline and corticosteroid (40 mg of methylprednisolone acetate) reported improved pain, range of active motion, shoulder-specific disability measure, and patient preference measure compared to placebo (arthrogram) at the 3-week mark(Buchbinder, 2004). In a Cochrane review that included five clinical trials, it was concluded that hydrodilation with steroids and saline may improve pain at 3 weeks and disability at up to 12 weeks; however, there may be no significant difference in pain and disability when compared to steroid injection alone(Buchbinder et al., 2008).

- *NSAIDs:*

Oral pain relievers and non-steroidal anti-inflammatory medications (NSAIDs) are frequently used to treat stage 1 pain. and 2 adherent capsulitis; further treatment options if required, along with more analgesic drugs. The majority of randomized controlled trials (RCTs) are looking. There are some short-term benefits from using oral corticosteroids, but the improvement in pain and increase. At longer-term follow-up, ROM is not maintained (Buchbinder, 2004)(BINDER et al., 1986). Consequently, the dangers and drawbacks related to Before using oral steroids, one must thoroughly evaluate the start of therapy.

- *Pharmacological Therapy:*

Pharmacological treatment, which includes the use of non-steroidal anti-inflammatory drugs (NSAIDs) and corticosteroids either systemically or through intra-articular injections, plays a role in managing symptoms and complements physical therapy efforts. In patients with adhesive capsulitis, both COX-1 and COX-2 expressions are elevated in the capsular and bursal tissues, and these anti-inflammatory agents are directed at reducing synovitis, a source of pain(Lho YM, 2013). Effective pain management is crucial to enable patients to undergo physical therapy and improve their range of motion (ROM).

NSAIDs are commonly used for short-term pain relief, especially during the early inflammatory stages of adhesive capsulitis(D'Orsi et al., 2012)(D. Van Der Windt, 1995). In a study by(RHIND et al., 1982), a double-blinded comparison was conducted between naproxen and indomethacin for treating adhesive capsulitis. Both groups experienced improved pain relief, but no objective enhancement in shoulder mobility was observed. Notably, 70% (14 out of 20) of patients taking naproxen and 76% (16 out of 21) of patients taking indomethacin reported side effects, with nausea and headache being the most frequent complaints.

- *Physiotherapy:*

Physiotherapy is widely adopted as an initial treatment in many shoulder conditions including (Diercks & Stevens, 2004)(Griggs et al., 2000). Good results have been reported with physiotherapy itself or in comparison with other conservative management (Griggs et al., 2000) (Russell et al., 2014). The use of gentle workouts in the ROM appears to be preferable to more vigorous methods (Diercks & Stevens, 2004)(Griggs et al., 2000). The most beneficial treatment for adhesive capsulitis of the at least stage 2, as stage 1 patients frequently discover their pain stretching, physical therapy, or other forms of rehabilitation are prohibited because of the severity (Sheridan & Hannafin, 2006).

For patients in the early stages of adhesive shoulder capsulitis, physical therapy is typically the initial treatment approach. However, research from a Cochrane study suggests that physical therapy alone may not have sufficient evidence to support its effectiveness in treating adhesive capsulitis(Green et al., 2003). Therefore, physical therapy is commonly used in combination with other treatment modalities. It is generally recommended to initiate early mobilization with physical therapy, but the specific technique (gentle therapy versus aggressive therapy beyond pain limits) and the frequency of therapy are still subject to debate and controversy, as indicated by(Diercks & Stevens, 2004).

One technique that has shown promise is the posterior glide mobilization technique, which is believed to result in improved external rotation compared to an anteriorly directed technique(Johnson et al., 2007). Physical therapy can also be complemented with other modalities such as ultrasonic therapy, transcutaneous electrical nerve stimulation, short-wave therapy, low-level laser therapy, and hydrotherapy.

In cases where patients do not respond well to non-operative treatments, more aggressive treatment modalities may be considered after approximately four months of physical therapy, as these individuals are more likely to experience refractory symptoms(Levine et al., 2007).

➢ *Surgical Treatment:*

Typically, surgical treatments for adhesive shoulder capsulitis are considered when patients continue to experience symptoms despite conservative treatment methods. These surgical options encompass Manipulation Under Anesthesia (MUA) as well as arthroscopic or open capsulotomy(Le et al., 2017).

Even though the illness has a self-limited natural history, some individuals do not respond to nonoperative measures as expected (Dias et al., 2005) (Redler & Dennis, 2019) (Itoi et al., 2016). Surgical interventions are normally used in situations with adhesive capsulitis, which often takes place over a long length of time usually from six to twelve months.

Only 3% of UK medical experts surveyed recently (Dennis et al., 2010) who had experienced the primary unpleasant "freezing" period advised surgical methods. Nearly 50% of responders recommended surgical therapy (including capsular distension injections and manipulation under anesthesia (MUA) for the second and third stages of a frozen shoulder. The degree and persistence of the symptoms, as well as the outcome of conservative care, are factors that affect the choice of surgical surgery (Brue et al., 2007)(Redler & Dennis, 2019).

- *Manipulation under Anesthesia (MUA):*

Manipulation under anesthesia (MUA) is a common treatment that looks to be successful, especially in situations when other treatments have failed(A. S. Neviaser & Hannafin, 2010) (Iannotti, 2008) or when the adhesive capsulitis has progressed to the point where the range of motion (ROM) is seriously restricted. While the patient is unconscious and under general anesthesia, the shoulder joint is expertly manipulated to ensure total relaxation and reduce pain. MUA is a medical procedure where the shoulder joint is forcefully moved beyond its usual pain limits to treat adhesions and stretch the tight capsule around it. While generally considered safe, there have been cases where complications like hemarthrosis, tears in the capsule, detachment of the labrum, SLAP lesions, and fractures have been reported (D. Van Der Windt, 1995)(Loew et al., 2005)(Magnussen & Taylor, 2011). People are still debating how effective MUA really is. One study suggests that a combination of medication and physical therapy might lead to better results compared to MUA (Melzer et al., 1995). However, another study supports MUA when combined with a brachial plexus block for treating adhesive capsulitis (Placzek et al., 1998). It turns out that whether MUA is done alone or with steroid injections into the joint, the improvements in mobility and pain relief are quite similar. A randomized trial found that combining MUA with exercises at home has similar effects to doing exercises alone. It's worth noting that MUA might not work as well for diabetic patients with adhesive shoulder capsulitis (Janda & Hawkins, 1993).

The main objective of MUA is to eliminate the adhesions, constrictive structures and scar tissue, that are responsible for the shoulder's limited mobility. This is accomplished by carefully using controlled force and manipulating the joints to different angles and directions.

Numerous research indicates good short- and long-term outcomes (Farrell et al., 2005) (Dodenhoff et al., 2000)(Andersen et al., 1998). The technique may lead to a number of problems, namely humeral fracture, subscapularis rupture, labral tears, and biceps tendon damage(A. S. Neviaser & Hannafin, 2010). Randomized clinical studies contrasting manipulation performed under anesthesia with alternative treatment modalities failed to detect any appreciable difference in the result(Quraishi et al., 2007) (Maund et al., 2012) (Kivimäki et al., 2007). Compared to arthroscopic capsular release, it is equally efficient but less expensive(Maund et al., 2012).

Manipulation can be done under general anesthesia (Lundberg, 1969), it's also possible under interscalene block(Roubal et al., 1996)(Itoi & Minagawa, 2015). The brachial plexus or cervical nerve root block, however, was made possible by recent advancements in ultrasound technology(Ando et al., 2018)(Sasanuma et al., 2016). Furthermore, there is still controversy over MUA's efficacy. According to(Melzer et al., 1995) patients who received medication and physical therapy performed better than those who underwent MUA in terms of ROM and subjective personal assessment (Melzer et al., 1995).

Additionally, the appropriate time for MUA has not yet been identified, (Vastamäki et al., 2015) hypothesised that if conservative treatment fails, the best time for MUA may be between 6 and 9 months after the symptom first appeared. Because the disorder is still in a phase of inflammation, they thought that too early management (before 6 months after the beginning of symptoms) may result in a resurgence(Vastamäki et al., 2015). When comparing enhancements in movement and pain mitigation, MUA done in isolation yields outcomes equivalent to MUA done in conjunction with an intra-articular steroid injection [consisting of 4 mL of lidocaine (10 mg/mL) and 1 mL of betamethasone (6 mg/mL)](Kivimäki & Pohjolainen, 2001).

According to (Thomas et al., 2011) 246 patients with idiopathic frozen shoulder (FS) who received MUA treatment had positive clinical results at a mean follow-up time of 42 months. At a 7-year follow-up,(Vastamäki et al., 2012) assessed 26 patients who had received MUA for FS and discovered a significant improvement in ROM and pain alleviation. In a sample of 16 shoulders underwent MUA, these authors similarly demonstrated sustained improvement in ROM, discomfort, and function after 23 years(Vastamäki et al., 2012).

Recurrence following MUA might occur anywhere between 3% and 40% of the time(Woods & Loganathan, 2017) (Jenkins et al., 2012)(Theodorides et al., 2014). According to (Jenkins et al., 2012), 36% of individuals with diabetic FS needed a second MUA compared to 15% of those with nondiabetic shoulders. 85% of those receiving treatment were effectively treated after the second MUA (Jenkins et al., 2012). 730 individuals with FS underwent

MUA by (Woods and Loganathan, 2017). Patients with type-1 diabetes mellitus had a 38% higher probability of needing another MUA, and an additional MUA procedure was performed in 17.8% of cases.

- *Arthroscopic Capsular Release (ACR):*

The most popular surgical procedure that has been demonstrated to provide long-term, sustained improvement in symptoms is arthroscopic capsular release (ACR) (Kwaees & Charalambous, 2014). It is used for treating specific joint issues notably frozen shoulder (adhesive capsulitis) and other disorders. ACR encompasses a few steps (block anesthesia, capsular releases, ligament splitting, adhesion removal, and shoulder manipulation) followed by an oral cortisone strategy post-surgery and a closely monitored rehabilitation program (Zuckerman & Rokito, 2011)(Nagy et al., 2013).

This surgery offers a meticulous and controlled procedure, in order to release the joint's capsule and ligaments which lowers the likelihood of traumatic consequences seen following vigorous manipulation (Itoi et al., 2016). The operation is carried out while the patient is completely conscious, using an inter-scalene block (Itoi et al., 2016) which numbs the arm area and the entire shoulder, relieves pain and helps muscles relax. In the initial phases of recuperation, non-steroidal anti-inflammatory drugs (NSAIDs) and oral corticosteroids may be administered to assist decrease inflammation and pain.

In comparison to other treatment modalities, studies have demonstrated that arthroscopic capsular release outperforms alternative treatment options in terms of speed while providing complete and long-lasting improvements in shoulder pain and function. Furthermore, the positive outcomes from arthroscopic capsular release persist over the long term, with encouraging results observed even after an average of 7 years, ranging from 4 to 13 years (Çınar et al., 2010; Le Lievre & Murrell, 2012). ACR enables visual diagnostic confirmation and provides opportunity for the treatment of intra-articular and subacromial conditions that could be causing the primary problem (Joseph P. Iannotti & Gerald R. Williams, 2007).

In a study by(Smith et al., 2014), it was discovered that after arthroscopic capsular release, 50% and 80% of patients reported satisfactory pain reduction between 1 and 6 weeks, respectively. Typically, it requires 16 days to have significant pain alleviation, which lowers the visual analog scale (VAS) score from 6.6 to 1. Out of the 136 patients involved in that research, only a single patient experienced a surgical site infection which was treated with oral antibiotics (Smith et al., 2014)

According to a study conducted by (Le Lievre & Murrell, 2012), 43 patients were treated with ACR and the results showed early, substantial improvements in range of motion (ROM), pain alleviation, and function. At seven years, these advancements were still present (Le Lievre & Murrell, 2012).

Patients who are prone to have less favorable results following ACR include females over the age of 50 with type 2 diabetes mellitus (Mubark et al., 2015). Additionally, the clinical outcomes of ACR were also positive, especially when measured against other treatments just as hydrodistension (HD) and MUA as reported by (Gallacher et al., 2018) made a contrast of the outcomes from a 6-month follow-up between HD (20 patients) and ACR (19 patients) for FS. According to their findings, patients who were randomly assigned to the ACR had substantially elevated Oxford shoulder scores than the HD group at six months(Gallacher et al., 2018)

ACR can be applied to the patient's specific needs and the severity of their adhesive capsulitis in a variety of ways, depending on the location and extent of the adhesions. These variations include partial releases for localized adhesions, 360º complete releases for significant improvement, selective releases targeting particular areas, interval releases maintaining equilibrium in the joint, and merged techniques, for instance, release with manipulation.

- *Treatment:*

Analgesics and non-steroidal anti-inflammatory drugs are commonly prescribed with the aim of managing pain in cases of Frozen Shoulder (FS), even though no controlled studies specific to FS have been documented. During the initial phase, intermittent periods of rest using a sling or collar-and-cuff can often provide relief. However, it's important to caution patients against engaging in exercises or movements that worsen their pain, as these actions could potentially hinder the recovery process(Binder et al., 1984).

III. CONCLUSION

In summary, adhesive capsulitis or frozen shoulder presents as a complex clinical syndrome marked by shoulder discomfort and restricted mobility. This review has encompassed risk factors, diagnostics, and treatments, evaluating their effectiveness. The condition's definition, prevalence, and influential factors, such as fibrosis and inflammation, have been discussed. Diagnostic standards and diverse therapeutic interventions, including corticosteroid-assisted physiotherapy, injections, oral medications, and surgery, have been scrutinized. Prognosis, symptom duration, and potential long-term effects were addressed. Ultimately, the review concludes by recommending a combined approach of corticosteroid-assisted physiotherapy and structured home exercises for optimal clinical management.

- *Author's Contribution:*

All authors have contributed equally.

- *Conflict of Interest:*

All authors have declared that there is no conflict of interest regarding this publication.

REFERENCES

[1]. Andersen, N. H., Søjbjerg, J. O., Johannsen, H. V., & Sneppen, O. (1998). Frozen shoulder: Arthroscopy and manipulation under general anesthesia and early passive motion. Journal of Shoulder and Elbow Surgery, 7(3), 218–222. https://doi.org/10.1016/S1058-2746(98)90048-9

[2]. Ando, A., Hamada, J., Hagiwara, Y., Sekiguchi, T., Koide, M., & Itoi, E. (2018). Short-term Clinical Results of Manipulation Under Ultrasound-Guided Brachial Plexus Block in Patients with Idiopathic Frozen Shoulder and Diabetic Secondary Frozen Shoulder. The Open Orthopaedics Journal, 12(1), 99–104. https://doi.org/10.2174/1874325001812010099

[3]. Arkkila, P. E., Kantola, I. M., Viikari, J. S., & Ronnemaa, T. (1996). Shoulder capsulitis in type I and II diabetic patients: association with diabetic complications and related diseases. Annals of the Rheumatic Diseases, 55(12), 907–914. https://doi.org/10.1136/ard.55.12.907

[4]. Baslund, B., Thomsen, B. S., & Jensen, E. M. (1990). Frozen Shoulder: Current Concepts. Scandinavian Journal of Rheumatology, 19(5), 321–325. https://doi.org/10.3109/0300974900 9096786

[5]. BINDER, A., HAZLEMAN, B. L., PARR, G., & ROBERTS, S. (1986). A CONTROLLED STUDY OF ORAL PREDNISOLONE IN FROZEN SHOULDER. Rheumatology, 25(3), 288–292. https://doi.org/10.1093/rheumatology/25.3.288

[6]. Binder, A. I., Bulgen, D. Y., Hazleman, B. L., & Roberts, S. (1984). Frozen shoulder: a long-term prospective study. Annals of the Rheumatic Diseases, 43(3), 361–364. https://doi.org/10.1136/ard.43.3.361

[7]. Brue, S., Valentin, A., Forssblad, M., Werner, S., Mikkelsen, C., & Cerulli, G. (2007). Idiopathic adhesive capsulitis of the shoulder: a review. Knee Surgery, Sports Traumatology, Arthroscopy, 15(8), 1048–1054. https://doi.org/10.1007/s00167-007-0291-2

[8]. Buchbinder, R. (2004). Arthrographic joint distension with saline and steroid improves function and reduces pain in patients with painful stiff shoulder: results of a randomised, double blind, placebo controlled trial. Annals of the Rheumatic Diseases, 63(3), 302–309. https://doi.org/10.1136/ard.2002.004655

[9]. Buchbinder, R., Green, S., Youd, J. M., Johnston, R. V, & Cumpston, M. (2008). Arthrographic distension for adhesive capsulitis (frozen shoulder). Cochrane Database of Systematic Reviews. https://doi.org/10.1002/ 14651858.CD007005

[10]. Bulgen, D. Y., Binder, A. I., Hazleman, B. L., Dutton, J., & Roberts, S. (1984). Frozen shoulder: prospective clinical study with an evaluation of three treatment regimens. Annals of the Rheumatic Diseases, 43(3), 353–360. https://doi.org/10.1136/ard.43.3.353

[11]. Bunker, T. (2009). Time for a New Name for Frozen Shoulder—Contracture of the Shoulder. Shoulder & Elbow, 1(1), 4–9. https://doi.org/10.1111/j.1758-5740.2009.00007.x

[12]. Bunker TD and Anthony PP. (1995). The pathology of frozen shoulder. A Dupuytren-like disease. J Bone Joint Surg Br, 77, 667–683.

[13]. Cofield, R. H. (1983). Arthroscopy of the shoulder. Mayo Clinic Proceedings, 58(8), 501–508.

[14]. Dennis, L., Brealey, S., Rangan, A., Rookmoneea, M., & Watson, J. (2010). Managing Idiopathic Frozen Shoulder: A Survey of Health Professionals' Current Practice and Research Priorities. Shoulder & Elbow, 2(4), 294–300. https://doi.org/10.1111/ j.1758-5740.2010.00073.x

[15]. Dias, R., Cutts, S., & Massoud, S. (2005). Frozen shoulder. BMJ, 331(7530), 1453–1456. https://doi.org/10.1136/bmj.331.7530.1453

[16]. Diercks, R. L., & Stevens, M. (2004). Gentle thawing of the frozen shoulder: A prospective study of supervised neglect versus intensive physical therapy in seventy-seven patients with frozen shoulder syndrome followed up for two years. Journal of Shoulder and Elbow Surgery, 13(5), 499–502. https://doi.org/10.1016/j.jse.2004.03.002

[17]. Dodenhoff, R. M., Levy, O., Wilson, A., & Copeland, S. A. (2000). Manipulation under anesthesia for primary frozen shoulder: Effect on early recovery and return to activity. Journal of Shoulder and Elbow Surgery, 9(1), 23–26. https://doi.org/10.1016/S1058-2746(00)90005-3

[18]. D'Orsi, G. M., Via, A. G., Frizziero, A., & Oliva, F. (2012). Treatment of adhesive capsulitis: a review. Muscles, Ligaments and Tendons Journal, 2(2), 70–78.

[19]. Farrell, C. M., Sperling, J. W., & Cofield, R. H. (2005). Manipulation for frozen shoulder: Long-term results. Journal of Shoulder and Elbow Surgery, 14(5), 480–484. https://doi.org/10.1016/j.jse.2005.02.012

[20]. Gallacher, S., Beazley, J. C., Evans, J., Anaspure, R., Silver, D., Redfern, A., Thomas, W., Kitson, J., & Smith, C. (2018). A randomized controlled trial of arthroscopic capsular release versus hydrodilatation in the treatment of primary frozen shoulder. Journal of Shoulder and Elbow Surgery, 27(8), 1401–1406. https://doi.org/10.1016/j.jse.2018.04.002

[21]. Green, S., Buchbinder, R., & Hetrick, S. E. (2003). Physiotherapy interventions for shoulder pain. Cochrane Database of Systematic Reviews, 2013(3). https://doi.org/10.1002/14651858.CD004258

[22]. Griggs, S. M., Ahn, A., & Green, A. (2000). Idiopathic adhesive capsulitis. A prospective functional outcome study of nonoperative treatment. The Journal of Bone and Joint Surgery. American Volume, 82(10), 1398–1407.

[23]. Hand GC, A. N. M. T. et al. (2007). The pathology of frozen shoulder. J Bone Joint Surg Br , 89, 928–932.

[24]. Harris, J., Griesser, M., Copelan, A., & Jones, G. (2011). Treatment of adhesive capsulitis with intra-articular hyaluronate: A systematic review. International Journal of Shoulder Surgery, 5(2), 31. https://doi.org/10.4103/0973-6042.83194

[25]. Hettrich, C. M., DiCarlo, E. F., Faryniarz, D., Vadasdi, K. B., Williams, R., & Hannafin, J. A. (2016). The effect of myofibroblasts and corticosteroid injections in adhesive capsulitis. Journal of Shoulder and Elbow Surgery, 25(8), 1274–1279. https://doi.org/10.1016/j.jse.2016.01.012
[26]. Hollingworth, G. R., Ellis, R. M., & Hattersley, T. S. (1983). Comparison of injection techniques for shoulder pain: results of a double blind, randomised study. BMJ, 287(6402), 1339–1341. https://doi.org/10.1136/bmj.287.6402.1339
[27]. Hunt, S. A., Kwon, Y. W., & Zuckerman, J. D. (2007). The Rotator Interval: Anatomy, Pathology, and Strategies for Treatment. Journal of the American Academy of Orthopaedic Surgeons, 15(4), 218–227. https://doi.org/10.5435/00124635-200704000-00005
[28]. Iannotti, J. P. (2008). Manipulation Under Anesthesia Did Not Enhance the Benefit Conferred by Home Exercises for Frozen Shoulder. The Journal of Bone and Joint Surgery-American Volume, 90(8), 1792. https://doi.org/10.2106/JBJS.9008.EBO2
[29]. Itoi, E., Arce, G., Bain, G. I., Diercks, R. L., Guttmann, D., Imhoff, A. B., Mazzocca, A. D., Sugaya, H., & Yoo, Y.-S. (2016). Shoulder Stiffness: Current Concepts and Concerns. Arthroscopy: The Journal of Arthroscopic & Related Surgery, 32(7), 1402–1414. https://doi.org/10.1016/j.arthro.2016.03.024
[30]. Itoi, E., & Minagawa, H. (2015). Manipulation Under Anesthesia for Frozen Shoulders. In Shoulder Stiffness (pp. 205–215). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-46370-3_19
[31]. Iwata, H. (1993). Pharmacologic and clinical aspects of intraarticular injection of hyaluronate. Clinical Orthopaedics and Related Research, 289, 285–291.
[32]. Janda, D. H., & Hawkins, R. J. (1993). Shoulder manipulation in patients with adhesive capsulitis and diabetes mellitus: A clinical note. Journal of Shoulder and Elbow Surgery, 2(1), 36–38. https://doi.org/10.1016/S1058-2746(09)80135-3
[33]. Jenkins, E. F., Thomas, W. J. C., Corcoran, J. P., Kirubanandan, R., Beynon, C. R., Sayers, A. E., & Woods, D. A. (2012). The outcome of manipulation under general anesthesia for the management of frozen shoulder in patients with diabetes mellitus. Journal of Shoulder and Elbow Surgery, 21(11), 1492–1498. https://doi.org/10.1016/j.jse. 2011.11.006
[34]. Johnson, A. J., Godges, J. J., Zimmerman, G. J., & Ounanian, L. L. (2007). The Effect of Anterior Versus Posterior Glide Joint Mobilization on External Rotation Range of Motion in Patients With Shoulder Adhesive Capsulitis. Journal of Orthopaedic & Sports Physical Therapy, 37(3), 88–99. https://doi.org/10.2519/jospt.2007.2307
[35]. Joseph P. Iannotti, & Gerald R. Williams. (2007). Disorders of the shoulder: diagnosis & management (2nd ed., Vol. 1). Lippincott Williams & Wilkins, 2007.
[36]. Kivimäki, J., & Pohjolainen, T. (2001). Manipulation under anesthesia for frozen shoulder with and without steroid injection. Archives of Physical Medicine and Rehabilitation, 82(9), 1188–1190. https://doi.org/10.1053/apmr.2001.24169
[37]. Kivimäki, J., Pohjolainen, T., Malmivaara, A., Kannisto, M., Guillaume, J., Seitsalo, S., & Nissinen, M. (2007). Manipulation under anesthesia with home exercises versus home exercises alone in the treatment of frozen shoulder: A randomized, controlled trial with 125 patients. Journal of Shoulder and Elbow Surgery, 16(6), 722–726. https://doi.org/10.1016/j.jse.2007.02.125
[38]. Kwaees, T. A., & Charalambous, C. P. (2014). Surgical and non-surgical treatment of frozen shoulder. Survey on surgeons treatment preferences. Muscles, Ligaments and Tendons Journal, 4(4), 420–424.
[39]. Le Lievre, H. M. J., & Murrell, G. A. C. (2012). Long-Term Outcomes After Arthroscopic Capsular Release for Idiopathic Adhesive Capsulitis. The Journal of Bone & Joint Surgery, 94(13), 1208–1216. https://doi.org/ 10.2106/JBJS.J.00952
[40]. Le, H. V., Lee, S. J., Nazarian, A., & Rodriguez, E. K. (2017). Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. Shoulder & Elbow, 9(2), 75–84. https://doi.org/10.1177/1758573216676786
[41]. Levine, W. N., Kashyap, C. P., Bak, S. F., Ahmad, C. S., Blaine, T. A., & Bigliani, L. U. (2007). Nonoperative management of idiopathic adhesive capsulitis. Journal of Shoulder and Elbow Surgery, 16(5), 569–573. https://doi.org/10.1016/j.jse.2006.12.007
[42]. Lho YM, H. E. C. C. et al. (2013). Inflammatory cytokines are overexpressed in the subacromial bursa of frozen shoulder. J Shoulder Elbow Surg , 22, 666–672.
[43]. Loew, M., Heichel, T. O., & Lehner, B. (2005). Intraarticular lesions in primary frozen shoulder after manipulation under general anesthesia. Journal of Shoulder and Elbow Surgery, 14(1), 16–21. https://doi.org/10.1016/j.jse.2004.04.004
[44]. Lorbach, O., Anagnostakos, K., Scherf, C., Seil, R., Kohn, D., & Pape, D. (2010). Nonoperative management of adhesive capsulitis of the shoulder: Oral cortisone application versus intra-articular cortisone injections. Journal of Shoulder and Elbow Surgery, 19(2), 172–179. https://doi.org/10.1016/j.jse.2009.06.013
[45]. Lundberg, B. J. (1969). The frozen shoulder. Clinical and radiographical observations. The effect of manipulation under general anesthesia. Structure and glycosaminoglycan content of the joint capsule. Local bone metabolism. Acta Orthopaedica Scandinavica. Supplementum, 119, 1–59.
[46]. Magnussen, R. A., & Taylor, D. C. (2011). Glenoid fracture during manipulation under anesthesia for adhesive capsulitis: a case report. Journal of Shoulder and Elbow Surgery, 20(3), e23–e26. https://doi.org/10.1016/j.jse.2010.11.024

[47]. Manske, R. C., & Prohaska, D. (2008). Diagnosis and management of adhesive capsulitis. Current Reviews in Musculoskeletal Medicine, 1(3–4), 180–189. https://doi.org/10.1007/s12178-008-9031-6
[48]. Maund, E., Craig, D., Suekarran, S., Neilson, A., Wright, K., Brealey, S., Dennis, L., Goodchild, L., Hanchard, N., Rangan, A., Richardson, G., Robertson, J., & McDaid, C. (2012). Management of frozen shoulder: a systematic review and cost-effectiveness analysis. Health Technology Assessment, 16(11). https://doi.org/10.3310/hta16110
[49]. Melzer, C., Hoffmann, S., Wallny, T., & Wirth, C. J. (1995). Frozen shoulder? treatment and results. Archives of Orthopaedic and Trauma Surgery, 114(2), 87–91. https://doi.org/10.1007/BF00422832
[50]. Mubark, I., Ragab, A., Nagi, A., & Motawea, B. (2015). Evaluation of The Results of Management of Frozen Shoulder Using the Arthroscopic Capsular Release. Ortopedia Traumatologia Rehabilitacja, 17(1), 21–28. https://doi.org/10.5604/15093492.1143530
[51]. Nagy, M. T., MacFarlane, R. J., Khan, Y., & Waseem, M. (2013). The Frozen Shoulder: Myths and Realities. The Open Orthopaedics Journal, 7(1), 352–355. https://doi.org/10.2174/1874325001307010352
[52]. Neviaser, A. S., & Hannafin, J. A. (2010). Adhesive Capsulitis. The American Journal of Sports Medicine, 38(11), 2346–2356. https://doi.org/10.1177/0363546509348048
[53]. Neviaser, A. S., & Neviaser, R. J. (2011). Adhesive Capsulitis of the Shoulder. American Academy of Orthopaedic Surgeon, 19(9), 536–542. https://doi.org/10.5435/00124635-201109000-00004
[54]. Neviaser, J. S. (1945). ADHESIVE CAPSULITIS OF THE SHOULDER: A Study of the Pathological Findings in Periarthritis of the Shoulder. Journal of Bone and Joint Surgery, American , 27, 211-222.
[55]. Placzek, J. D., Roubal, P. J., Freeman, D. C., Kulig, K., Nasser, S., & Pagett, B. T. (1998). Long Term Effectiveness of Translational Manipulation for Adhesive Capsulitis. Clinical Orthopaedics and Related Research, 356, 181–191. https://doi.org/10.1097/00003086-199811000-00025
[56]. Quraishi, N. A., Johnston, P., Bayer, J., Crowe, M., & Chakrabarti, A. J. (2007). Thawing the frozen shoulder. The Journal of Bone and Joint Surgery. British Volume, 89-B(9), 1197–1200. https://doi.org/10.1302/0301-620X.89B9.18863
[57]. Redler, L. H., & Dennis, E. R. (2019). Treatment of Adhesive Capsulitis of the Shoulder. Journal of the American Academy of Orthopaedic Surgeons, 27(12), e544–e554. https://doi.org/10.5435/JAAOS-D-17-00606
[58]. RHIND, V., DOWNIE, W. W., BIRD, H. A., WRIGHT, V., & ENGLER, C. (1982). NAPROXEN AND INDOMETHACIN IN PERIARTHRITIS OF THE SHOULDER. Rheumatology, 21(1), 51–53. https://doi.org/10.1093/rheumatology/21.1.51
[59]. Rizk, T. E., & Pinals, R. S. (1982). Frozen shoulder. Seminars in Arthritis and Rheumatism, 11(4), 440–452. https://doi.org/10.1016/0049-0172(82)90030-0
[60]. Rizk, T. E., Pinals, R. S., & Talaiver, A. S. (1991). Corticosteroid injections in adhesive capsulitis: investigation of their value and site. Archives of Physical Medicine and Rehabilitation, 72(1), 20–22.
[61]. Roubal, P. J., Dobritt, D., & Placzek, J. D. (1996). Glenohumeral Gliding Manipulation Following Interscalene Brachial Plexus Block in Patients With Adhesive Capsulitis. Journal of Orthopaedic & Sports Physical Therapy, 24(2), 66–77. https://doi.org/10.2519/jospt.1996.24.2.66
[62]. Rovetta, G., & Monteforte, P. (1998). Intraarticular injection of sodium hyaluronate plus steroid versus steroid in adhesive capsulitis of the shoulder. International Journal of Tissue Reactions, 20(4), 125–130.
[63]. Russell, S., Jariwala, A., Conlon, R., Selfe, J., Richards, J., & Walton, M. (2014). A blinded, randomized, controlled trial assessing conservative management strategies for frozen shoulder. Journal of Shoulder and Elbow Surgery, 23(4), 500–507. https://doi.org/10.1016/j.jse.2013.12.026
[64]. Ryans, I. (2005). A randomized controlled trial of intra-articular triamcinolone and/or physiotherapy in shoulder capsulitis. Rheumatology, 44(4), 529–535. https://doi.org/10.1093/rheumatology/keh535
[65]. Sasanuma, H., Sugimoto, H., Kanaya, Y., Iijima, Y., Saito, T., Saito, T., & Takeshita, K. (2016). Magnetic resonance imaging and short-term clinical results of severe frozen shoulder treated with manipulation under ultrasound-guided cervical nerve root block. Journal of Shoulder and Elbow Surgery, 25(1), e13–e20. https://doi.org/10.1016/j.jse.2015.06.019
[66]. Sharma, R. K., Bajekal, R. A., & Bhan, S. (1993). Frozen shoulder syndrome. International Orthopaedics, 17(5). https://doi.org/10.1007/BF00181697
[67]. Sheridan, M. A., & Hannafin, J. A. (2006). Upper Extremity: Emphasis on Frozen Shoulder. Orthopedic Clinics of North America, 37(4), 531–539. https://doi.org/10.1016/j.ocl.2006.09.009
[68]. Smith, C., Hamer, P., & Bunker, T. (2014). Arthroscopic capsular release for idiopathic frozen shoulder with intra-articular injection and a controlled manipulation. The Annals of The Royal College of Surgeons of England, 96(1), 55–60. https://doi.org/10.1308/003588414X13824511650452
[69]. Tamai, K., Mashitori, H., Ohno, W., Hamada, J., Sakai, H., & Saotome, K. (2004). Synovial response to intraarticular injections of hyaluronate in frozen shoulder: a quantitative assessment with dynamic magnetic resonance imaging. Journal of Orthopaedic Science, 9(3), 230–234. https://doi.org/10.1007/s00776-004-0766-7
[70]. Theodorides, A. A., Owen, J. M., Sayers, A. E., & Woods, D. A. (2014). Factors affecting short- and long-term outcomes of manipulation under anaesthesia in patients with adhesive capsulitis of the shoulder. Shoulder & Elbow, 6(4), 245–256. https://doi.org/10.1177/1758573214528155

[71]. Thomas, W. J. C., Jenkins, E. F., Owen, J. M., Sangster, M. J., Kirubanandan, R., Beynon, C., & Woods, D. A. (2011). Treatment of frozen shoulder by manipulation under anaesthetic and injection. The Journal of Bone and Joint Surgery. British Volume, 93-B(10), 1377–1381. https://doi.org/10.1302/0301-620X.93B10.27224
[72]. Uppal, H. S. (2015). Frozen shoulder: A systematic review of therapeutic options. World Journal of Orthopedics, 6(2), 263. https://doi.org/10.5312/wjo.v6.i2.263
[73]. Van Der Windt, D. (1995). The efficacy of non-steroidal anti-inflammatory drugs (NSAIDS) for shoulder complaints. A systematic review. Journal of Clinical Epidemiology, 48(5), 691–704. https://doi.org/10.1016/0895-4356(94)00170-U
[74]. Van der Windt, D. A. W. M., Koes, B. W., Deville, W., Boeke, A. J. P., de Jong, B. A., & Bouter, L. M. (1998). Effectiveness of corticosteroid injections versus physiotherapy for treatment of painful stiff shoulder in primary care: randomised trial. BMJ, 317(7168), 1292–1296. https://doi.org/10.1136/bmj.317.7168.1292
[75]. Vastamäki, H., Kettunen, J., & Vastamäki, M. (2012). The Natural History of Idiopathic Frozen Shoulder: A 2- to 27-year Followup Study. Clinical Orthopaedics & Related Research, 470(4), 1133–1143. https://doi.org/10.1007/s11999-011-2176-4
[76]. Vastamäki, H., Varjonen, L., & Vastamäki, M. (2015). Optimal time for manipulation of frozen shoulder may be between 6 and 9 months. Scandinavian Journal of Surgery, 104(4), 260–266. https://doi.org/10.1177/1457496914566637
[77]. Watson, L., Bialocerkowski, A., Dalziel, R., Balster, S., Burke, F., & Finch, C. (2007). Hydrodilatation (distension arthrography): a long-term clinical outcome series. British Journal of Sports Medicine, 41(3), 167–173. https://doi.org/10.1136/bjsm.2006.028431
[78]. Widiastuti-Samekto, M., & Sianturi, G. P. (2004). Frozen shoulder syndrome: comparison of oral route corticosteroid and intra-articular corticosteroid injection. The Medical Journal of Malaysia, 59(3), 312–316.
[79]. Woods, D. A., & Loganathan, K. (2017). Recurrence of frozen shoulder after manipulation under anaesthetic (MUA). The Bone & Joint Journal, 99-B(6), 812–817. https://doi.org/10.1302/0301-620X.99B6.BJJ-2016-1133.R1
[80]. Wright, V., & Haq, A. M. (1976). Periarthritis of the shoulder. I. Aetiological considerations with particular reference to personality factors. Annals of the Rheumatic Diseases, 35(3), 213–219. https://doi.org/10.1136/ard.35.3.213
[81]. Zuckerman, J. D., & Rokito, A. (2011). Frozen shoulder: a consensus definition. Journal of Shoulder and Elbow Surgery, 20(2), 322–325. https://doi.org/10.1016/j.jse.2010.07.008.