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A NARRATIVE REVIEW ON CLASSIFICATION OF PAIN CONDITIONS OF THE UPPER EXTREMITIES

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ABSTRACT. Local and regional musculoskeletal discomfort and pain in the shoulder girdle or upper extremities are often reported, especially in the working population. In this review we describe the most important problems and factors when classifying musculotendinous pain in the upper extremities and shoulders. This includes an analysis of how four common diagnoses (wrist tenosynovitis, lateral epicondylitis, rotator-cuff tendinitis, myofascial pain syndrome) fulfil basic criteria of validity. It is evident that there are some serious problems regarding the validity of the current classification of the conditions. Clinical criteria are often poorly defined and the reliability insufficiently tested. The relationship to objective pathoanatomic or physiological findings seems inconsistent. Although magnetic resonance and ultrasonographic imaging are promising, they are still only preliminary methods for evaluation of tendon and connective tissue structures. The prognosis with and without treatment also seems heterogeneous and can vary between studies. A generally accepted terminology is lacking in the pathogenetically complex regional muscle pain conditions.

Key words: upper extremity; pain syndrome; classification; validity; shoulder; elbow; tendinitis; myalgia.

INTRODUCTION

Local and regional musculoskeletal discomfort and pain are frequently reported in the general population of western countries (3, 22). About 30–40% of the Danish population is reported to have had long-lasting symptoms within the last year, usually in the back and the neck. In the working population, diagnoses relating to muscles, tendons and tendon sheaths of the shoulder girdle or upper extremities account for more than half of the recorded possible work-related musculoskeletal ailments in both Denmark and the USA: most of the other diagnoses are related to the neck and the back (5, 47). Furthermore, these diagnoses make up 80% of the musculoskeletal diagnoses in which the exposure is classified as monotonous, repetitive work (5). Most of the symptoms relating to the upper extremities are diagnosed as tendinitis, peritendinitis, tendovaginitis/tenosynovitis, epicondylitis and muscle-related conditions (myalgia, myofascial pain syndrome) (5, 71).

The extent to which these disorders/diseases are caused by physical workload (52, 123) is still a matter of dispute because of the difficulties in evaluating exposure, the poorly defined diagnoses and the difficulty in evaluating the degree of severity of symptoms. In a study where ICD-9 soft tissue diagnostic terminology on more than 1000 persons was examined, it was often found that different diagnostic terms were used for similar symptoms and that up to four different diagnostic codes were used for the same condition (24). It was concluded that the present classification required improvement.

Standardized criteria for classification, quantification and outcome evaluation are essential for establishing firm knowledge on rheumatic diseases (44).

The purpose of this review is to describe the most important problems and factors when establishing criteria for classification of musculoskeletal pain in the upper extremities and shoulders. This includes an analysis of the degree to which four common diagnoses (wrist tenosynovitis, lateral epicondylitis, rotator-cuff tendinitis, myofascial pain syndrome) fulfil basic criteria of validity.

A systematic review of this very wide subject would be very space consuming. We therefore present a broad narrative review, which is intended to build a connection between different research areas.

A systematic search of the literature for references on the four diagnoses was conducted on MEDLINE in 1966–1996. The search terms used were diagnostic or pathological terms with a possible association with pain in the tendons and muscles of the upper extremities. Relevant papers were selected from the titles and abstracts. This was supplemented with a review of the bibliographies from the selected papers and books on the subject. The papers included in this review were selected on the basis of use of a good methodology. For studies on clinical, radiological or laboratory findings, this essentially also entailed the examination of a relevant control group, and if possible that the examination was performed blinded. For studies on treatment response, trials had to be performed as randomized controlled trials.

Diagnostic classification and validity

When making a diagnosis, an abstraction from the actual case is made, and the patient is classified. Establishment of a diagnosis can be based on different principles and have different purposes, of which the establishment of communicable experiences seems to be the most important (133). The oldest and simplest types of diagnoses are the symptom diagnoses that have descriptive designations (headache, back pain, adipositis). In modern medicine, the criteria used for classification are often aetiological, structural (pathoanatomic) or pathophysiological (Table I). Sometimes the defining diagnostic criterion is “hidden” and cannot be registered in a living patient but only verified by autopsy (133). Often the diagnosis is based upon a combination of symptoms, clinical and paraclinical findings. In some instances the diagnoses are hierarchical, which makes it possible for them to be subdivided by another of the criteria. However, the type of criteria that defines the top level of the hierarchy tends to vary.

In many clinical syndromes a specific aetiologic factor, abnormal paraclinical findings (histology, anatomy or function) and a specific treatment response can be demonstrated. In such cases the validity of the diagnosis seems evident (68). In many clinical syndromes no specific objective tests are positive in the single patient and the diagnosis is based upon clinical findings and symptoms. What is fundamental in the validation of such clinical syndromes is to document that the single criterion and the criteria set used are reliable. This implies that the criteria are reproducible and have a high accuracy (means of sensitivity and specificity). In calculating the accuracy there has to be a gold standard (usually the clinical diagnosis) against which the criteria can be upheld (44). The results obtained might be greatly dependent upon the patient groups used.

There is no general consensus on how many and which criteria are needed to validate a diagnosis, although doctors usually perceive aetiology to be the most important factor, followed by structure, function and clinical symptoms (98).

Table I. *Principles of classification*

		Examples
Aetiology		
Environmental	Physical	Trauma, cold, heat, biomechanical load
	Chemical	Nutrition, toxic compounds
	Biological	Virus, bacteria, secondary to other diseases
	Psychosocial	Family, occupation
Genetic	Inborn	Tissue type, metabolic diseases
Developmental	Degenerative diseases	
Clinical presentation		
Subjective symptoms	Pain, fatigue, dyspnoea, emotional	
Clinical findings	Tenderness	
	Abnormal function	
	Structural abnormalities	
Para-clinical findings		
	Histology	Cell structures, inflammation
	X-ray	Structural abnormalities, erosions
	Scanning	
	Physiology	Pulmonary function, blood flow, EMG
	Biochemistry	Blood tests, spinal fluid
Prognosis		
Natural history	Morbidity	Chronicity vs remission
	Mortality	
Treatment response	Subjective	Asthma, inflammatory diseases
	Clinical	
	Para-clinical	

AETIOLOGY

Genetic factors

In subjects with familial type II hyperlipidaemia, increased occurrence of tendinitis has been described (40). Persons with various musculoskeletal abnormalities (hypermobility, Marfan's syndrome, Ehlers-Danlos disease, scoliosis, kyphosis) have an increased frequency of musculoskeletal pain (12). Tendinitis, peritendinitis and muscle pain frequently occur in patients with medical conditions, especially inflammatory rheumatic diseases, which may be associated with genetic factors. However, these factors are of minor quantitative importance in the general and working population.

Environmental factors

Chemical and biological factors are scarcely examined in the pain conditions studied, probably because they are assumed to be of minor importance. Physical factors include noise, heat, cold, draught, humidity, vibration and, most importantly, biomechanical load and strain (31); the latter will be described next.

Muscle and tendon reactions to work and age-related changes

Muscles: Acute effects. During contraction, an increase in muscle tension leads to an increase in the intramuscular pressure. This may be the most important peripheral factor influencing the sensory feeling of exertion but does not usually elicit pain (65). During repetitive or long-lasting contractions muscular fatigue develops, which includes a decrease in the contractile strength of the muscle. The biochemical basis for this involves intra- and extracellular changes in lactate, electrolytes, energy-rich phosphates, glycogen and pH (41). Pain may occur when the free nerve endings are stimulated, e.g. by potassium and low pH. Contractile strength and the metabolic changes are almost normalized one hour after acute exhausting work/exercise. Exercise-induced pain without injury usually disappears immediately after cessation of work.

Muscle strain. Acute painful muscle strain can occur as a result of strong, especially eccentric, contractions (104). These strains occur especially at the myotendinous junction but lesions at the tendon-bone insertion may also appear. The sensation that is related to strains is that of acute pain. Though an insufficient number of studies have been conducted to support this assumption, it seems likely that acute muscle strain constitutes only a small part of upper-extremity muscle pain.

Muscle cramps. Muscle cramps are sudden, intense electrically active contractions elicited by motor neuron hyperexcitability. They often occur in relation to work-induced dehydration and electrolyte changes. However, the exact physiological mechanism is unclear (96). One questionnaire study in the community has suggested a relationship between muscle cramps and reported pain (62).

Delayed reactions. Delayed onset muscle soreness (DOMS) develops one or two days after hard eccentric work (33). Microscopic findings include ultrastructural changes (disruption of z-membrane, muscle cell necrosis, migration of lymphocytes and macrophages) (7). The concentration of the muscle enzymes increases in the serum. Physically inactive and elderly people develop more structural changes after eccentric work (90). The correlations between pain, structural changes and increase in the enzymes are only moderate and the primary cause of DOMS is not fully understood. However, sensitization of free nerve endings by debris from the necrotic muscle cells or enzymes from the mononuclear cells may be an important mechanism here (117).

An increase in the creatine kinase after heavy lifting work has been described in a field study of workers during physical work (53). This may indicate that a part of reported pain at the workplace is due to DOMS.

Long-term effects. No long-term symptoms or structural changes of the muscles have been described after exercise. The long-term effect of exercise includes an increase in muscle strength and endurance (66).

Tendons: Acute reactions. The metabolism in tendon and connective tissue structures during exhausting work has not been thoroughly examined. Nor has there been a study to determine how much of the sensation of pain experienced during exercise comes from the tendon structures. In one study (116) acute partial or total rotator-cuff ruptures were found to be the cause of around 10% of shoulder pain.

Effects of repetitive strain. Studies on rabbits subjected to intensive activity for six weeks have shown oedema, fibrosis, cellular infiltrates, and increased vascularity in and around the tendons and tendon sheath (10). Similar changes in the tendon matrix and in the structure of the tendons have also been described in human acute tendinitis (79).

Chronic and age-related changes. The histology of the tendons among patients with chronic pain or tendon ruptures is not usually characterized by inflammation, but rather by changes in the structure of the collagenous fibrils, and hyaline degeneration, termed tendinosis (79, 132). Calcification may be observed, which could be of special importance for the rotator-cuff tendons (39). The mechanisms responsible for the degenerative changes in the tendons (tendinosis) are not fully understood (79).

Tendon blood flow decreases with age, influencing the ability to regenerate. Degenerative changes of the supraspinatus tendon have been described as increasing with increased age (35). Tendons have lower ultimate strength in elderly persons and the deformation before failure is smaller (26, 105). Many subjects with degenerative tendon changes have no symptoms and the pathophysiology of tendon pain is unclear. In tendinosis the tendons are, however, probably more vulnerable to micro-trauma, which can lead to tendinitis (132).

Relation of symptoms to overuse and occupational workload

Overuse injuries of the type tendinitis/peritendinitis of the wrist, elbow and shoulder are often described in connection with sports (110). To what extent the mechanisms are micro-trauma due to heavy eccentric contractions rather than low–moderate repetitive contractions is unclear. Tendinitis/peritendinitis/tendinosis in the Achilles tendon, patellar ligament and tractus iliotibialis are injuries which may be found after repetitive, moderate loads (e.g. in long-distance runners).

Increased frequency of self-reported pain in the shoulder, neck and arm is reported in a number of occupations (47, 54, 63). In other studies different combinations of self-reported symptoms, tenderness and other findings have been used to define outcome diagnosis (8, 47, 126). A few studies have shown tenderness and other clinical findings of both shoulder and arm to be separately related to repetitive work (4, 45, 125). Because there are no criteria for the duration of the symptoms before diagnosis, simple exercise reactions (acute exercise-induced pain, DOMS and slight peritendinitis) may also have been registered as cases.

Large prospective epidemiologic studies using standardized exposure assessment and examination technique are actually taking place in Sweden (MUSIC) (119) and Denmark (PRIM) (115). These studies could solve some of the problems surrounding the relationship between physical exposure, symptoms and clinical findings.

SYMPTOMS, FINDINGS AND PROGNOSIS OF THE SINGLE DIAGNOSIS

Wrist tendinitis/peritendinitis/tenosynovitis

Classification/diagnoses. Daily pain in the hand or wrist within the last year is reported by approximately 4% of the Danish population (22). Pain and tenderness of the wrist are common in people in heavy manual work (9). The most used non-articular diagnostic terms are tendovaginitis/synovitis, peritendinitis and tendinitis. In tendovaginitis there is swelling and perhaps increased warmth of the tendon sheaths, and in peritendinitis, crepitation is found (74). The different terms are, however, used more or less synonymously (126). Palpation pressure to elicit pain is not standardized and the reliability of clinical examinations and diagnoses has not been thoroughly investigated. This may be a minor problem in the few cases of severe tendovaginitis, but a critical one in the large number of cases with moderate pain and no definite crepitation.

Histology. Oedema and fibrin precipitation in the tendon sheaths are usually found in acute crepitating tendovaginitis in humans (58, 106). In stenosing tendovaginitis (de Quervain), hypertrophy of synovialis with fibroblast hypertrophy and increased collagen formation have been found (83, 92). It has not yet been investigated whether common pain conditions of the tendon of the wrist involve the tendon substance, i.e. tendinitis or tendinosis. Calcific tendinitis in the wrist tendons has been described but is rare (100).

Prognosis/treatment. The prognosis of the conditions has not been thoroughly studied. In a large study of tenosynovitis, most cases were reported to have improved with immobilization after a mean period of 11 days. This improvement was twice as fast as that without any treatment (58).

Epicondylitis

Classification/diagnoses. About 2% of the Danish population report having suffered daily pain of the elbow within the past year (22). The most commonly used non-articular diagnoses are epicondylitis lateralis (tennis elbow), epicondylitis medialis, bursitis, capsule/ligament lesions and nerve lesions/compression syndromes. Epicondylitis lateralis is definitely the most common diagnosis in relation to sports and work-related elbow pain (3, 102, 125). A great variety of clinical criteria for lateral epicondylitis have been used in different studies (126). However, the most used criteria are lateral elbow pain, local tenderness at the lateral epicondyle and pain during wrist extension. In a recently published manual on classification of pain conditions, however, "maximal tenderness" is specified to be 5 cm distal to the lateral epicondyle (1)! Other clinical findings, which have been used in various studies, are oedema, decreased extension and hand-grip strength, pain by pronation or supination against resistance, and muscle atrophy (126). In most studies there is neither any statement about the pressure needed to evoke pain nor any description of symptom duration. The reliability of the different clinical tests and of the diagnosis has not been studied sufficiently.

Histology. Most of the studies performed do not specify the diagnostic criteria used, nor do they use a blinded, controlled design. They are surgical studies and represent the most severe and chronic cases. The tissues that are examined are taken from the proximal part of the extensor tendons of the forearm, the tendon insertions at the lateral epicondyle and the tissue underneath the tendon.

Surgical studies have focused primarily on the extensor tendons showing signs of degeneration (tendinosis), especially in the extensor brevis tendon (34, 48, 107, 109, 124). Partial ruptures of the tendons have been described in 0–20% of cases (29, 37). No signs of inflammation of the tendons or peritendon have been found in these chronic cases. An impressive occurrence of granulation tissue was shown in only one of three studies of the tissue around and underneath the extensor tendons (21, 49, 109). In studies where decortication of the lateral epicondyle was performed, signs of remodelling and reactive changes in 30–40% of the patients and in none of the control patients were found (29, 37).

Imaging. Magnetic resonance imaging (MRI) has shown signs of degeneration of the extensor carpi radialis brevis tendon in patients before surgery (107). The MRI changes correlated with the histologic findings. In an uncontrolled study using ultrasonography, heterogeneous density of the extensor carpi brevis tendon was reported in 15 out of 41 cases of epicondylitis, which had lasted for two months (88). The value of these methods for a broader clinical or scientific application has not been clarified.

An increase in temperature of the lateral elbow shown by thermography (15, 118) may be due to altered sympathetic activity in the elbow region or to changes in inflammatory modulation, e.g. due to an axon reflex.

Prognosis/treatment. Epicondylitis is described as having a good prognosis with recovery rates of 90% during the first year (34, 70). However, other studies have found that 30–40% of the patients had severe symptoms one or several years after the first examination (16, 124). A higher remission rate has been found among middle-aged women (3). No clinically relevant effects of the many treatment forms used in epicondylitis have been documented (75, 124).

Rotator-cuff tendinitis

Classification/diagnosis. In Denmark, 6% of the adult population reported daily discomfort in the shoulders during the past year (22). There is terminological chaos within the field of shoulder pain (17). Trained clinicians often do not agree about the diagnosis when examining the same patients (11). Musculotendinous pain can be separated into pain in relation to the rotator-cuff, and pain in the muscles of the shoulder and shoulder girdle; the latter type of pain will be described in the section on muscle pain. The condition known as "frozen shoulder" and capsular lesions will not be discussed. Common diagnoses associated with the rotator-cuff are rotator-cuff tendinitis, supraspinatus tendinitis, and impingement syndrome (121). The clinical tests used when describing these conditions are examination of flexion, abduction and rotation, and local pain below the acromion during abduction or manual pressure (126). The various clinical tests are only cursorily validated. There is no consensus on clinical criteria and different criteria sets have been used in the epidemiologic studies conducted (17). "Subacromial pain syndrome" (SPS) has been suggested as the common name for these conditions (128).

Objective findings

Macroscopic anatomy. SPS has been found in association with radiographic and clinical verifiable abnormalities of the shoulder (113). It has been reported that persons with slight instability (especially athletes) have an increased frequency of SPS and a relationship between narrow subacromial space and SPS (97). This could be due to bone abnormalities such as exostoses or a hooked acromion. At operations/arthroscopy of patients with SPS, partial or complete ruptures of the supraspinatus tendon are often found. Operative and autopsy studies have suggested that supraspinatus tendon lesions can be divided into superficial (bursal), intrasubstance and deep (articular) lesions (122), the last mentioned being the most common finding.

Physiology. It has been suggested that the lesions in the supraspinatus are due to decreased blood flow, especially in the central part of the tendon, where the vascular supply is critical (28). SPS can be divided aetiologically into internal or external mechanisms. The internal mechanisms may be due to strain, age, and ischaemia (46), the external mechanism due to impingement. It has been suggested that a number of asymptomatic cases of degeneration in the deep part of the supraspinatus tendon are due to ischaemia, and that symptomatic cases are due to impingement.

Histology. A number of studies on histology of the rotator-cuff tendons in SPS have been performed, reviewed in (46). The material has mostly been obtained at operations or autopsy. Most studies have observed degenerative changes of the tendinosis type including hyalin degeneration, hypervascularity and abnormal ossification at the insertion site. Calcification of the tendons has also been found in some studies.

Imaging. It has been found that MRI is valid and reproducible for determining major lesions in the supraspinatus tendon, but minor lesions or tendinitis are less reproducible and have a weaker correlation to operative findings (45, 61, 111, 135). Some but not all ultrasonographic studies have reported results comparable with MRI in examination of tendons (25, 95). The main difference between the various studies in the value of scanning may be due to differences in the equipment used, the experience of the examiner, and the study population.

Prognosis/treatment. Because different criteria for classification as well as measures of degree of severity have been used, the few prognostic studies performed can hardly be compared. In one study it was found that half of the patients still had pain 18 months after the first examination (30). Uncontrolled operative studies have reported good results on total tendon ruptures, but a smaller effect on partial ruptures and tendinitis. A recent study demonstrated the effect of corticosteroid injection for treating subjects with pain during movement of the glenohumeral joint or movement restriction (127). A single controlled study showed a similar effect of surgical treatment and exercise training. Both were more successful than placebo treatment (23). The effects of other treatments used have not been scientifically documented.

Myofascial pain syndromes

Classification/diagnoses. Localized and regional muscle pain and tenderness of the shoulder girdle (mm. trapezius, infraspinatus, supraspinatus, levator scapula) are very common (4, 114). In the international literature the most commonly used diagnostic term is myofascial pain syndrome. This is defined by the occurrence of trigger points characterized by localized tenderness, referred pain, the occurrence of a taut band, pain recognition at palpation, jump sign and the occurrence of twitch response by a snapping palpation (120). However, no reliable diagnostic criteria for the myofascial pain syndrome have been established and there is no consensus on the use of criteria in research.

In a study of low-back muscle pain, localized pain, jump sign and pain recognition were fairly reproducible, but the occurrence of referred pain and twitch response had poor reproducibility (103). Even experts find it difficult to distinguish between trigger points and tender points, which are described in fibromyalgia (130).

Many of the patients with muscle pain do not have localized pain, but have regional pain and decreased pain thresholds (e.g. in the arm or shoulder-girdle) or “all over the body” (18, 50). Today fibromyalgia is the most commonly used diagnosis for patients with widespread chronic pain and tenderness (131). Epidemiological studies have shown that up to 10% of middle-aged women fulfil the criteria of fibromyalgia (43). Patients with fibromyalgia often complain of local pain in relation to exhaustion and many patients complain primarily of local or regional pain (14). No established terminology has been established for the regional muscle pain (50). However, it seems that reliable criteria for regional tenderness can be established (4). Most of the studies conducted patients with the reviewed localized diagnoses have not investigated whether the patients had regional or generalized pain.

Histology. Localized and regional muscle pain has been examined most thoroughly in the trapezius muscle. Muscle biopsy studies have not shown signs of inflammation as described in myositis or vasculitis or other substantial structural abnormalities. A higher frequency of so-called ragged red fibres has been found by a Swedish group (57) in biopsy studies of patients with work-related regional muscle pain; a single small study found this to be non-specific, as it also occurred in workers without pain (76).

Physiology. In persons with trapezius myalgia, a decrease in the trapezius muscle blood flow has been reported during rest (78), and exhaustion (77), and after ultrasound treatment (72). In other studies, a decreased content of ATP and ADP and an increased mitochondrial density in muscle biopsies have been found (81, 82). These findings may be related to alteration in the microcirculation due to increased intramuscular pressure or changes in sympathetic function (57). The clinical relevance of these findings is unclear.

For many years increased muscle tone or activation of the muscles has been assumed to be a cause of muscle pain, partly due to a vicious circle of pain and reflectory contraction (36, 64). Increased surface EMG activity during rest has not been observed in patients with muscle pain, and a pain-related muscle inhibition has, on the contrary, been observed when the tender muscle acted as an agonist (87). Experimental muscle lesions have also been found to reduce gamma motor neuron activity (94).

The literature is not consistent about the EMG activity in the localized tender/trigger points. Recently, increased EMG activity in trigger points was found in patients with generalized muscle pain (fibromyalgia) and tension-type headache (59). These areas were very small, approximately 2 mm in diameter, and there was normal activity outside them. It was suggested that the findings were due to increased activity in intrafusal muscle fibres activated by the sympathetic nervous system. These findings have not been documented so far.

Increased EMG activity in trigger points has been observed in relation to stress in healthy subjects and in patients with pain in the masticatory muscles and in the back (42, 91). Increased muscle activity has also been reported if motivation is increased (134). Whether the moderate increase in muscle activity can cause pain is yet unclear.

Prognosis/treatment. Muscle pain of the DOMS type recovers in 2–14 days. The prognosis for other muscle pain conditions is generally insufficiently studied. In a study of patients with severe neck/shoulder pain, it was found that the majority of patients continued to have pain 10 years later (38). However, it was not stated whether the patients also fulfilled criteria for fibromyalgia. In a recent study of patients with definite regional muscle pain primarily in the neck–shoulder region, a large proportion still had pain after 20 months' observation (56). Numerous modes of treatment are said to affect local and regional muscle pain, but the scientific documentation is insufficient.

Upper-extremity pain as a secondary phenomenon

Secondary overload. Biomechanical mechanisms may explain regional pain primarily from local pain. A lesion in the muscle tendon structure may cause direct load on agonistic muscle and tendon; e.g. a partial rupture of the supraspinatus tendon can cause an increased load on the biceps muscle and tendon (122), an increased strain on the partial agonists such as mm. levator scapula and trapezius will also result. A slight stenosing tendovaginitis will increase the strain on the contracting muscles of the forearm. Another important aspect is the coordination of the muscles. The neural control of movements will be influenced by pain and cause altered muscle activation during movements (6, 87). These changes in coordination may cause muscle pain of the DOMS type or tendon pain due to slight tendinitis/peritendinitis.

Neurogenic mechanisms. The classical description of the diagnoses mentioned in the introduction is based upon an assumption of pain to be nociceptive, which indicates that pain is caused by tissue damage/dysfunction outside the nerve tissue (1). Another point of view is that the symptoms are primarily due to neurogenic mechanisms. Neurogenic pain is pain initiated or caused by a lesion or a dysfunction in the peripheral or central nervous system (1). A peripheral tissue lesion may cause a decrease in pain thresholds in the peripheral tissue (primary hyperalgesia) and in the surrounding tissue structures (secondary hyperalgesia), because of a number of biochemical changes taking place at both the peripheral and the spinal level (27, 93). Studies have shown signs of increased neurogenic inflammation in patients with regional muscle pain and fibromyalgia, suggesting the pathophysiological relevance of this mechanism (55, 86).

Muscle pain may also be due to neuropathy as observed in relation to cervical nerve lesions resulting from a herniated disc or osteophytes. Entrapment of peripheral nerves can also occur at a number of other peripheral locations (e.g. scalenus anterior, pectoralis minor, pronator teres, supinator, ulnar tunnel, carpal tunnel). Whereas a reduction in nerve conduction velocities can often be demonstrated in the latter, rather rare, condition, nerve conduction abnormalities are said to be absent in the majority of cases of thoracic outlet syndrome (51). In these cases the diagnosis is solely dependent upon clinical symptoms and a positive Tinel's test. MRI may be of relevance in evaluation of the entrapment syndromes (13).

It has also been suggested that muscle pain can often be due to neuropathy of small peripheral nerves (108), but there is no strong evidence to support this view.

Joint dysfunction/vertebral syndromes. In association with pain from organs or muscle, referred pain is often observed in other areas (67). This is probably due to convergence of pain pathways at the spinal level (94).

Distension of specific cervical zygapophyseal joints has been shown to cause referred pain and tenderness in specific muscle regions of the neck and shoulder, and pain can often be relieved by anaesthetizing the joint (19). These mechanisms might be involved in a large proportion of neck/shoulder pain in particular. The reliability of possible clinical findings other than joint tenderness is poor, however (60). The pathophysiological mechanism behind the decreased mobility might solely be increased muscle activation (51).

Psychological factors. The perceived exertion, complaints of pain and decreased pain thresholds are related to psychological, cultural and social factors (69, 80, 99). The temporal relationship between psychology and pain has not, however, been studied in any great depth (89). The individual stress reaction may be relevant for pain in at least two important ways. First, acute stress may cause increased muscle tension, as described above, regarding muscle pain. Secondly, stress induces numerous central-nervous and neuroendocrine alterations, which may influence pain modulation (32). Abnormalities in related neurotransmitter systems have been documented in fibromyalgia, chronic fatigue syndrome and related conditions that suggest central nervous mechanisms to be of major importance (20, 101, 112). Whether these factors are of importance in local or regional pain is unknown.

Recently, it has been stated that using diagnoses and treatment on patients, where the pathology is uncertain should be avoided as this tends to make the subject obsessive about the pain problem (2). This point of view is partly based on an increase in sickness reports and absence resulting from pain despite considerable ergonomic improvements at the workplace.

Correspondingly, the Australian experience suggests that reported work-related pain and sickness in the workplace depend on the social compensation and the public focus on the problem (84).

Patients with generalized pain usually complain of fatigue and many other unspecific somatic or dysfunctional symptoms (18, 73, 129). It has been reported that the subjects with regional pain also may have such complaints (85, 129). In some cases alternative diagnosis such as "somatization disorder" or "general somatic distress" would to a higher extent embrace the whole spectrum of symptoms reported by the patients.

CONCLUSIONS

It is evident that there are serious problems regarding the validity of the current classification of the conditions. Clinical criteria are often poorly defined and do not include time duration. It would, however, be a simple matter to discriminate between the acute "exercise reactions", which disappear within a few weeks, and the chronic cases. The reliability of the clinical signs and the diagnoses has for many reasons not been sufficiently examined in any of the conditions. In relation to the tendon-related diagnoses, the pathoanatomical mechanisms such as tendinitis, peritendinitis, tendinosis, calcification, bone remodelling at insertion, partial rupture, partial avulsion at the musculotendinous junction or at the bone insertion are essentially different. These reactions/tissue lesions may differ in severity, ranging from very slight inflammation to severe damage and ruptures. The relationship between histology and clinical findings has rarely been studied, but nevertheless, a pathoanatomic definition is often used in the diagnostic designations. The mechanism and importance of the chronic degenerative changes in the tendons in tendon-related pain is unclear. It is also unclear which physical loads are likely to cause tissue inflammatory changes and/or degeneration in and around the tendons, and their relationship to physical capacity and age-related changes. MRI, ultrasonography and arthroscopy are new and promising methods for evaluation of tendon and connective tissue structures, but the relationship between these and the various clinical findings is only at a preliminary level.

A generally accepted terminology is lacking, especially in the muscle pain conditions. These conditions are probably pathogenetically very complex, involving peripheral (musculotendinous and articular) and neurogenic (peripheral nerve, spinal modulation, psychological/supraspinal) factors to a varying extent in different subjects and to a varying degree in the individual subject at different points in time. At the aetiological level, physical exposure, psychosocial factors and age-related changes may differ in importance. Basic research in the study of these factors and their interaction is thus needed.

From a pragmatic point of view a simple phenomenological classification of the pain according to duration and area of distribution seems more honest (18) (Table II). A combination of history and specific local clinical findings should establish the local conditions. If regional tenderness is observed, the pain should be classified as regional (e.g. regional elbow pain, e.g. regional neck–shoulder pain). If paraesthesia in the hands is reported, a careful examination for neuropathy and entrapments including muscle atrophy should be performed. If pain is

Table II. *Clinical classification*

Duration	Area of distribution	Diagnostic terms	Subdivision or confirmation by
Acute	Localized tendon	Acute peritendinitis/tendinitis, tendon tears	MRI, ultrasonography, arthroscopy, biopsy
	muscle	Acute muscle strain	
	Regional	Delayed onset muscle soreness	
	Nerve related	Entrapments	Neurophysiology, MRI
	Joint related	Vertebral dysfunction, distortion	Clinical tests
	Generalized	Acute somatic disease, overtraining	Blood tests
Persisting	Localized tendon	Tendinosis and/or tendinitis	MRI, ultrasonography, arthroscopy, biopsy
	muscle	Trigger points	
	Regional	Regional fibromyalgia/myalgia	
	Nerve related	Entrapments	Neurophysiology, MRI
	Joint related	Vertebral dysfunction, joint disease	
	Generalized	Somatic disease, fibromyalgia	Blood tests, biopsies

Acute can be defined as pain lasting for less than one month.
Localized can be defined as local or regional pain, specific local tenderness and/or pain during contraction, movements or stretching.
Regional syndromes can occur secondary to local pathology.
Joint related can be defined as joint tenderness and passive movement restriction.

reported in several regions (e.g. more than three), a palpation of the general pain hypersensitivity/tenderness can confirm whether the patient has a generalized pain condition (e.g. using the ACR fibromyalgia criteria).

There are no generally accepted/validated criteria for the evaluation of degree of severity for any of the studied conditions. Grading for severity of pain should be based upon self-reported scoring of pain in regions (hand, elbow, shoulder, neck) and function, and clinical signs as tenderness/pain thresholds and function tests. Function tests can be performed either as complex movements or by muscle contractions of specific muscle groups (e.g. hand dorsal flexors), the outcome parameter can be either pain during contraction or muscle strength. This type of scoring might also be used for establishing standardized criteria for classification for research purposes.

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