OVERVIEW

Background

Approximately 10% of the general adult population will experience an episode of shoulder pain in their lifetime (van der Heijden et al 1996); pain in the shoulder is exceeded only by pain in the low back and the neck (Cailliet 1981). Shoulder pain is a common reason for care seeking as it impacts upon a range of activities of daily living, including sleep. It is estimated that around 95% of people with shoulder pain are treated in primary care settings (van der Heijden 1999).

Many people presenting with acute shoulder pain are likely to have conditions that will resolve spontaneously regardless of treatment. Indeed, there are reports that 50% of people with shoulder pain do not seek care at all. Van der Windt et al (1996) report that 23% of all new episodes of shoulder pain resolve fully within one month and 44% resolve within three months of onset. However, the results of studies on the natural history of shoulder pain vary considerably because of the range of definitions used to describe shoulder disorders (van der Heijden 1999).

The risk that uncomplicated shoulder pain will persist beyond the acute phase appears to be related to personality traits, coping style and occupational factors (van der Heijden 1999). Van der Windt et al (1996) note that 41% had persistent symptoms after one year. It is important to take prognostic risk factors into consideration and to intervene early to prevent progression to chronic pain.

Definition of Acute Shoulder Pain

In these guidelines, the term ‘acute’ is defined as pain that has been present for less than three months; it does not refer to the severity or quality of pain. Chronic pain is pain that has been present for at least three months (Merskey et al 1994).

There is no universal definition of shoulder pain. For the purposes of these guidelines, ‘shoulder’ refers to the articulations of the scapula, clavicle and humerus together with the ligaments, tendons, muscles and other soft tissues with a functional relationship to these structures.

Scope

These guidelines describe the diagnosis and treatment of acute shoulder pain of unknown or uncertain origin. The following conditions are beyond the scope of this document:

- serious conditions: infection, neoplasia, inflammatory arthropathies and fracture, rupture, instability or joint dislocation related to trauma
- neurological conditions
- hemiplegic shoulder pain (post-cerebro-vascular accident)
- conditions characterised by pain referred from the shoulder
- chronic pain
Guideline Development Process

(Refer to the Executive Summary for full detail).

Evaluation of Existing Guidelines

Guidelines developed by other groups were obtained to determine whether an existing guideline could be adapted for use in the Australian context. The Philadelphia Panel Evidence-Based Clinical Practice Guidelines on Selected Rehabilitation Interventions for Shoulder Pain (Albright et al 2001) were viewed. As they did not specifically look at acute shoulder pain and recommendations were based on a combination of expert opinion and evidence, the decision was made to proceed with an update of (unpublished) Australian guidelines for the management of acute shoulder pain. The update involved a review and description of the evidence on acute shoulder pain conducted by a multidisciplinary group.

Study Selection Criteria

The following criteria guided the literature search and appraisal that was performed to update the existing guidelines. Evidence was sought explicitly for studies on acute pain. In the case of interventions, studies containing mixed populations of people with acute and chronic shoulder pain were included if there was a paucity of studies describing the effectiveness of treatment for ‘acute’ shoulder pain.

<table>
<thead>
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<th>Systematic reviews, cross-sectional studies</th>
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<th>Systematic reviews, cohort studies</th>
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<td>No age specification</td>
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<tr>
<td>Exclusion criteria</td>
<td>Chronic pain</td>
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</table>

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<tr>
<th>Interventions</th>
<th>Inclusion criteria</th>
<th>Systematic reviews, RCTs</th>
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<td></td>
<td>No age specification</td>
</tr>
<tr>
<td>Exclusion criteria</td>
<td>Chronic pain (studies with mixed acute and chronic populations were included if there were no data specifically on interventions for ‘acute’ shoulder pain)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specific diseases and conditions</td>
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</tbody>
</table>

Search Strategy

Sensitive searches were performed; electronic searches were limited to adults, humans, and articles published in English in peer-reviewed journals. Where available, methodological filters were used. There were no handsearches conducted.

Literature describing the diagnosis and prognosis of acute shoulder pain was sought from an electronic search. This encompassed new literature published since the initial guidelines were developed (1998-2002).

The evidence for interventions for acute shoulder pain was sourced from material reviewed for the Cochrane Review on interventions for shoulder pain. This material was reviewed to locate articles specifically describing the effectiveness of interventions for shoulder pain of less than 3 months duration. In addition, an electronic literature search was conducted spanning the time elapsed since the last update of the Cochrane Review (2001-2002).

Articles that group members felt were important to the topic that did not appear in the search results were submitted to the review process.
The following databases were searched in August 2002:

- (PubMed) Clinical Queries
- CINAHL
- EMBASE – Physical and Rehabilitation Medicine
- The Cochrane Library, 2002, Issue 2

Access to CHIROLARS/MANTIS was unavailable. PEDro was not searched as it contains articles available on the included databases.

**Search Terms**

- Shoulder pain .exp
- Arm injury .exp
- analgesics
- anti-inflammatory drugs
- NSAID
- Shoulder girdle .exp
- Shoulder radiography .exp
- shock wave therapy .tw
- orthopaedic surgery .tw
- physiotherapy .exp
- mobilisat*
- manual .tw
- LLLT .tw
- Shortwave .tw
- Injection .exp
- tendinitis .exp
- tendonitis .tw
- glenohumeral .tw
- Diagnosis .exp
- Systematic review .tw
- Controlled trial .tw
- Clinical trial .tw
- Etiology .exp
- Acute .tw
- acupuncture
- cervicobrachial neuralgia .exp
- N.S.A.I.D.S.
- Shoulder impingement syndrome .exp
- Shoulder dislocation .exp
- extra corporeal shock wave therapy .tw
- non steroidal anti-inflammatory .exp
- surgery .exp
- exercise .exp
- manipulat*
- Ultrasound .tw
- Laser .tw
- TENS .tw
- adhesive capsulitis .tw
- rotator cuff .exp
- frozen shoulder .exp
- Therapies .exp
- Prognosis .exp
- Pain assessment .tw
- Randomised .tw
- Drug therapy .exp

**Key Messages from the Evidence**

**Aetiology**

- Acute shoulder pain may arise in the shoulder, or be referred from another site.
- Clinicians should be alert to the potential for rare, serious conditions (fracture/dislocation, tumour, infection) presenting as acute shoulder pain.
- Most cases of acute shoulder pain are of ‘mechanical’ origin and can be managed as acute regional pain.
- Biological factors, such as age, female gender, past history and response to repetitive physical tasks may contribute to the development of acute shoulder pain.
- Psychosocial factors, such as job dissatisfaction and work demands may contribute to the onset of acute shoulder pain.

**History**

- The reliability and validity of individual features in histories have low diagnostic significance; the history is to be interpreted with caution when choosing a course of action.
- The information may alert to the presence of a serious condition as the underlying cause of acute shoulder pain.
- The history provides baseline information to enable monitoring of progress and ongoing vigilance for serious conditions.
### Physical Examination
- Findings of shoulder examination must be interpreted cautiously in light of the evidence of limited utility; no clinical test is both reliable and valid for any specific diagnostic entity.
- Physical examination is an opportunity to enhance rapport between clinician and consumer and to place the index condition into context.

### Diagnostic Terminology
- Causes of acute shoulder pain cannot be diagnosed by clinical assessment; however, with the exception of serious conditions, satisfactory outcomes do not depend on precise identification of cause.
- Terms to describe acute shoulder pain should summarise the discernible features of the condition to form the basis for a management plan (suggested terms are presented to promote consistent usage).

### Investigations
- Imaging and other special investigations are rarely necessary for the management of acute shoulder pain; diagnostic utility is minimal and the results are unlikely to improve management.
- Investigations are indicated for acute shoulder pain when alerting features (‘red flags’) of serious conditions are identified.
- There is a need to educate consumers about the limitations of imaging and the risks of radiation exposure.

### Prognosis
- Approximately 50% of people with acute shoulder pain (treated conservatively) recover within six months; approximately 60% recover within 12 months.
- Shoulder pain may recur even in those who appear to fully recover in the short term.
- The effects of interventions and prognostic risk factors (biological and psychosocial) influence the course of acute shoulder pain and should be taken into account in the management plan.

### Interventions

#### Evidence of Benefit
- Topical and oral non-steroidal anti-inflammatory drugs (NSAIDs) improve acute shoulder pain by a small to moderate degree for up to 4 weeks compared to placebo. *RCTs of adults with acute shoulder pain (Ginsberg, Mena, Adebajo)*
- Subacromial corticosteroid injection for acute shoulder pain may improve pain at 4 weeks compared to placebo but this benefit is not maintained at 12 weeks. *RCTs of adults with acute shoulder pain (Adebajo, Vecchio)*; *systematic review of steroid injections for shoulder pain (Buchbinder 2002)*
- Acupuncture may improve acute shoulder pain and function to a small degree in the short-term. *RCT in acute shoulder pain (Kleinhenz)*
- Ultrasound may provide short-term pain relief in calcific tendonitis. *RCT in acute shoulder pain (Ebenbichler)*
- Shoulder joint mobilisation may improve pain in the short term. *RCT of 14 patients (Conroy)*

#### Insufficient Evidence
- From the available evidence, no conclusions about the efficacy or safety of ESWT, suprascapular nerve blocks, oral corticosteroids or surgery for acute shoulder pain can be drawn. *No RCTs in acute shoulder pain*

### Research Priorities for Acute Shoulder Pain
- Establish consistent terminology
- Develop a prognostic model for shoulder disorders
- Develop standard outcome measures
- Conduct well-designed studies on the effectiveness of interventions
- Conduct studies on the cost-effectiveness of interventions and other aspects of care
AETIOLOGY

What conditions can cause acute shoulder pain?
- Acute shoulder pain may arise in the shoulder, or be referred from another site.
- Clinicians should be alert to the potential for rare, serious conditions (fracture/dislocation, tumour, infection) presenting as acute shoulder pain.
- Most cases of acute shoulder pain are of ‘mechanical’ origin and can be managed as acute regional pain.

What risk factors can contribute to the onset of acute shoulder pain?
- Biological factors, such as age, female gender, past history and response to repetitive physical tasks may contribute to the development of acute shoulder pain.
- Psychosocial factors, such as job dissatisfaction and work demands may contribute to the onset of acute shoulder pain.

Acute shoulder pain has many possible sources, including all diseases, injuries and other impairments that invoke nociceptive mechanisms in the region. The following information is provided as a means to familiarize clinicians with some of the possible causes of acute shoulder pain; it is not intended as a checklist of conditions. Attempts to diagnose the cause of acute shoulder pain by systematically eliminating the possible causes are likely to be confounded by the unreliability of clinical methods and the variability in the understanding and description of clinical entities.

With the exception of conditions posing a serious threat to health, identification of a specific cause is not a precondition for effective management of acute pain.

Potential causes of acute shoulder pain may be classified as:
- painful conditions of the shoulder, and
- conditions referring pain to the shoulder

<table>
<thead>
<tr>
<th>Painful Conditions of the Shoulder</th>
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<tbody>
<tr>
<td>Serious conditions</td>
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<tr>
<td>fracture, dislocation, rupture and instability; tumours; infection (septic arthritis, penetrating injury); inflammatory arthropathies</td>
</tr>
<tr>
<td>Intrinsic neurological conditions</td>
</tr>
<tr>
<td>peripheral neuropathies (suprascapular, axillary, and musculocutaneous nerve impairment) (Bonnici et al 1993; Biundo et al 1995)</td>
</tr>
<tr>
<td>brachial plexus injuries (Travlos et al 1990)</td>
</tr>
<tr>
<td>complex regional pain syndromes (types I and II) (Veldman et al 1995).</td>
</tr>
<tr>
<td>Mechanical conditions involving patho-anatomical entities</td>
</tr>
<tr>
<td>sprain, subluxation or dislocation of articulations (glenohumeral joint, acromioclavicular joint, sternoclavicular joint)</td>
</tr>
<tr>
<td>tear, contracture of joint capsules (glenohumeral joint, acromioclavicular joint, sternoclavicular joint)</td>
</tr>
<tr>
<td>effusion of bursae (subacromial bursa, others)</td>
</tr>
<tr>
<td>sprain, tear of ligaments (glenohumeral ligaments, acromioclavicular ligaments, sternoclavicular ligaments)</td>
</tr>
<tr>
<td>sprain, tear of muscles and tendons (supraspinatus, infraspinatus, teres minor, subscapularis, deltoid, others)</td>
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<thead>
<tr>
<th>Conditions Referring Pain to the Shoulder</th>
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</thead>
<tbody>
<tr>
<td>Extrinsic neurological conditions</td>
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<tr>
<td>central pain syndromes; nerve root syndromes; peripheral nerve irritation</td>
</tr>
<tr>
<td>Somatic conditions</td>
</tr>
<tr>
<td>cervical zygapophysial joint impairment (especially at the C5-6 and C6-7 spinal levels); cervical intervertebral disc impairment (especially at the C5-6 and C6-7 spinal levels); cervical muscle impairment</td>
</tr>
<tr>
<td>Visceral conditions</td>
</tr>
<tr>
<td>pericardial irritation; pleural irritation; diaphragmatic peritoneal irritation; liver and gall bladder disease; vascular conditions (variant angina pectoris, aortic aneurysm, thoracic outlet syndrome) (Brown 1983)</td>
</tr>
</tbody>
</table>

Table 7.1: A guide to described causes of acute shoulder pain
Painful Conditions of the Shoulder

Local impairments of anatomical structures of the shoulder comprise the vast majority of causes of acute shoulder pain. They in turn may be classified, broadly, as:

- serious conditions
- intrinsic neurological conditions
- mechanical conditions

The first two types are uncommon but the conditions they encompass must not be overlooked in the assessment process as a missed diagnosis may have serious consequences.

Serious Conditions

Serious conditions manifesting as shoulder pain pose more serious health risks than common ‘mechanical’ disorders of local structures. The best response to the danger of serious conditions is vigilance. Appropriate vigilance depends on knowledge of the conditions and the potential for their existence, the extent of the threat they pose to health and the features that provide clues to their presence. When necessary, ancillary investigations can be used astutely. Management of serious conditions is outside the scope of these guidelines.

Fractures and Dislocations

Major trauma is the common cause of fracture in otherwise healthy people. Healthy bones resist large forces and break only if subjected to severe, deforming stresses. Resultant injuries include disruption of the shaft, avulsion of the greater tuberosity and more subtle lesions such as Hill-Sachs compression fracture of the humeral head (Hill et al 1940). Dislocation involves major forces with vectors that damage the soft tissue restraints of a joint rather than the bones, causing injuries such as anterior detachment of the glenoid labrum, known as the Bankart lesion (Bankart 1923), or superior labrum anterior and posterior (SLAP) lesion (Andrews et al 1985).

Minor trauma does not cause fracture unless the consumer has a predisposing condition of bone:

- Osteoporosis is the most common such condition, by far. It affects most elderly women and many elderly men in Australia. A large study (Jones et al 1994) showed that 56% of women and 29% of men over 60 years of age suffer osteoporotic fractures; 11% involve the humerus.
- Osteomalacia is another disorder of bone metabolism leading to poor bone mineralisation, osteopaenia and tendency to fracture. It results from inadequacy of calcium intake, mostly due to malabsorption but sometimes due to dietary insufficiency.
- Paget’s disease of bone (or osteitis deformans) is an uncommon condition in which increases of osteoclastic and osteoblastic activity cause thickening, weakening and deformity of affected bones. The shoulder is seldom involved. Paget’s disease is usually painless but may cause low-grade pain. Occasionally it is associated with pathological fractures.
- Other medical conditions in which bones are prone to fracture after minor trauma are rare. One is osteogenesis imperfecta, a hereditary disorder of collagen synthesis causing brittle bones and lax ligaments; about two-thirds of those affected have blue sclerae and about half have crumbling teeth (dentinogenesis imperfecta).
- Pathological fractures associated with neoplasia, Pagetic bone disease etc. may occur after minimal trauma or even without any trauma at all.

Tumours

Tumours are rare in the shoulder but they do occur. The shoulder is second only to the knee in the ranking of peripheral sites of neoplasia. The proximal humerus is the third most common long bone site of tumour formation, after the distal femur and the proximal tibia (Kaempffe 1995).

- Primary bone tumours in the proximal humerus include osteoclastoma (giant cell tumour), osteogenic sarcoma, chondroblastoma and chondrosarcoma, amongst others (Barlow et al 1994).
- Secondary malignancies in the bones of the shoulder mainly affect the proximal humerus. Their primary sites include lung, breast, prostate, kidney and thyroid (Welch 1994).
- Soft tissue tumours in the shoulder include primaries like malignant fibrous histiocytoma (in those aged 50 to 70 years), synovial chondromas (Buess et al 2001) and sarcomas (in younger people), and a variety of secondaries including local extension of an apical carcinoma of lung or ‘Pancoast tumour’ (Pancoast 1932).
Infections

Infection may be related to septic arthritis or a history of penetrating injury, including medical procedures.

Inflammatory Arthropathies

Inflammatory arthropathies are difficult to identify in the early stages. The inflammatory diseases that affect the shoulder include, amongst others:

- rheumatoid arthritis
- crystal arthropathies (gout, pseudo-gout)
- polymyalgia rheumatica
- psoriatic arthropathy
- reactive arthropathy associated with inflammatory bowel disease
- amyloid arthropathy.

Intrinsic Neurological Conditions

Intrinsic neurological conditions are those primarily involving local neural structures of the shoulder (Bateman 1983).

Mechanical Conditions

‘Mechanical’ musculoskeletal disorders are characterised by altered biomechanical function. In the broadest sense, most conditions have biomechanical implications. Disorders termed ‘mechanical’ are those in which changes of function are the principal features. They are due to mechanical impairment either directly by injury or indirectly by internal change.

When a stress is applied to a tissue, a strain is produced within it. If the strain force exceeds the tissue’s load-bearing capacity, mechanical injury (sprain or tear) results. Less unaffected tissue is then available for load bearing and it has greater stresses imposed on it by subsequent applications of force. Mechanical transduction occurs when the force applied to a particular Aδ or C nerve fibre reaches its threshold for stimulation. This is the main mechanism of the pain associated with musculoskeletal injuries.

Identifying precise causes of mechanical pain is difficult. Management plans based on mistaken assumptions of cause can lead to treatment errors and iatrogenic prolongation and complication of simple conditions.

Loose terminology applied inconsistently to describe mechanical shoulder disorders further complicates the picture. The literature describes several more-or-less distinct syndromes considered ‘mechanical’ but the terms used to name them are unclear. The wide usage of diagnostic labels implies they have specific meanings, but traditional entities are not defined in exclusive terms. There is overlap between ‘frozen shoulder’, ‘periarthritids’ and ‘capsulitis’, and between ‘rotator cuff lesion’, ‘supraspinatus tendinitis’, ‘subacromial bursitis’ and ‘impingement syndrome’. There is potential for confusion between all these supposedly distinct conditions. The difficulties of identifying and naming conditions associated with acute shoulder pain are acknowledged, and a rational taxonomy is suggested in ‘Diagnostic Terminology’.

It may be useful to consider the array of terms and concepts by considering mechanical entities from two perspectives:

- conditions recognised by tradition, and
- patho-anatomical entities.

Mechanical Conditions Recognised by Tradition

Minor Sprains

Sprains of ligaments, tendons and muscles account for the vast majority of acute shoulder pains. Sprain of a muscle and its tendon usually affects the myotendonous junction, which is the weakest part of the structure when it is loaded so as to cause longitudinal stretch. Minor sprains usually heal spontaneously over a period of days unless perpetuating factors are at work. The evidence shows that a defect in the collagenous structure of a sprained tendon will be filled with fibroblasts producing new collagen within three days of injury and will gain its normal strength within a matter of weeks (Lundborg et al 1978; Manske et al 1984).
‘Impingement Syndrome’

The ‘impingement syndrome’, as it was described originally by Neer (1972) and corroborated later by Hawkins (1980), is defined as pain on active shoulder flexion (forward elevation of the arm) above horizontal that is relieved by injection of local anaesthetic into the subacromial space. The rationale is that as the greater tuberosity of the humeral head and the acromion move closer together in flexion they impinge on tissues in the subacromial space.

The term ‘impingement syndrome’ is also applied loosely to other conditions in which there is pain on movement, such as pain on combined active internal rotation and abduction beyond the horizontal.

‘Impingement syndrome’ is usually attributed to subacromial bursitis or rotator cuff lesions (Neer 1983; Limb 2000).

Subacromial Bursitis

Inflammation of the subacromial bursa is associated with the development of an effusion that causes the bursa to swell (Neer 1983a; Gotoh et al 2001; Szomor et al 2001). The swollen structure tends to become entrapped and compressed between the humeral head and the acromion as they move closer together in shoulder flexion, internal rotation and abduction. Such impingement on an already tense structure may precipitate or aggravate the pain. It may be relieved by movement to a position in which the humeral head and the acromion are further apart, such as in external rotation.

Rotator Cuff Lesions

The rotator cuff tendons may be torn by sudden overloading in a traumatic event or frayed by rubbing against the acromion over time. The injury invokes an inflammatory response that causes the tendon to swell and become painful (Neer 1983b; Ozaki et al 1988; Ogata et al 1990; Hijikata et al 1993). The swollen structure may also be trapped between the humeral head and the acromion, causing the impingement syndrome.

‘Supraspinatus Tendonosis’

The supraspinatus tendon, in particular, is thought to become torn or frayed in the manner outlined above (Codman et al 1931). The more specific term implies that the structure primarily involved in the mechanism of the painful condition can be identified specifically. If indeed that tendon is the primary site of pathology, the term ‘supraspinatus tendonosis’ is more appropriate than the traditional ‘tendonitis’, as it carries less presumption of the pathogenesis.

Instability

The glenohumeral joint is stabilised by the glenoid labrum, the joint capsule and the ligaments and tendons that insert into it. If one of these structures is impaired (eg by dislocation) and the damage does not resolve, the joint will be unstable in the direction in which its restraints are inadequate (Protzman 1980; Rowe et al 1981; Matsen et al 1990).

Clinical instability of the shoulder is manifest as recurrent pain and ‘giving way’ or ‘locking’ after particular movements such as reaching upwards and outwards, or overhead throwing. Episodes are sometimes accompanied by numbness, tingling and weakness, the so-called ‘dead arm syndrome’. Active movements are restricted because of a reluctance to move into positions that precipitate symptoms. Abduction and external rotation are most commonly affected, especially in combination, but instability can occur in any direction.

‘Frozen Shoulder’

The term ‘frozen shoulder’ is commonly employed to describe a condition characterised by pain and stiffness.

Classic ‘frozen shoulder’ manifests as pain and stiffness of gradual onset over weeks or months. The condition is usually unilateral and more often affects the non-dominant side. Active and passive movements are restricted progressively in the onset or ‘freezing’ phase. Often the range most affected is external rotation, with abduction next most restricted, then internal rotation. The pain and stiffness tend to persist for a period of months (the so-called ‘frozen phase’) before gradually wearing off in the ‘thawing phase’ (Lundberg, 1969; Baslund et al 1990). The whole process usually takes from one to two years (Reeves, 1975; Grey, 1978) and recovery is generally substantial (Binder et al 1984), although many people have persistent problems (Shaffer et al 1992) of a relatively minor nature.
The problem was described by Duplay (1872) as ‘périarthrite scapulo-humerale’ or in English ‘scapulo-humeral periarthritis’. Codman used the name ‘frozen shoulder’ in his authoritative textbook published in 1934. Over the years others have used the term loosely to describe combinations of pain and stiffness that do not match the classic syndrome at all (Nevasier et al 1987), and some have applied it to any shoulder condition involving both symptoms. Thus in general usage the label ‘frozen shoulder’ is nebulous. Quigley (1963) described the term ‘frozen shoulder’ as having only the ‘dubious respectability of long usage, and … no greater precision than ‘surgical belly’ or ‘back strain’’.

In 1995 Bunker showed that the classic ‘frozen shoulder’ was due to fibromatosis similar to the pathological change that causes Dupuytren’s contracture, a common co-existing condition (Bunker et al 2000).

Patho-Anatomical Entities

Reference to an anatomical matrix provides a means to classify mechanical problems of the shoulder.

Articulations

Impairments of the joints of the shoulder include:

- glenohumeral joint sprain, subluxation and dislocation (including Bankart, Hill-Sachs and superior labrum anterior and posterior (SLAP) lesions),
- acromioclavicular joint sprain, subluxation and dislocation, and
- sternoclavicular joint sprain, subluxation and dislocation.

Joint Capsules

The capsules of the same joints may be partially torn or completely disrupted. The glenohumeral joint in particular may become contracted; thus:

- glenohumeral capsular tear, disruption and contracture,
- acromioclavicular capsular tear and disruption, and
- sternoclavicular capsular tear and disruption.

Bursae

Any of the bursae of the shoulder may become injured, resulting in effusion:

- subacromial bursal effusion is the most common;
- other bursal effusions should also be considered.

Ligaments

Any ligament of the shoulder may be partially torn or completely disrupted:

- glenohumeral ligamentous tears and disruptions,
- acromioclavicular ligamentous tears and disruptions, and
- sternoclavicular ligamentous tears and disruptions.

Muscles and Tendons

Any muscle attached to the shoulder may become compromised mechanically by a single large force or series of repeated insults. The most common injuries are simple sprains and tears, which typically occur at myotendinous junctions. Taking the rotator cuff group of muscles as examples, the classification of entities would be:

- supraspinatus sprains and tears
- infraspinatus sprains and tears
- teres minor sprains and tears
- subscapularis sprains and tears
- other muscle and tendon sprains and tears.
Conditions Referring Pain to the Shoulder

Three groups of conditions refer pain to the shoulder:

- extrinsic neurological conditions
- somatic conditions
- visceral conditions

The mechanism of pain referral to the shoulder is convergence in the nervous system. Thus sources of shoulder pain include neural structures of both peripheral and central nervous systems that receive sensory fibres from the shoulder, and any somatic or visceral structure with sensory innervation converging with that of the shoulder in the afferent sensory pathways. Patterns of shoulder pain that arise in this way vary from localised to diffuse.

Extrinsic Neurological Conditions

Neurological disorders are classified as intrinsic and extrinsic. Extrinsic conditions are those that arise at sites outside the shoulder but refer pain to it (Bateman 1983; Campbell et al 1995).

Conditions that irritate any of the peripheral nerves supplying the shoulder are also capable of causing shoulder pain (Brown 1983; Biundo et al 1995), for example cervical lymphadenopathy and Pancoast tumour (Pancoast 1932).

Intrinsic neurological conditions are considered later in this chapter.

Somatic Conditions

Pain is referred to the shoulder from other somatic structures. The sources of such somatic referred pain include anatomical structures whose sensory afferent neural pathways converge with those of the sensory nerves of the shoulder in the central nervous system.

Patterns of pain referral are described in detail for the cervical zygapophysial joints (Dwyer et al 1990; Aprill et al 1990; Fukui et al 1996) but less precisely for the cervical intervertebral discs (Friedenberg et al 1963) and the muscles of the neck (Bogduk et al 1993).

Visceral Conditions

Pain may be referred to the shoulder by visceral disease processes. In particular, diseases of tissues innervated by the phrenic nerve (which forms part of the fourth, and to lesser extents the third and fifth, cervical nerves) are associated with shoulder pain (Cousins 1987).

Prevalence of Conditions Causing Acute Shoulder Pain

The prevalence of some conditions causing acute shoulder pain has been established; serious (ie threatening) conditions are rare.

<table>
<thead>
<tr>
<th>Prevalence Rates of Some Conditions Causing Acute Shoulder Pain</th>
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<tbody>
<tr>
<td>Frequency</td>
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<tr>
<td>-----------</td>
</tr>
<tr>
<td>Rare causes (&lt;1%)</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Uncommon causes (&lt;5%)</td>
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<tr>
<td>Common causes</td>
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Table 7.2: Summary of available prevalence data on causes of acute shoulder pain
Sprains

Sprains of tendons and muscles are probably the most common reason for acute shoulder pain. Their prevalence is unknown because many are so minor as not to require professional care and are not recorded.

Rotator Cuff Tears

Tears of the rotator cuff tendons have been shown by post mortem pathological studies (Wellfing et al 1964; Rothman et al 1965) to occur in adults beyond the third decade of life in direct proportion to age. The finding has been borne out by imaging and arthroscopic studies that have shown rotator cuffs tears to be common in both symptomatic (Torstensen et al 1999) and asymptomatic individuals (Chandnani et al 1992; Milgrom et al 1995; Sher et al 1995). Tendon tears can occur at any age but are so common especially in older age groups as to raise serious doubts about the clinical significance of finding a cuff tear.

Impingement Syndrome

‘Impingement syndrome’ proved to have prevalences of 4.3% of men and 9.3% of women in a large survey in Sweden (Jacobsson et al 1989).

Fractures

Osteoporotic fractures of the humerus are uncommon overall but do occur in older people. More than half (56%) of women and one third (29%) of men over 60 years of age in Australia have osteoporotic fractures. The humerus is the site of 11% of these fractures. The prevalence of osteoporotic fracture in women over 60 years is 6% and the prevalence of osteoporotic fracture in men over age 60 is 3% (Jones et al 1994).

Neoplasia

Neoplastic causes of shoulder pain are comparatively rare. Precise figures for their prevalence have not been determined but the pre-test probability of a consumer in primary care presenting with shoulder pain and having neoplasm as the cause is thought to be substantially less than 1%.

Primary bone tumours involved the shoulder in 7% of one reported series of 2039 cases of primary bone neoplasm; 145 tumours occurred in the shoulder, with about equal prevalence of benign and malignant lesions. Malignant tumours tended to occur in an older age group (mean age 43 years) and benign tumours in younger people (mean age 17 years). In this series, 75% of the shoulder primaries were in the proximal humerus, 20% in the scapula and 5% in the outer clavicle (Barlow et al 1994).

Secondary malignancies in the bones of the shoulder affect the proximal humerus most often, with about 5% to 7% of osseous metastases occurring there. Primary sites are mainly the lung, breast, prostate, kidney and thyroid (Welch 1994).

Inflammatory Arthropathies

Inflammatory arthropathies are uncommon with prevalences of less than 5% and some much less, depending on the specific condition and the age group considered. Rheumatoid arthritis is the most common with a prevalence of up to 4.7% of elderly females and 2.5% of elderly males (Linos et al 1980).
Aetiological Risk Factors

Risk factors are features associated with the causation or perpetuation of a health problem. Their presence is correlated statistically with the chance of developing that problem or going on to suffer from it over a long period. These correlations do not prove direct involvement in aetiology; it is likely that the factors outlined below reflect characteristics of lifestyles:

- Advanced age is a factor relevant to osteoporosis and neoplasia. Osteoporosis is uncommon below the age of 50 and its incidence increases with age after that (Jones et al 1994).

- Female gender is associated with increased risk of osteoporosis (Cummings et al 1995; Sambrook 1996) and with shoulder pain in general as found in two large European epidemiological studies (Ekberg et al 1995; Skov et al 1996).

- Past health is also relevant to both osteoporosis and neoplasia. Early menopause and endocrine disturbances are other risk factors for osteoporosis (Cummings et al 1995; Sambrook 1996). A past history of neoplasia is a risk factor for developing metastatic disease.

- Sleep disturbances, smoking and caffeine consumption have all been associated with shoulder pain (in general) in large European and American epidemiological studies (Bergenudd et al 1994; Marcus et al 1996; Skov et al 1996).

- Repetitive physical tasks, whether at work or elsewhere, have been repeatedly associated with shoulder pain (Ekberg et al 1995; English et al 1995). Repetitive work tasks are implicated in many occupational conditions. The undertaking of an overhead task such as painting ceilings may bring on a subacromial disorder in a person unused to such activity.

- Other physical work stresses specifically associated with onset of shoulder pain in studies include work pace (Ekberg et al 1995), long periods of driving (Skov et al 1996) and prolonged exposure to vibration (Futatsaka et al 1985).

- Psychological work stresses such as job dissatisfaction, work demands, uncertainty about performance, decreased social support in the workplace and uncertain employment prospects have all been correlated with shoulder pain in studies (Bergenudd et al 1994; Ekberg et al 1995; Marcus et al 1996; Skov et al 1996).

- Immigrant status is another factor associated with shoulder pain (in general) in a European epidemiological survey (Ekberg et al 1995).
HISTORY

How does eliciting a history influence the management of acute shoulder pain?

- The reliability and validity of individual features in histories have low diagnostic significance; the history is to be interpreted with caution when choosing a course of action.
- The information may alert to the presence of a serious condition as the underlying cause of acute shoulder pain.
- The history provides baseline information to enable monitoring of progress and ongoing vigilance for serious conditions.

The aim in taking a history is to assess for the presence of serious conditions that may present as acute shoulder pain. The following is a framework for collecting relevant information and identifying features ('red flags') that may alert to the presence of serious conditions. However, as there is no evidence to demonstrate that such features are reliable, valid indicators of serious conditions causing acute shoulder pain, ongoing vigilance is vital.

Pain History

Site

The site where pain is felt tends to be the anatomical reference by which the index condition is designated but it may not be the site of origin. The clinician should ask which part of the shoulder hurts most and whether the pain started there or occurred somewhere else first. If there has been pain at multiple sites, the original site should be noted and an extrinsic cause or a serious condition considered.

Distribution

Distribution provides a clue to the source of pain. For example, shoulder pain associated with abdominal pain may be visceral referred pain. A specific pattern from the sternoclavicular region up into the side of the neck has been described for sternoclavicular joint pain on the basis of provocation studies (Hassett et al 2001). Distribution of pain from other parts of the shoulder girdle can be deduced from studies of the sensory supply of shoulder components (Gardner 1948).

Quality

Somatic impairment usually causes dull, aching pain. Such pain distributed from the neck to the shoulder suggests somatic referred pain of cervical origin. Sharp, stabbing pain shooting from the neck to the shoulder and arm is likely to be radicular. Burning pain is often neurogenic. Sharp pain in the shoulder and abdomen may be visceral referred pain.

Duration

Duration may reflect type and degree of impairment. Minor sprains and tears generally heal spontaneously; they are usually of short duration. Longer-term pain may be due to more severe impairment or the effects of perpetuating factors.

Periodicity

Constant pain may be associated with conditions involving joint distension or diffuse inflammation. Intermittent pain, especially pain on movement, may be associated with injury or focal inflammation. Such relationships are not constant; caution should be exercised in drawing conclusions from particular patterns of periodicity.
Intensity

The intensity of pain should be assessed (refer to Pain Management). Intensity of pain is often related to shoulder movement if there is somatic impairment or other local pathology, and unrelated to activities when the pain is of extrinsic origin.

Precipitating and Aggravating Factors

Aggravating factors include biomechanical stresses that load structures beyond their physiological capacities. A study of people with shoulder pain identified lifting above shoulder height, attempting to throw overhand and sleeping on the affected side as aggravating factors common to over 85% of them (Smith et al 2000). If pain is of extrinsic origin, precipitating and aggravating factors may be unrelated to shoulder movement or loading. Pain at rest should alert to the possibility of fracture.

Relieving Factors

If pain is due to injury or other somatic impairment, relieving factors usually reduce biomechanical stresses, eg avoiding particular movements and activities, or preforming them in different ways. When acute shoulder pain is of extrinsic origin, any relieving factors are often unrelated to shoulder movement or loading.

Effect of Pain on Activities of Daily Living

Assessing the effect of pain on activities of daily living (ADL) allows the clinician to determine the impact of pain on the individual's lifestyle. Ongoing assessment of the impact on ADL provides a practical measure of the progress of the condition and associated disabilities.

Associated Symptoms

Symptoms associated with ‘mechanical’ shoulder pain may include stiffness or limitation of shoulder movement. Unexpected weight loss, fever, night sweats or other unexplained symptom should alert the clinician to the possibility of a serious condition.

Onset (Precipitating Event)

A history of trauma is the main feature alerting to possible fracture or dislocation. The usual history is sudden onset of shoulder pain after substantial force was applied to the region, or a history of a fall. Further alerting features are pain at rest and swelling (Fraenkel et al 2000).

In cases of ‘mechanical’ shoulder pain, the onset is usually due to an incident of trauma or to repeated biomechanical stress of the affected part. Appraisal of the onset may suggest the vectors of applied force(s), however multiple structures are involved.

If there is no history of trauma or repeated stress the clinician should consider the possibility of a serious condition. Conversely, a history of trauma may have aggravated a pre-existing condition.

Previous Similar Symptoms

History of previous similar symptoms casts doubt on the acute nature of a pain and suggests an acute manifestation of a chronic condition. If there have been previous similar episodes that apparently resolved the possible effects of risk factors should be considered (see Prognosis).

Previous Treatment for the Index Condition

If multiple interventions have all failed to provide relief, the possibility of a serious condition should be considered.

Current Treatment for the Index Condition

All forms of treatment in current use should be noted together with information on the helpfulness of each. Alleviation, even temporarily, by particular measures may provide clues to the nature of the condition. Pain that responds to physical interventions often has a mechanical basis, or at least a mechanical contribution to its pathogenesis.
General History

- Note should be taken of any current treatment (for other conditions) that may have a bearing on the index condition or its treatment
- Reviewing past and present symptoms from each system of the body may reveal conditions that influence the index condition
- Involvement in activities that entail shoulder use, the likely impacts of disabilities and handicaps associated with the index condition, and the presence of supportive relationships and other social resources
- Lateral dominance is relevant as a possible aetiological factor, eg as a determinant of the way a person engages in particular activities, and as a factor in the impact of the condition on the consumer’s activities of daily living
- Occupation is relevant as a guide to ways the shoulder has been used in the past and to tasks the consumer may have to undertake, or try to undertake, in the future
- Past history of other musculoskeletal conditions or of significant trauma suggests the possibility of an acute manifestation of a chronic condition. Past history of fracture due to minor trauma, recurrent infection, immunological compromise or neoplasm suggests the possibility of a serious condition
- Age is relevant to acute shoulder pain as a risk factor. Osteoporosis is uncommon below the age of 50 so advanced age is an alerting factor. Age over 50 is also associated with an increased risk of neoplasia
- Fever is an indication of systemic infection; this may be an alerting feature for septic arthritis (Lossos et al 1998). A history of bodily penetration is another alerting feature. Infective organisms must have a portal of entry, either directly into the joint or into other parts of the body. Events providing such portals include penetrating injuries, surgery, medical procedures using needles, catheters or other instruments, acupuncture, piercing of ears or other parts for jewellery, tattooing and self-injection with drugs
- Previous malignancy, age over 50, weight loss and failure to improve with treatment are alerting features
- While the predictive values of these alerting features have not been tested formally in relation to shoulder pain, the quoted features are generally associated with serious conditions such as malignancy, infection, and fractures.

Psychological History

An assessment of whether the patient’s affect, cognitions and beliefs are likely to influence the course of the condition can identify whether there are psychological factors that warrant special psychological management.

In all cases, appreciation of the psychological response to the condition assists clinicians to empathise and care for the individual in the manner advocated by Cochrane (1977).

Psychological history should include:
- affect generally, and in particular whether anxious or depressed
- understanding of and reaction to the index condition, and any associated fears
- relevant cognitions and beliefs, both personal and socio-cultural
- coping strategies used in relation to the index condition, or lack of them

Evidence of Reliability

There are few data on the diagnostic utility of history taking. The value of the history in clinical assessment is often taken for granted. There are no reports in the literature of formal studies of histories of people with acute shoulder pain but one study exists on the reliability of histories taken from those with chronic shoulder pain.

Nørregaard et al (2002) studied histories obtained by an orthopaedic surgeon and a rheumatologist who each assessed 86 patients in a teaching hospital shoulder clinic, in random order. The interobserver agreement on symptoms was low; the results are presented in Table 7.3.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Kappa</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain deep in the shoulder</td>
<td>0.15</td>
<td>0.08</td>
</tr>
<tr>
<td>Pain in the upper shoulder</td>
<td>0.09</td>
<td>0.07</td>
</tr>
<tr>
<td>Pain in the front of the shoulder</td>
<td>0.15</td>
<td>0.08</td>
</tr>
<tr>
<td>Pain in the back of the shoulder</td>
<td>0.49</td>
<td>0.10</td>
</tr>
<tr>
<td>Pain on lifting or throwing</td>
<td>0.26</td>
<td>0.16</td>
</tr>
<tr>
<td>Pain at rest</td>
<td>0.54</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Table 7.3: Reliability of symptoms elicited by two experienced clinicians, as shown by Nørregaard et al (2002).
Evidence of Validity

There are no data on the validity of history taking only, without physical examination, pertaining solely to those with acute shoulder pain but there are data for histories of those with shoulder pain of mixed (acute and chronic) durations.

Litaker et al (2000) studied the histories of 448 people who had double contrast arthrography for investigation of shoulder problems. The features in the histories were correlated with arthrographic evidence of rotator cuff tendon tears (Table 7.4).

<table>
<thead>
<tr>
<th>Features in History</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Likelihood Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of trauma</td>
<td>0.36</td>
<td>0.73</td>
<td>1.33</td>
</tr>
<tr>
<td>Pain on shoulder movement</td>
<td>0.98</td>
<td>0.10</td>
<td>1.10</td>
</tr>
<tr>
<td>Night pain</td>
<td>0.88</td>
<td>0.20</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Table 7.4: Validity of histories of rotator cuff lesions, shown by Litaker et al (2000)

These data of reliability and validity suggest a need for caution in the interpretation of clinical histories obtained from people with shoulder pain.
PHYSICAL EXAMINATION

How does physical examination influence management of acute shoulder pain?

- Findings of shoulder examination must be interpreted cautiously in light of the evidence of limited utility; no clinical test is both reliable and valid for any specific diagnostic entity.
- Physical examination is an opportunity to enhance rapport between clinician and consumer and to place the index condition into context.

A physical examination of the shoulder may include the following elements:

Inspection

Observations on visual inspection of the shoulder may include peculiarities of posture, of bodily contours or of bony landmarks that suggest structural abnormality. Swelling should alert to the possibility of fracture. Inflammatory arthropathies are characterised by effusion and should be considered if the consumer presents with joint swelling.

Palpation

Tenderness is the main physical sign elicited by palpation. It may be focal or diffuse. Focal tenderness is usually regarded as more significant, especially if it reproduces the individual’s typical pain. On finding focal tenderness, the conventional approach is to try to determine its anatomical reference.

Other signs elicited by palpation include apparent alterations of skin sensitivity such as hypoaesthesia, suggesting neurological deficit, and hyperaesthesia, suggesting alldynia, and apparent alteration of bony landmarks, soft tissue conformation and muscle tone.

Palpable deformities of bones and other tissues alert to the possibility of neoplasm.

Movement Testing

Movements of the shoulder are tested by assessing the active, passive and accessory ranges of movement, and challenging the restraints to movement.

Ranges of Movement

Ranges of active movement are assessed based on the ability to extend, flex, abduct, adduct, externally rotate and internally rotate the shoulder from a neutral position. Conventions have been set (Russe et al 1976; Green et al 1994) for performing these tests and recording their results. The ranges may be assessed visually or by use of a measuring instrument, a goniometer or an inclinometer. The examiner should note any limitation of range and any movement associated with pain.

Ranges of passive and accessory movement are tested similarly, with the examiner supplying the effort to move the shoulder through each range in turn.

Challenging Restraints

The restraints to the various movements are bony contours, capsules, ligaments, tendons and muscles that limit movement in each direction. They are tested actively by asking the individual to move the shoulder as far as possible and to describe what seems to be limiting further movement, whether pain, tethering, a bony stop or otherwise. By resisting active movements the examiner can gain an impression of the strength of muscles involved and any association with pain.

Restraints are challenged passively by the examiner moving a joint through its physiological ranges and testing its accessory movements, the translations and rotations possible along and around each of the biomechanical axes. Restraints may be deemed to be intact or impaired.
• ‘End-feel’ is described as what is felt by the examiner when a joint is taken to the limit of its movement. It is deemed to be ‘hard’ or ‘soft’ (Frisch 1994).

• A ‘painful arc’ is another sign described in relation to movement testing. It is part of a range through which movement is associated with pain (Kessel et al 977).

• The original ‘impingement sign’ is said to be present when shoulder flexion (forward elevation of the arm) is limited by pain as the humeral head and the acromion move closer together, apparently impinging on tissues in the subacromial space (Neer 1972). It should be noted that in the original description, Neer included abolition of the positive response after subacromial injection of lignocaine as a second stage of the test.

• Another clinical sign described as denoting impingement is a positive ‘Hawkins test’ (Hawkins et al 1980), pain on passive internal rotation of the shoulder at 90° flexion (forward elevation of the arm).

• Many other clinical tests have been developed for the assessment of suspected subacromial impingement. One of many examples is the ‘Yocum test’ (Yocum 1983), which is described as positive when pain is provoked by raising the individual’s elbow when their hand is on the opposite shoulder. Clinicians should note that tests are sometimes called by eponymous names even though they are not done as originally described, and what is described as a positive clinical test may not be the same in the hands of different examiners.

• The ‘drop arm test’ for a torn rotator cuff tendon is described as positive if there is a sudden drop on active adduction of the arm from 90° abduction.

• The ‘apprehension sign’ is described when guarding and apprehension are exhibited as the examiner starts to test restraints to a particular movement. It is said to signify instability (Blazina et al 1969).

Other tests are described for assessment of the biceps tendon:

• Provocation of pain by active shoulder flexion (forward elevation) against resistance is called a positive ‘Speed test’ (Speed 1952). It is said to denote a disorder of the tendon of the long head of the biceps.

• Another test of the long head of the biceps is the ‘Yergason test’ (Yergason 1931), which is described as positive when anterior shoulder pain is provoked by resisted active supination of the forearm from pronation.

Tests are also described for challenging the restraints of the acromioclavicular joint (American Academy of Orthopaedic Surgeons 1962) and the sternoclavicular joint (Burrows 1951).

Evidence of Reliability

Inspection

In the absence of data yielding kappa scores or other indices of agreement, the reliability of inspection of the shoulder is unknown.

Palpation

Palmer et al (2000) showed a high degree of reliability for elicitation of tenderness somewhere around the shoulder (kappa 0.80, with a standard error of 0.11). The diagnostic utility of such non-specific tenderness is unknown.

The reliability of focal tenderness or other palpatory signs is unknown; no data exist.

Movement Testing

Ranges of Movement

There are no data on movement testing specifically related to acute shoulder pain. Data have been published for normal subjects, people with shoulder pain of mixed duration from one to 48 months and some with shoulder pain of unstated duration.

• Visual estimations of ranges of shoulder movement seem of inconsistent reliability. Croft et al (1994) reported good agreement between six trained observers for visual estimation of abduction, with an intra-class correlation coefficient (ICC) of 0.84, but poor agreement for external rotation (ICC 0.43). Other ranges were not studied.
• Goniometry (using an instrument like a protractor with a scale marked in degrees and arms) might be expected to confer advantage. Williams et al (1990) studied 22 observers using visual estimation and three different types of goniometer to assess ranges of abduction. They showed visual estimation was the most reliable method. Other studies of goniometry have also showed only moderate inter-observer reliability (Boone et al 1978; Riddle et al 1987; Bostrom et al 1991).

• Inclinometry (using a device with gravitational reference and a dial displaying degrees) can produce reliable measurements if performed by trained clinicians but it is not uniformly reliable. Two inclinometric studies by Green et al (1998) and Hoving et al (2002) showed inter-rater reliability varies for different ranges of movement and groups of observers, as in Table 7.5.

<table>
<thead>
<tr>
<th>Ranges</th>
<th>ICCs (6 physiotherapists)</th>
<th>ICCs (6 rheumatologists)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total shoulder flexion</td>
<td>0.82</td>
<td>0.73</td>
</tr>
<tr>
<td>Total shoulder abduction</td>
<td>0.88</td>
<td>0.56</td>
</tr>
<tr>
<td>External rotation in neutral</td>
<td>0.95</td>
<td>0.30</td>
</tr>
<tr>
<td>External rotation in abduction</td>
<td>0.73</td>
<td>0.19</td>
</tr>
<tr>
<td>Internal rotation in abduction</td>
<td>0.48</td>
<td>0.02</td>
</tr>
<tr>
<td>Hand behind back</td>
<td>0.71</td>
<td>0.80</td>
</tr>
</tbody>
</table>

Table 7.5: Inter-rater reliability of shoulder range inclinometry by physiotherapists and rheumatologists as shown by Green et al (1998) and Hoving et al (2002).

Challenging Restraints

There are no data on the reliability of challenging restraints pertaining solely to those with acute shoulder pain but data have been published for physical examination of people with shoulder pain of unstated durations, and for those without shoulder conditions (to act as controls).

Palmer et al (2000) studied the interobserver reliability of physical signs elicited by challenging restraints to shoulder movement. The tests were performed on 43 subjects by two trained examiners (a research nurse and a rheumatologist). The results are presented in Table 7.6, showing kappa scores and their standard errors.

<table>
<thead>
<tr>
<th>Physical Signs</th>
<th>Kappa</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painful arc</td>
<td>0.93</td>
<td>0.11</td>
</tr>
<tr>
<td>Painful resisted external rotation</td>
<td>0.90</td>
<td>0.11</td>
</tr>
<tr>
<td>Painful resisted internal rotation</td>
<td>0.54</td>
<td>0.11</td>
</tr>
<tr>
<td>Painful resisted abduction</td>
<td>0.81</td>
<td>0.11</td>
</tr>
<tr>
<td>Acromio-clavicular joint ‘stress’</td>
<td>0.80</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Table 7.6: Reliability of physical signs elicited by challenging restraints, as reported by Palmer et al (2000).

Çalış et al (2000) studied seven physical tests of shoulder restraints. The tests were performed by two experienced physicians and their interobserver reliability values were reported as ‘above 98%’.

Evidence of Validity

Inspection

In the absence of data yielding indices of sensitivity and specificity, and likelihood ratios, the validity of inspection of the shoulder girdle is unknown.

Palpation

There are no data on the validity of tenderness (either focal or diffuse) or of other palpatory signs associated with shoulder disorders. The diagnostic utility of palpation for such signs is unknown.
Movement Testing

Ranges of Movement

There are no data on the validity of testing ranges of movement of the shoulder girdle so the diagnostic utility of such tests is also unknown.

Challenging Restraints

There are no data on the validity of challenging restraints pertaining solely to acute shoulder pain. Data have been published for physical examination of people with shoulder pain of mixed duration, from one to 48 months, and of unstated duration.

Çaliş et al (2000) studied physical examination of the shoulder for the impingement syndrome. Physical signs were compared with a criterion standard of combined radiography, magnetic resonance imaging and relief of pain after subacromial injection of local anaesthetic. The sensitivity, specificity and likelihood ratio of each sign are presented in Table 7.7.

<table>
<thead>
<tr>
<th>Validity of Physical Signs Elicited by Tests to Challenge Restraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Sign(s)</td>
</tr>
<tr>
<td>Pain on passive forward elevation (‘Neer test’)</td>
</tr>
<tr>
<td>Pain on passive internal rotation at 900 flexion (‘Hawkins test’)</td>
</tr>
<tr>
<td>Pain on passive horizontal adduction with elbow flexed</td>
</tr>
<tr>
<td>Painful arc between 600 and 1200 of active shoulder abduction</td>
</tr>
<tr>
<td>Sudden drop on active adduction from horizontal (‘drop arm test’)</td>
</tr>
<tr>
<td>Shoulder pain on resisted forearm supination (‘Yergason test’)</td>
</tr>
<tr>
<td>Pain on resisted shoulder flexion (‘Speed test’)</td>
</tr>
<tr>
<td>All 7 of the above ‘impingement’ tests positive</td>
</tr>
</tbody>
</table>

Table 7.7: Validity of physical signs elicited by tests that challenge restraints to shoulder movement, according to Çaliş et al (2000).

Other investigators have studied the validity of impingement signs. MacDonald et al (2000) investigated the ‘Neer’ and ‘Hawkins’ clinical tests using arthroscopy as the criterion standard. They compared specific arthroscopic findings of subacromial bursitis with the clinical findings recorded pre-operatively by the treating orthopaedic surgeon. Naredo et al (2002) investigated physical examination using ultrasonographic findings as their criterion standard. They studied a combination of ten clinical tests, including the ‘Neer’, ‘Hawkins’ and ‘Yocum’ tests to elicit signs of impingement. Results of both studies are presented in Table 7.8.

<table>
<thead>
<tr>
<th>Validity of Physical Signs of Impingement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Sign(s)</td>
</tr>
<tr>
<td>Pain on passive forward elevation (‘Neer test’) [M]</td>
</tr>
<tr>
<td>Pain on internal rotation at 900 flexion (‘Hawkins test’) [M]</td>
</tr>
<tr>
<td>Both ‘Neer’ and ‘Hawkins’ tests positive [M]</td>
</tr>
<tr>
<td>‘Neer’, ‘Hawkins’, ‘Yocum’ and other tests all positive [N]</td>
</tr>
</tbody>
</table>

Table 7.8: Validity of physical signs of impingement, according to MacDonald et al (2000) designated [M] and to Naredo et al (2002) designated [N].

MacDonald et al (2000) also compared positive ‘Neer’ and ‘Hawkins’ tests with arthroscopic findings of rotator cuff tendon lesions. Naredo et al (2002) did a similar study using ultrasonographic findings as the criterion standard. Itoi et al (1999) studied two clinical tests, called the ‘full can test’ (Jobe et al 1982) and ‘the empty can test’ (Kelly et al 1996) for rotator cuff tears using magnetic resonance imaging as a criterion standard. Their results are presented in Table 7.9.
### Validity of Physical Signs for Rotator Cuff Lesions

<table>
<thead>
<tr>
<th>Physical Sign(s)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Likelihood Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain on passive forward elevation (‘Neer test’) [M]</td>
<td>83%</td>
<td>51%</td>
<td>1.69</td>
</tr>
<tr>
<td>Pain on internal rotation at 900 flexion (‘Hawkins test’) [M]</td>
<td>88%</td>
<td>43%</td>
<td>1.54</td>
</tr>
<tr>
<td>Both ‘Neer’ and ‘Hawkins’ tests positive [M]</td>
<td>83%</td>
<td>56%</td>
<td>1.89</td>
</tr>
<tr>
<td>‘Neer’, ‘Hawkins’, ‘Yocum’ and other tests all positive [N]</td>
<td>79%</td>
<td>50%</td>
<td>1.58</td>
</tr>
<tr>
<td>Pain on external rotation in elevation (‘the full can test’) [I]</td>
<td>66%</td>
<td>64%</td>
<td>1.83</td>
</tr>
<tr>
<td>Pain on internal rotation in elevation (‘the empty can test’) [I]</td>
<td>63%</td>
<td>55%</td>
<td>1.40</td>
</tr>
</tbody>
</table>


Naredo et al (2002) also investigated physical examination for biceps tendon lesions using ultrasonographic findings as the criterion standard. Bennett (1998) studied the ‘Speed test’ for testing the biceps tendon at the level of the bicipital groove. He compared its results with those of arthroscopy. The results are displayed in Table 7.10.

### Validity of Physical Signs of Biceps Tendon Lesions

<table>
<thead>
<tr>
<th>Physical Sign(s)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Likelihood Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Neer’, ‘Hawkins’, ‘Yocum’ and other tests all positive [N]</td>
<td>74%</td>
<td>58%</td>
<td>1.76</td>
</tr>
<tr>
<td>Pain on resisted shoulder flexion (‘Speed test’) [B]</td>
<td>90%</td>
<td>14%</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Table 7.10: Validity of physical signs of biceps tendon lesions, according to Naredo et al (2002) designated [N] and to Bennett (1998) designated [B].

Readers will note that the tables show many of the same clinical tests being used to detect apparently distinct disorders.

### Summary

The evidence on the diagnostic utility of tests used in physical examination of the shoulder girdle is summed up in the conclusion reached by Çalış et al (2000). As they stated ‘the highly sensitive tests seem to have low specificity values and the highly specific ones to have low sensitivity values’. This is reflected in the low likelihood ratios of all individual tests and most combinations that have been studied.
Do clinical features allow specific diagnosis of acute shoulder pain?

- Causes of acute shoulder pain cannot be diagnosed by clinical assessment; however, with the exception of serious conditions, satisfactory outcomes do not depend on precise identification of cause.

How should acute shoulder pain be described?

- Terms to describe acute shoulder pain should summarise the discernible features of the condition to form the basis for a management plan (suggested terms are presented to promote consistent usage).

Diagnosis of Acute Shoulder Pain

The evidence shows that symptoms and physical signs do not correlate sufficiently for definitive diagnosis of shoulder pain. Despite traditional teaching and the best efforts of expert clinicians, structure-specific clinical diagnosis cannot be reliably achieved. Five studies of clinical diagnosis involving different clinicians have concluded that it is of limited reliability. The results are tabulated below.

![Table 7.11: Reliability of clinical diagnosis, as shown by five studies.](image)

Clinical assessment methods do not discriminate sufficiently for definitive diagnosis. As the cause of acute shoulder pain cannot, in most cases, be identified at the initial consultation (Phillips et al 1997; Solomon et al 2000), clinicians may be inclined to proceed to ancillary investigations. While such investigations are warranted in the presence of features alerting to a serious condition, they lack utility in acute ‘mechanical’ conditions as the results will not alter management or outcome.

Acute conditions are, by definition, likely to heal spontaneously. The evidence on treatment of common ‘mechanical’ disorders shows that satisfactory outcomes do not depend on precise identification of causes (Solomon et al 2001). However, management must still be guided by some concept of the index condition. The clinician can formulate a working diagnosis that summarises the discernible features of the condition accurately even if it is not definitive. A descriptive label can be applied to the working diagnosis describing what is known of the condition.

Alerting Features for Serious Causes

The following are some features generally associated with serious conditions such as malignancy, infection and fracture/dislocation that may be noted during clinical assessment. While the predictive values of these alerting features have not been tested specifically in relation to shoulder pain, their presence in conjunction with acute shoulder pain should prompt further investigation.

![Table 7.12: Alerting features of serious causes of acute shoulder pain](image)
**Terminology**

Diagnostic labelling has two main purposes:

- To enable the formulation of a management plan
- To facilitate effective communication between clinician and consumer

A diagnostic label must be as specific as possible and scientifically valid. Inaccurate description or use of inappropriate terms obscures the diagnosis, hinders communication and understanding and increases the risk of treatment errors. The use of appropriate terms is essential to minimise such problems.

To promote consistency, the terms recommended by the International Association for the Study of Pain (IASP) in the latest edition of its taxonomy (1994) are preferred. However, the IASP taxonomy lists chronic pain terms; additional terms are needed for acute pain. Suggested terms for common ‘mechanical’ conditions giving rise to acute shoulder pain on the basis of clinical assessment findings are presented in Figure 7.2.

<table>
<thead>
<tr>
<th>Suggested Terms to Describe Acute Shoulder Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When the origin of pain is unclear but unlikely to be related to local tissue damage:</strong></td>
</tr>
<tr>
<td>• acute shoulder pain of uncertain origin</td>
</tr>
<tr>
<td><strong>When the pain appears to be of local somatic origin but nothing else can be specified:</strong></td>
</tr>
<tr>
<td>• acute somatic shoulder impairment</td>
</tr>
<tr>
<td><strong>When the pain appears to arise from a particular region of the shoulder:</strong></td>
</tr>
<tr>
<td>• acute anterior shoulder impairment</td>
</tr>
<tr>
<td>• acute posterior shoulder impairment</td>
</tr>
<tr>
<td>• acute lateral shoulder impairment</td>
</tr>
<tr>
<td>• acute superior shoulder impairment</td>
</tr>
<tr>
<td>• acute inferior shoulder impairment</td>
</tr>
</tbody>
</table>

**Figure 7.3: Suggested terms to describe acute shoulder pain**

These terms are not intended as definitive diagnoses. They express what is known about the presenting condition after clinical assessment. Clinicians should note that it is not necessary to identify an underlying condition at the outset unless a serious condition is suspected.

The suggested taxonomy aims to reduce the confusion arising from the inappropriate use of terms to describe acute shoulder pain. For example, ‘subacromial bursitis’, ‘supraspinatus tendonitis’, ‘rotator cuff tear’ and ‘impingement syndrome’ are terms used more or less interchangeably to describe similar clinical presentations (Buchbinder et al 1996a&b). They create false impressions of disparate diagnostic entities that are readily distinguishable clinically. The substitution for all of them of ‘acute superior shoulder impairment’ avoids ambiguity and facilitates comparison between conditions that are similar.

These terms are deliberately not tissue-specific. The concept of impairment is central to their understanding. 'Impairment' is defined, in the World Health Organisation list (1986) of terms related to disability, as ‘loss or abnormality of anatomical structure, or physiological or psychological function’. It is a general term implying damage and/or loss of function without attributing cause. It is more than a description of a symptom but not a presumption of specific pathology, and it allows for both the psychological and physical dimensions of the condition.

**Acute Shoulder Pain of Uncertain Origin**

Acute shoulder pain of uncertain origin refers to pain in the shoulder where the source of pain is unclear after clinical assessment. Its use is best confined to cases in which the pain is likely to be mediated by factors other than local tissue damage, such as pain arising outside the shoulder, and then it should be supplemented by explanation. Consideration of serious conditions should be an urgent priority in such cases.
Acute Somatic Shoulder Impairment

Acute somatic shoulder impairment means the pain is due to impairment of somatic structure(s) of the shoulder. The word ‘somatic’ denotes that the condition is physical and not the expression of a psychological state. While not specifying the tissue(s) affected, the descriptor implies the pain is arising locally rather than from outside the shoulder, is not of neurological origin and is not due to a serious condition.

Acute Regional Shoulder Pain

Acute anterior shoulder impairment means the pain is due to impairment of one or more of the structures at the front of the shoulder, without specifying the particular tissue(s) involved. Acute posterior, lateral, superior or inferior shoulder impairment imply impairment of one or more of the structures at the back, outer part, top or underpart of the shoulder, respectively, without specifying the particular tissue(s) involved.
Are special investigations useful for the management of acute shoulder pain?

- Imaging and other special investigations are rarely necessary for the management of acute shoulder pain; diagnostic utility is minimal and the results are unlikely to improve management.
- Investigations are indicated for acute shoulder pain when alerting features of serious conditions are identified.
- There is a need to educate consumers about the limitations of imaging and the risks of radiation exposure.

Medical Imaging

Medical imaging enables indirect visualisation of internal structures of the body that otherwise can only be assessed by palpation. Imaging technology provides numerous modalities with different capacities, applications and indications.

Imaging is indicated when a serious condition is suspected, however the limitations of imaging require consideration. The evidence shows that visualisation of internal structures is compromised by limitations of reliability and validity, and imaging results may actually confuse the diagnostic process. Additionally, there are safety and cost issues to consider.

If there are no features suggesting the presence of a serious condition, imaging is not indicated as the condition is likely to resolve spontaneously. In acute shoulder pain, the diagnostic utility of imaging is minimal.

The situation is different with chronic conditions where imaging has a greater role. However care must be exercised in the interpretation of imaging findings.

Plain Radiography

In plain radiography, the x-ray beam is impeded by tissue in its path to produce an image on a radiosensitive plate. Radiographic images depend on the relative radiolucencies of tissues. They show the outlines and contours of bones and joints clearly, but are less useful for assessing soft tissues. ‘Stress views’, in which a joint is imaged under biomechanical stress, show the relationships of the bones and provide some idea of whether anatomical restraints to joint movement are intact.

Safety

The ionising radiation used in plain radiography is teratogenic and carcinogenic. Those who are (or might be) pregnant should not be exposed to it. All others should only be exposed when necessary and then only to the minimum dose required for satisfactory images. The potentially serious consequences of radiation should be considered and the consumer warned of them to allow informed consent before radiography is undertaken (Roebuck 1995).

Reliability

There are no formal studies of the reliability of plain radiography in the investigation of acute shoulder pain. Studies of plain radiography of other joints suggest variation between radiographers in the methods used to produce images, and between radiologists in the detection, interpretation and designation of changes. Those studies show the limited reliability of plain radiography generally; it is unknown whether this finding can be extrapolated to radiography of the shoulder.
Validity

There are no formal studies of the validity of plain radiography in the diagnosis of acute shoulder pain. Plain films have been described as having abilities to show relationships between the segments of the proximal humerus and the glenohumeral joint, alterations of them due to trauma (Neer 1970), and signs of neoplasia (Stiles et al 1993; Tyson 1995). No studies have quantified those abilities. One paper reports sensitivity of 78% and specificity of 98% for plain X-ray diagnosis of instability after massive rotator cuff tears (Kaneko et al 1995).

Cost Effectiveness

In the absence of dependable data on reliability and validity, the cost-effectiveness of plain radiography in the diagnosis of acute shoulder pain is unknown.

Diagnostic Utility

Plain radiography seems useful in the diagnosis of fractures, dislocations, tumours and advanced arthritides. In acute cases it should be reserved for those with such suspected serious conditions. It does not show soft tissue lesions such as rotator cuff tears. One study showed plain radiography is often uninformative in the assessment of acute shoulder pain (Fraenkel et al 2000).

Ultrasonography

In ultrasonography (or just ‘sonography’), images are produced when an ultrasound beam is reflected by tissue in its path. Reflection occurs at surfaces and interfaces so they are imaged best by the method. Ultrasonic images show the surfaces and contours of soft tissues such as tendons and ligaments but do not show the internal structure of solid tissue such as bone.

Ultrasonography does not involve ionising radiation. There is no evidence that ultrasound has any harmful effects on human tissues and the method is considered non-invasive.

There are no data on the intra-observer or inter-observer reliability of ultrasonography explicitly related to the diagnosis of acute shoulder pain. Factors likely to threaten the reliability of the technique are similar to those described for other imaging modalities including:

Safety

Equipment used in ultrasonography includes an ultrasonic transducer and a scanner. Current standards of shoulder ultrasonography (Middleton 1992; Teefey et al 2000) require use of a variable high-frequency linear-array transducer (7.5-10 megahertz). Sector transducers produce images of insufficient resolution and are best avoided.

Reliability

Scanning technique includes the position of the patient, the operator and the monitor screen, and the orientation of the transducer relative to anatomical structures imaged. Ultrasonography of the shoulder is usually performed with the patient seated and the operator standing behind so both face the monitor screen and the ultrasonographer can orientate the transducer under the guidance of the image.

Skill of the operator is a major factor in inter-observer reliability. Ultrasonography is said to be highly dependent on the operator’s training and experience (Tyson 1995; van Moppes 1995).

Diagnostic criteria determine the changes identified and their interpretation. It is useful to understand the criteria applied in the judgment of ultrasonic findings.

Interpretation is particularly important in ultrasonography as changes in reflection of the ultrasound beam must be observed as they occur for proper appreciation. Ultrasonography cannot be interpreted effectively by subsequent viewing of the films.
Validity

There are no data on the validity of ultrasonography explicitly related to the diagnosis of acute shoulder pain, but data are available from studies of subjects with shoulder pain of mixed and unstated durations, very likely including some acute cases.

In these studies, ultrasonography has been compared with diagnostic interventions including both single and double contrast arthrography, CT, MRI and surgical findings (both open and arthroscopic) in investigation of the rotator cuff tendons and the subacromial bursa. In one study, ultrasonography has also been compared with clinical examination of the shoulder.

There have been several studies of the validity of ultrasonography in the investigation of rotator cuff tendon lesions using double contrast arthrography as a criterion standard. The results of seven such studies are set out in Table 7.13.

<table>
<thead>
<tr>
<th>Authors</th>
<th>N</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Likelihood Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>D'Erme et al (1993)</td>
<td>15</td>
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<td>0% *</td>
<td>0.83 *</td>
</tr>
<tr>
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<td>58</td>
<td>75%</td>
<td>43%</td>
<td>1.3</td>
</tr>
<tr>
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<td>93%</td>
<td>8.3</td>
</tr>
<tr>
<td>Middleton et al (1986)</td>
<td>100</td>
<td>91%</td>
<td>91%</td>
<td>10</td>
</tr>
<tr>
<td>Farin et al (1996)</td>
<td>86</td>
<td>89%</td>
<td>95%</td>
<td>18</td>
</tr>
<tr>
<td>Mack et al (1988)</td>
<td>99</td>
<td>88%</td>
<td>96%</td>
<td>22</td>
</tr>
<tr>
<td>Mack et al (1985)</td>
<td>72</td>
<td>93%</td>
<td>97%</td>
<td>31</td>
</tr>
</tbody>
</table>

Table 7.13: Validity of ultrasonography of rotator cuff tendons, using arthrography as the criterion standard, as reported by several authors. * The specificity of 0% and low likelihood ratio were due to a lack of true negative scores in the results.

Many investigators have studied the validity of ultrasonography in diagnosis of rotator cuff lesions using surgical findings (in recent years mostly those of arthroscopy) as criterion standard. The results of ten such studies are set out in Table 7.14.

<table>
<thead>
<tr>
<th>Authors</th>
<th>N</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Likelihood Ratio</th>
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</thead>
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<td>86%</td>
<td>0% *</td>
<td>0.86 *</td>
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<tr>
<td>Brandt et al (1989)</td>
<td>38</td>
<td>71%</td>
<td>29%</td>
<td>1.0</td>
</tr>
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<td>Kurol et al (1991)</td>
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<td>42%</td>
<td>88%</td>
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<td>Brenneke et al (1992)</td>
<td>120</td>
<td>78%</td>
<td>82%</td>
<td>4.3</td>
</tr>
<tr>
<td>Teefey et al (2000)</td>
<td>120</td>
<td>94%</td>
<td>85%</td>
<td>6.3</td>
</tr>
<tr>
<td>Crass et al (1988)</td>
<td>108</td>
<td>90%</td>
<td>92%</td>
<td>11</td>
</tr>
<tr>
<td>Mack et al (1985)</td>
<td>47</td>
<td>100%</td>
<td>91%</td>
<td>11</td>
</tr>
<tr>
<td>Wiener et al (1993)</td>
<td>225</td>
<td>95%</td>
<td>94%</td>
<td>16</td>
</tr>
<tr>
<td>Farin et al (1996)</td>
<td>86</td>
<td>87%</td>
<td>98%</td>
<td>44</td>
</tr>
<tr>
<td>Mack et al (1988)</td>
<td>90</td>
<td>91%</td>
<td>98%</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 7.14: Validity of ultrasonography of rotator cuff tendons, using surgical findings as the criterion standard, as reported by several authors.

* The specificity of 0% and low likelihood ratio were due to a lack of true negative scores in the results.
Tempelhof et al (1999) performed a similar study of 411 asymptomatic volunteers. They reported only ultrasonic findings of full-thickness (complete) tears. Their results are also shown in Table 7.15.

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>All Tears (Milgrom et al 1995) N = 90</th>
<th>Complete Tears (Tempelhof et al 1999) N = 411</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>33%</td>
<td>13%</td>
</tr>
<tr>
<td>60 – 69</td>
<td>53%</td>
<td>20%</td>
</tr>
<tr>
<td>70 – 79</td>
<td>70%</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>80%</td>
<td>51%</td>
</tr>
</tbody>
</table>

Table 7.15: Ultrasonographic findings of rotator cuff tears in asymptomatic people, as found in two studies.


All of the studies of ultrasonography in the diagnosis of rotator cuff lesions are affected by selection bias; they involve only those who also underwent other investigations and/or surgery for rotator cuff problems. Extrapolating the findings to the wider population with shoulder pain is not possible.

Clinical significance is another issue raised in the diagnosis of rotator cuff tears. The finding of a tear by ultrasonography (or by other methods) does not prove the cause of the symptoms, as the presence of a tear does not correlate closely with pain. There are data showing that rotator cuff tears also occur in asymptomatic people.

Cost Effectiveness

In the absence of dependable data, the cost effectiveness of ultrasonography in the diagnosis of acute shoulder pain is unknown.

Diagnostic Utility

The diagnostic utility of ultrasonography for the investigation of acute shoulder pain is not simply a reflection of its ability to detect rotator cuff tears or other lesions. There are issues of selection bias and clinical significance to be considered in the interpretation of the validity data.

Ultrasonography seems useful for investigation of the rotator cuff and biceps tendons. It is very sensitive and specific for identifying full-thickness tears of the rotator cuff according to some reports (Mack et al 1988; Wiener et al 1993; Farin et al 1996), although not all (Brandt et al 1989; Miller et al 1989; Kurol et al 1991). It is not so useful for detecting partial thickness tears, with sensitivity of about 70% and specificity ranging from 29% to 96% in different reports (Norris et al 1993).

If ultrasonography detects a rotator cuff tear, the decision must be made whether the finding is of clinical significance in the circumstances (Milgrom et al 1995; Tempelhof et al; 1999).

Magnetic Resonance Imaging

MRI is based on the motion in bodily tissues of hydrogen and other atoms with odd numbers of protons. The procedure involves use of a radiofrequency pulse to deflect the atoms from their usual axes and a powerful magnetic field to realign them, images being generated by associated electromagnetic changes (Harms et al 1984; Seeger, 1989a).

The high-resolution images produced by MRI show soft tissues clearly and bones reasonably too. They are used for assessing the rotator cuff muscles and tendons, the subdeltoid and subacromial spaces, the glenohumeral joint capsule and ligaments, the glenoid labrum, the biceps tendon and its groove, and the architecture of the shoulder girdle bones (Seeger 1989b; Tsai et al 1990).
Safety

A major advantage is that MRI does not involve ionising radiation. A consideration peculiar to it is the risk of metallic foreign bodies, especially intraocular ones, being drawn through tissues by the magnetic field. Another is that claustrophobic consumers may feel threatened by being placed in the tunnel of the apparatus.

Reliability

The reliability of MRI of the shoulder has been assessed in relation to the diagnosis of rotator cuff tendon tears, in a study of five experienced musculoskeletal radiologists who each read 222 MR images (Balich et al 1997).

<table>
<thead>
<tr>
<th>Partial Tears</th>
<th>Complete Tears</th>
<th>All Tears</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\kappa = 0.17 - 0.44$</td>
<td>$\kappa = 0.73 - 0.88$</td>
<td>$\kappa = 0.63 - 0.80$</td>
</tr>
</tbody>
</table>

Table 7.16: Inter-observer reliability of MRI in the diagnosis of rotator cuff tears, as reported by Balich et al (1997).

Validity

There are no data on the validity of MRI explicitly related to the investigation of acute shoulder pain, but data are available from studies of consumers with shoulder pain of mixed and unstated durations, very likely including at least some acute cases.

The literature is very varied because MRI is the only imaging modality that seems to show all the soft tissues of the shoulder well while also demonstrating the bones quite reasonably. Authors of formal scientific reports and topical reviews give credence to the ability of MR scans to identify a wide range of conditions including fractures, labral injuries, osteopenic conditions, tumours in the bones and adjacent soft tissues, joint effusions and bursal swellings, cysts, muscle atrophy, tendon tears of grades I, II and III, and biceps tendonosis (Tsai et al 1990; Blanchard et al 1997).

The quality of evidence varies too, from purely descriptive reports to formal studies of different designs and sizes yielding indices of sensitivity and specificity, and likelihood ratios. That evidence is considered according to the structures investigated and the lesions detected.

- Fractures are usually demonstrated by MRI (Reinus et al 1998), although some subtle and complex fractures are not shown as well by MR scans as they are by plain radiography or CT.
- Other bone conditions are shown distinctly. MRI is the most sensitive and specific technique for detecting osteonecrosis (Tsai et al 1990). It is also more sensitive than both plain radiography and arthroscopy for demonstrating Hill-Sachs lesions (Workman et al 1992).
- Tumours of bone and soft tissues are usually shown clearly by MRI. It often reveals rare tumours such as lipomas, haemangiomas and neuromas (Tyson 1995).
- Joint effusions and cysts including ganglia image starkly on MR and so are readily identified by it (Tsai et al 1990; Fritts et al 1994).
- Biceps tendon pathology is said to be demonstrated well by MRI and several distinct appearances are described (Fritts et al 1994).
- Impingement syndromes and tendinosis are identified by MRI with a sensitivity of 93% and specificity of 76%, yielding a likelihood ratio of 3.9 (Iannotti et al 1991).

Data are available for labral injuries and rotator cuff tendon tears, conditions that MRI is believed to be especially useful for investigating.

Labral injuries are often demonstrated well by MRI. Its validity in the diagnosis has been variously reported as only moderate in some publications but high in others, with sensitivity in the range 33% – 95% and specificity 69% – 100% (Green et al 1994). Some representative results are shown in Table 7.17.
Validity of MRI vs Surgical Findings in the Diagnosis of Labral Injuries

<table>
<thead>
<tr>
<th>Authors</th>
<th>N</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Likelihood Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torstensen et al (1999)</td>
<td>15</td>
<td>73%</td>
<td>58%</td>
<td>1.7</td>
</tr>
<tr>
<td>Gross et al (1990)</td>
<td>22</td>
<td>91%</td>
<td>69%</td>
<td>2.9</td>
</tr>
<tr>
<td>Ianotti et al (1991)</td>
<td>39</td>
<td>88%</td>
<td>93%</td>
<td>13</td>
</tr>
<tr>
<td>Green et al (1994)</td>
<td>33</td>
<td>75%</td>
<td>100%</td>
<td>*</td>
</tr>
</tbody>
</table>

Table 7.17: Validity of MRI in the diagnosis of labral injuries, using surgery as the criterion standard, as reported by several authors. * The specificity of 100% due to a lack of false negative scores produces a very high likelihood ratio.

Rotator cuff tears are said to be imaged distinctly by MRI. Many investigators have studied the validity of MRI in the investigation of the rotator cuff tendons using surgical findings (mostly those of arthroscopy) as the criterion standard. The results of eight such studies are set out in Table 7.18.

Validity of MRI vs Surgical Findings in the Diagnosis of Rotator Cuff Tears

<table>
<thead>
<tr>
<th>Authors</th>
<th>N</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Likelihood Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torstensen et al (1999)</td>
<td>24</td>
<td>96%</td>
<td>49%</td>
<td>1.9</td>
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<td>110</td>
<td>67%</td>
<td>77%</td>
<td>2.9</td>
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<td>Blanchard et al (1999)</td>
<td>54</td>
<td>81%</td>
<td>78%</td>
<td>3.7</td>
</tr>
<tr>
<td>Maurer et al (1997)</td>
<td>14</td>
<td>79%</td>
<td>88%</td>
<td>6.6</td>
</tr>
<tr>
<td>Zlatkin et al (1989)</td>
<td>32</td>
<td>91%</td>
<td>88%</td>
<td>7.6</td>
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<tr>
<td>Evancho et al (1988)</td>
<td>31</td>
<td>69%</td>
<td>94%</td>
<td>12</td>
</tr>
<tr>
<td>Balich et al (1997)</td>
<td>222</td>
<td>84%</td>
<td>94%</td>
<td>14</td>
</tr>
<tr>
<td>Ianotti et al (1991)</td>
<td>88</td>
<td>100%</td>
<td>95%</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 7.18: Validity of MRI in the diagnosis of rotator cuff tears, using surgery as the criterion standard, as reported by several authors.

There are liabilities to be considered in interpretation of these data as with the evidence on validity of ultrasonography.

The evidence of the validity of MRI varies markedly from study to study. One reason for this is that the studies differ in the criteria they use for diagnosis of rotator cuff tears. In particular, those showing higher specificities and likelihood ratios are based on diagnosis of full-thickness tears, whereas those with lower specificities and likelihood ratios include partial-thickness tears. It seems MRI is extremely sensitive and specific for detection of complete rotator cuff tears, but much less specific for partial tears.

Selection bias is a problem in these data too, with most if not all study groups biased towards people destined to undergo surgery.

Clinical significance is the most challenging issue for clinicians. If MRI can detect rotator cuff tears with reasonable accuracy, the treating clinician has to decide how to interpret the imaging findings in relation to the clinical situation. Ultrasonographic data have demonstrated that rotator cuff tears occur in many asymptomatic people (see Table 7.24). Studies based on MRI have produced similar data (Cher et al 1995; Miniaci et al 1995; Needell et al 1996). The results of two of these studies are strikingly similar. They are set out in Tables 7.19 and 7.20.

MRI Findings of Rotator Cuff Tears in 96 People Without Symptoms

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Partial Tears</th>
<th>Complete Tears</th>
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<td>40 – 60</td>
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<td>28%</td>
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<td>&gt; 60</td>
<td>26%</td>
<td>28%</td>
<td>54%</td>
</tr>
<tr>
<td>ALL</td>
<td>20%</td>
<td>15%</td>
<td>34%</td>
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</table>

Table 7.19: MRI findings of rotator cuff tears in asymptomatic people, as reported by Cher et al (1995).
MRI Findings of Rotator Cuff Tears in 100 People Without Symptoms

<table>
<thead>
<tr>
<th>Age Groups</th>
<th>Partial Tears</th>
<th>Complete Tears</th>
<th>All Tears</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 – 39</td>
<td>8%</td>
<td>0%</td>
<td>8%</td>
</tr>
<tr>
<td>40 – 60</td>
<td>27%</td>
<td>4%</td>
<td>31%</td>
</tr>
<tr>
<td>&gt; 60</td>
<td>27%</td>
<td>27%</td>
<td>54%</td>
</tr>
<tr>
<td>ALL</td>
<td>22%</td>
<td>14%</td>
<td>36%</td>
</tr>
</tbody>
</table>

Table 7.20: MRI findings of rotator cuff tears in asymptomatic people, as reported by Needell et al (1996).

Miniaci et al (1995) studied a younger group of 20 asymptomatic people who had undergone shoulder MRI. Thirty-nine of the 40 subjects were under 40 years of age. They reported MRI signs of partial-thickness tears in 23% of the subjects' supraspinatus tendons and in 13% of their infraspinatus tendons.

These data raise the issue of how to interpret common findings in imaging studies. No imaging modality can show pain per se, but they can demonstrate morphological appearances that may be associated with pain. The prevalence of radiological ‘abnormalities’ in asymptomatic individuals brings the significance of those radiological findings into question and casts serious doubt on the validity of diagnostic imaging as a guide to management.

Chandnani et al (1992) pursued this issue in another study involving two matched groups of 20 patients and 20 asymptomatic volunteers between ages 25 to 55 years. The results show the relative prevalence of various features seen on MRI in those with and those without symptoms (Table 7.21).

Prevalence of MRI ‘Abnormalities’ in People With and Without Symptoms

<table>
<thead>
<tr>
<th>MRI Findings</th>
<th>Symptomatic People with</th>
<th>Asymptomatic People with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acromioclavicular osteophytes</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Anterior instability</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Posterior instability</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Abnormal labral morphology</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Abnormal labral signal</td>
<td>11</td>
<td>10</td>
</tr>
<tr>
<td>Bony glenoid defect</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Joint fluid</td>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Absent subacromial fat</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Absent subdeltoid fat</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Supraspinatus depression</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Abnormal tendon morphology</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Abnormal tendon signal</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Impingement</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tendonitis</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Partial rotator cuff tear</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Tendon discontinuity</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Complete rotator cuff tear</td>
<td>6</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 7.21: MRI findings in people with and without symptoms, as reported by Chandnani et al (1992).

These data also cast doubt on the clinical significance of many MRI findings including acromioclavicular osteophytes, abnormal labral signal, joint fluid, absent subacromial or subdeltoid fat, abnormal tendon signal and ‘tendonitis’, as well as partial tears of the rotator cuff tendons. The clinician should be careful to interpret MRI reports accordingly, and not to simply take them at face value.

Cost Effectiveness

MRI is more expensive than other imaging modalities. There are no explicit data on its cost-effectiveness in the investigation of acute shoulder pain. The clinician must decide whether the diagnostic advantages of MRI in particular circumstances outweigh the cost disadvantage.
Diagnosis Utility

MRI is a useful modality for imaging the shoulder, with the ability to demonstrate all the soft tissues clearly and bone quite well. It can be used to assess the rotator cuff muscles and tendons, the subdeltoid and subacromial spaces, the glenohumeral joint capsule and ligaments, the glenoid labrum, the biceps tendon and its groove, and the bones of the shoulder girdle. It may not demonstrate fractures and tumours as well as plain radiographs or CT, but is unlikely to miss such lesions. As with other imaging modalities, the findings of MRI have to be interpreted carefully, particularly with regard to clinical significance.

Plain Arthrography

In plain arthrography a joint is injected with a soluble radio-opaque contrast medium such as ioxaglic acid and X-rays are directed through the region to produce an image by differential impedance of the beam as in other forms of radiography.

Arthrographic images outline joint spaces and show any breaches of their integrity (Lindblom 1938). In single-contrast arthrography the glenohumeral joint is filled with about 7mls of contrast medium. In double-contrast arthrography a smaller volume of the contrast material (4mls) and 10mls of air is injected and images recorded so that the contrast medium outlines the margins of the joint space and any folds or pockets in it (Goldman et al 1978). Leakage of the contrast medium from the joint signifies rupture of the capsule and perhaps tearing of the overlying rotator cuff tendons. The method is more likely to show full-thickness tears of the rotator cuff. Partial tears on the articular surface of a tendon are seldom detected, and tears on the bursal surface or within the substance of a tendon will not be detected (Resnick 1981).

Arthrography can also be used to image the acromioclavicular and sternoclavicular joints.

Safety

Arthrography involves the danger of ionising radiation as do other forms of plain radiography. It also involves the risks of allergy and infection that apply to other forms of joint injection. Contrast media have specific contraindications such as renal or cardiovascular insufficiency, hyperthyroidism and phaeochromocytoma. Morbidity has also been reported due to irritation of the joint lining by the injectate or simply due to joint distension (Hall et al 1981).

Reliability

There are no formal studies of the reliability of plain arthrography in the investigation of acute shoulder pain so its reliability for that purpose is unknown.

Validity

There are no explicit data on the validity of arthrography in the investigation of acute shoulder pain (in general) but there are on the validity of arthrography in the diagnosis of rotator cuff tears, using surgical findings as the criterion standard (Table 7.22).

| Validity of Plain Arthrography vs Surgical Findings in the Diagnosis of Rotator Cuff Tears |
|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|
| Technique       | N   | Sensitivity | Specificity | Likelihood Ratio |
| Single-contrast | 77  | 78%         | 89%         | 7.1             |
| Double-contrast | 86  | 83%         | 96%         | 21              |

Table 7.22: Validity of plain arthrography in the diagnosis of rotator cuff tears, using surgical findings as criterion standard, as reported for the single-contrast technique by Crass et al (1988) and for the double-contrast technique by Farin et al (1996). Crass et al (1988) also compared single-contrast arthrography with ultrasonography and in the investigation of 77 consumers who underwent surgery for rotator cuff lesions. They found the diagnostic utility of ultrasonography (likelihood ratio 11) better than that of single-contrast arthrography (likelihood ratio 7.1) for finding rotator cuff tears.
Farin et al (1996) compared plain radiological double-contrast arthrography with CT-arthrography and ultrasonic scans in detecting and evaluating the extent of rotator cuff tears in their 86 consumers. They concluded that plain X-ray double-contrast arthrography was less discerning than CT-arthrography and ultrasonography, which were of similar accuracy for assessing such lesions.

Cost Effectiveness

In the absence of explicit data, the cost-effectiveness of arthrography is unknown. Plain arthrography is cheaper than CT-arthrography but ultrasonography is the least expensive of the three modalities.

Diagnostic Utility

Plain arthrography of the glenohumeral joint has been used to image capsular tears, rotator cuff lesions, labral injuries and ‘frozen shoulder’. The role of arthrography is now limited, given the availability of other, non-invasive, investigations. Its previous utility as a pre-surgical investigation for complete tears of the rotator cuff has been supplanted by ultrasonography and MRI. The only application in which it has no immediate rival is in diagnosing adhesive capsulitis.

Plain Arthrotomography

Arthrotomography is a refinement of plain arthrography. It involves injecting a joint with contrast medium and directing X-rays through the region as in other forms of radiography, but recording multiple images focussed at slightly different depths. Each image provides a ‘slice’ view of the joint outlined by contrast medium. The technique was developed originally for imaging the glenoid labrum (El-Khoury et al 1979). As with plain arthrography, either a single- or double-contrast technique can be used.

- Safety considerations are the same as for plain arthrography
- No data exist on the reliability of plain arthrotomography in the investigation of acute shoulder pain so its reliability for that purpose is unknown
- There are no sound data on the validity of plain arthrotomography but its positive predictive value has been shown to be high for identification of labral tears in studies by McGlynn et al (1982), Deutsch et al (1984) and Kleinman et al (1984)
- Arthrotomography costs more than plain arthrography but less than CT and MRI
- Plain arthrotomography has been found useful for detecting labral and capsular tears but offers no advantage if MRI is available

Computerised Tomography

CT involves the recording of two series of tomographs along sagittal and transverse axes. The images are processed by a computer that arranges the slices for systematic scanning and three-dimensional reconstruction. This provides images with greater definition than other radiographic modalities.

Like conventional radiography, CT images bones better than it does soft tissues but the higher resolution of CT allows some assessment of soft tissue structures.

- The danger of ionising radiation is much higher with CT than with other radiological imaging modalities as the consumer is exposed to a very much larger dose of X-rays
- There are no data on the reliability of CT for investigation of acute shoulder pain
- No formal studies have been published of the validity of CT in the investigation of acute shoulder pain. No sensitivity or specificity indices are available but reports in the literature describe the utility of CT for assessing subtle and complex fractures of the proximal humerus and the scapula (Castagno et al 1987; Kuhlman et al 1988)
- There are no data on the cost-effectiveness of CT for imaging the shoulder
- Other modalities have supplanted CT in many of its former applications. Its main use in investigation of the shoulder is for delineation of subtle and complex fractures
CT Arthrography

CT-arthrography involves injecting the target joint with contrast medium before CT to enhance the images. The technique was developed for imaging the glenoid labrum (Shuman et al 1983) and the glenohumeral joint capsule (Rafii et al 1986).

- The procedure is doubly invasive, combining joint injection with ionising radiation
- There are no data on the reliability of CT-arthrography of the shoulder
- CT-arthrography has been shown to have a high positive predictive value for diagnosis of labral lesions (Deutsch et al 1984; Hunter et al 1992)
- There are no data on the cost-effectiveness of CT-arthrography of the shoulder
- In the past its main use was for imaging the glenoid labrum but CT-arthrography is seldom performed these days. It offers no advantage if MRI is available

MR Arthrography

The paramagnetic agent gadolinium, injected either intravenously or intra-articularly before MRI, enhances the images and improves their capacity for showing partial rotator cuff tears (Flannigan et al 1990) and subtle changes such as inflammation of the biceps tendon sheath (Gückel et al 1998).

- The safety considerations are the same as for unenhanced MRI with the additional risks involved in joint injection and use of contrast medium
- There are no data on the reliability of MR-arthrography in the investigation of acute shoulder pain
- There are no data on the validity of MR-arthrography for acute shoulder pain
- The arthrographic technique is more expensive than unenhanced MRI but probably more discriminatory of subtle lesions
- MR-arthrography offers a means of investigating conditions that are not shown well on unenhanced MRI
  The same cautions apply in interpretation of findings

Radionuclide Bone Scanning (Scintigraphy)

An isotopic bone scan entails injection of a radioactive isotope such as technetium-99 into the blood and subsequent imaging of isotope distribution through the body. Concentrations of the isotope show up as darker spots on the images and indicate ‘pooling’, or regions in which blood is collected.

Scintigraphy is used for detecting occult fractures (Matin 1979), tumours (McNeil 1984), infections (Merkel et al 1984) and inflammatory arthropathies (Weisseberg et al 1978). Mechanical conditions can also be imaged using this modality (Clunie et al 1997).

- Isotopic scanning involves a relatively high dose of ionising radiation and carries proportionate risks of carcinogenesis and teratogenesis
- There are no data on the reliability of isotopic scans for acute shoulder pain
- There are no data on the validity of isotopic scans for acute shoulder pain
- There are no data on the cost-effectiveness of isotopic scans for acute shoulder pain
- Isotopic scans are best reserved for investigating suspected serious conditions

Other Ancillary Investigations

Other special investigations such as blood counts, serological tests, nerve conduction studies, electromyography and bone density estimations have specific roles in the investigation of suspected serious conditions but there are no other indications for their use in the assessment of a consumer with acute shoulder pain. Their applications are beyond the scope of these guidelines.
What is the prognosis for acute shoulder pain?

- Approximately 50% of people with acute shoulder pain (treated conservatively) recover within six months; approximately 60% recover within 12 months.
- Shoulder pain may recur even in those who appear to fully recover in the short term.
- The effects of interventions and prognostic risk factors (biological and psychosocial) influence the course of acute shoulder pain and should be taken into account in the management plan.

Prognosis is determined by:

- Natural history
- The influence of risk factors
- The effects of interventions

Natural History

The natural history of a condition is the course it is likely to follow under natural circumstances (ie if no interventions are applied).

By the original definition, ‘acute’ shoulder pain is ‘that due to a condition which is likely to resolve spontaneously by natural healing’ (Bonica 1953). To that definition could be added ‘so long as it is not compounded by iatrogenic complications’. Accordingly, acute shoulder pain can be expected to resolve within a short time (a period of less than three months) if the causative condition is simply left alone.

By the current definition of ‘acute’ shoulder pain, ‘that of less than three months’ duration’ (Merskey 1979), some cases will be due to conditions characterised by more severe damage or pathology that are unlikely to resolve spontaneously.

Evidence

There are few data on the natural history of acute shoulder pain and those that do exist are compromised by methodological constraints.

There are obvious ethical restraints to studying people with painful conditions and deliberately leaving them untreated. Most published reports document the course of shoulder pain in patients in tertiary settings. Information about natural history can be deduced from data related to those treated symptomatically only, or in other ways unlikely to have altered the natural course of the condition.

Uncertainty of diagnosis creates problems in epidemiological research and in practice. Classifying patients into diagnostic groups on the basis of clinical assessment is unreliable and all studies based on such classification are inherently internally invalid (and thus also externally invalid). Their results and conclusions must be interpreted carefully in the light of diagnostic uncertainty. Apparent differences between cohorts should be discounted if selection criteria were imprecise.

Three reports in the literature provide data on outcomes of acute shoulder pain when treated conservatively by general practitioners. These data are presented in Tables 7.23 and 7.24.

Winters et al (1997) studied the course of acute shoulder pain at weekly intervals until the pain resolved or 25 weeks had elapsed. After the first fortnight 9% had recovered and this figure grew to 48% after 6 weeks, 76% after 12 weeks and 91% after the 25 weeks, as shown in Table 7.23. Their results for recovery of range of movement followed a similar trend.
Acute Shoulder Pain

**Short Term Recovery of Acute Shoulder Pain**

<table>
<thead>
<tr>
<th></th>
<th>2 weeks</th>
<th>6 weeks</th>
<th>12 weeks</th>
<th>25 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery</td>
<td>9%</td>
<td>48%</td>
<td>76%</td>
<td>91%</td>
</tr>
</tbody>
</table>

Table 7.23: Recovery rates of acute shoulder pain, as reported by Winters et al (1997).

Further progress was reported in a later publication (Winters et al 1999) demonstrating a substantial rate of recurrence of shoulder pain in the study cohort after the initial period. The later data suggest more moderate recovery rates when the recurrences are taken into account. The figures are very similar to the results of a study by van der Windt et al (1996).

Analysis of associated factors suggested recovery was more likely to be rapid when onset was related to minor trauma or an episode of overuse, and in those who presented soon after onset (possibly those with no major problems).

**Longer Term Recovery of Acute Shoulder Pain**

<table>
<thead>
<tr>
<th></th>
<th>1 month</th>
<th>3 months</th>
<th>6 months</th>
<th>12 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery</td>
<td>23%</td>
<td>44%</td>
<td>51%</td>
<td>59%</td>
</tr>
</tbody>
</table>

Table 7.24: Recovery rates of acute shoulder pain, as reported by van der Windt et al (1996) [upper figures] and Winters et al (1997) [lower figures].

Croft et al (1996) reported a prospective study of disabilities associated with acute shoulder pain treated conservatively by general practitioners in England. Their results are presented in Table 7.25.

**Recovery of Disability Associated with Acute Shoulder Pain**

<table>
<thead>
<tr>
<th></th>
<th>6 months</th>
<th>18 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disability</td>
<td>21%</td>
<td>49%</td>
</tr>
</tbody>
</table>

Table 7.25: Recovery rates of disability associated with acute shoulder pain, as reported by Croft et al (1996).

The natural history of acute shoulder pain in general, based on the these studies, is for recovery in the majority of cases within 12 weeks, but with substantial risk of recurrence of pain leading to chronic problems.

This information provides the treating clinician with a sound basis for treating acute shoulder pain conservatively in the early stages, so long as there are no alerting features of serious conditions. The data also suggest the clinician should be wary of the risk of recurrence, even in those who seem to have recovered, and consider the possible role of prognostic risk factors.

**Prognostic Risk Factors**

**Clinical Relevance**

Recognising risk factors enables clinicians to counteract their influence (potential or actual) on the onset of acute shoulder pain or the progression to chronic problems. Risk factors may be immutable or potentially remediable.

Biological and psychosocial factors may be involved:

- biological risk factors as both aetiological and prognostic determinants, and
- psychosocial risk factors as aggravating and perpetuating influences.
Biological Risk Factors

Biological or physical risk factors include physique, demographic status, clinical features and physical influences on them. They may be intrinsic or extrinsic.

- Intrinsic biological factors include gender, age, bodily habitus and health status, the physical attributes that determine susceptibility to pathogenetic mechanisms.
- Extrinsic biological factors include external physical influences such as forces sustained during activities. Of special relevance are the ways in which a person goes about activities of daily living, work and leisure pursuits.

Both intrinsic and extrinsic biological risk factors may be involved in causation (aetiological risk factors) and in the progression of an acute condition to chronicity (prognostic risk factors). Because of their potential to act in both ways, biological risk factors should be considered at the initial assessment and reconsidered at each review of progress.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Subjects</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work above shoulder height</td>
<td>industrial workers</td>
<td>Bjelle et al (1979)</td>
</tr>
<tr>
<td></td>
<td>forestry workers</td>
<td>Miranda et al (2001)</td>
</tr>
<tr>
<td>low frequency vibration</td>
<td>industrial workers</td>
<td>Futatsaka et al (1985)</td>
</tr>
<tr>
<td>Heavy work load</td>
<td>forestry workers</td>
<td>Miranda et al (2001)</td>
</tr>
<tr>
<td>driving for long periods</td>
<td>commercial travellers</td>
<td>Skov et al (1996)</td>
</tr>
<tr>
<td>Shift work</td>
<td>male workers</td>
<td>Fredriksson et al (1999)</td>
</tr>
<tr>
<td>Sleep disturbance</td>
<td>male and female workers</td>
<td>Bergenudd et al (1994)</td>
</tr>
<tr>
<td>smoking</td>
<td>male workers</td>
<td>Bergenudd et al (1994)</td>
</tr>
<tr>
<td></td>
<td>video display unit users</td>
<td>Marcus et al (1996)</td>
</tr>
<tr>
<td>caffeine consumption</td>
<td>video display unit users</td>
<td>Marcus et al (1996)</td>
</tr>
</tbody>
</table>

Table 7.26: Biological risk factors for shoulder pain, as shown in various reports.

Psychosocial Risk Factors

Psychosocial risk factors are those related to a consumer’s psyche and sociocultural relationships. They include:

- intrapsychic factors
- interpersonal factors
- sociocultural factors

Psychosocial risk factors are prognostic; they predict chronicity. The term ‘yellow flags’ is used to describe psychosocial risk factors.
### Psychosocial Risk Factors for Shoulder Pain

<table>
<thead>
<tr>
<th>Factors ('yellow flags')</th>
<th>Subjects</th>
<th>Authors</th>
</tr>
</thead>
</table>

Table 7.27: Psychosocial risk factors for shoulder pain, as shown in various reports.

### Effects of Interventions

Comparing the progress of a condition with the natural history, after taking measures to counteract the effects of known risk factors, provides guidance with respect to diagnostic or therapeutic interventions. Such decisions should rest on the expectation of spontaneous recovery and the clinician’s assessment of whether the effect of the intervention is likely to improve the clinical outcome (Cochrane 1977). It is important to consider diagnostic utility as well as efficacy of interventions.
What evidence exists for specific interventions for acute shoulder pain?

Evidence of Benefit
- Topical and oral non-steroidal anti-inflammatory drugs (NSAIDs) improve acute shoulder pain by a small to moderate degree for up to 4 weeks compared to placebo.
- Subacromial corticosteroid injection for acute shoulder pain may improve pain at 4 weeks compared to placebo but this benefit is not maintained at 12 weeks.
- Acupuncture may improve acute shoulder pain and function to a small degree in the short-term.
- Ultrasound may provide short-term pain relief in calcific tendonitis.
- Shoulder joint mobilisation may improve pain in the short term.

Insufficient Evidence
- From the available evidence, no conclusions about the efficacy or safety of ESWT, suprascapular nerve blocks, oral corticosteroids or surgery for acute shoulder pain can be drawn.

Although there are many accepted standard forms of conservative therapy for acute shoulder pain including non-steroidal anti-inflammatory drugs, glucocorticosteroid injections and physical therapy, evidence of their efficacy is not well established. Furthermore, as outlined in the preceding chapters, the interpretation of the results of trials in shoulder disorders is often hampered by the fact that these disorders are labelled and defined in diverse and often conflicting ways (Green et al 1998).

To determine the efficacy of common interventions for acute shoulder pain, we performed a systematic review of the literature investigating these modalities as described in the Executive Summary. As there were few trials that specifically addressed therapy for acute shoulder pain according to our prespecified inclusion criterion of pain less than three months, we also included the findings of systematic reviews of interventions for shoulder pain in populations with longer duration of symptoms, where available.

Analgesics (paracetamol or compound analgesics)

There is no evidence to either support or refute the efficacy of analgesia for acute shoulder pain. There are no randomised controlled trials of analgesia (eg paracetamol or compound analgesics) in acute shoulder pain or in shoulder pain of longer duration.

Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

There were three placebo-controlled trials of NSAID for acute shoulder pain (Ginsberg et al 1991; Mena et al 1986; Adebajo et al 1990). All demonstrated a short-term benefit of NSAID compared to placebo. One cross-over trial of 30 participants compared 4% topical indomethacin spray to placebo for acute shoulder pain of less than 3 weeks duration (28 participants had ‘periarthritis of the shoulder’ which was not defined further and 2 participants had epicondylitis (site not specified)(Ginsberg et al 1991). There was a statistically significant improvement favouring the active group with respect to all outcomes measured. Overall improvement at 14 days favoured the active group (26/30 versus 18/30 for the active and placebo groups respectively, χ² =5.455, p <0.025). Two participants reported minor signs of local irritation that did not require interruption of treatment.

Another trial of 68 participants compared flurbiprofen (300 mg daily in four divided doses, dose decreased if symptoms had improved sufficiently after Day 1 and Day 3) to placebo for acute ‘bursitis or tendinitis’ of the shoulder (defined as symptoms of no more than four days’ duration and localised tenderness over the shoulder area, limitation of motion, pain on motion, pain severity interfering with sleep, and either normal X Rays or periarticular calcification)(Mena et al 1986). There was a reportedly statistically significantly greater proportion of participants in the active group with improvement according to investigators’ global assessments at all follow-up points (Day 1, 3 or 4, 7 and 14) and at Day 7 according to patients’ assessments (data not shown for patient assessment of overall improvement). There was a trend in a similar direction for other outcomes reported.
One trial of 60 participants compared diclofenac (50 mg three times daily) (and placebo injection) to placebo (and to steroid injection, see below) for rotator cuff disease of less than 3 months duration (Adebajo et al 1990). Results favoured the NSAID group at 4 weeks: mean difference between groups in pain at 4 weeks was –2.25 (95% CI –3.6, -0.9) and mean difference between groups in range of abduction at 4 weeks was 41.4 degrees (95% CI 18.09, 64.71). Systematic review of trials of mixed duration of symptoms of shoulder pain verifies the results of trials performed in acute shoulder pain of a short-term benefit of NSAID (Green et al 1998).

There were 4 trials comparing one NSAID to another for acute shoulder pain (Vidal et al 2001; Gotter 1987; Soave et al 1982, Wielandts et al 1979). These included between 26 and 599 participants and were all performed using different NSAIDs (Meloxicam versus piroxicam (Vidal et al 2001), tenoxicam versus piroxicam (Gotter 1987) indoprofen versus indomethacin (Soave et al 1982) and phenylbutazone versus fentiazac (Wielandts et al 1979). There were no appreciable differences in outcome between NSAIDS in any of the trials.

Corticosteroid Injections

There were two trials of subacromial injection of corticosteroid and local anaesthetic compared to local anaesthetic injection alone for acute shoulder pain (Adebajo et al 1990; Vecchio et al 1993). Adebajo et al compared 3ml 0.5% lignocaine and 1ml of 80mg/ml triamcinolone hexacetomide to lignocaine alone (and NSAID, see above) for rotator cuff disease of less than three months duration (Adebajo et al 1990). Results favoured the steroid injection group at four weeks: mean difference between groups in pain at four weeks was 3.6 (95% CI 1.5, 5.6) and mean difference between groups in range of abduction at four weeks was 45 degrees (95% CI 19.12, 70.88). Vecchio et al compared 40 mg methylprednisolone and 1% lignocaine (1ml) to lignocaine alone in 57 trial participants with rotator cuff tendonitis (defined as shoulder pain exacerbated by resistance in at least one of abduction, external or internal rotation, and normal passive motion) of less than three months duration. At three months there were no reported differences between treatment groups for pain or passive range of motion however only median changes were reported and only completers were analysed.

Systematic review of trials of mixed duration of symptoms of shoulder pain (including the two trials described above) concluded that there is some evidence to support the use of subacromial corticosteroid injection for rotator cuff disease although its effect may be small and not well maintained, and it may be no better than NSAID (Buchbinder et al 2002). There is also a suggestion that intra-articular steroid injection may be beneficial in the short-term for adhesive capsulitis but again the effect may be small and not well maintained (Buchbinder et al 2002). While this updated systematic review found 26 randomised controlled trials of corticosteroid injections for shoulder pain, small sample sizes, variable methodological quality and heterogeneity in terms of population studied, injection modality employed and choice of comparator, means that there is still little overall evidence to guide treatment. It remains to be clarified whether the accuracy of needle placement, anatomical site, frequency, dose and type of corticosteroid influences efficacy.

Systematic review of trials of mixed duration of symptoms of shoulder pain yielded one trial which compared frequency of adverse effects between intra-articular steroids and physiotherapy groups for adhesive capsulitis and found no significant differences apart from facial flushing which was more common in the steroid injection group (RR=9.0, 95% CI 1.18, 68.74) (Buchbinder 2002, van der Windt 1998).

Corticosteroid Injections Versus Other Treatment Modalities

There were two trials that compared corticosteroid injection to NSAID for acute shoulder pain (labeled ‘rotator cuff tendonitis’ in both trials)(Adebajo et al 1990; White et al 1986). Adebajo compared 2ml 0.5% lignocaine and 1ml of 80mg/ml triamcinolone hexacetomide to diclofenac (50 mg three times daily)(Adebajo et al 1990) and White compared subacromial injection of 40mg triamcinalone acetonide to indomethacin (25 mg four times daily)(White et al 1986). No significant differences between treatment groups at four and six weeks following treatment were demonstrated in either trial for any of the measured outcomes including pain, range of active abduction, function or global assessment. A systematic review of trials comparing corticosteroid injection to NSAID for shoulder pain of mixed duration in which the results of these two trials were pooled together with a third trial (Petri et al 1987) for rotator cuff tendinitis also failed to find any benefit of subacromial steroid injection over NSAID with respect to improvement in pain, function or range of shoulder abduction at four or six weeks (Buchbinder et al 2002).

There have been no other trials that have specifically compared corticosteroid injection to other modalities such as physiotherapy for acute shoulder pain. However systematic review of trials comparing corticosteroid injection to physiotherapy for shoulder pain of mixed duration has yielded variable results (Buchbinder et al 2002). Two of three trials comparing the efficacy of intra-articular steroid injection and physiotherapy for adhesive capsulitis reported early differential benefit of steroid injection although this benefit was no longer apparent by 6 months. The other trial found no difference between groups at any time point and an additional trial comparing intra-articular corticosteroid injection to a combination of NSAID and physiotherapy for adhesive capsulitis (mean
duration of symptoms was greater than 3 months in both treatment groups) found no difference between groups at two or twelve weeks (Buchbinder et al 2002). The review also found one trial comparing intra-articular, sub-acromial and acromioclavicular steroid injections to physiotherapy and to manipulation for general shoulder pain (mixed diagnoses)(Winters 1997). While most studies (22/26, 84.6%) did not confirm the accurate placement of the injection, two reviewed studies used ultrasound to confirm needle placement (intra-articular Gam 1998; sub-acromial Plafki 2000). Two other studies checked the accuracy of injection following the procedure (Richardson et al 1975, White 1996). Richardson et al performed an arthrogram following steroid injection and reported that the injection was intra-articular ‘only inconstantly’ when intra-articular injection was performed using the posterior approach, but ‘readily obtained’ when subacromial injection was performed (Richardson 1975). White et al mixed urograffin with the corticosteroid preparation and took post-injection plain films. They reported that 10/20 (50%) intra-articular injections using the posterior approach were correctly placed, compared to 19/20 (95%) using the anterior approach (White 1996). Eustace et al also assessed the accuracy of steroid injection and found that 10/24 (42%) of intra-articular injections using the anterior approach were correctly placed and 4/14 (29%) of subacromial injections were correctly placed (Eustace 1997). Benefit favouring steroid injections over both physiotherapy (not manipulation) and manipulation with respect to pain at the end of treatment was demonstrated (WMD -2.30, 95% CI -4.10, -0.50; and WMD -3.40, 95% CI -5.46, -1.34, respectively)(Winters 1997).

Systematic review of trials of mixed duration of symptoms of shoulder pain yielded one trial which compared frequency of adverse effects between intra-articular steroids and physiotherapy groups for adhesive capsulitis and found no significant differences apart from facial flushing which was more common in the steroid injection group (RR=9.0, 95% CI 1.18, 68.74) (Buchbinder 2002, van der Windt 1998).

**Physiotherapy (Manual Therapy, Ultrasound and TENS)**

There were three randomised controlled trials of physiotherapy interventions for acute shoulder pain (Conroy et al 1998; Ebenbichler et al 1999; Shehab et al 2000). Ebenbichler et al included 54 participants with radiologically verified calcific tendonitis and pain or restricted range of motion for less than four weeks and compared 24 treatments with therapeutic ultrasound to placebo (Ebenbichler et al 1999). Immediately following the course of treatment there was a significant difference between groups in perceived recovery favouring ultrasound (RR 1.81 (95%CI 1.26, 2.60)). At nine months following treatment this benefit was not maintained, however there continued to be a significantly greater benefit in terms of radiological appearance of the calcific tendonitis in the treated group (RR 3.74, 95%CI 1.26, 8.66).

One small trial of 14 participants compared shoulder joint mobilisation combined with ‘comprehensive treatment’ (hot packs, active exercise, stretching, soft tissue mobilisation and education) to comprehensive treatment alone in primary shoulder impingement syndrome (not defined) (Conroy et al 1998). Three weeks following treatment there was a statistically significant difference between groups in pain favouring the addition of mobilisation (WMD -32.07 mm on VAS, 95%CI -58.04, -6.10). There was however no significant difference between groups in range of elevation (WMD –7.28 degrees, 95%CI –25.74, 11.8).

Another trial compared transcutaneous nerve stimulation (TENS) to therapeutic ultrasound in 50 female participants with acute shoulder pain (Shehab et al 2000). Following the intervention period (three to five times a week for 13 sessions) participants in the ultrasound group were significantly better than the TENS group with respect to pain and range of motion.

Systematic review of trials of mixed duration of symptoms of shoulder pain found weak evidence from two trials suggesting that exercise may be effective for rotator cuff disease in both the short and longer-term (Green et al 1999). One placebo-controlled trial of a supervised exercise regime in 56 participants with mixed shoulder disorders demonstrated significantly greater recovery (RR 7.74 (1.97, 30.32), function (RR 1.53 (0.98, 2.39) and range of abduction (RR for worsening range 0.33 (0.11, 0.96) at one month (Ginn 1997). A second trial, with a two and a half year follow up demonstrated sustained benefit with respect to function for exercise over placebo in rotator cuff disease (RR for good or excellent function 2.45 (1.24, 4.86) (Brox 1997).

No trials have reported adverse effects of physiotherapy interventions for shoulder pain.
Acupuncture

There was one randomised controlled trial of acupuncture for acute rotator cuff disease in a population of 52 athletes (Kleinhenz et al 1999). This trial of eight acupuncture sessions in four weeks, compared to the identical number of sessions of placebo ultrasound demonstrated a significant difference favouring acupuncture at four weeks in Constant-Murley score (which incorporates pain, function and range of motion) (WMD = 10.83 (95% CI 2.46, 19.20)) but no difference at 4 months (WMD = 3.53 (95% CI 0.74, 6.42)). There was no difference between groups in proportion with short-term success of therapy (RR = 0.56 (95% CI 0.26, 1.17)).

When data from this trial was combined with data from another trial in patients with mixed duration of symptoms (Berry 1980), no benefit of acupuncture over placebo was demonstrated (Green 2003).

Extracorporeal Shock Wave Therapy (ESWT)

There are no published randomised controlled trials investigating the value of ESWT in the treatment of acute shoulder pain. Systematic review of ESWT for shoulder pain of mixed duration identified four trials, two for calcific tendonitis (one trial unspecified duration and one trial more than six months of symptoms) and two for rotator cuff tendonitis (duration of symptoms at least three and six months) (Buchbinder et al 2003). Results of the two trials in rotator cuff tendonitis did not demonstrate any significant benefit of ESWT over placebo with respect to pain or function up to 12 weeks following therapy (Buchbinder et al 2003). The two trials in calcific tendonitis both reported benefit of different doses of ESWT. Transient hematomas and petechiae were reported to occur in both calcific tendonitis trials.

Suprascapular Nerve Blocks

There are no published randomised controlled trials investigating the value of suprascapular nerve blocks in the treatment of acute shoulder pain (excluding trauma). Systematic review of suprascapular nerve blocks for shoulder pain of mixed duration identified 4 trials performed in both adhesive capsulitis and rotator cuff disease suggesting short-term benefit with respect to pain (Buchbinder 2003).

Oral Corticosteroids

There are no published randomised controlled trials investigating the value of oral corticosteroids for acute shoulder pain. Systematic review of corticosteroids for shoulder pain of mixed duration identified one placebo-controlled trial and one trial comparing oral steroids to no treatment in adhesive capsulitis (Green et al 1998). While neither trial reported any significant benefit of oral steroids, methodological weaknesses may have influenced trial outcomes in both studies.

Surgery

There are no published randomised controlled trials investigating the value of surgery in the treatment of acute shoulder pain (excluding trauma).
<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Participants</th>
<th>Results</th>
<th>Reference Standard</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bennett WF 1998</td>
<td>Speeds test evaluated in a prospective study to determine sens, spec, PPV and NPV</td>
<td>n=45; 31 male, 14 female *variety of diagnoses including acute and chronic</td>
<td>PPV=23%; NPV=83%; sensitivity=90%; specificity=13.8% *concluded that Speeds test is a nonspecific but sensitive test for macroscopic labral/biceps pathology</td>
<td>Speeds test vs arthroscopy</td>
<td>duration of pain is unstated however this is not relevant in the case of diagnostic tests</td>
</tr>
<tr>
<td>Blanchard TK 1999</td>
<td>RCT comparing MRI and arthrography for diagnostic impact in shoulder patients *f/u 10/12</td>
<td>patients referred from a rheumatology clinic *29 shoulders randomised to MRI; 24 to arthrography</td>
<td>MRI and arthrography had similar therapeutic impact although MRI was associated with a significant shift towards surgical intervention</td>
<td></td>
<td>duration of pain is unstated however this is not relevant in the case of diagnostic tests</td>
</tr>
<tr>
<td>Bunker TD 2000</td>
<td>aim to determine whether there was an abnormal expression or secretion of cytokines, growth factors and matrix metalloproteinases in tissue samples from patients with frozen shoulder</td>
<td>n=14 consecutive patients undergoing surgical release from a group of 93 fitting criteria for frozen shoulder *F=9; M=5; mean age=54.6 years; duration of disorder was 21.8 months</td>
<td>frequency and % of tissues showing positive PCR for genetic expression of individual cytokine or growth factor *imbalance between aggressive healing, scarring, contracture and failure of remodelling may lead to protracted stiffening of the capsule</td>
<td></td>
<td>included as a pathological reference only</td>
</tr>
<tr>
<td>Clunie GPR 1997</td>
<td>to evaluate whether specific patterns of scintigraphic abnormality could be detected in people with painful shoulder</td>
<td>consecutive patients n=28 presenting to rheumatology clinic with a painful shoulder *LTFU 4/28</td>
<td>Technetium-99m MDP scans detected abnormalities in 79% of patients whereas radiographs detected abnormalities in 33% *Distinct patterns of abnormality in uptake of Tc-MDP may be associated with clinically distinct patterns of abnormalities in people with shoulder pain</td>
<td></td>
<td>goes to excluding red flags</td>
</tr>
<tr>
<td>de Winter AF 1999</td>
<td>to assess interobserver agreement on the diagnostic classification of shoulder disorders based on hx and physical examinatio and identify determinants of diagnostic disagreement *2 physiotherapists independently performed physical exam +hx taken and classified into 1 of 6 diagnostic categories</td>
<td>n=201 with varying severity and duration of complaints recruited over a 20 month period by doctors *26% had pain duration ≤ 3 months; the rest had pain from 3 months to &gt;12 months</td>
<td>only moderate agreement found on classifying shoulder disorders</td>
<td></td>
<td>include because of evidence of reliability</td>
</tr>
<tr>
<td>Fraenkel L2000</td>
<td>improving the selective use of plain radiographs *descriptive study, not analytic *prospective f/u of patients for 3/12</td>
<td>patients presenting to ER with shoulder pain, excluding ‘red flag’ conditions *206 had shoulder xray of which 88% were TU</td>
<td>findings suggest that specific clinical criteria can identify patients who do not need xray as part of initial mgt of shoulder pain *of the 60% of patients presenting with shoulder pain, findings suggest that only 20% of these xrays revealed significant abnormalities (primarily #s or dislocations) *revealed only 1/135 in the low risk groups had a TI radiograph - this person had a lytic lesion and hx of lymphoma *results suggest that patients without a precipitating fall, no swelling or deformity on exam might not need xray, and those with no pain or swelling but have sustained a fall may also be managed without xray if no pain at rest and normal ROM</td>
<td>plain x-ray</td>
<td>Useful for better utilisation of x-rays; pain duration unknown and half patients had no x-ray, however 88% TI and 66% TU had pain &lt;1 day; some patients had specific conditions and unknown pain duration so not a pure sample; low risk of bias</td>
</tr>
</tbody>
</table>
## SHOULDER PAIN – INCLUDED STUDIES (DIAGNOSIS)

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Participants</th>
<th>Results</th>
<th>Reference Standard</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gotoh M 2001</td>
<td>Synovial tissue samples were taken during sx from the subacromial bursa of 39 subjects with hx of shoulder pain and compared with SAB specimens obtained from 10 control subjects with anterior shoulder instability</td>
<td>n=39 with rotator cuff diseases *average duration of pain one year (4/12-8 years) *average age 56 (39-76 years) *VAS mean 6.5 (3-10)</td>
<td>The mRNA expression levels of cytokines were significantly correlated with the degree of pain (r=0.806; p&lt;0.001) *the differential regulation of the 2 forms of Interleukin -1ra mRNAs may play a role in shoulder pain in rotator cuff diseases, regulating IL-1 induced subacromial synovitis</td>
<td>Standard</td>
<td>Include as a reference to causes of shoulder pain</td>
</tr>
<tr>
<td>Green S 1998</td>
<td>Standardised protocol for measurement of ROM shoulder using plurimeter-V inclinometer and assessment of inter/intrarater reliability</td>
<td>Mean duration of symptoms=16.5 months (9-24 months) *3 of the 6 patients had hx of shoulder trauma; 4 had previous shoulder sx</td>
<td>This study demonstrated that one or more active movements of the shoulder would probably fulfill the requirement of an outcome measure, with total shoulder flexion and abduction, external rotation in neutral, and hand behind back may be the most reliable active movements of the shoulder</td>
<td></td>
<td>Subjects not acute; useful reference re the reliability of physical examination</td>
</tr>
<tr>
<td>Hoving JL 2002</td>
<td>Retrospective chart review looking at how well bedside history and physical exam predict arthrography results in older patients suspected of having rotator cuff tears</td>
<td>n=448 consecutive patients with suspected RTCs</td>
<td>Weakness with external rotation; age &gt;65 years; and night pain were predictors of rotator cuff tears</td>
<td></td>
<td>Mixed data; useful as a reference to the validity of medical history taking</td>
</tr>
<tr>
<td>MacDonald PB 2000</td>
<td>Looked at the diagnostic accuracy of Hawkins and Neer subacromial impingement signs</td>
<td>n=31 with first flare of shoulder pain *all underwent exam and U/S was carried out one week later by a third examiner with no knowledge of the clinical findings</td>
<td>Clinical assessment showed low accuracy in diagnosis of periarticular shoulder lesions through physical examination; U/S should be used when possible to aid diagnosis and treatment</td>
<td></td>
<td>Included as a reference to the validity of physical examination</td>
</tr>
<tr>
<td>Naredo E 2002</td>
<td>Compared clinical diagnosis established by physical examination with high frequency ultrasonographic findings in patients with shoulder pain *all underwent exam and U/S was carried out one week later by a third examiner with no knowledge of the clinical findings</td>
<td>n=31 with first flare of shoulder pain *all underwent exam and U/S was carried out one week later by a third examiner with no knowledge of the clinical findings</td>
<td>Clinical assessment showed low accuracy in diagnosis of periarticular shoulder lesions through physical examination; U/S should be used when possible to aid diagnosis and treatment</td>
<td></td>
<td>Reference to validity of physical examination</td>
</tr>
<tr>
<td>Norregaard J 2002</td>
<td>Diagnostic patients with long-standing shoulder joint pain - to examine the interobserver agreement of commonly used clinical tests and diagnoses in patients with shoulder pain *U/S exam was performed followed by clinical exam performed randomly by orthoped or rheumatologist who had no knowledge of pt hx</td>
<td>86 consecutive patients with long-standing shoulder pain of at least 2, 3 and 6 months duration (mean symptom duration=25 months *they either steroid injection without lasting effect or this was not indicated</td>
<td>Accuracy of clinical tests and diagnoses in comparison with arthoscopic findings was low and only slightly better when the results of U/S became available in addition to clinical examination</td>
<td>Arthroscopic examination</td>
<td>Although duration of pain is mixed, study included as a reference</td>
</tr>
<tr>
<td>Pal B 2000</td>
<td>Clinical audit of practice in emergency department (QA exercise to determine how people with shoulder pain were managed)</td>
<td>n=6; age range 27-51, mean age 40.5 5*6 reported direct trauma to their shoulders suggestive of #; 1/6 had shoulder pain after # an ankle in a fall</td>
<td>Authors conclude that in these cases MRI detected subtle # of the greater tuberosity in people suspected of having rotator cuff tears and in whom no # was visible on plain x-ray</td>
<td></td>
<td>Include as a reference to the difficulty in clinical diagnosis</td>
</tr>
<tr>
<td>Reinus WR 1998</td>
<td>Case series of patients with subtle greater tuberosity fractures who were sent for MRI because of possible rotator cuff tear</td>
<td>n=6; age range 27-51, mean age 40.5 5*6 reported direct trauma to their shoulders suggestive of #; 1/6 had shoulder pain after # an ankle in a fall</td>
<td>Authors conclude that in these cases MRI detected subtle # of the greater tuberosity in people suspected of having rotator cuff tears and in whom no # was visible on plain x-ray</td>
<td></td>
<td>For use as reference to diagnosis of red flags</td>
</tr>
<tr>
<td>Study</td>
<td>Method</td>
<td>Participants</td>
<td>Results</td>
<td>Reference Standard</td>
<td>Notes</td>
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<tr>
<td>Rissen D 2000</td>
<td>looks at relationship between psychophysiological stress, muscle activity and musculoskeletal problems</td>
<td>female cashiers</td>
<td>workload and physiological stress responses did not correlate significantly with surface EMG activity; perceived negative stress may have a specific influence on muscle activity which may be of importance for musculoskeletal disorders in jobs with low-moderate physical load and negative psychosocial factors</td>
<td>Include as a reference only</td>
<td></td>
</tr>
<tr>
<td>Sano A 1998</td>
<td>comparison of MR images of 140 painful shoulders to determine the relationship between cystic changes of the humeral head and integrity of the rotator cuff</td>
<td>n=134 (105 male with 110 shoulders; 29 female with 30 shoulders) *average age 41 (13-78 years)</td>
<td>cystic changes were noted in 35% of shoulders; the commonest site was in the bare bone area of the anatomical neck; the second commonest site was at the attachment of the supraspinatus tendon *the incidence of cystic changes increased with age</td>
<td>Include as a mention in the ancillary investigations section *diagnosis made by MRI and not confirmed by surgery</td>
<td></td>
</tr>
<tr>
<td>Sher JS 1998</td>
<td>looked at impact of MRI use on clinical decision making</td>
<td></td>
<td></td>
<td>Does not meet criteria; useful as a reference only</td>
<td></td>
</tr>
<tr>
<td>Szomor ZL 2001</td>
<td>differential expression of cytokines and nitric oxide synthase isoforms in rotator cuff bursae *subacromial bursal samples were collected at open sx</td>
<td>n=17; Sydney Australia</td>
<td>there was a consistent pattern of cytokine mRNA expression in the subacromial bursal samples *the study was unable to detect correlation between expression levels of cytokines or NOS isoforms and patient age, symptom duration and shoulder pain scores</td>
<td>Reference to bursitis mechanism</td>
<td></td>
</tr>
<tr>
<td>Teefey SA 2000</td>
<td>study to identify differences in the sonographic appearance of acute and chronic full-thickness rotator cuff tears</td>
<td>n=28 consecutive patients examined following arthroscopy to identify full thickness tears; 24 with acute RC tear and 20 with chronic reviewed for tear width, location and presence and distribution of fluid</td>
<td>a mid-substance location and presence of fluid was more commonly associated with acute tear; non-visualised cuff and absence of any fluid more commonly associated with chronic tear</td>
<td>Mixed data; relevant to course of pain: useful as a reference only</td>
<td></td>
</tr>
<tr>
<td>Torstensen 1999</td>
<td>looked at utility of MRI as a diagnostic tool in comparison with arthroscopy.</td>
<td></td>
<td></td>
<td>Pain duration not mentioned; a range of conditions were involved; useful for reference only</td>
<td></td>
</tr>
<tr>
<td>Winters JC 1999</td>
<td>prospective study in general practice of the long term course of shoulder complaints *assessed diagnostic category and fluctuations in pain *all were given same treatment with NSAID during first 2 weeks of inclusion *after this, the GP prescribed therapies tailored to the patients</td>
<td>all patients with shoulder complaints presenting to four practices in the Netherlands over a 6 month period were followed for up to 18/12 *n=101</td>
<td>the character of the symptoms changes considerably in the first week *51% had recurrent complaints after 26/52 (assessed at visit) and 41% after 12-18 months (assessed via survey)</td>
<td>Mixed data; relevant to course of pain: useful as a reference only</td>
<td></td>
</tr>
<tr>
<td>Yamaguchi K 2000</td>
<td>investigated the relationship between glenohumeral kinematics and shoulder pain to determine why some rotator cuff tears are painful and some are not</td>
<td>concluded that there was no significant difference between rct that were symptomatic and asymptomatic; loss of glenohumeral kinematics alone did not correlate with symptom occurrence</td>
<td>Small sample size; useful for reference only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teefey SA 2000</td>
<td>ultrasonography of the rotator cuff *patients about to undergo shoulder arthroscopy had U/S pre-operatively and the result was compared with what was seen on arthroscopy</td>
<td>U/S was accurate at detecting full-thickness rotator cuff tears *it was less sensitive for detecting partial thickness rct and ruptures of biceps tendon</td>
<td>Arthroscopy</td>
<td>Talks to chronic shoulder pain; useful as a reference only</td>
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<tr>
<td>Study</td>
<td>Reason</td>
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<tr>
<td>Binkert CA 2001</td>
<td>Exclude - not relevant to these guidelines; doesn't meet selection criteria</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Blanchard TK 1999</td>
<td>No pain data/small numbers.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Bredella MA 1999</td>
<td>Patient group not relevant</td>
<td></td>
<td></td>
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<tr>
<td>Carrillon Y 1999</td>
<td>High chronic pain - specific diagnosis.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Clunie GP 1998</td>
<td>Chronic pain &gt; 4/12</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Coari G 1999</td>
<td>Doesn’t meet any inclusion criteria.</td>
<td></td>
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<tr>
<td>Culic V 2001</td>
<td>Myocardial infarction. Article does not deal with acute shoulder pain.</td>
<td></td>
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<tr>
<td>Fermand M 2000</td>
<td>Chronic medicinal pain.</td>
<td></td>
<td></td>
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<tr>
<td>Gartsman GM 1998</td>
<td>Not relevant; looks at patient perceptions of shoulder conditions on general health status</td>
<td></td>
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<tr>
<td>Johnson MP 2001</td>
<td>Need review</td>
<td></td>
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<tr>
<td>Kim SH 2001</td>
<td>Apparent selection bias therefore exclude</td>
<td></td>
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<tr>
<td>Law TC 1998</td>
<td>Case report of chronic pain (5 year duration).</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lee HS 2002</td>
<td>Chronic only</td>
<td></td>
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<tr>
<td>Murrell GAL 2001</td>
<td>Does not meet criteria; data appears incomplete</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Saxton JM 2000</td>
<td>Chronic - no shoulder specific data - review paper - no data.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Struhl S 2002</td>
<td>Chronic except one subject with 2/12 duration of symptoms. No differentiation between anterior and posterior impingent.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teefey SA 2000</td>
<td>Chronic pain &gt; 6/12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viikari-Juntura E 2000</td>
<td>Irrelevant to these guidelines; mixed data on neck and shoulder</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worland RL 2000</td>
<td>Doesn't meet any inclusion criteria.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yanagisawa K 2001</td>
<td>Chronic pain. Study related to the mechanics of pain (subacromial).</td>
<td></td>
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</tr>
</tbody>
</table>
### SHOULDER PAIN – INCLUDED STUDIES (PROGNOSIS)

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Participants</th>
<th>Results</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MacFarlane GJ 1998</td>
<td>prospective cohort study over 3 years to determine the natural hx of shoulder symptoms in the general pop'n and whether long term outcome can be predicted on the basis of clinical (pain related) and individual (host related) factors</td>
<td>n=92; cross-section of UK population</td>
<td>baseline factors that were predictive of continuing symptoms in follow up were s/s &gt;1 year duration; pain on day of initial exam; high score on General Health Questionnaire; seeing a GP re the pain; psychological stress</td>
<td>include because goes to natural hx; useful as a reference only</td>
</tr>
<tr>
<td>Miranda H 2001</td>
<td>prospective study of work-related risk factors and physical exercise as predictors of shoulder pain among forestry workers *questionnaire administered to 7000 employees with 75% response rate</td>
<td>subjects estimated the number of days they had pain in past 12 months and described what sort of activities they did</td>
<td>conclude that shoulder pain the result of multiple factors; physical exercise appears to have more protective than impairing effects on the shoulders *one year incidence of shoulder pain was 14% *awkward work postures, obesity, heavy physical work and mental stress were risk factors</td>
<td>mixture of acute and chronic subjects *gives some idea of predictors of pain and factors that are associated with chronicity; useful as a reference only</td>
</tr>
<tr>
<td>Nahit ES 2001</td>
<td>questionnaire given to newly employed workers to determine presence of shoulder etc pain present in past month lasting for &gt;1 day</td>
<td>1081 subjects recruited; 20% reported shoulder pain</td>
<td>high levels of stress were associated with increased likelihood of pain, particularly job demand and control</td>
<td>general point that psychosocial stress at work is associated with more pain and indicated need to assess this at first presentation although not specifically based on acute pain *use for yellow flags/reference only</td>
</tr>
<tr>
<td>Punnett L2000</td>
<td>cohort study conducted in auto-assembly plant to evaluate risk of shoulder disorders associated with non-neutral postures *used questionnaire to rate discomfort *10 month study period</td>
<td>cases identified prospectively over 10 month period from workers reporting shoulder c/o 93 potential cases (89%) were interviewed and 79 (85%) of these met the study case definition</td>
<td>the risk increased as the proportion of the work cycle exposed increased and with use of hand-held tools</td>
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</tr>
<tr>
<td>Solomon DH 2000</td>
<td>examined medical records to determine whether treating physicians documented key hx and exam findings to determine whether documentation linked with patient satisfaction and clinical outcome</td>
<td></td>
<td>there was no association between documentation and 3-month pain relief or functional status</td>
<td>mixed data and prognostic value of history taking/examination. 50% had pain &gt;12 weeks *may be of use in the section on medical history; useful as a reference only</td>
</tr>
<tr>
<td>Solomon DH 2001</td>
<td>to examine the factors that influence referral of patients with musculoskeletal pain and whether referral influences outcome *f/u 12/12</td>
<td>41% (65/160) of patients presenting with knee or shoulder c/o were referred *29% were referred to an orthoped; 8% to a rheumatologist; 4% to both</td>
<td>referral was not associated with improvement of pain or function and may be associated with worse outcomes among patients with shoulder pain *referral for shoulder c/o was associated with significantly less improvement in clinical outcomes than non-referral (p=0.02)</td>
<td>mixed data and prognostic value of referral. Not specifically acute pain; useful as a reference only</td>
</tr>
<tr>
<td>Tempelhof S 1999</td>
<td>looked at the prevalence of rotator cuff tears in asymptomatic shoulders using U/S</td>
<td>no previous hx of shoulder pain or dysfunction</td>
<td></td>
<td>talks to prevalence of tears in the general population; useful as a reference only</td>
</tr>
<tr>
<td>Tuite MJ 1998</td>
<td>to determine the relative distribution of the locations of rotator cuff tears and sens of of anterior versus posterior tears on MR images</td>
<td>n=110 consecutive patients who had MR and full/partial/rim rent tear of cuff at arthroscopy</td>
<td>in patients less than 36 years old, most partial and small full-thickness tears are centered in the anterior half of the supraspinatus</td>
<td>likely to be a chronic population due to the diagnosis is made at arthroscopy; useful as a reference only</td>
</tr>
<tr>
<td>van der Windt 1996</td>
<td>shoulder disorders in general practice - what are the prognostic indicators of outcome *prospective f/u study (observational) by 11 Dutch GPs</td>
<td>n=549 pts with new episodes of shoulder pain with f/u at 1,3,6,12 months</td>
<td>at 1/12 23% showed complete recovery; @ 3/12 44% fully recovered; at 12/12 59% fully recovered; 41% had persistent symptoms after 12/12</td>
<td>mixed data of yellow flags; data mixed (not clearly acute); useful as a reference only</td>
</tr>
<tr>
<td>Vasseljen O 2001</td>
<td>shoulder and neck complaints in customer relations - a study of individual risk factors and perceived exposures at work</td>
<td>n=66 females selected from screening sample of 400 *</td>
<td>80% of workers with pain attributed their pain to unspecified exposures at work; 45% were uncertain about the cause of their pain in terms of work/non-work exposures *perceived general tension clearly differentiated women with and without pain and may be an independent risk factor for muscle pain and secondly, it may be related to personality factors</td>
<td>mixed data of yellow flags; data mixed (not clearly acute); useful as a reference only</td>
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</table>
### SHOULDER PAIN – INCLUDED STUDIES (PROGNOSIS)

<table>
<thead>
<tr>
<th>Study</th>
<th>Method</th>
<th>Participants</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Winters JC</td>
<td>prospective study in general practice of the long term course of shoulder complaints *assessed diagnostic category and fluctuations in pain *all were given same treatment with NSAID during first 2 weeks of inclusion *after this, the GP prescribed therapies tailored to the patients</td>
<td>all patients with shoulder complaints presenting to 4 practices in the Netherlands over a 6 month period were followed for up to 18/12 *n=101</td>
<td>the character of the symptoms changes considerably in the first week *51% had recurrent complaints after 26/52 (assessed at visit) and 41% after 12-18 months (assessed via survey)</td>
<td>included for information on long term course of shoulder pain; although has mixed data; useful as a reference only</td>
</tr>
<tr>
<td>Yamaguchi K</td>
<td>natural history of asymptomatic cuff tears *bilateral U/S and questionnaire then followed up after 3-6 years</td>
<td>n=58 with drop out 13/58 *22 asymptomatic and 23 symptomatic</td>
<td>only ADL and VAS score were significantly different between asymptomatic and symptomatic groups *appears to be a risk of tear progression over time and risk of pain development in people with asymptomatic tears</td>
<td>mixed acute and chronic; moderate bias as inter-examiner or test-retest reliability details not stated; useful as a reference only</td>
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</tbody>
</table>

### SHOULDER PAIN – EXCLUDED STUDIES (PROGNOSIS)

<table>
<thead>
<tr>
<th>Study</th>
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</thead>
<tbody>
<tr>
<td>Albright 2001</td>
<td>Chronic pain.</td>
</tr>
<tr>
<td>Brulin C 2002</td>
<td>Follow up study - issue of interest - pain - 5 years previously.</td>
</tr>
<tr>
<td>Chiou HJ 2002</td>
<td>As per all exclusion criteria. Not specifically acute pain patients.</td>
</tr>
<tr>
<td>Feldman DE 2002</td>
<td>Can't separate local causes of shoulder pain from those referred.</td>
</tr>
<tr>
<td>Fredriksson K 1999</td>
<td>No baseline shoulder data. No specificity of data; diagnosis. Data mining!</td>
</tr>
<tr>
<td>Goh GJM 1997</td>
<td>Retrospective. Duration of pain not specified</td>
</tr>
<tr>
<td>Griggs SM 2000</td>
<td>As per all exclusion criteria. Majority of patients chronic</td>
</tr>
<tr>
<td>Hudak 1998</td>
<td>No data. Review.</td>
</tr>
<tr>
<td>Kaergaard A 2000</td>
<td>Data mixed - neck and shoulder.</td>
</tr>
<tr>
<td>Lowe BD 2001</td>
<td>Eight subjects recruited; 4/8 had musculoskeletal pain in the past 12/12; compares effects on localised muscle fatigue of two welding processes performed in confined spaces in shipyards; results do not differentiate for shoulder pain</td>
</tr>
<tr>
<td>Rahme H 1998</td>
<td>Chronic patients &gt; 1 year duration.</td>
</tr>
<tr>
<td>Smith SP 2001</td>
<td>Chronic pain - association between two chronic conditions.</td>
</tr>
<tr>
<td>Winters JC 1999</td>
<td>50% of sample acute - 25% chronic - 25%?</td>
</tr>
</tbody>
</table>
### SHOULDER PAIN – INCLUDED STUDIES (INTERVENTIONS)

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<tr>
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<tbody>
<tr>
<td><strong>NSAIDS versus Placebo</strong></td>
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<tr>
<td>Adebowo A 1990</td>
<td>Randomised, controlled trial. Both participants and outcome assessors blinded. No loss to follow-up. Intention to treat analysis.</td>
<td>60 patients. Inclusion criteria: symptoms &lt; 3 months and rotator cuff tendinitis defined by pain exacerbated by resisted movement, on abduction with a painful arc or external rotation; active range frequently limited by pain and passive range always &gt; active range of movement; normal glenohumeral range of passive movement. Exclusion criteria: Systemic inflammatory arthropathy; recent peptic ulceration or gastrointestinal bleeding or sensitivity to NSAID or triamcinolone; shoulder injection within previous 3 months; glenohumeral arthritis, acromioclavicular arthritis, bicipital tendinitis or a suspected rotator cuff tear (weak arm elevation, positive ‘drop arm sign’ or a high riding humerus seen radiologically); local infection. NSAIDs stopped at least one week before study entry.</td>
<td>Group 1 (20 patients): 50 mg diclofenac 3 times a day for 28 days + subacromial injection of 3ml of 0.5% lignocaine Group 2 (20 patients): diclofenac placebo tablets + subacromial injection of 2ml 0.5% lignocaine &amp; 1ml of 80mg/ml triamcinolone hexacetonide. Group 3 (20 patients): diclofenac placebo tablets + subacromial injection of 3ml 0.5% lignocaine. All patients instructed in pendulum and wall climbing exercises to perform at home.</td>
<td><strong>NSAID VS PLACEBO</strong> At 4 weeks, significant difference between groups in pain favours NSAID (mean difference between groups –2.25 (95% CI –3.6, -0.9); significant difference between groups in range of abduction favours NSAID (mean difference between groups 41. degrees (95% CI 18.09, 64.71).</td>
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<td><strong>INJECTION VS PLACEBO</strong> At 4 weeks, significant difference between groups favours injection (mean difference between groups 3.6 (95% CI 1.55, 5.65); significant difference between groups in range of abduction favours injection (mean difference between groups 45 degrees (95% CI 19.12, 70.88).</td>
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<td><strong>NSAID VS INJECTION</strong> At 4 weeks, no significant difference between groups in pain (mean difference between groups –1.35 (95% CI –3.3, 0.6); no significant difference between groups in range of abduction (mean difference between groups –3.6 (95% CI –22.86, 15.66)</td>
<td></td>
</tr>
<tr>
<td>Ginsberg F 1991</td>
<td>Randomised double-blind crossover trial</td>
<td>30 (2 with epicondyliitis; 28 with peri-arthritus of the shoulder)*</td>
<td>Group 1: 4% indomethacin spray (approx 5mg dose/spray) 3-5 times/day for 14 days, then placebo for 14 days * Group 2: placebo for 14 days, followed by 4% indomethacin spray for 14 days</td>
<td>At 14 days: significant difference between groups in pain (mean difference between groups 0.6 (95% CI 0.3, 0.9); significant difference between groups in range of abduction (mean difference between groups 13 degrees (95% CI 3.8, 22.2)).</td>
<td>Trial sponsored by pharmaceutical company</td>
</tr>
<tr>
<td>Mena 1986</td>
<td>Randomised double-blind placebo-controlled trial</td>
<td>68</td>
<td>Group 1: Placebo NSAID plus physiotherapy Group 2: Flurbiprofen 200-300mg QID plus physiotherapy</td>
<td>Authors concluded that Flurbiprofen was well tolerated and effective for treatment of acute shoulder pain. There was a statistically significantly greater proportion of participants in the active group with improvement according to investigators’ global assessments at all follow-up points (Day 1, 3 or 4, 7 and 14) and at day 7 according to patients’ assessments (data not shown for patient assessment of overall improvement). There was a trend in a similar direction for other outcomes reported.</td>
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### SHOULDER PAIN – INCLUDED STUDIES (INTERVENTIONS)

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<tr>
<td><strong>One NSAID Compared to Another</strong></td>
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<tr>
<td>Vidal 2001</td>
<td>Double blind randomised controlled trial. Intention to treat analysis.</td>
<td>n =599</td>
<td>Group 1: Meloxicam 7.5mg once daily&lt;br&gt;Group 2: Meloxicam 15mg once daily&lt;br&gt;Group 3: Piroxicam 20mg once daily</td>
<td>Follow up Day 3, 7 and 14. All treatment groups improved with respect to pain and shoulder score. There were no differences between groups for improvement in pain on active movement on Day 7 (primary endpoint)&lt;br&gt;(Group 1: -47 (SD 25); Group 2: -46 (SD 25); Group 3: -43 (SD 26), p=0.19).</td>
<td>Sponsored by pharmaceutical company</td>
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<tr>
<td>Gotter 1987</td>
<td>Double blind, randomised controlled trial. Method of analysis not described. One patient lost to follow up on day 2 in piroxicam group.</td>
<td>n=30</td>
<td>Group 1: tenoxicam&lt;br&gt;Group 2: piroxicam</td>
<td>Both groups improved rapidly with complete remission of symptoms at 14 days: 10/15 tenoxicam versus 6/14 patients treated with piroxicam, p &gt; 0.05. There were no differences in outcome between the two treatment groups.</td>
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<tr>
<td>Soave G, 1982</td>
<td>Double blind randomised controlled trial. Analysis performed for completers only (39/40 patients). No loss to follow up.</td>
<td>n=40 adults with painful shoulder (24 patients) or some other form of soft tissue rheumatic complaint (epicondylitis n=10, tendinitis n=5, olecranon bursitis n=1), symptoms developing within previous 4 days; localised tenderness over involved area, limitation of motion, pain at rest severe enough to interfere with sleep and pain on motion.</td>
<td>Group 1: Indomethacin 100mg/day&lt;br&gt;Group 2: Indoprofen 800mg/day</td>
<td>Significant improvement in pain, quality of sleep, range of active motion and patient’s assessment found with both drugs, measured on days 4, 8 and 15. No significant difference between the two groups. Results presented graphically.</td>
<td>Acute shoulder pain in 24/40 patients. Results for shoulder pain not presented separately.</td>
</tr>
<tr>
<td>Wielandts</td>
<td>Randomised double blind trial&lt;br&gt;Completer analysis only. 5/26 patients lost to follow up at 1 week, all in phenylbutazone group</td>
<td>n=26</td>
<td>Group1: 100mg phenylbutazone QID for 7 days&lt;br&gt;Group 2: 100mg fentiazac QID for 7 days</td>
<td>Follow up one week: Both groups improved over time with respect to pain and tenderness. There were no differences between groups</td>
<td>Wyeth supplied the drug.</td>
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<tr>
<td><strong>Corticosteroid Injection</strong></td>
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<tr>
<td>Adebajo A, 1990</td>
<td>See NSAID section</td>
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### SHOULDER PAIN – INCLUDED STUDIES (INTERVENTIONS)

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</thead>
<tbody>
<tr>
<td>Vecchio 1993</td>
<td>Randomised controlled trial</td>
<td>n=57</td>
<td>Group 1 (28 patients): subacromial injection of 1% lignocaine, 1ml</td>
<td>Authors conclude no significant difference in pain and active and passive ROM between groups. No reported means or standard deviations</td>
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<td></td>
<td>Both patients and outcome assessors were blinded</td>
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<td>Group 2 (29 patients): subacromial injection of 40mg methylprednisolone plus 1ml 1% lignocaine</td>
<td>NSAIDS were discontinued one week prior to study</td>
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<td></td>
<td>One patient from each group failed to complete 12 week assessment period</td>
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<td>Compliers analysis only</td>
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<td></td>
<td>Completers analysis only</td>
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<td>Inclusion criteria: clinically defined rotator cuff tendinitis (shoulder pain exacerbated by resistance in at least one of abduction, external or internal rotation, and normal passive motion). Duration of symptoms &lt; 3 months. Exclusion criteria included adhesive capsulitis, rotator cuff tears, biceps tendinitis, acromioclavicular arthritis, previous steroid injections into shoulders</td>
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<td></td>
<td>Duration of symptoms &lt; 3 months.</td>
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<td></td>
<td>Exclusion criteria</td>
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<td></td>
<td>No evidence of a systemic inflammatory arthritis or frozen shoulder (defined as external rotation &lt; 30 degrees, abduction &lt;90 degrees)</td>
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<tr>
<td></td>
<td>Exclusion criteria</td>
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<tr>
<td></td>
<td>active peptic ulcer disease, recent gastrointestinal bleed, contraindication to NSAIDS, evidence of symptomatic acromioclavicular arthritis or bicipitis tendinitis or major rotator cuff tear</td>
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<td></td>
<td>Group 1 (20 patients): Subacromial injection (unguided) of 40mg triamcinolone acetonide plus placebo indomethacin tablets 4x daily</td>
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<td>Group 2 (20 patients): 25mg indomethacin 4x daily plus placebo (1cc saline) injection. Repeat injection and refill of medication was given after 3 weeks, if necessary.</td>
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<tr>
<td>Corticosteroid Injection vs NSAID</td>
<td></td>
<td>N=40</td>
<td>At 6 weeks: no significant difference between groups in pain: mean difference between groups 1.2 (95% CI -3.76, 6.16)</td>
<td>At 4 weeks: no significant difference between groups in range of abduction: mean difference between groups -0.18 (95% CI -0.95, 0.68)</td>
<td></td>
</tr>
<tr>
<td>Adebajo AO  1990</td>
<td>See NSAID section</td>
<td></td>
<td>Group 1 (20 patients): Subacromial injection (unguided) of 40mg triamcinolone acetonide plus placebo indomethacin tablets 4x daily</td>
<td>At 6 weeks: no significant difference between groups in pain: mean difference between groups 1.2 (95% CI -3.76, 6.16)</td>
<td>At 4 weeks: no significant difference between groups in range of abduction: mean difference between groups -0.18 (95% CI -0.95, 0.68)</td>
</tr>
<tr>
<td>White 1986</td>
<td>Randomised, controlled trial Blinding: both participants and outcome assessors were blinded Loss to follow-up: 5(25%) patients in each group. Appropriate statistical analysis: yes, intention to treat</td>
<td>N=40</td>
<td>Group 2 (20 patients): 25mg indomethacin 4x daily plus placebo (1cc saline) injection. Repeat injection and refill of medication was given after 3 weeks, if necessary.</td>
<td>All patients were instructed to begin home exercise program of Codman pendulum exercises. 10-15 min twice daily and slow shoulder abduction exercises using finger-up-the-wall technique.</td>
<td>All patients were instructed to begin home exercise program of Codman pendulum exercises. 10-15 min twice daily and slow shoulder abduction exercises using finger-up-the-wall technique.</td>
</tr>
<tr>
<td></td>
<td>Inclusion criteria: ‘Rotator cuff tendinitis’</td>
<td></td>
<td>At 3 weeks significant difference between groups in pain: WMD -32.07 mm on VAS (95% CI -38.04, -26.10)- favours addition of mobilisation.</td>
<td>At 3 weeks significant difference between groups in range of elevation: WMD -7.28 (-25.74, 11.18)</td>
<td>At 3 weeks significant difference between groups in pain: WMD -32.07 mm on VAS (95% CI -38.04, -26.10)- favours addition of mobilisation.</td>
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<tr>
<td></td>
<td>Painful arc between 40-120 degrees abduction, shoulder pain less than 12 weeks duration, no signs of acute calcific tendinitis, no evidence of a systemic inflammatory arthritis or frozen shoulder (defined as external rotation &lt; 30 degrees, abduction &lt;90 degrees)</td>
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<td>Exclusion criteria: active peptic ulcer disease, recent gastrointestinal bleed, contraindication to NSAIDS, evidence of symptomatic acromioclavicular arthritis or bicipitis tendinitis or major rotator cuff tear</td>
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<tr>
<td>Physiotherapy Interventions</td>
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<tr>
<td>Conroy DE 1998</td>
<td>Randomised controlled trial Methodological quality as follows: Concealed allocation: No; Baseline comparability: Yes; Blind assessors: Yes; Blind therapists: No; Adequate follow-up: Yes; Intention-to-treat analysis: No; Between-group comparisons: Yes; Point estimates &amp; variability: Yes; Eligibility criteria: Yes.</td>
<td>14 participants with primary shoulder impingement syndrome.</td>
<td>Group 1: Shoulder joint mobilisation and comprehensive treatment (hot packs, active exercises, stretching, strengthening, soft tissue mobilisation, education) 3 times per week for 3 weeks</td>
<td>At 3 weeks significant difference between groups in pain: WMD -32.07 mm on VAS (95% CI -38.04, -26.10)- favours addition of mobilisation.</td>
<td>At 3 weeks significant difference between groups in pain: WMD -32.07 mm on VAS (95% CI -38.04, -26.10)- favours addition of mobilisation.</td>
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<tr>
<td></td>
<td></td>
<td>14 participants with primary shoulder impingement syndrome.</td>
<td>Group 2: Comprehensive treatment alone.</td>
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### SHOULDER PAIN – INCLUDED STUDIES (INTERVENTIONS)

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<tr>
<td>Ebenbichler</td>
<td>RCT design with random allocation to groups. Methodological quality as follows: Concealed allocation: Yes; Baseline comparability: Yes; Blind assessors: Yes; Blind subjects: Yes; Blind therapists: Yes; Adequate follow-up: No; Intention-to-treat analysis: No; Between-group comparisons: Yes; Point estimates &amp; variability: Yes; Eligibility criteria: Yes</td>
<td>54 participants (61 shoulders) Radiographically verified calcific tendinitis. Mild-mod pain for &gt;4 weeks or restricted ROM</td>
<td>Compared ultrasound therapy (15 mins., 89MHz, 2.5w cm², pulsed 1:4, transducer size 5 cm² versus sham ultrasound with 24 treatment sessions (first 15 were daily then last 9 were 5 times weekly)</td>
<td>Assessed following treatment course and at 9 months 1. Assessment of change from baseline in calcium deposits on radiography 2. 100 point Constant score (pain, AROM, strength, ADL’s), 3. Pain (pain score and VAS and on abduction (4 point scale)) QOL 10cm VAS. Following treatment significant difference between groups in perceived recovery: RR 1.81 (95%CI 1.26, 2.60)- favours ultrasound Significant difference between groups in radiological appearance of calcific tendinitis in the short term (end of treatment) (RR 4.53 (1.46, 14.07)) and long term (nine month follow-up) (RR 3.74 (1.62, 8.66)). At 9 months no significant difference between groups for perceived recovery: RR 1.26 (95%CI 0.9, 1.77)</td>
<td></td>
</tr>
<tr>
<td>Shehab D</td>
<td>RCT design with random allocation to groups. Methodological quality as follows: Concealed allocation: Yes; Baseline comparability: Yes; Blind assessors: Yes; Blind subjects: No; Blind therapists: No; Adequate follow-up: No; Intention-to-treat analysis: Yes; Between-group comparisons: Yes; Point estimates &amp; variability: Yes; Eligibility criteria: Yes</td>
<td>50 female participants with painful shoulder movement of at least 1 month's duration. Diagnosis confirmed with provocative testing</td>
<td>Group 1: Transcutaneous Nerve Stimulation (TNS), 30 mins 50Hz, to anterior and posterior shoulder 3-5 times a week for 13 sessions. Group 2: US (0.5W for 10 mins, increased by 0.1W for each session) 3-5 times a week for 13 sessions. Both groups had ice and stretching.</td>
<td>Pain post intervention: Median (Range) TENS 0(0-65) US 0.5(0-2.75). Significantly better in US group Flexion score post intervention: Median (Range) TENS 140 (120-160) US 175 (115-180). Significantly better in US group Abduction score post intervention: Median (Range) TENS 130 (116.7-156.5) US 180 (101.2-180). Significantly better in US group</td>
<td></td>
</tr>
<tr>
<td>Kleinhenz J</td>
<td>RCT design with random allocation to groups. Methodological quality as follows: Concealed allocation: Yes; Baseline comparability: Yes; Blind assessors: Yes; Blind subjects: Yes; Blind therapists: No; Adequate follow-up: Yes; Intention-to-treat analysis: Yes; Between-group comparisons: Yes; Point estimates and variability: Yes; Eligibility criteria: Yes</td>
<td>52 Athletes with rotator cuff disease, excluding rotator cuff tear on ultrasound. Inclusion criteria: rotator cuff disease due to sport; 18 - 50 years old; shoulder pain for &gt; 4 weeks; no acupuncture therapy in past 6 months. Exclusion criteria: cervical or thoracic pain; previous surgery; rotator cuff tear; calcific tendinitis; arthritis</td>
<td>Group 1: Eight acupuncture sessions in four weeks Group 2: Identical regimen of placebo ultrasound.</td>
<td>At 4 weeks significant difference between groups in Constant-Murley score (a composite score of pain, function and range of motion) WMD 10.83 (2.46, 19.20) out of a possible 100-favours acupuncture. At four months difference between groups WMD 3.53 (0.74, 6.32)-statistically significant but clinically unimportant benefit in favour of acupuncture.</td>
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<tr>
<td>Study</td>
<td>Reason</td>
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<tr>
<td>Aaras A 2001</td>
<td>Not shoulder-specific - shoulder data not presented separately; not acute; not randomised</td>
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<tr>
<td>Arslan 2001</td>
<td>Mean duration of symptoms greater than 3 months</td>
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<tr>
<td>Bang M 2000</td>
<td>Mean duration of symptoms &gt;5 months</td>
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<tr>
<td>Barber FA 2001</td>
<td>Does not fit inclusion criteria.</td>
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<tr>
<td>Berry H 1980</td>
<td>Duration of symptoms greater than three months</td>
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<tr>
<td>Binder A 1984</td>
<td>Duration of symptoms greater than three months</td>
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<tr>
<td>Binder A 1986</td>
<td>Chronic pain</td>
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<tr>
<td>Blockey NJ 1954</td>
<td>Frozen shoulder, periarthritis not defined; not acute (some acute patients but not reported separately)</td>
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<tr>
<td>Bottini CR 2002</td>
<td>Fracture dislocation rather than acute (non-specific) shoulder pain</td>
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<td>Brosseau L 2002</td>
<td>Exclude as relates to knee tendinitis only</td>
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<td>Brox J 1993/7</td>
<td>Duration of symptoms greater than three months</td>
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<td>Bulgen D 1984</td>
<td>Duration of symptoms greater than three months</td>
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<td>Carter B 2001</td>
<td>Case series</td>
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<td>Ceccherelli F 2001</td>
<td>Chronic pain</td>
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<tr>
<td>Chiou HJ 2001</td>
<td>All chronic subjects</td>
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<tr>
<td>Dacre 1989</td>
<td>Duration of symptoms at least 4 weeks and periarthritis. Duration of symptoms not reported</td>
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<td>Dahan THM 2000</td>
<td>Mean duration of pain is 1 year; inclusion criteria is at least 1 month of surgery</td>
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<td>Dal Conte G 1990</td>
<td>Duration of symptoms greater than three months</td>
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<td>Downing D 1986</td>
<td>Duration of symptoms greater than three months</td>
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<td>England S 1989</td>
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<td>Fankhauser F 2002</td>
<td>Not an RCT</td>
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<td>Ferrante FM 1998</td>
<td>Results not separate for shoulder; subjects had pain duration &gt;6 months</td>
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<td>Gam AN 1995</td>
<td>Exclude as includes many musculoskeletal conditions; not specific to shoulder</td>
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<tr>
<td>Cinn KA 1997</td>
<td>Duration of symptoms greater than three months</td>
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<tr>
<td>Green S 2002</td>
<td>Mixture of acute and chronic pain duration</td>
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<tr>
<td>Haake M 2002</td>
<td>Exclude due to chronic pain &gt;6 months</td>
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<tr>
<td>Horneij E 2001</td>
<td>Heterogeneous group - prospective prevention trial.</td>
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<td>Invargarsson T 1996</td>
<td>Surgery trial. Duration of symptoms unlikely to be less than 3 months</td>
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<tr>
<td>Johansson K 2002</td>
<td>Not acute shoulder pain (based on references included). Not stated in paper but studies included in SR are on chronic patients.</td>
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<td>Jones DS 1999</td>
<td>Likely not to be acute but no duration given (2nd or 3rd stage capsulitis)</td>
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<tr>
<td>Study</td>
<td>Reason</td>
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<tr>
<td>Karatas GK 2002</td>
<td>Duration of symptoms not defined except for &gt;4 weeks; likely to be &gt;12 weeks; duration of study f/u is 60 minutes</td>
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<tr>
<td>Karjalainen K 2002</td>
<td>Greater than 3 weeks; chronic</td>
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<tr>
<td>Kivimaki J 2003</td>
<td>Pain duration &gt;12 weeks; no control (placebo); poor inclusion definition; inadequate manipulation</td>
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<tr>
<td>Klein MG 2002</td>
<td>Polio survivors therefore not representative of the general population presenting to primary practice; maximum duration of symptoms unclear</td>
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<tr>
<td>Leclaire R 1999</td>
<td>Duration of symptoms greater than three months</td>
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<td>Lee M 1973</td>
<td>Duration of symptoms greater than three months</td>
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<td>Lesprit E 2001</td>
<td>Case series</td>
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<td>Lindh M 1993</td>
<td>Surgery trial. Duration of symptoms unlikely to be less than 3 months</td>
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<tr>
<td>Moore ME 1976</td>
<td>Mean duration of symptoms not reported</td>
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<tr>
<td>Nicholson G 1985</td>
<td>Duration of symptoms greater than three months</td>
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<tr>
<td>Nykanen M 1995</td>
<td>Duration of symptoms reported to be greater than two months; mean duration not reported but unlikely to be less than three months</td>
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<tr>
<td>Oldervoll LM 2001</td>
<td>Not a randomised trial; not acute duration; not just shoulder pain</td>
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<tr>
<td>Perron M 1997</td>
<td>Duration of symptoms greater than three months</td>
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<tr>
<td>Price CIM 2002</td>
<td>Post stroke.</td>
<td></td>
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<tr>
<td>Reid D 1996</td>
<td>Unlikely to be acute</td>
<td></td>
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<tr>
<td>Ritchie LD 1995</td>
<td>Not a RCT</td>
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<tr>
<td>Rizk TE 1991</td>
<td>Chronic pain (mean duration = 13.2 weeks)</td>
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<tr>
<td>Rompe JD 2001</td>
<td>Pain duration greater than 3 months (&gt;12 months)</td>
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<tr>
<td>Saunders L 1995</td>
<td>Duration of symptoms greater than three months</td>
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<tr>
<td>Schmitt J 2001</td>
<td>Chronic pain (&gt; 6 months).</td>
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<td>Shibata Y 2001</td>
<td>Chronic pain.</td>
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<tr>
<td>Sileghem A 1991</td>
<td>Chronic pain - definition of diagnosis unclear.</td>
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<tr>
<td>Snels IAK 2000</td>
<td>Hemiplegic shoulder pain therefore exclude</td>
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<tr>
<td>Snels IAK 2000</td>
<td>Survey</td>
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<tr>
<td>Spangehl M 2002</td>
<td>Exclude: chronic pain; mean duration &gt;12 months</td>
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<tr>
<td>Speed CA 2002</td>
<td>Not acute - useful for chronic.</td>
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<tr>
<td>Sperber A 2001</td>
<td>For post-traumatic instability.</td>
<td></td>
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<tr>
<td>Sun KO 2001</td>
<td>Duration of pain &gt;3/12 based on mean duration of symptoms</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Taverna E 1990</td>
<td>Duration of symptoms greater than three months</td>
<td></td>
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<tr>
<td>van der Heijden GJM 1996</td>
<td>3/16 RCTs included are acute; included studies poor quality; unable to pool results. To obtain the 3/16 studies</td>
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</tbody>
</table>
# Acute Shoulder Pain Summary Tables

## SHOULDER PAIN – EXCLUDED STUDIES (INTERVENTIONS)

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason</th>
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<tbody>
<tr>
<td>van der Heijden GJM 1997</td>
<td>Physiotherapy for soft tissue disorders -</td>
</tr>
<tr>
<td>van der Windt DAWM 1998</td>
<td>Half the participants had pain for greater than three months</td>
</tr>
<tr>
<td>van der Windt DAWM 1995</td>
<td>Efficacy of NSAIDs for shoulder c/o -</td>
</tr>
<tr>
<td>van der Windt DAWM 1999</td>
<td>Not shoulder-specific</td>
</tr>
<tr>
<td>Waling K 2002</td>
<td>Not acute - includes cervical spine.</td>
</tr>
<tr>
<td>Walsh RM 2001</td>
<td>Case report</td>
</tr>
<tr>
<td>Wang CJ 2001</td>
<td>No comparison group (case series). All had pain longer than 6 months.</td>
</tr>
<tr>
<td>Weldon EJ 2001</td>
<td>Not a systematic review or a RCT</td>
</tr>
<tr>
<td>Wielandts L 1979</td>
<td>Drug not available in Australia and unlikely to become available</td>
</tr>
<tr>
<td>Winters JC 1997</td>
<td>Heterogeneous, variable treatments. Different diagnostic groups</td>
</tr>
<tr>
<td>Winters JC 1999</td>
<td>Not acute</td>
</tr>
<tr>
<td>Withrington RH 1985</td>
<td>RCT lignocaine and steroid vs saline; outcomes pain and paracetamol count; no significant difference; exclude due to chronic pain</td>
</tr>
<tr>
<td>Zuinen C 1993</td>
<td>Met inclusion criteria but not relevant question (ie comparing diclofenac and misoprostol to diclofenac alone. Concluded equal benefit with regard to shoulder symptoms, increased gastro-intestinal adverse events with additional misoprostol</td>
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</tbody>
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## SHOULDER PAIN – EXCLUDED STUDIES (COST EFFECTIVENESS)

<table>
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<th>Study</th>
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</thead>
<tbody>
<tr>
<td>Bongers PM 2001</td>
<td>Exclude because not a cost effectiveness study; a narrative review</td>
</tr>
</tbody>
</table>
REFERENCES


Bennett WF. Specificity of the Speed's test: arthroscopic technique for evaluating the biceps tendon at the level of the bicipital groove. Arthroscopy 1998; 14: 789-796.


Acute Shoulder Pain


Acute Shoulder Pain


Kleinman PK, Kanzaria PK, Goss TP, Pappas AM. Axillary arthrotonography of the glenoid labrum. AJR 1984; 141: 993-999.


Matin P. Appearance of bone scans following fractures: including immediate and long-term studies. J Nucl Med 1979; 20: 1227-.


Merskey H. Pain terms: a list with definitions and notes on usage recommended by the IASP Subcommittee on Taxonomy. Pain 1979; 6: 249-252.


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Reinus WR, Hatem SF. Fractures of the greater tuberosity presenting as rotator cuff abnormality: magnetic resonance demonstration. J Trauma 1998; 44: 670-675


Seeger LL. Physical principles of magnetic resonance imaging. Clin Orthop Rel Res 1989b; 244: 7-16.


Solomon DH, Schaffer JL, Katz JN, Horsky J, Burdick E, Nadler E, Bates DW. Can history and physical examination be used as markers of quality? An analysis of the initial visit note in musculoskeletal care. Medical Care 2000; 38: 383-391


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Torstensen AT, Hollinshead RM. Comparison of magnetic resonance imaging and arthroscopy in the evaluation of shoulder pathology. J Shoulder Elbow Surg 1999; 8: 42-45


Vasselen J, Holte KA, Westgaard RH. Shoulder and neck complaints in customer relations: individual risk factors and perceived exposures at work. Ergonomics 2001; 44: 355-372


Zuinen C.Diclofenac/misoprostol vs diclofenac/placebo in treating acute episodes of tendinitis/bursitis of the shoulder. Drugs 1993; 45: 17-23