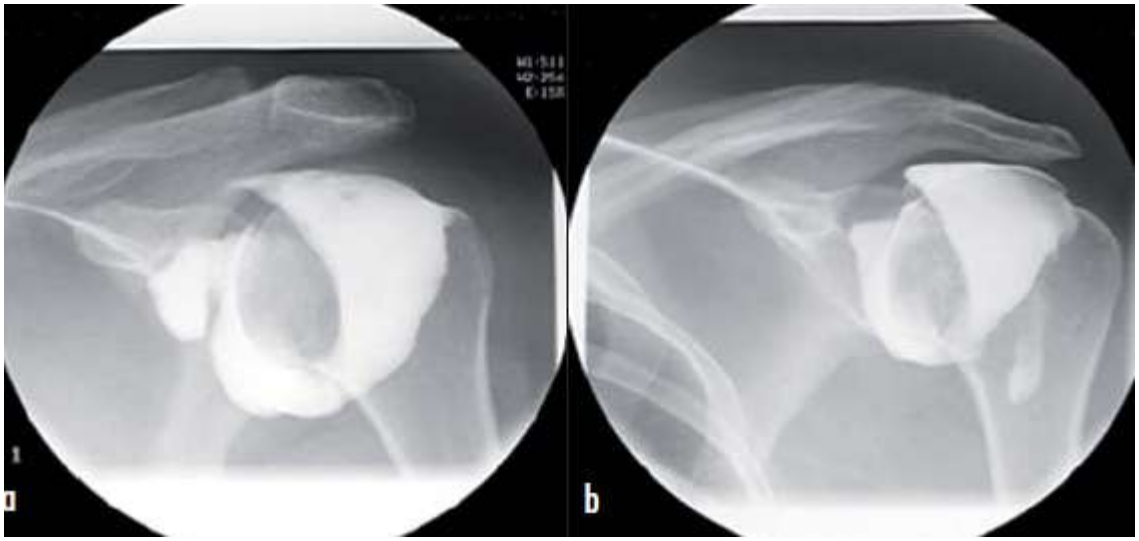
FROZEN SHOULDER



Andreas Panagopoulos

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Terminology

Duplay = ‘‘peri-arthritis scapulohumerale’’ (1896)

Codman = ‘‘frozen shoulder’’ (1934), a condition characterized by pain and reduced range of motion in the affected shoulder

Neviaser = ‘‘adhesive capsulitis’’ (1945, pre-arthroscopic era), chronic inflammation and fibrosis of the joint capsule

…although arthroscopic examination would support the term ‘‘fibrotic capsulitis’’ with the absence of adhesions

Definition

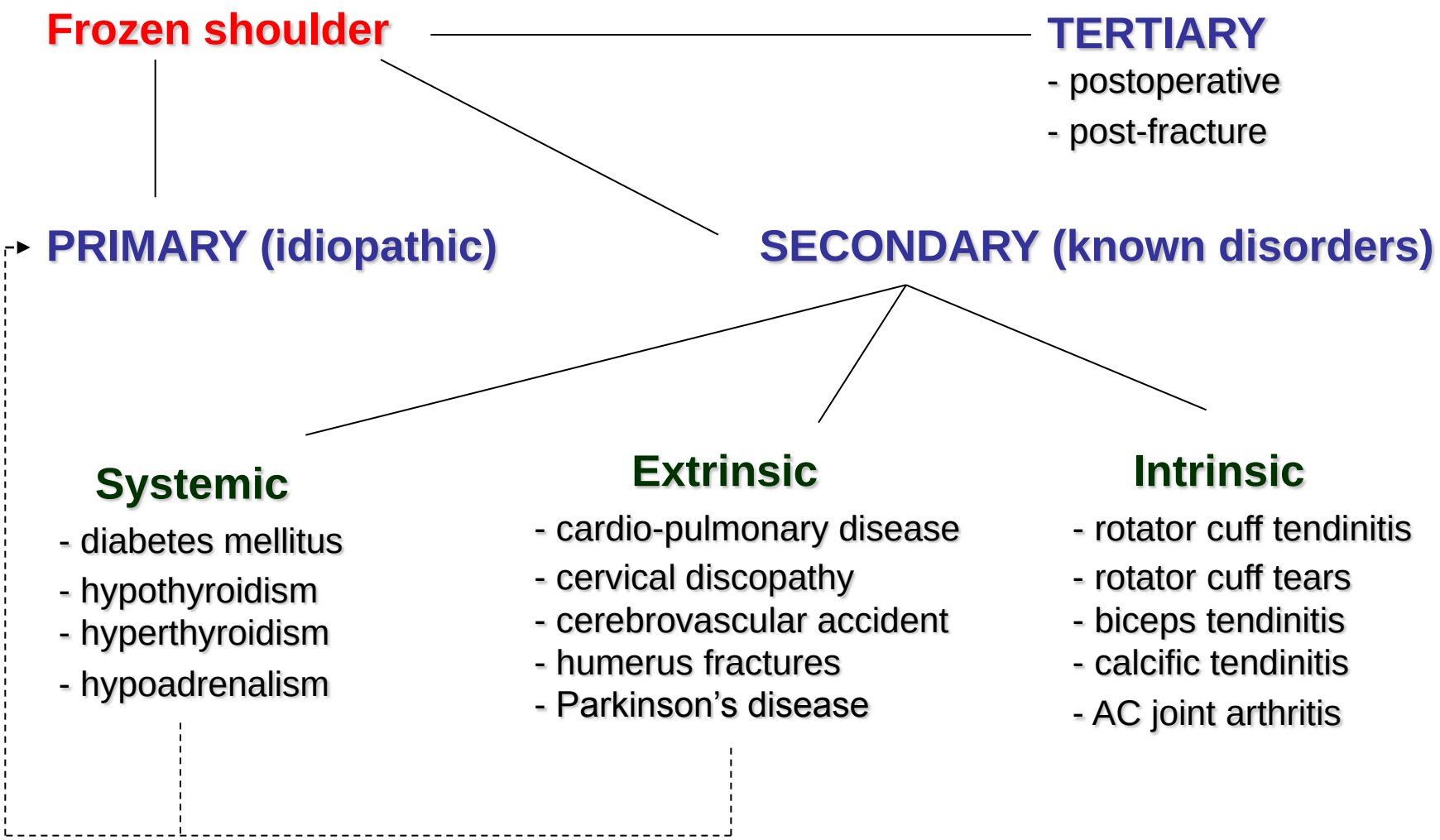
….Condition difficult to define, difficult to treat and difficult to explain from the point of view of pathology...

Codman 1934

ASES: Frozen shoulder is

- a condition of uncertain cause
- characterized by spontaneous onset of pain
- with significant restriction of both active and passive range of motion

Classification

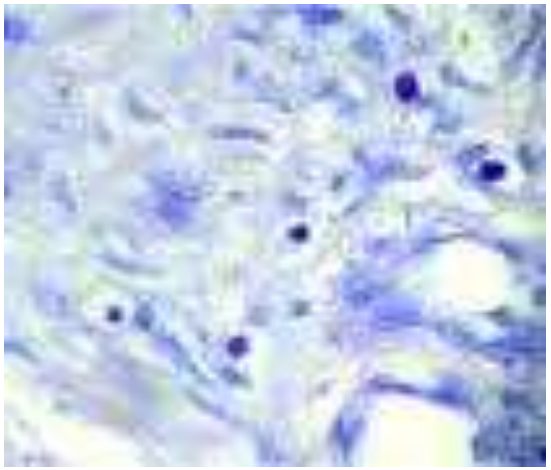


Conditions associated with adhesive capsulitis

Condition	Author	Description
Trauma/surgical		
Upper extremity trauma	Hand et al[47]	22% of patients report minor trauma to limb before symptoms
Radial neck dissection	Patten and Hillel[85]	31 of 44 patients who underwent neck dissections
Hormonal		
Diabetes	Bridgman[12]	Incidence of 10.8% in diabetic patients and 2.3% in nondiabetic patients
	Thomas et al[102]	Incidence of 4.3% in diabetic patients and 0.5% in nondiabetic patients
	Arkkila et al[2]	Incidence of 10.3% in patients with type I diabetes and 22.4% in patients with type II diabetes
ACTH deficiency	Choy et al[27]	Case of bilateral frozen shoulder in isolated ACTH deficiency
Thyroid disease	Wohlgethan[109]	Case of bilateral frozen shoulder in hyperthyroidism
	Bowman et al[10]	Case of bilateral frozen shoulder in hypothyroidism
	Cakir et al[22]	10.9% incidence in patients with thyroid disease
Cardiac		
Cardiac disease	Tuten et al[103]	3.3% incidence in male cardiac surgery patients (7 of 214)
	Bridgman[12]	10 of 14 nondiabetic patients with frozen shoulder had ischemic heart disease or hypertension
Diabetes and cardiac disease	Boyle-Walker et al[11]	Diabetes and heart disease more prevalent in patients diagnosed with adhesive capsulitis compared with controls
Neurologic		
Parkinson	Riley et al[91]	Incidence of 12.7% in Parkinson patients and 1.7% in controls
Stroke	Lo et al[63]	50% incidence in patients with hemiplegic shoulder pain after first stroke
Neurosurgery	Bruckner and Nye[15]	25.3% incidence in neurosurgical patients
Aneurysm surgery	Tanishima and Yoshimasu[101]	41% of patients undergoing acute aneurysm surgery
Other		
Malignancy	Gheita et al[42]	9 of 60 patients with malignant disease
Hyperlipidemia	Bunker and Esler[20]	Higher triglyceride and cholesterol levels in frozen shoulder patients vs controls
	Hand et al[46]	17% had hypercholesterolemia
Drug related	Hutchinson et al[51]	12 patients treated with matrix metalloproteinase inhibitor for gastric carcinoma
	Grasland et al[43]	8 patients treated with protease inhibitor (indinavir)
	De Ponti et al[32]	6 patients treated with antiretrovirals (stavudine, lamivudine, indinavir)
	Bodor and Montalvo[9]	2 cases after influenza and pneumococcal vaccine
	Freiss et al[41]	2 cases after fluoroquinolones
Dupuytren	Smith et al[97]	52% of patients with frozen shoulder were found to have Dupuytren
	Degreef et al[33]	45% of patients with Dupuytren diagnosed with frozen shoulder

Pathogenesis

Synovial inflammation and capsular fibrosis with the involvement of cytokines (TGF-b, platelet-derived growth factor, IL-1b, TNF)



Histology shows a vascular, collagenous tissue with high cellularity, (fibroblasts and myofibroblasts). The fibroblastic process is similar to Dupuytren disease

Patients treated with a synthetic matrix metalloproteinase inhibitor for gastric carcinoma had high rates of frozen shoulder and Dupuytren disease, suggesting that abnormal expression of matrix metalloproteinase inhibitors is involved in the pathogenesis of the disease

Classification

3 phases, *Reeves, Scand J Reumatology, 1975*

Phase I = pain with progressive stiffness (2-9 months)

Phase II = progressive stiffness with contractions (4-12 months)

Phase III = recovery, motion gradually improves (12-42 months)

Classification

4 stages, *Hannefin & Chiaia, Clin Orthop 2000*

Stage I = 'painful stage': pain with movements, but no loss of motion (3 m)

Arthroscopy: diffuse synovitis of the anterosuperior capsule

Stage II = 'freezing stage': pain and ↓ range of motion (3-9 m)

Arthroscopy: diffuse synovitis

Stage III = 'frozen stage': minimal pain except at extremes (9-15 m)

Arthroscopy: thickened, fibrotic capsule with no hypervascularity

Stage III = 'thawing stage': minimal pain an improve of motion (15-24 m)

Arthroscopy: almost normal

Pathology- Predisposing factors

- Intra-articular breakdown of the biceps tendon
- Contracture of the subscapularis
- Autoimmune basis (↑ HLA B27, ↓ IgA, ↑ CRP)
- Active trigger points
- Neurological dysfunction (like RSD syndrome)
- ↑ serum lipid levels (triglyceride & cholesterol)
- Endocrine disorders (diabetes mellitus)
- Trivial trauma (especially after prolonged immobilization)
- Psychological factors

Pathology- Predisposing factors

Active trigger points

Trigger points are locally tender, hyperirritable foci located in the skeletal muscles or fascia, related to a zone of referred pain when they are stimulated

The subscapularis trigger point exert an influence on the sympathetic vasomotor activity, leading to hypoxia of the periarticular tissues. The hypoxia leads to local proliferation of fibrous tissue about the shoulder capsule, resulting in the clinical picture of frozen shoulder.

Travel JG & Simmons DG, 1983

Pathology- Predisposing factors

Endocrine disorders (diabetes mellitus)

Incidence of about 10.8%, instead of 2.3% in the general population

Abnormal glucose tolerance in 28% of patients with frozen shoulder

Excessive glucose concentration in diabetic patients can lead to a faster rate of collagen glycosylation and cross-linking in the shoulder capsule, restricting shoulder range of motion. This collagen cross-linking may also be responsible for the higher incidence of Dupuytren contractures and trigger finger in diabetic patients

Thyroid disorders, hypoadrenalism, corticotropin deficiency

Pathology- Predisposing factors

Psychological factors

Certain personality structure? (periarthritic personality)

- *patients unable to tolerate pain*
- *expect others to get them well*
- *refuse to contribute to their management*

Physiological characteristics must be considered as a secondary factor in the management of these patients

Epidemiology

- 2% cumulative risk for at least one episode of FS
- Between forth and fifth decade of life
- More common in women
- Non-dominant extremity is usually involved
- Bilateral involvement occurs in 6-50% but only 14% simultaneously
- Among diabetic patients bilateral involvement is present in 77%
- The same shoulder is rarely involved again with FS

Clinical evaluation

History

Pain is critical in FS and is expressed at night, with dressing and daily activities as with common use of the arm

Early on patients describe an intense burning pain compared to a dull fullness during the contracting stage

Patients report difficulties to put on a coat or fastening a bra

Most significant loss of motion is with external rotation

Sharp pain at the endpoint of restricted shoulder motion

Specific medication: barbiturates, antituberculosis agents, protease inhibitors (for HIV treatment)

Clinical evaluation

Physical examination

Commonly confused with RC pathology

Typically pain on palpation at deltoid, deep capsule anteriorly

Loss of active or passive range of motion

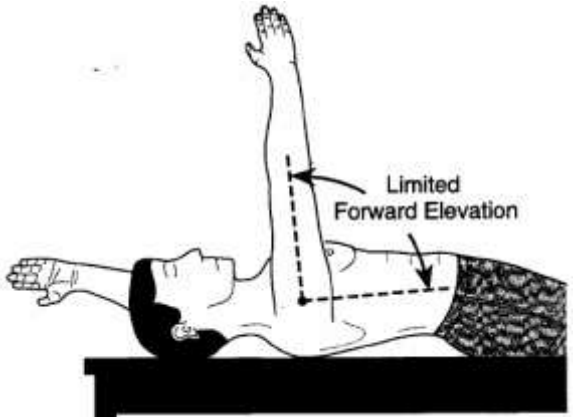
Pain present at the extremes of motion

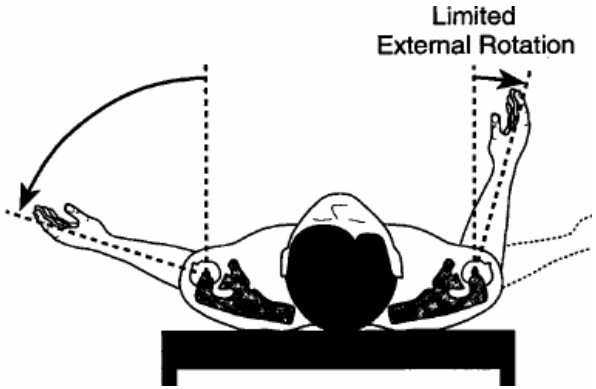
Complete evaluation of cervical spine

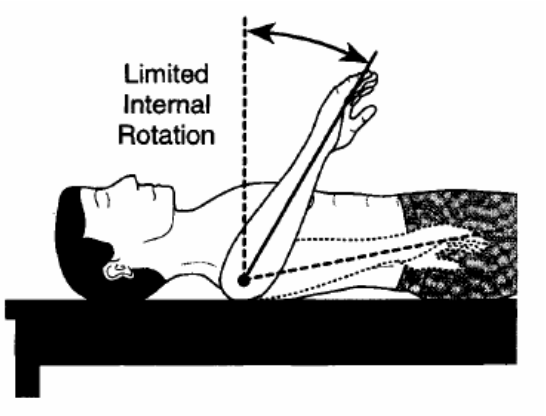
Lidocaine injection test – no improvement

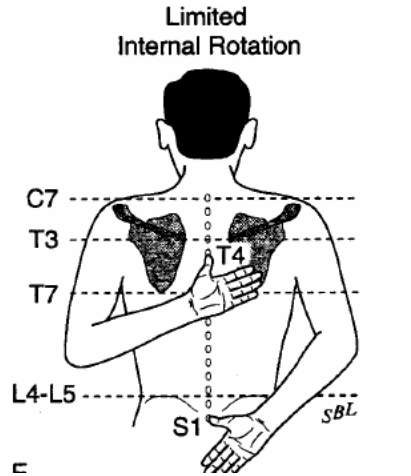
Clinical evaluation

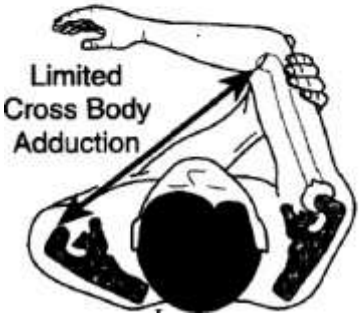
Physical examination











Clinical evaluation

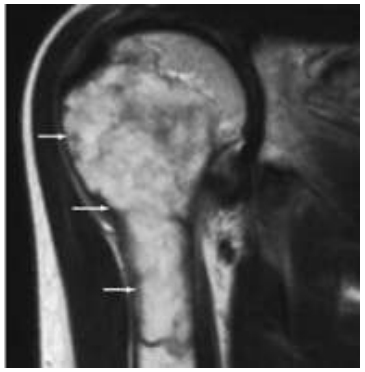
Differential diagnosis

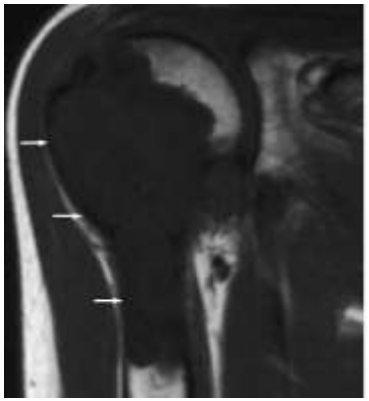
- Osteoarthritis
- Avascular Necrosis
- Rotator Cuff Disease
- Cervical Radiculopathy
- Biceps Tendiniits
- Subacromial Bursitis
- Thoracic Outlet Syndrome
- Brachial Plexopathy
- Humeral Fracture
- Tumor

Tumors masked as frozen shoulders: A retrospective analysis

J Shoulder Elbow Surg (2010) 19, 262-266

Hirotaka Sano, MD*, Masahito Hatori, MD, Mitsuyoshi Mineta, MD,
Masami Hosaka, MD, Eiji Itoi, MD





Clinical records of 34 patients (age > 40) with malignant shoulder tumors and those of 505 patients (age > 40) with shoulder pain and stiffness were reviewed

9/34 tumor patients, (26%) had been initially misdiagnosed with FS syndrome.
Among 505 patients with shoulder pain and stiffness, 4 (0.8%) were diagnosed later as having malignant tumors

In 10 patients, initial misdiagnosis as frozen shoulder syndrome did cause a significant delay to reach the correct diagnosis as malignant tumors

Imagine studies

Complete set of radiographs (AP in internal and external rotation, axillary and supraspinatus outlet view) to exclude other pathology

In FS usually x-rays are normal, **disuse osteopenia** maybe present

Technetium bone scan exhibits increase uptake (hypervascularity)

Ultrasound can show thickening of coracohumeral ligament

Shoulder arthrography:

- decreased joint volume (10-12 ml, instead of – 15 ml normally)
- lack of filling of the axillary fold & subscapular bursa

Imagine studies

MRI or MRI-arthrography is currently no helpful to diagnose FS

- significant thickening of coracohumeral ligament and rotator interval
- complete obliteration of subcoracoid triangle (between CH and coracoid)
- increased thickness of the inferior capsule
- Decreased filling ratio of the axillary recess

Helpful to identify concomitant pathology

Laboratory studies

Are usually normal

ECR and CRP are usually elevated

Glucose tolerance, lipid panel

Rheumatoid factor and antinuclear antibody

Thyroid and autoimmune disorders

Treatment

General principles

Goal of treatment is relief of pain and restore motion and function

Avoid misdiagnosis of other shoulder pathology

Surgery addressing other pathology may dramatically worsen the pain and stiffness of frozen shoulder

Individualized program of rehabilitation based on severity and chronicity of patients symptoms

Non-steroidal anti-inflammatory agents, oral corticosteroids, corticosteroids injections, transcutaneous electrical nerve stimulation (TENS) etc

Treatment

Options

Non-operative treatment - Benign neglect

Capsular distention (Brisement)

Manipulation under anaesthesia

Arthroscopic capsular release

Open release

Acupuncture therapy, botulinum injections

Non-operative treatment

Exercise protocol

Indicated in patients with less than 6 months of stiffness

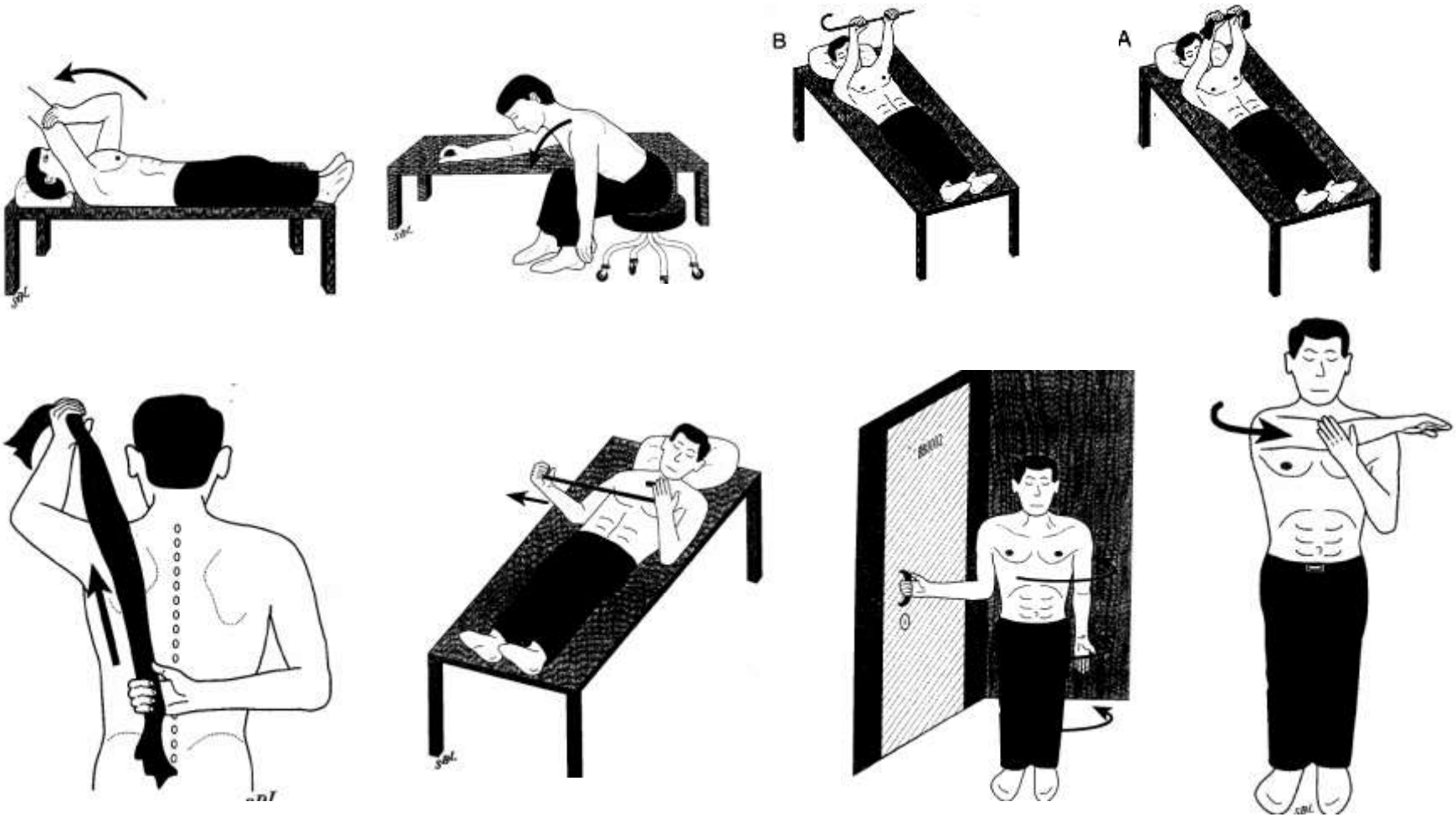
Active-assisted ROM exercises plus gentle passive stretching

Better 5-6 times per day lasting 10-15 minutes

Daily bar charts to document progress

Constant reassurance to promote continue compliance

Non-operative treatment



JBJS Am 2000

Idiopathic Adhesive Capsulitis

A Prospective Functional Outcome Study of Nonoperative Treatment*

BY SEAN M. GRIGGS, M.D.†, ANTHONY AHN, M.D.‡, AND ANDREW GREEN, M.D.§

Sixty-four **(90%)** of the patients reported satisfactory outcome
Seven (10 percent) were not satisfied and five (7 percent) underwent manipulation and/or arthroscopic capsular release

Despite the significant improvements and the high rate of patient satisfaction, there were still significant differences in the pain and motion of the affected shoulder when compared with those of the unaffected, contralateral shoulder

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

J Shoulder Elbow Surg
September/October 2004

Ronald L. Diercks, MD, PhD, and Martin Stevens, PhD, *Groningen, The Netherlands*

Table III Mean range of motion of both groups (part of Constant score)

	Supervised neglect group		Physical therapy group	
	Median Constant score value at inclusion	**Median Constant score value at final follow-up**	**Median Constant score value at inclusion**	**Median Constant score value at final follow-up**
Forward elevation	2 (31°–60°)	10 (151°–180°)	2 (31°–60°)	10 (151°–180°)
Lateral elevation	2 (31°–60°)	8 (121°–150°)	2 (31°–60°)	8 (121°–150°)
External rotation	2*	10‡	2*	8‖
Internal rotation	2†	8§	2†	8§

*Back of head/elbow forward; †dorsum of hand to buttock; ‡full elevation; §dorsum of hand to DV 12; ‖top of head/elbow back.

In the patients treated with supervised neglect, 89% had normal or near-normal painless shoulder function (Constant score 80) at the end of the observation period. In contrast, of the group receiving intensive physical therapy treatment, only 63% reached a Constant score of 80 or higher after 24 months.

Capsular distension or Brisement

Distension of the capsule:

- with contrast as part of an arthrogram
- with injection of saline and local anaesthetic such as hydraulic distension
- with water during arthoscopic release

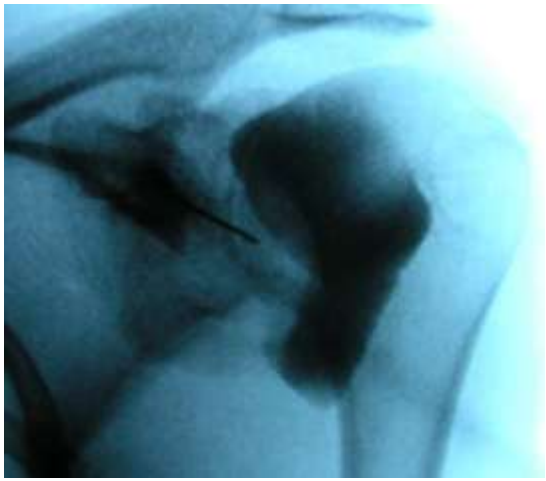
Better to performed in patients who had failed conservative treatment and are in Hannafin stage II with early loss of motion before the capsule become thickened

Shoulder distension arthrography in adhesive capsulitis

Nicolas Amoretti*, Anne Grimaud, Olivier Brocq, Christian Roux, Fabien Dausse, Maud Fournol, Patrick Chevallier, Jean-Noël Bruneton

Clinical Imaging 30 (2006) 254–256

In the performance of diagnostic arthrography, we observed a clinical improvement of painful symptoms



The analysis of the outcome observed in 200 joint distensions showed that, in 85% of cases, the results were satisfactory, with the disappearance of painful symptoms after 45 days and an almost complete recuperation of the range of motion of the shoulder

Manipulation under anaesthesia

Mainstay of interventional methods

Usually after failed physiotherapy for 3 to 6 months

Wait until pain is present only at the extremes of ROM

Better with combined general and regional anesthesia

Gentle, controlled fashion with the patient supine

Avoid in elderly osteoporotic patients

No significant difference with use of corticosteroids

Risk for fractures, dislocation of the head, RC injury, SLAP lesions and nerve injuries

Arthroscopic capsular release

3 basic components:

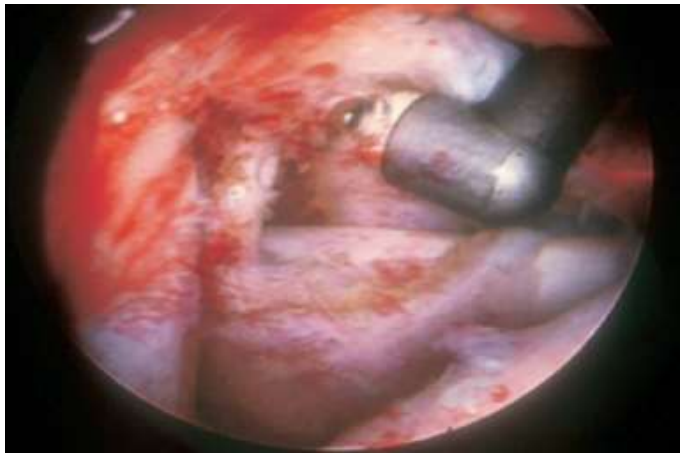
Anesthesia (general? & interscalene block)

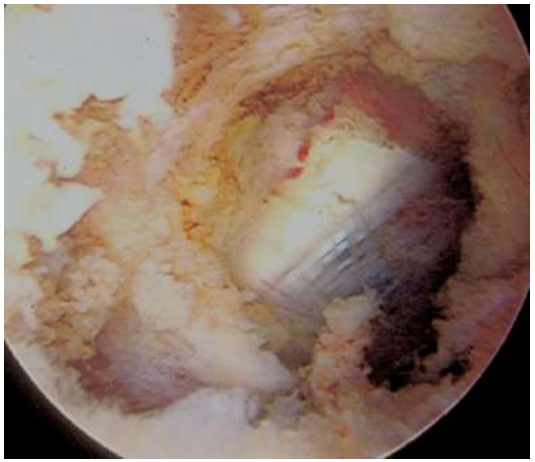
Manipulation (before, during or after)

Arthroscopic release

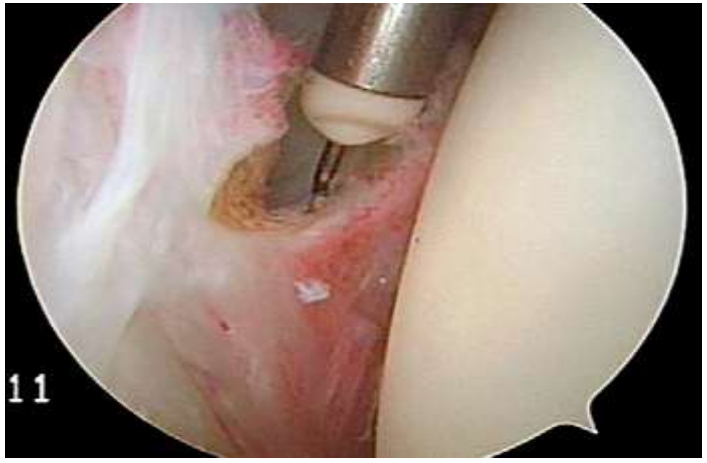
- rotator interval division (CHL and anterosuperior capsule)
- anterior capsule over subscapularis (MGL)
- inferior capsule (risk for axillary nerve)
- superior and posterior capsular release

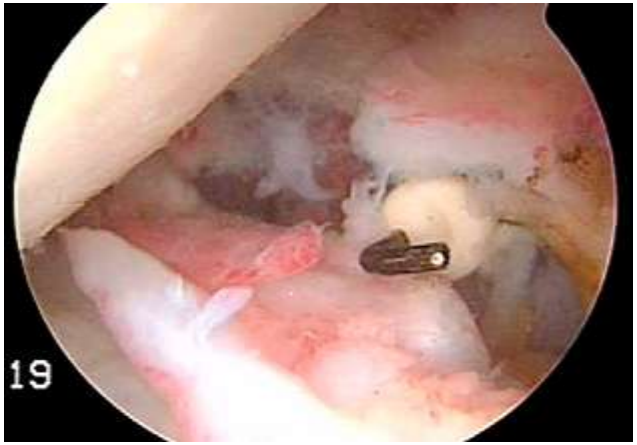
		and coracohumeral ligament				
Arthroscopic						
Snow et al[98]	2009	Anterior + inferior release vs anterior, inferior, and posterior release	48	5 mo	No difference with addition of posterior release	Constant: Standard, 66, + posterior, 71
Musil et al[72]	2009	RI, CH ligament, S/M/AIGHL release, anterior GH joint capsule	27		23 gained normal shoulder function	Constant, 80.3 UCLA, 28.6
Elhassan et al[37]	2010		115	46 mo	Idiopathic and post-traumatic stiffness have better outcomes than postsurgical stiffness	Constant, 86
Cinar et al[28]	2010		14 idiopathic 14 diabetic	48.5 mo 60.2 mo	No difference in duration of pain relief or ROM	UCLA Diabetic, 29.0 Idiopathic, 32.7 Constant Diabetic, 82.0 Idiopathic, 93.6
Liem et al[62]	2008	Release of subscapularis and capsule	22	53 mo	No loss of internal rotation strength	Constant, 82.8 ASES, 76.8
Baums et al[3]	2007		30	36 mo	Reliable improvement in arthroscopic release with gentle manipulation	ASES, 91 VAS, 2 SST, 10
Castellarin et al[25]	2004	MUA, then arthroscopic release	40	42 mo	MUA, followed by arthroscopic release, is effective for resistant cases	Constant, 91.7 SST, 10.8
Berghs et al[6]	2004	Arthroscopic release	25	14.8 mo	Arthroscopic release yields rapid relief of pain and improvement in function	Constant, 75.5 SF-36, 48.7
Yamaguchi et al[111]	2002	Arthroscopic release + intra-articular pain catheter	23	22.4 mo	19/20 achieved near complete ROM without pain	SSI, 90.9 VAS, 1.2
Klinger et al[59]	2002	Arthroscopic	36	18 mo	Safe and effective, no complications	Constant, 66 (median)
Holloway et al[49]	2001	Arthroscopic	50	20 mo	Less improvement in subjective scores in postoperative stiffness compared with post-traumatic and idiopathic	ASES, 57 (postoperative) ASES, 82, 86 (post-traumatic, idiopathic)
Bennett[5]	2000	Arthroscopic	31	>18 mo	30/31 retained intra-operative ROM gain, no difference in primary vs secondary stiffness	ASES, 82 Constant, 78
Watson et al[107]	2000	Arthroscopic	73	12 mo	11% with recurrent pain/stiffness	





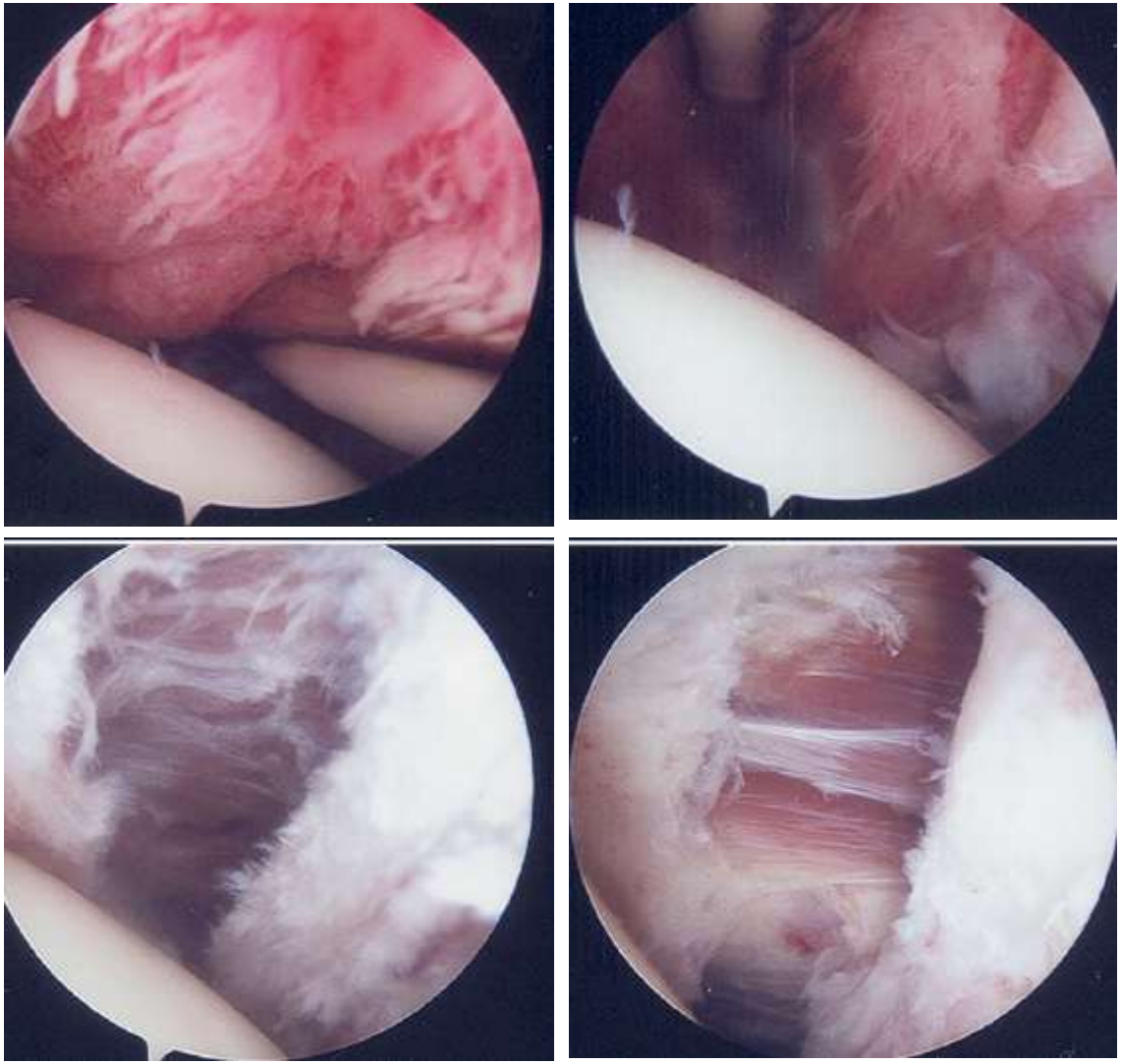
Release of rotator interval stops when CA ligament is viewed from posterior





Anterior capsule release

posterior capsule release



P.G. 56 y old, 5 months of physical therapy, MUA and anterior-inferior release, Constant score 84 at 16 months follow-up

Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 25, No 1 (January), 2009: pp 19-23

Posterior Arthroscopic Capsular Release in Frozen Shoulder

Martyn Snow, F.R.C.S., Ihab Boutros, M.R.C.S., and Lennard Funk, F.R.C.S.

We have shown an overall rapid significant improvement following arthroscopic capsular release for primary and secondary frozen shoulder.

There was no significant difference in the overall outcome with the addition of a posterior release

Is the Extended Release of the Inferior Glenohumeral Ligament Necessary for Frozen Shoulder?

Jiwu Chen, M.D., Ph.D., Shiyi Chen, M.D., Ph.D., Yunxia Li, M.D., Yinghui Hua, M.D., Ph.D., and Hongyun Li, M.D.

Arthroscopy: The Journal of Arthroscopic and Related Surgery, Vol 26, No 4 (April), 2010: pp 529-535

74 consecutive patients with refractory frozen shoulder underwent arthroscopic capsular release and were divided into 2 groups randomly. The release of anterior capsular structures, including the anterior band of the IGHL, was performed in group 1. In group 2 the release extended inferiorly and posteriorly.

In this broad group of patients with recalcitrant adhesive capsulitis, the addition of the posterior capsular release did not improve patient function or ROM over anterior capsular release alone at 6 months.

J Shoulder Elbow Surg (2010) 19, 580-587

Arthroscopic capsular release for refractory shoulder stiffness: A critical analysis of effectiveness in specific etiologies

Bassem Elhassan, MD[a], Mehmet Ozbaydar, MD[b], Daniel Massimini, PhD[c], Laurence Higgins, MD[d], Jon J.P. Warner, MD[e,*]

Retrospective review of 115 patients, mean 9 months of physiotherapy

3 groups of stiffness: post-traumatic (26 patients), postsurgical (48 patients), and idiopathic (41 patients).

At a mean follow-up of 46 months, the overall subjective shoulder value in all groups improved from 29% to 73% and the age- and gender-adjusted Constant score improved from 35% to 86%.

Constant score was significantly lower in the postsurgical group compared with the idiopathic and post-traumatic groups

Open release

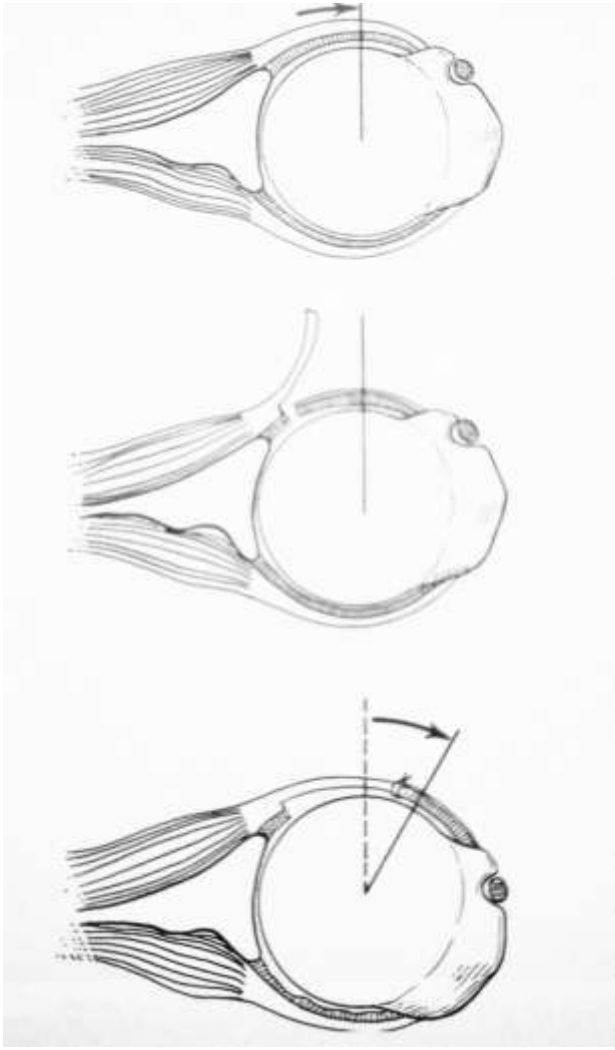
Reserved for patients who have failed manipulation and/or arthroscopic release

FZ in the setting of shoulder arthroplasty

Offers direct visualization, but increase postop pain wich interfere with physiotherapy

Release include:

- subacromial and subdeltoid adhesions
- CHL and rotator interval
- perilabral capsular release
- subscapularis release and lengthening



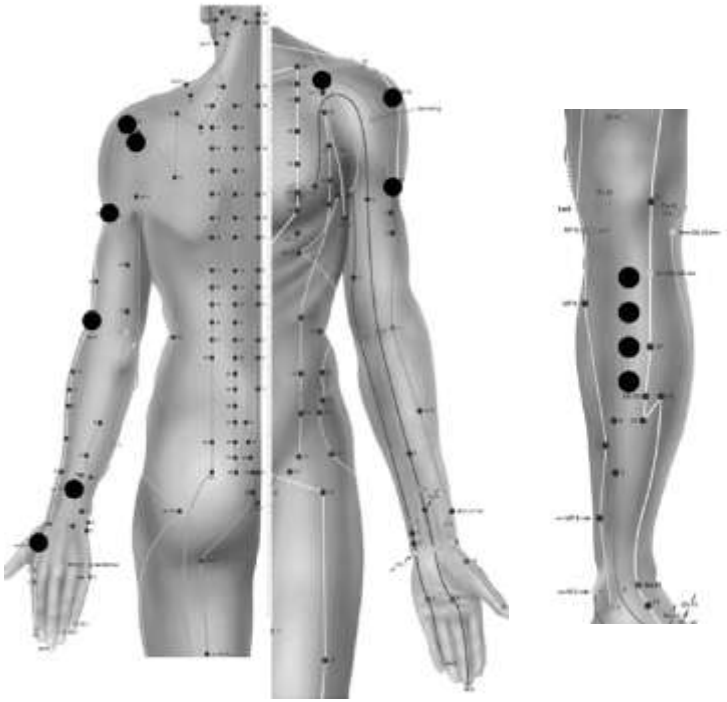
PAIN® 151 (2010) 146–154

German Randomized Acupuncture Trial for chronic shoulder pain (GRASP) – A pragmatic, controlled, patient-blinded, multi-centre trial in an outpatient care environment ☆

Albrecht F. Molsberger [a,*], Thomas Schneider [b], Hermann Gotthardt [c], Attyla Drabik [d,e]

424 outpatients with chronic shoulder pain (CSP) >6 weeks and an average pain score of VAS >50 mm, who were randomly assigned to receive Chinese acupuncture (verum), sham acupuncture (sham) or conventional conservative orthopaedic treatment (COT)

Chinese acupuncture is an effective alternative to conventional standard therapy in chronic shoulder pain. Fifteen Chinese acupuncture treatments over 6 weeks are more effective than conventional standard therapy with NSAIDs and physiotherapy.



Verum Sham

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Medical Hypotheses xxx (2011) xxx–xxx

Contents lists available at ScienceDirect

Medical Hypotheses

Treatment of frozen shoulder with intra-articular injection of botulinum toxin in shoulder joints

Hung-Sheng Chen [a], Kwang-Hwa Chang [c], Jiunn-Horng Kang [a,b], Yen-Hsia Hsu [a], Allen Chia-Lin Hsu [a,*], Shih-Ching Chen [a,b,*]

Possible mechanisms of BTX in treatment of FS

Through inhibition of neurotransmitter release

Through inhibition of C-fiber nociceptive transmission

Through inhibition of fibrosis

The analgesic effect can be expected to last longer than steroid injection. The use is generally safe with minimal side effects. Preliminary results in intra-articular use showed promising outlooks.