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The comparative and prospective study on efficacy and functional outcome of autologous platelet rich plasma injection vs hydrodissection in adhesive capsulitis of shoulder

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ABSTRACT

Background: Adhesive capsulitis of should is also called frozen shoulder which describes a chronic, indolent pathological process in which the body forms excessive adhesions across the glenohumeral joint which in turn leads to pain, stiffness, and loss of range of movements which compromises the quality of life. The objective of the study was to evaluate the efficacy and functional outcome of autologous PRP injection and hydrodissection in adhesive capsulitis of shoulder.
Methods: After excluding the patients who failed to satisfy the study protocol, the remaining 100 patients are divided equally into two groups namely group A (n=50) who receive autologous PRP injection and group B (n=50) who receive hydrodissection for adhesive capsulitis of shoulder. Both group participants are followed up pre-procedurally and post-procedurally at the end of 1st, 6th and 12th month for pain relief and range of movements. The improvements in pain and range of movements are charted in terms of VAS and DASH scoring system.
Results: The statistical analysis were done for 46 patients in group A and 45 patients in group B which showed a statistical improvement in pain and range of movements ($p<0.001$ for VAS score and $p<0.01$ for DASH score) in group A who received autologous platelet rich plasma therapy. Autologous PRP therapy improves the functional quality of life with a long term outcome.
Conclusions: For adhesive capsulitis of shoulder, autologous PRP therapy remains functionally superior than hydrodissection as autologous PRP is a constructive procedure by rejuvenating the degenerative tissues.

Keywords: Platelet rich plasma, Hydrodissection, Adhesive capsulitis, Periarthritis

INTRODUCTION

Adhesive capsulitis of shoulder is also called frozen shoulder or periarthritis of shoulder. Adhesive capsulitis is an idiopathic and a progressive chronic, indolent pathological process in which the body forms excessive adhesions across the glenohumeral joint which in turn leads to pain, stiffness, and loss of range of movements.[1] Painful stiffness of the shoulder can adversely affect activities of daily living and consequently impair quality of life. The incidence of adhesive capsulitis is 3–5% in general population and 20% in diabetic individuals.[2] The histological biopsy of the contracted capsule revealed the deposition of fibroblasts admixed with type 1 and 3 collagen where there will be a transformation of fibroblasts into myofibroblasts with altered levels of matrix metalloproteinases. The management of adhesive capsulitis of shoulder ranges from non-operative management to surgical release of fibrosis of shoulder joint. In this study, we aimed in evaluating the efficacy

and functional outcome of autologous platelet rich injection and hydrodissection in adhesive capsulitis of shoulder.

METHODS

This prospective cohort study was conducted in 123 cases of adhesive capsulitis of shoulder in JJM Medical College, Davangere, a tertiary care hospital from June 2016 to June 2018. A total of 123 patients of adhesive capsulitis are clinically identified and 17 patients are excluded from the study who failed to satisfy the inclusion criteria and 6 patients declined to participate the study. The remaining 100 cases were taken up for this study which was divided equally into two groups namely group A who receive autologous platelet rich plasma injection and group B who receive hydrodissection of the shoulder as per our study protocol.

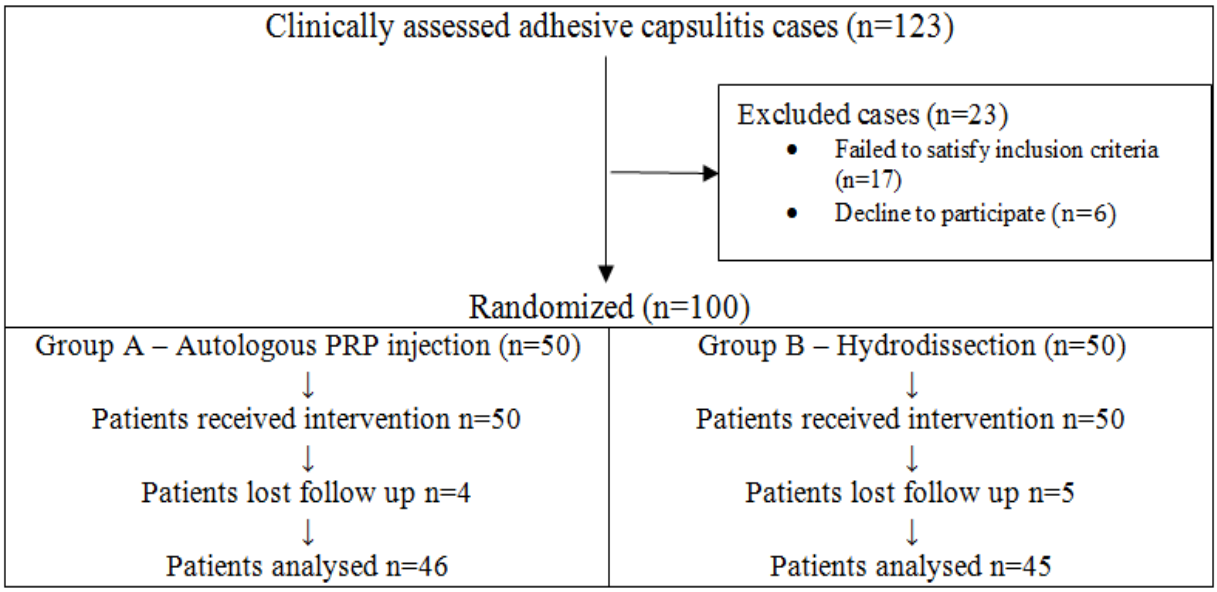

Figure 1: Patient's allocation into group A and B.

Inclusion criteria

Inclusion criteria were patients with stiff and painful shoulder not relieved by conservative treatment from past 1 month; patients with confirmed diagnosis of adhesive capsulitis; patients who gave consent for treatment with PRP or hydrodissection as per our protocol; regular visits in the out-patient department.

Exclusion criteria

Exclusion criteria were patients with haemoglobin <10 gm/dL and platelet count $<10^5/\mu L$; patients with corticosteroid injection at treatment site within 1 month; patients with local infection at the site of the procedure, HIV, Hepatitis B or C, septicaemia and other systemic disorders; patients refusal for PRP and hydrodissection treatment as per our protocol

After getting IEC clearance from the institute and informed written consent from the patients enrolled in our study, they are subjected for thorough clinical examination to rule out the other causes of stiff and painful shoulder syndrome. The baseline investigations such as complete hemogram, ESR, CRP, renal function tests, random blood glucose, serological testing for HIV 1 and 2 and HbsAg and radiographic analysis of affected shoulder joint are done.

In both the groups, the shoulder joint is approached from posteriorly by 1 cm below the tip of angle of acromion. The patients in both the groups were subjected for clinical examination. The patients who got enrolled in group A (n=50) are treated with one dose of 3 ml of autologous platelet rich plasma injection under fluoroscopic guidance after securing all sterile precautions. The patients who got enrolled in group B (n=50) are treated with mixture of 20 ml of normal saline with 5 ml of lignocaine under fluoroscopic guidance after securing all sterile precautions. After 10 minutes of post procedure in both the groups, a gentle shoulder mobilization was done. The patients were trained for home based shoulder strengthening programme.

All the patients are advised not to bear weight for minimum of 2 weeks and the pain is combated with paracetamol. Cuff and collar application have been advised in the post-procedural period. The patients are followed up for pain and range of movements in accordance with VAS and DASH scoring system on (pre-procedure) day 0 and (post-procedure) at the end of 1^{st}, 6^{th} and 12^{th} month. All the recorded data were subjected for statistical analysis with Mann–Whitney U test and p value.

RESULTS

Group A–Autologous PRP group (n=50)

Out of 50 patients, 4 patients lost follow up. Hence the statistical analyses were done for 46 patients. Out of 46 cases, 29 (63.04%) were males and 17 (36.95%) were females. The age ranged from minimum of 36 years to maximum of 72 years. The mean age of patients in group A is 51.85±10.14. The mean pre-procedural range of shoulder movements were 70 degree flexion, 30 degree extension, 60 degree abduction, 30 degree adduction, 30 degree internal rotation and 30 degree external rotation. The mean pre-procedural VAS and DASH were 8.98±0.57 and 77.91±5.03 respectively. At the end of 6th month, the mean VAS and DASH score improved to 3.96±1.94 and 45.22±6.63 respectively. By the end of 1 year, there were a significant improvement in the mean VAS (2.11±1.28) and DASH (30.20±4.55) scores. The mean range of movements at the end of 1 year were 130 degree flexion, 50 degree extension, 165 degree abduction, 80 degree adduction, 60 degree internal rotation and 70 degree external rotation.

Out of 46 patients who underwent autologous PRP injection therapy, 29 (63.04%) patients reported excellent results, 11 (23.91%) patients reported good results and 6 (13.04%) patients reported poor results. By the end of 1st month follow up, the complications reported by group A participants are pain in 17 cases (36.95%) and swelling in 7 cases (15.21%). 6 patients who reported poor results were counselled for surgical release of fibrosis.

Table 1: Patient's demography.

Variables		Group A (n=50)	Group B (n=50)	P value
Sex	Male	29	32	0.41
	Female	17	13	
Age	Mean±SD	51.85±10.14	57.49±10.00	0.01
	Range	(36–72)	(39–77)	

Table 2: VAS and DASH scoring.

Follow up	Group A	Group B	P value
VAS score			
Pre procedural	8.98±0.57	9.18±0.38	0.06
1st month	7.09±1.09	4.42±1.30	<0.001
6th month	3.96±1.94	6.00±1.41	<0.001
12th month	2.11±1.28	3.93±1.95	<0.001
DASH score			
Pre procedural	77.91±5.03	78.08±5.03	0.83
1st month	63.70±4.18	65.44±7.15	0.26
6th month	45.22±6.63	48.63±4.49	0.005
12th month	30.20±4.55	32.28±3.64	0.01

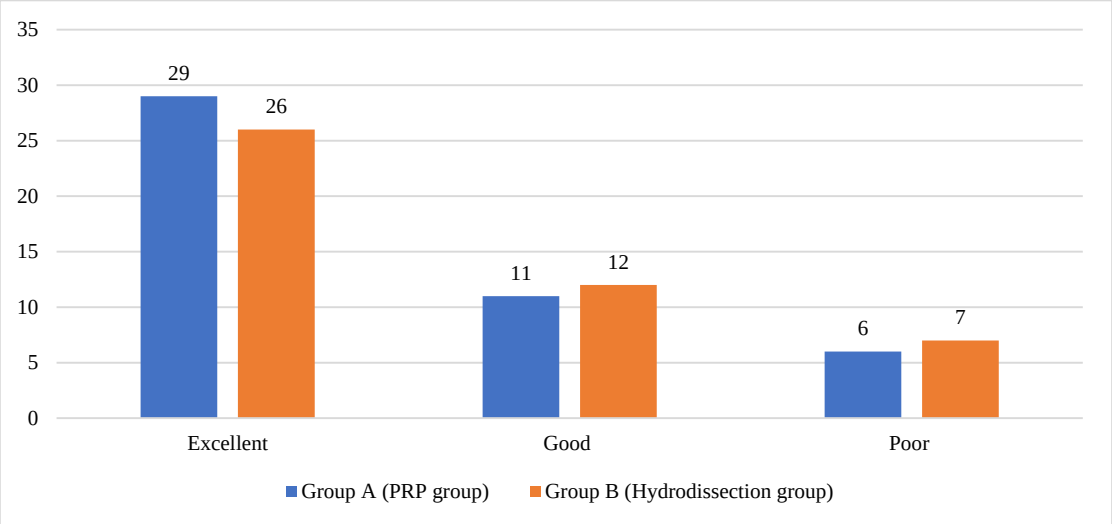

Figure 2: Quality of treatment among group A and B.

Group B–Hydrodissection group

Out of 50 patients, 5 patients lost follow up. Hence the statistical analysis was done for 45 patients. Out of 45 cases, 32 (71.11%) were males and 13 (28.88%) were females. The age ranged from minimum of 39 years to maximum of 77 years. The mean age of patients in group B is 57.49±10.00. The mean pre-procedural range of shoulder movements were 45 degree flexion, 30 degree extension, 50 degree abduction, 25 degree adduction, 20 degree internal rotation and 30 degree external rotation. The mean pre-procedural VAS and DASH were 9.18±0.38 and 78.08±5.03 respectively. At the end of 6th month, the mean VAS and DASH score improved to 6.00±1.41 and 48.63±4.49 respectively. By the end of 1 year, there were a significant improvement in the mean VAS (3.93±1.95) and DASH (32.28±3.64) scores. The mean range of movements at the end of 1 year were 120 degree flexion, 50 degree extension, 145 degree abduction, 65 degree adduction, 55 degree internal rotation and 60 degree external rotation.

Out of 45 patients who underwent hydrodissection therapy, 26 (57.77%) patients reported excellent results, 12 (26.66%) patients reported good results and 7 (15.55%) patients reported poor results. By the end of 1st month follow up, the complications reported by group B participants are pain in 23 cases (51.11%). 7 patients who reported poor results were counselled for surgical release of fibrosis.

DISCUSSION

In 1845, Duplay recognized chronic shoulder pain which he named as 'scapulohumeral periarthritis'.[3] In 1934, Codman coined the term 'Frozen shoulder' which is characterized by debilitating loss of shoulder motion & described this condition as 'difficult to define, difficult to treat and difficult to explain from the point of view of pathology'.[4] In 1945, Neviaser termed shoulder pain syndrome as 'Adhesive capsulitis' who revealed the histological inflammatory and fibrotic changes in the contracted capsule or adjacent bursa.[5]

Adhesive capsulitis of shoulder is also called scapulohumeral periarthritis, frozen shoulder, arthrofibrosis or periarthritis of shoulder. Lundberg classified frozen shoulder into two groups namely primary frozen shoulder which is of idiopathic in nature and secondary frozen shoulder which is due to trauma, tendinitis or systemic disorders. It affects the age group of 4th to 5th decade of life.[2]

The natural history of diseases follows an indolent course into four stages namely 1) inflammatory stage which is a stage of transient synovitis without contracture or fibrosis, 2) freezing stage which shows early formation of adhesions and capsular contracture, 3) frozen stage which is a stage of resolving synovitis with global profound loss of range of movements around the shoulder joint, and 4) thawing stage which shows persistent stiffness with slow improvement in shoulder mobility. Advanced adhesions and restriction of the glenohumeral joint space is observed.[2]

The incidence of adhesive capsulitis of shoulder in general population is 3–5% and is diagnosed clinically on the basis of medical history and physical examination and is often a diagnosis of exclusion. The other causes of a painful stiff shoulder must be excluded before a diagnosis of adhesive capsulitis. Clinically, patients present with shoulder pain followed by gradual loss of both active and passive range of motion (ROM) due to fibrosis of the glenohumeral joint capsule.

The incidence of adhesive capsulitis in diabetic individuals is more (20%) due to the formation of glucosepane which is a lysine-arginine protein cross-linking product and advanced glycation end product (AGE) derived from D-glucose. Glucosepane enhances the extracellular matrix turnover processes, which leads to the degradation of cross-linked proteins in turn leads to stiffness across shoulder joint and loss of range of movements.[1]

The histological evidence of adhesive capsulitis is characterised by the presence of myofibroblasts admixed collagen type 1 and 3 with altered levels of matrix metalloproteinases in the contracted capsule. The elevation of mitogen-activated protein kinases, NF kappa B, CD29, TGF-β and VEGF are observed. The histological hallmark of adhesive capsulitis is neoangiogenesis and neoinnervation in the contracted capsule of the shoulder.

Management options for adhesive capsulitis of shoulder varies from a) physical therapy in the form of active range of shoulder movements, pendulum, ladder and wheel exercises, short wave diathermy, ultrasonic therapy and interferential therapy of the shoulder joint, b) pharmacological management with analgesics and muscle relaxants, c) home based exercise programme in the form of hot fomentation and active range of shoulder movement exercises, d) intra-articular steroid injection in the form of 40 mg of triamcinolone into the affected shoulder joint, e) intra-articular sodium hyaluronate injection, which acts as a viscosupplement by increasing the viscosity of the synovial fluid, which helps lubricate, cushion and reduce pain in the joint, f) brisement in the form of distension arthrography (hydroplasty or hydrodissection), which mechanically ruptures the contracted capsule by injecting a mixture of normal saline admixed with local anaesthetic agent and thus relieves the shoulder pain, g) manipulation of shoulder in all the directions under general anaesthesia which ruptures the fibrosis across the shoulder joint, h) whole body cryotherapy with -110 degree C to -140 degree C provides anti-inflammatory and analgesic effect to the body, i) surgical management in the form of open or arthroscopic release of fibrosis of shoulder joint and j)

biological therapy with autologous platelet rich plasma injection. The future treatment modalities of adhesive capsulitis of shoulder are intra-articular collagenase injections which breaks down the peptide bonds in collagen and biological agents of anti-TNF agents are under clinical research.

Agarwal et al conducted a study on 24 patients with hydroplasty revealed significant range of movements immediately post-procedure and at 4 weeks with 70% excellent results. Hence, he concluded hydroplasty acts as a low cost, effective and economical outpatient procedure for adhesive capsulitis of shoulder.[6]

Rawat et al conducted a study on 32 patients with intra-articular steroid injection in frozen shoulder showed a significant pain relief after 12 weeks of follow up which are statistically significant.[7] Shah conducted a study on 40 patients with 3 doses of intra-articular steroid at regular intervals revealed a significant improvement with a $p<0.05$ in VAS and CSS scores.[8]

Aslani et al conducted an experimental PRP therapy for frozen shoulder in a volunteer revealed 2 consecutive doses of PRP with an interval of 4 weeks improved functional range of movements and pain relief. He emphasised 2-fold improvement for range of movements with PRP therapy.[9] Kumar et al conducted an observational study to compare local steroid injections and ultrasonic wave therapy in frozen shoulder patients revealed immediate improvement of range of movements is better with local steroid injections. They concluded long term effects are same in both the groups.[10]

Jadhav et al performed arthroscopic 360 degree capsular release for 40 patients showed maximum gain in range of movements in 2 months duration.[11] Kothari et al compared the efficacy of PRP injection, corticosteroid injection and ultrasonic therapy in treatment of periarthritis shoulder revealed PRP therapy resulted in statistically significant improvements over steroid injections and ultrasonic therapy. Hence they concluded PRP therapy is superior and biological therapy than steroid injections and ultrasonic therapy for periarthritis shoulder.[12]

Here in this article, we considered autologous platelet rich plasma injection and hydrodissection as the treatment modality for the patients with adhesive capsulitis of the shoulder. The patients who received platelet rich plasma therapy showed improved range of movements by the end of 1st month follow up. Our study shows platelet rich plasma therapy for adhesive capsulitis is superior with $p<0.001$ for VAS score and 0.01 for DASH score which is statistically significant than hydrodissection. The dose response relationship curve in autologous PRP for treating adhesive capsulitis follow a sigmoid shaped kinetics. The group who received PRP therapy showed better pain relief, functional range of movements and improved quality of life than the group who received hydrodissection for adhesive capsulitis.

Limitation

Further research on the natural history of adhesive capsulitis of shoulder has to be evaluated which will guide the researchers to target the micromolecules which prevents the degeneration of soft tissues around the joint and improve the functional quality of life.

CONCLUSION

The autologous platelet rich plasma injection is considered superior to hydrodissection in adhesive capsulitis as platelet rich plasma injection provides growth factors for tissue rejuvenation and hydro-dissection leads to forced capsular rupture. Platelet rich plasma injection become the biological novel agent in reducing inflammation, scarring and fibrosis of tissues and improves the range of movements and quality of life in a long term sequelae in patients with adhesive capsulitis of shoulder.

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Ethical approval: The study was approved by the institutional ethics committee

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