

WORK RELATED UPPER LIMB PAIN SYNDROMES
- ORIGINS AND MANAGEMENT -

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JM Harrington
J Hancock
D Gompertz
A Spurgeon

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1 BACKGROUND

Work related musculoskeletal disorders form the largest category of work related illnesses in Britain by a wide margin. Estimates vary of the actual toll on health depending on the source of the statistics¹. A limited number of these disorders are prescribed for compensation under the Industrial Injuries scheme. The restriction of benefit to those with at least 14% disability greatly limits the value of these statistics but around 1000 new cases of tenosynovitis are assessed each year of which about a quarter receive benefit. Some cases now receive compensation for carpal tunnel syndrome (CTS) in association with occupational exposure to vibration and about 40 cases for cramp of the hand or forearm. The numbers of cases are increasing, partly due to increased awareness of the possible work related nature of these conditions. Surveys of general practitioners suggest that at half of the cases of CTS they see are caused or exacerbated by work or interfere with the capacity to work. Extrapolations from the survey suggest 20,000 work related cases of CTS per year. Figures from the Labour Force Survey² suggest that 880,000 individuals believe that their musculoskeletal disorders are caused or made worse by work. A further 74,000 complained of "RSI" (repetitive strain injury) with the vast majority of cases confined to the upper limb and most of those to the hand, wrist and forearm.

RSI is, however a misleading term and the Labour Force Survey figures cited above may well be an overestimate of the problem. Nevertheless, work related upper limb disorders cover a range of disorders of the hand, wrist, arm, shoulder and neck which include some supposedly well defined conditions such as carpal tunnel syndrome, tenosynovitis and epicondylitis as well as some less defined syndromes such as shoulder girdle problems.

Whilst there is little doubt that in relation to repetitive work or sustained posture some of the conditions are biologically plausible and therefore at least intuitively could be construed as work related, considerable confusion and controversy surrounds all aspects of work related upper limb disorders.

The purpose of this workshop was to bring together various authorities in this area including - epidemiologists, ergonomists, occupational health professionals, psychiatrists, hand surgeons and muscle physiologists, in

order that their research and their opinions could be heard in a single forum. The aim of the -workshop was to find out what was known both scientifically and clinically about the occurrence, origins, and mechanisms of these syndromes as well as their clinical management. By the same token, such a discussion should enable the group to confirm what is not known and to indicate what might be practical and potentially fruitful avenues for future focused research.

The papers available to the participants consisted of a mix of review articles, seminal research publications and papers produced by speakers specifically for the meeting. Selected contributions are presented in Annex 3. The structure of the two day workshop is detailed in Annex 1 and the list of participants in Annex 2.

The text that follows is a synoptic view of the workshops grouped into two main categories:

- * occurrence, origins and mechanisms (aetiology & pathogenesis)
- * clinical management

The report concludes with pointers for research priority setting discussed in the final session (reference to these Research Priorities is made throughout the text).

For its part, the Health and Safety Executive recognises the need for increased industrial awareness of this problem. However, in a time of financial restraint, future research funding must be geared to investigating agreed areas of concern and the projects developed to address these areas must be firmly rooted in research which, if successfully executed, would lead to practical solutions to diminish the current high level of workers' complaints of upper limb pain and discomfort.

2 OCCURRENCE, ORIGINS AND MECHANISMS

2.1 Origins and Occurrence

From the point of view of the clinical-epidemiologist, workers' complaints of upper limb disorders vary from readily diagnosable conditions such as carpal tunnel syndrome (CTS), tenosynovitis, peritendinitis and epicondylitis to ill defined regional pain disorders particularly those associated with the neck and shoulder. Most epidemiological studies have concentrated on specific tendon or nerve disorders. Many of the major contributors to the epidemiologic and ergonomic literature on upper limb disorders contributed to and still support the conceptual model for the pathogenesis of these conditions proposed in a paper by Armstrong et al in 1993 (Annex 3).

The authors explain that this model contains sets of cascading exposure, dose, capacity and response variables, so that response at one level can act as dose at the next.

CTS is by far the most commonly studied disorder and the recent (1992) review of Hagberg et al summarised much of this literatures. It is interesting to note there are no longitudinal studies of the role of physical factors in the aetiology of CTS, thus many of the published reports are of survivor populations which will tend to diminish the associations observed.

Notwithstanding this, a high risk of CTS has been reported for a number of occupational groups. These studies are, in the main, consistent in reporting exposure/effect risk factors such as force, repetition, vibration and work with a flexed or extended wrist. Inconsistent results are found for some non-neutral wrist postures and pinch force. There are no properly designed epidemiological studies for other nerve entrapment disorders.

Despite the consistency in the literature on cross sectional and case control studies for CTS, little is known about exposure effect, induction time, prognosis and the effects of interventions such as surgery.

For tendinitis, case reports have appeared from the early part of this century linking such conditions with work. Yet well designed epidemiological studies are few and far between. Cross sectional studies

have shown the risk factors for the wrist and hand to include repetition and force. While certain strenuous manual tasks using the upper limb seem to be clearly associated with- tenosynovitis as well as peritendinitis of the wrist and forearm, the role of these factors is known only in qualitative terms. Little is known about exposure effect relationships, the role of fatigue or unaccustomed work or even cold conditions.

The results of studies of epicondylitis are conflicting - some showing an effect of strenuous work whilst others do not.

Finally, little is known about the role of individual factors in the aetiology and pathogenesis of these upper limb disorders although they certainly play an important part. Such factors include age, gender, individual anatomical variation, -previous trauma and psychosocial factors at work and at home.

So far as neck/shoulder syndrome are concerned, there are very few good studies. Some good evidence exists linking them with working with the hands at or above shoulder level and with fine hand manipulations requiring static loading of the shoulder to hold the upper limb in place.

Nevertheless, using Bradford Hill's⁴ nine criteria for assessing whether an association is likely to be causal (strength, consistency, specificity, time relationship, biological gradient, plausibility, coherence, experimental evidence and analogy), many of the better designed studies fall well short of providing conclusive evidence of a causal relationship between work practice and upper limb disorder. Furthermore, studies often suffer from severe design faults such as failure to account for confounding factors, the use of inadequate measures of exposure such as job titles (rather than measurements of job activity) and failure to allow for non-occupational activities (such as leisure or home activities). Two recent books are good summaries of current **knowledge**^{5,6}.

For the future, there is an urgent need for agreed case definitions for the various upper limb syndromes and a need to understand not **only** of what the worker is complaining but also what exactly the worker does on that job (Research priority **A3,A2**). Other needs include a better understanding of the chain of events from fatigue to disorder to impairment and then disability. Too little attention has been paid to the thorough investigation

of natural experiments in industry where jobs change for occupational reasons and where opportunities for “before/after” studies are missed [Research Priority A5]. Too little is known about the influence of psychosocial factors [Research **Priority B5**] and although studies are appearing that emphasise their importance virtually nothing is known about induction/latency time for the development of these disorders [Research **priority B2**].

2.2 Mechanisms

A key element in developing preventive strategies for work related upper limb disorders is understanding the nature of the initial damage and the tissue reaction to that damage. Assumptions have been made by the epidemiologists about workers’ complaints of pain and discomfort and where the site might be for the tissue damage which is presumed to lead to the symptoms.

For muscle, for example, it is extremely difficult experimentally to induce lasting damage. Excluding direct trauma, such as cutting or tearing, skeletal muscle can be damaged by stretching, metabolic depletion and so called cramp. Delayed onset muscle pain is familiar to everyone 24-48 hours after unaccustomed exercise. Training will diminish this effect leading, eventually, to less pain for the same degree of exercise.

Whilst this pain following unaccustomed exercise can be shown to be associated with local inflammation at cellular level, recovery is rapid (within days) after even quite severe inflammatory change. Muscles can be stretched experimentally in order to induce severe muscle fibril damage but, again, recovery is rapid and usually complete. Some activities, such as painting a ceiling can induce ischaemia in muscle with pain associated - at least partially - with the build up of metabolic products such as free radicals. Yet muscle is extremely resistant to ischaemic damage requiring 4-6 hours of ischaemia to produce histological evidence of injury. Even then, recovery is rapid and repair usually complete. Cramp is associated with electrically active muscle and is usually precipitated by tensing a muscle in its shortened position. Pam correlates with the electrical activity and recovery is usually rapid and complete.

In short, it is difficult from studies of the physiology of muscle to equate workers' complaints of muscle pain with long term muscle damage. The same may not be true of tendons [*Research Priority B4*]. Tendons (and their associated connective tissues) have a less ample blood supply than muscles and they are slower to heal following injury.

Nevertheless, while it seems clear that the initial workplace activity must involve some mechanical stress to the limbs, there would seem to be little knowledge of the forces generated in muscles, tendons and articulating surfaces. Correlating these measures with the occurrence of clinical problems could be a fruitful area for future **research**⁷. The physiological and biochemical processes involved in injury and **inflammation** of muscle and tendon are poorly understood⁸ [*Research Priority B4*].

Indeed, knowledge about generation and perception of pain has undergone much change in recent years. The old, and simple, model was that pain was mediated from peripheral nociceptors via the **A δ -C** fibre nerve pathways for physiological pain. In addition there is pain associated with actual inflammatory damage and with neuropathic causes.

Recent work by Woolf and others (Annex 3) suggests that chronic pain may be different from acute pain due to an increased sensitivity to pain stimuli both centrally and peripherally. This appears to be due to the activation of low threshold mechano-receptive **A β** fibres that normally generate innocuous sensations. This marked alteration in sensory processing is due to three distinct processes - increased excitability, decreased inhibition and structural reorganisation. All have been demonstrated experimentally and separately, or in concert, they may be underlying factors in a range of chronic inflammatory or neuropathic disorders. Understanding the mechanisms should lead to more appropriate analgesic regimes by developing specific pharmacological agents to block some of these mechanisms [*Research Priority B3*]. Such hyperalgesia syndromes might underpin a number of conditions which, at present, are often resistant to current therapeutic strategies. These might include irritable bowel syndrome, migraine, some forms of arthritis, and, perhaps, some of the pain syndromes associated with work related upper limb disorders.

A further mechanism that may be at work in these disorders is the role of the patients' psychological reaction to workplace events. There is a school of thought that the symptoms of work related upper limb disorders lack any physical or physiological basis. Whether this is true or not, the psychological aspects of physical symptoms cannot be ignored and may indeed play an important part in work related upper limb disorders [Research priority B5].

Mayou et al⁹ have proposed a multi causal model which describes the interaction between biological, psychological and social factors which, in concert may influence the experience as well as the reporting of symptoms. Central to this model is the relationship between an individuals' perception of a bodily change and the interpretation of such a change where the change is perceived as indicative of disease. This may be translated into symptom reporting and medical advice may be sought.

Certain personality traits, such as "negative affectivity" (Watson and Pennebaker¹⁰) have been shown to be associated with higher lifetime rates of symptom reporting. Other predisposing factors include the individual's knowledge, beliefs and attitudes towards illness. These factors themselves can be augmented in their eventual outcome as symptoms by the reactions of others who experience similar workplace (or environmental) exposures as well as the reactions of friends, family, medical advisers, lawyers and the media. A resulting outcome has been the reporting of an increased prevalence of non specific symptomatology following a number of workplace or environmental exposures. An HSE sponsored workshop reviewed this phenomenon recently and a summary of the workshop is included in Annex 3.

2.3 Psychosocial factors

The influence of psychosocial factors on the pathogenesis of work related upper limb disorders has been alluded to earlier but these factors need to be reviewed as an entity as well as in their relation to physical factors. The current state of research on psychosocial factors has been reviewed by Toomingas (Annex 3).

In the first place, such factors need to be distinguished from the characteristics associated with the individual worker. In relation to

musculoskeletal disorders, the most common variables to be considered are:

- (i) Psychological and mental demands, work load, time pressure; concentration and responsibility;
- (ii) Control over work situation and autonomy;
- (iii) Quality of work content, monotony, stimulus from work itself;
- (iv) Social support from management and co workers;
- (v) Clarity of work duties, responsibilities and relationships with others.

Work in this area is usually viewed in the context of the “demand, - control - support model” of Karasek and Theorell 1. Whilst published studies of the influence of psychological factors at work are increasing these factors are frequently difficult to quantify. Consensus is needed in order to define more accurately these factors as until this is done, measurement of their influence will remain problematical - whether it concerns factual organisational issues or social work characteristics [Research Priority B5].

From the work undertaken so far, there is emerging some degree of consensus on the association of psychosocial factors with work related upper limb disorders. Such studies have concentrated to a large extent on neck/shoulder syndromes and less on hand/arm complaints. There appears to be some epidemiological support for a statistical association between poor self related psychosocial work conditions (mainly high psychological demand and low support) and the prevalence of shoulder/neck pain. However, data linking such factors with the hand and arm are sparse and conflicting. Nevertheless, most of the studies are cross sectional in design and concern self reported conditions and symptoms. Whilst the statistical association between common psychosocial factors and neck/shoulder symptoms are of the same magnitude as those for physical load, few studies have attempted to measure the interaction between the two.

If the effects of psychosocial factors are real, what are the possible mechanisms for such a relationship? A common theory is that pain can be secondary to frequent or long lasting muscle tension or occur after sustained static contraction. The hypothesis of psychogenic muscle

tension is, however, not proven and the mechanisms if they exist are poorly delineated. Indeed there appears to be little evidence that work on psychosomatic causes of pain have been reviewed in the light of current knowledge of muscle physiology or organic pain generation. By the same token, fundamental research on muscle or tendon damage as well as the pathophysiology of pain has rarely considered the whole person and the possible influence of psychological factors in the perception of that damage or its resulting symptoms and signs [Research *priorities* J33, B4, B5].

Clearly there is a need for these two groups of researchers to collaborate on interactions between these areas of interest. If, for example, reported unfavourable psychosocial factors were causally related to neck and shoulder problems, then preventive action should be feasible - and more importantly - testable in controlled trials. (Some have even questioned whether the distinction between physical and psychosocial factors is a useful one). Many occupational groups appear to have the same complaints but their work situations, both physically and psychosocially, are often widely divergent - for example, journalists on the Financial Times and chicken processing operatives.

It is clear that the measurement of exposure variables for work related upper limb disorders have, in the past, concentrated too much on "soft" exposure estimates such as self report by questionnaire and too little on objective observation of the task and direct measurements of the work.

For the future, there is a need for more carefully designed studies of postural behaviour and fatigue as well as the influence of stress on musculoskeletal problems. To do this, it is first necessary to standardise the terminology, develop objective measures, where possible, and delineate such measurable factors before commencing the studies [Research *Priorities* AZ, A3]. Because these conditions develop with time and may be modulated by factors which come into play during the process, longitudinal studies are essential. Using longitudinal prospective designs, it should also be possible to generate testable preventive strategies [Research *Priority* A1]. Other reasons for longitudinal studies are the difficulty in assessing exposures retrospectively and the problems in cross sectional studies of selection bias as well as difficulty in distinguishing cause and effect.

At the same time, a more meaningful dialogue needs to be developed between the epidemiologists and ergonomists on the one hand and the muscle physiologists and pain researchers on the other. There is much in each area of research which could enlighten the other and perhaps act as the spur to new research questions. At present, little dialogue seems to take place at all.

2.4 Overview

The distinction between occupational and work related conditions is unhelpful for epidemiological purposes. Both terms imply a job-related **aetiology** - for which there is epidemiological evidence for many upper limb disorders. In managing the individual case implied aetiology should not be inferred without a clear definition of the workplace factors (exposures) and confirmation of the diagnosis (outcome).

There is good evidence for 'job-relatedness' in shoulder and hand/wrist tenosynovitis, carpal tunnel syndrome, hypothenar hammer syndrome and tension neck syndrome. The evidence for epicondylitis is less consistent. Many conditions do not fit into recognised diagnostic categories: it is important that they are not mislabelled. Force and repetition have emerged as the strongest risk factors for work related upper limb disorders. Extreme postures, vibration and cold have also been identified as important. Psychosocial factors, including paced work and organisational culture appear also to play a part.

Studies of muscle and tendon have identified that tendon injury is likely to account for most structural damage in upper limb disorders: this may result from disruption of the blood supply to tendons. The intimate perifibrillary association of tendon with muscle may explain the mis-attribution of pain to muscle rather than tendon.

Studies of pain mechanisms have shown that central sensitisation can produce chronic pain after resolution of peripheral inflammation and, lead to production of pain through stimulation of non-nociceptive modalities, (eg light touch) with referral to the area surrounding the initial injury.

Psychological factors may facilitate central sensitisation through disinhibitory mechanisms; psychological disorders are clinically

associated with musculoskeletal pain in the manifestation of somatiform symptoms. Psychological stress producing muscle tension may contribute to abnormal postures.

Most epidemiological study designs have been cross sectional, and, therefore, subject to the limitations of selection (healthy survivor) effects and the under representation of acute effects which might lead to withdrawal from the workforce. Case control studies are limited by accuracy and consistency of diagnostic category and, more importantly, by the retrospective nature of the exposure assessment. Overall there is a need for more longitudinal prospective studies which should be relatively easy, in epidemiological terms, due to the high incidence and relatively short latency for most work related upper limb disorders. Such studies would also allow intervention studies to be designed for measurable outcomes.

There is a clear need for uniformity of diagnostic criteria (response) between research groups, more accurate measurement of physical and psychological factors (exposure) and thereby clarification of exposure response relationships.

Response needs to be standardised in terms of case definition: this requires knowledge of the distribution of diagnostic criteria in the general population and repeatability of diagnostic methods. Diagnostic criteria are relevant to clinical medicine; differing case definitions may be more relevant to aetiological studies. It would be useful to measure response on a scale of fatigue - structural damage (impairment) - disability: this would require further studies on mechanisms of fatigue and injury in muscle and tendon - preferably in collaboration with the physiologists.

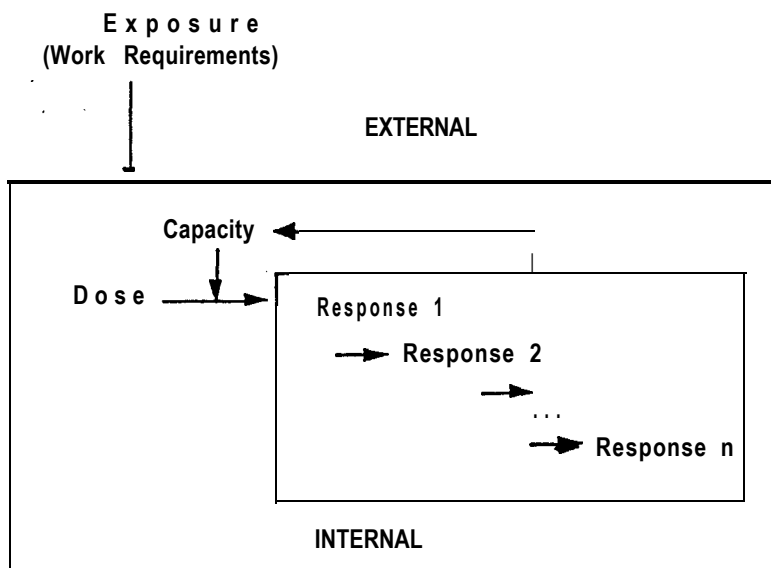
Exposure can be assessed on a scale of precision ranging from job title, questionnaire about work activity (self administered) and interview about work activity, to direct observation and measurement. There is a compromise between detail and reliability versus expense. Monotonous work (a psychological factor) needs to be distinguished from work involving repetitive movements (a physical factor): 'monotonous' and 'repetitive' are often incorrectly used as synonymous terms. Studies need to include the frequency, duration and intensity of physical loads

accurately to identify repetitive movement and forceful exertion and thereby -produce an exposure index for assessing exposure-response relationships. Force can be measured by dynamometry and posture by goniometry. It may also be important to measure activity outside the workplace. Psychological loads should include measures of monotony, autonomy and pressure of time restrictions and production needs (work pace).

Because of the limitations of study design, misclassification of response and inaccuracy of exposure measurement the true relationship between workplace risk factors and observed upper limb disorders could well have been underestimated in previous studies.

Finally, the factors and processes involved in work related neck and upper limb disorders have previously been described in a model derived through consensus agreement (Annex 3 & Figure). Inserted between exposure and response are dose (workplace factors actually disturbing the internal state of the individual) and capacity (the physical and psychological resistance of the worker to dose effects). Responses may *then* act as doses in cascade (feedback) mechanisms; for example, connective tissue thickness as a response to physical stress (dose) can then lead to nerve entrapment (response).

Figure



From Armstrong et al, 1993
(Annex 3)

3 CLINICAL MANAGEMENT

The preceding review of epidemiology and pathogenesis of WRULDS developed the background against which current therapeutic approaches **should** be viewed. Although there is a large body of information relating ergonomic studies of the workplace to WRULDS and some good quality (mainly cross **sectional**) epidemiology, there is inadequate knowledge of the aetiologies and natural histories of these conditions and this is compounded by a lack of agreement on diagnostic categories [*Research priority A3*]. However cross-sectional studies such as the Labour Force Survey show that a large number of people are complaining of upper limb **pain** and a proportion of them present themselves for clinical support, ie diagnosis and treatment. Against this background, it can be seen that most therapeutic approaches can only be empirical. Where there is a specific anatomical diagnosis such as CTS, treatment options are relatively clear cut but even so there is a lack of formal evidence for the indications for surgery and the longer term outcomes associated with each type of treatment [*Research priorities A3, B2*]

Many patients with upper limb pain conditions do not fit into the accepted diagnostic categories and there is evidence that a range of psychosocial factors affect the presentation and persistence of these pain syndromes. Awareness of these problems does not **help** an individual practitioner faced with a patient presenting with an upper **limb** problem. The number of diagnostic approaches (radiography, diagnostic ultrasound, **arthrography**, magnetic resonance imaging [**MRI**]) and the range of therapeutic options (steroid injections, physiotherapy, surgery) available are limited but so is the formal evidence on which to base treatment [*Research priority A5*]. The diagnostic labels attached to individuals and the treatment approaches are often dependent upon the initial and subsequent referral pathway.

In short, there is inadequate evidence available to establish agreed treatment regimes.

3.1 Treatment Options

Although a large proportion of patients suffering from upper limb pain syndromes will be treated in a primary care setting and will not be referred on for specialist treatment, a view of the treatment options can best be obtained from specialist practitioners who see enough patients to

evaluate different approaches. An outline of treatment options **from** such a perspective aids assessment of the various contributions that can be made by primary care -physicians;- physiotherapists and surgeons and the possible role of occupational physicians in the diagnosis and treatment activities. Such an outline for some **WRULD's** is presented below, (Cooper C . Workshop paper).

(i) The Shoulder ^(Refs. 12-17)

The major causes of shoulder pain are disorders of the rotator cuff (chronic tears and tendonitis), bicipital tendonitis, capsulitis, acromioclavicular dysfunction, glenohumeral arthritis and referred pain from cervical spondylosis. It is usually possible to differentiate between these entities on the basis of **the** history and physical examination. In some instances, further diagnostic tests are required, most usually plain radiography (for evidence of calcification or cartilage thinning). Diagnostic ultrasound and arthrography have generally given way to MRI for more **difficult** situations.

The treatment of rotator cuff tendonitis is often difficult. Rest and modification of aggravating activities are necessary to prevent the problem becoming chronic. Initial treatment should be directed at reducing inflammation by means of physical therapy (for example ultrasound) and a non-steroidal anti-inflammatory agent. If symptoms fail to settle by **these** means, a subacromial injection of corticosteroid is useful. Once **the** pain has reduced and normal shoulder movements have been restored, a muscle strengthening exercise programme should be instituted, concentrating on rotator cuff exercises. Failure to respond to a conservative programme within around a year is a reasonable indication for surgical repair of the rotator cuff and release of acromial impingement.

Many therapies have been tried to modify **the** natural history of adhesive capsulitis of the shoulder joint and clinical studies have been compromised by the difficulties with patient selection, diagnostic criteria and the variability in natural resolution of the disorder. Anti-inflammatory drugs provide limited relief of pain but do little to alter the course of the disorder. Physiotherapy, using modalities such as **megapulse**, reduces protective muscle spasm, but the mainstay of treatment remains **intra-articular** corticosteroid injection which has been

shown to improve pain and range of movement in the short term. It has been harder to demonstrate that any of these **modalities** has a long-term benefit in this disorder. Manipulation under anaesthetic has been advocated as a means of restoring joint motion, but long-term recovery **appears** unchanged following this manoeuvre.

Carefully directed corticosteroid injections **also** comprise **the mainstay** of **treatment** for acromioclavicular joint dysfunction, bicipital tendonitis and subacromial bursitis. Again, controlled trials demonstrating long term benefit are not yet available.

(ii) The Elbow ^(Refs. 18-22)

The major work related elbow disorders are lateral and medial epicondylitis (tennis and golfer's elbow respectively), olecranon bursitis, entrapment neuropathy and referred pain from cervical and shoulder disease. Over 40 treatment regimens for lateral epicondylitis have been described in the literature, ranging from the extremes of prolonged observation to radiotherapy. Reduced activity may result in resolution of symptoms in a few patients and may be effective in early cases, especially with some form of splinting. A simple sling can be used but is unlikely to be effective as the forearm is usually held in position with the wrist flexed. A plastic brace may be helpful, but **immobilisation** in plaster is not usually required. Non steroidal anti inflammatory drugs (**NSAIDs**) are often used but evidence for their efficacy is tenuous. Numerous physical modalities of treatment have been used including ultrasound, which by its ability to cross **myofascial** planes has theoretical advantages, as well as laser therapy. A double-blind controlled trial has been confirmed an advantage for pulsed therapeutic ultrasound. Local injections of **corticosteroid** have also been used widely, but long term response to such therapy remains uncertain. Up to 10% of patients fail to respond to physical therapy and injections. Surgical intervention, including a lateral release procedure, should be considered in these subjects.

(iii) The Wrist and Hand ^(Refs. 19, 23-26)

Several disorders can give rise to wrist and hand pain, but most noteworthy in the context of occupational use are De Quervain's **tenosynovitis**, trigger finger and carpal tunnel syndrome. De Quervain's **tenosynovitis** presents as a repetitive strain injury due to chronic over use of the wrist and hand. It may also occur in association with rheumatoid

arthritis and other inflammatory polyarthritides, direct trauma and **pregnancy**. The diagnosis is most easily confused with osteoarthritis of the thumb base, but radiological assessment assists in this differential **diagnosis**. The treatment consists of local heat, non steroidal anti-inflammatory drugs, and wrist and thumb immobilisation by thermoplastic splinting. In patients with severe or persistent pain, one or more local corticosteroid injections can be helpful, giving complete and lasting relief in about **70%** of patients. Surgical decompression of the **first** extensor compartment with or without tenosynovectomy is indicated in those with persistent symptoms lasting longer than 6 months.

Trigger finger is the result of tenosynovitis affecting the flexor tendons of the finger or thumb. The resulting fibrosis and constriction lead to obstruction of the tendon's motion at the first annular pulley which overlies the metacarpophalangeal joint. The most common cause of trigger finger is overuse of the hands from repetitive gripping activities. Management consists of modification of hand activity, local heat treatment, gentle exercises and NSAIDs as required. One or more corticosteroid injections to the **affected** flexor tendons are curative in the majority of patients. Surgical transection of the fibrous annual pulley is rarely required.

The specific treatment of carpal tunnel syndrome depends to a large degree on whether there is an identifiable cause of the entrapment. Conservative measures may suffice when symptoms are of short duration. Repeated electromyographic determinations, done over time, may help the clinician determine the correct therapeutic approach. Other measures which are known to be of benefit include splinting, local corticosteroid injection during the first year of symptoms, the use of NSAIDs and, finally, surgical release.

The evidence that is available for the usefulness of various treatments usually relates to short term improvement and there is clearly a need to demonstrate the long term benefit of these treatments using controlled trails of adequate design [Research priorities **A5, B2**]. Such trials must reflect the occupational environment in which the pain syndrome developed and the effects of ergonomic interventions instituted during the trial period.

This brief review of treatment options is clinically based and does not consider the effects of changing the occupational and psychosocial factors that affect the underlying condition or the extent to which it disables. [Research priority B5].

3.2 primary Referral

The clinical management of a patient complaining of work related upper limb pain usually starts with a self referral to either the patient's general practitioner or the occupational physician at work or both. Secondary referrals affect a small fraction of this group and are usually to a physiotherapist or surgeon. The "first time" practitioners do not necessarily view these conditions as specific work-related conditions whilst the patient's perception can already be influenced by psychosocial factors at work as well as the individual and peer influences. Frequently, it seems, this can also be the start of management problems with a combination of "misdiagnosis", "mistreatments" and "misreferrals". A label of "repetitive strain injury - RSI" at this stage can lead to amplification of the original complaint and general practitioner needs to acquire knowledge and skill to handle their patients if problems are not to be compounded for the future [Research priority B5].

Despite the large numbers of individuals cited in the Labour Force Survey as perceiving their musculoskeletal problems to be work related, the average general practitioner will probably see few such patients in a year. There are no satisfactory studies of how these individuals present to their general practitioner, what diagnostic labels are attached to them, the effects of early treatments (anti inflammatory drugs, steroids, Physiotherapy), nor the various outcomes including return to full function and normal working [Research priority 2351].

3.3 Physiotherapy^(Refs. 27-29)

This particular therapeutic approach is much involved in the management of upper limb disorders. Although various treatment regimes have been used, few have been evaluated formally. A survey of treatments of epicondylitis (Robertson S.- this workshop) showed that few evaluations were satisfactory and those that were could not be used as a basis for recommending treatment options. Such treatments are often used in conjunction with medication, such as steroids or non-steroidal anti inflammatory agents, psychotherapy or "alternative" medicine such as

acupuncture or Tai Chi. One additional manoeuvre which is in vogue both diagnostically and therapeutically is the upper limb tension test (also known as the brachial plexus tension test or Elvey's test). Some consider this test to be valuable on both scores but the validity and repeatability of the test for diagnosis and its contribution to treatment require further evaluation.

Indeed, despite the general perception that physiotherapy of one sort or another is a beneficial factor in the management of work related upper limb disorders, carefully designed clinical trials are few and far between, [Research priority A5]. Of the well designed ones, the results frequently show little or no difference between the treatments and placebo management. There is the suggestion that physiotherapy confers benefit more through countering chronicity from immobilisation rather than in the acute specific disorders where functional recovery may occur equally as well from rest alone [Research priority A5].

3.4 Surgical Treatment

There is a considerable gulf between the diagnostic labels used by the clinical epidemiologists for populations and the stricter anatomical criteria used by the surgeons on an individual basis although for some conditions such as CTS there is little disagreement [Research priority A3]. The surgeon inevitably sees a small proportion of the cases who refer themselves to the general practitioner or occupational physician - who themselves only see a fraction of the total who have problems. The occupational causation may not be obvious as far as the surgeon is concerned and does not necessarily affect the treatment options. This was reflected in the review of 186 patients with a diagnosis of CTS from one health authority (Southern Derbyshire Health Authority, Burke F - this workshop)³⁰.

This review showed that by the time of the first out-patient appointment with a tentative diagnosis of CTS, several months may have passed since the patient first appeared at the general practice. The original symptoms in those continuing to go forward for secondary and tertiary referral will, by definition, be persistent and may well have worsened. This selection effect ensures that the patients reviewed after surgery are a special group and that the benefits to be seen from surgical decompression can not easily be related back to original population. Furthermore, as most of the

surgeons see only the more severe/chronic cases, study of these cases adds little to the knowledge of the natural history of these conditions and thus the benefits of treatment are largely unproven [*Research priority B2*].

3.5 The Role of the Occupational Physician in Clinical Management

Although detailed dose-response relationships are not yet available from ergonomic studies on an epidemiological basis [*Research priority A4*], it is clear that bad ergonomic practices do give rise to a range of work-related upper limb pain syndromes. The occupational physician is in a position to recognise the possible work-relatedness of upper limb pain conditions and to suggest appropriate ergonomic input and/or remedial action. The importance of psychosocial factors in the workplace in influencing and amplifying the production of pain syndromes has been emphasised (Toomingas A.- Annex 3) [*Research priority B5*]. The occupational physician, by an appropriate response to an increased incidence of complaints of upper limb pain, can identify the ergonomic and psychosocial factors involved and by appropriate referral arrange suitable specialist clinical input and ergonomic advice.

Evidence from pain physiology (Woolf - see Annex 3) suggests that early treatment of acute but minor trauma prevents the development of chronic pain and studies of psychosocial effects that early and appropriate responses to wider workplace issues may limit the spread throughout the workforce. Targeted intervention at both levels by an occupational physician should assist management on an individual and group basis. Although there are opportunities for studying controlled interventions in different parts of industry, these do not seem to be taken [*Research priority A5*].

3.6 Problems associated with the Evaluation of Clinical Management

The initial diagnosis given to a patient may have considerable influence on his/her response to subsequent management. It is recognised that there is a significant prevalence of upper limb pain in the population that is not caused by work but may be aggravated by work activities. Any diagnosis such as "repetitive strain injury" or "WRULD" implies a responsibility for the condition that alters the patient's perception of the problem and may contribute to chronicity. Work related diagnoses made early in the referral chain and not supported by an evaluation of work-

activities will not necessarily be in the patient's interest and unless **revised** will make the **evaluation of** any treatment **difficult**.

Evidence from pain physiology (Woolf) and from psychosocial studies (**Toomingas**) suggest that early diagnosis and treatment can prevent **chronicity**. Any studies evaluating clinical management should now consider the timing of treatment as an important variable. The influence of pain **chronicity** on subsequent treatment is unclear and there is clearly a need to revisit the basic science of pain and the workplace exposures [Research **priority B3**].

Much remains to be learnt about these conditions - even from the perspective of the more severe and chronic cases seen in hospital. Given the conflicting results of epidemiological studies and the inconclusive outcomes of **clinical** trials much more needs to be known (and **practised**) concerning accurate diagnosis [Research priority **A3**]. Well *designed* clinical trials of treatment cannot be undertaken without this prerequisite and such clinical trials are urgently required.

3.7 Clinical Management - **Overview**

In assessing the various aspects of the clinical management of work related upper limb disorders, several themes appear. There are the aetiological themes concerning the terminology, case definition, exposure assessments and the use of longitudinal epidemiological studies. Practical themes include a greater knowledge, awareness - and agreement - on diagnosis and treatment criteria. So little is known about the natural history of all of the conditions subsumed under the term work related upper limb disorders,

Apart from such "ground clearing" activities as agreement on terminology and work assessment criteria, well designed trials **will** be required to test the validity of any agreed set of terms, job categories and treatment regimes. Co-ordination and collaboration remains the order of the day as each group involved in the disorder from causation to diagnosis to treatment must see the perspectives of others and this is best served by agreement on definitions as well as research priorities.

Generally, it was **recognised** that diagnostic terminology is used inconsistently and often inappropriately. 'Gold standard' tests are not

available for many disorders inevitably leading to some degree of arbitrariness. Caution should be used in applying the labels 'repetitive strain injury' or 'work related' by the practitioner of first contact particularly in the absence of diagnostic confirmation or workplace assessment. The term 'upper limb regional pain syndrome' - although non-specific - prevents prejudicial labelling. A better classification of forearm pain is needed with greater consistency of application by different health practitioners.

The integration of different specialists and therapists in evaluation, referral and treatment of work related upper limb disorders ("lines-linking") is needed to establish a coherent approach. This may be achieved through multi disciplinary groups agreeing diagnostic criteria, management methods and research priorities. The effects of activity outside work also need to be considered.

Many different health practitioners are involved in the clinical management of upper limb disorders. Anecdotal experience is that general practitioners and surgeons recognise only a minority of upper limb disorders as being work related (Wheeler and Burke). The perception of occupational physicians and research scientists is often the opposite (Viikari-Juntura, Silverstein). There is scant scientific evidence to support the effectiveness of many of the treatments administered by physiotherapists (Robertson).

The role of employer, affected employee and public perception are also important. Work related upper limb disorders have had a high media profile. Both employers and employees need help in understanding the meaning of multiple terminology used in describing upper limb disorders and their different implications. Employers need clarification of the relative degree of health risk presented by upper limb disorders compared to other occupational health problems. It is only with employer agreement that further research, health surveillance and workplace intervention can effectively proceed (D'Auria). Employees complaining of upper limb disorders must retain control of the problem and not become 'dispossessed' through interaction with many different health specialists and advisers.

RESEARCH PRIORITIES

The following "research priorities" were agreed during the final discussion session of the workshop.

GENERAL

A1 STUDY DESIGN

There is a clear need to concentrate on more longitudinal studies to assess exposure - response relationships. Further cross sectional studies using job title will add little to knowledge.

A2 EXPOSURES

Better methods for measuring exposure are required. These need to be agreed by multi disciplinary consensus and incorporate, physical, psychosocial and ergonomic factors.

A3 RESPONSE

Better diagnostic standardisation is required to counter arbitrariness in disease definition. Splitting of upper limb disorders into specific (confirmed diagnosis) and non-specific (no diagnosis applicable) may be the first stage in this process. A working party of different specialists should be convened to agree case definitions for clinical diagnosis. This would be a major step towards integration of multi disciplinary teams and would prevent further divisive argument between epidemiologists and clinicians which are now counter productive to advances in knowledge.

A4 EXPOSURE-RESPONSE RELATIONSHIPS

With improved exposure and response criteria and better study design, exposure-response relationships can be more accurately studied. The resultant research should be reviewed in a structured way along the lines being Proposed by proponents of evidence - based medicine.

A5 INTERVENTION

Well designed randomised controlled ^{STUDIES} trials are needed to assess the benefits of many different forms of therapy and whether early intervention is as beneficial as is generally thought.

A6 MANAGEMENT AUDIT

Current management methods for upper limb disorders need to be audited in terms of process and outcome to assess their benefits in relation to disease prevention and cost effectiveness.

B SPECIFIC

B1 THE EXTENT OF THE PROBLEM

More needs to be known about the incidence of work related upper limb disorders in different industries (outside journalism and manufacturing) and the numbers seeing different practitioners. HSE's next Labour Force Survey will include General Practitioner confirmation of cases in addition to self reporting of symptoms. Improved surveillance by and interaction between occupational health services across different industries could provide useful data.

B2 NATURAL HISTORY

There have been no studies to date on the natural history of upper limb disorders: research is needed in this area to evaluate the relative benefit of interventions and treatments.

B3 PAIN MECHANISMS

There have been no reported studies on pain mechanisms in upper limb disorders. The concept of central sensitisation of pain needs critical evaluation in this group of conditions and this will require collaboration with the basic sciences involved in muscle/tendon physiology and the neurology of pain.

B4 TENDON INJURY & NERVE ENTRAPMENT

More research into both the aetiology of tendon injury and the mechanisms of nerve entrapment may help prevent the vast majority of upper limb disorders.

B5 PSYCHOSOCIAL FACTORS

The interaction between psychosocial factors and **mechanisms of both** pain (through central disinhibition, for example) and abnormal posture (through muscle tension) needs critical evaluation in upper limb disorders. Controlled clinical trials would be **a way forward.**

B6 NON-WORK ACTIVITIES

The effects of non-occupational activities in the production of upper limb disorders should always be studied in conjunction with the putative work related exposures.

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Annex 1

**WORK RELATED UPPER LIMB PAIN SYNDROMES
- ORIGINS AND MANAGEMENT**

Research Priorities Workshop Sponsored by the Health and Safety Executive

10-11 **October** 1995

First day 10:00 to 5:00

**‘WHAT IS KNOWN SCIENTIFICALLY AND CLINICALLY ABOUT
THE OCCURRENCE, ORIGINS AND MECHANISMS OF
UPPER LIMB PAIN SYNDROMES’**

- | | | |
|------------------------------|---|---|
| 1 | Introduction and welcome | Professor J M Harrington/
Dr P Davies 10 minutes |
| 2 | Risk factors of upper limb disorders | Dr E Viikari-Juntura
20+5 minutes |
| 3 | Epidemiologic evidence for
workrelatedness | Dr B Silverstein
20+5 minutes |
| 4 | Mechanisms of injury to muscle | Professor D Jones
20+5 minutes |
| 5 | Mechanisms of pain | Professor C Woolf
20+5 minutes |
| 6 | Pain behaviour | Dr R Mayou
20+5 minutes |
| 12.30 - 1.30 pm Lunch | | |
| 7 | Association between psycho-social factors
and upper limb disorders | Dr A Toomingas
20+5 minutes |
| 8 | Integrating physical and psychosocial
factors | Dr P Buckle
20+5 minutes |
| 9 | Open discussion | Professor J M Harrington
40 minutes |
| 3 - 3.30 pm Tea | | |
| 10 | Overview | Dr D Coggon
20 minutes |
| 11 | Knowledge gaps and research priorities
(discussion) | Dr D Gompertz |

*At Horton Grange pre drinks will be served at 7 pm and dinner
will be served at 7.30 pm at Horton Grange*

WORK RELATED UPPER LIMB PAIN SYNDROMES - ORIGINS AND MANAGEMENT

Research Priorities Workshop Sponsored by the Health and Safety Executive

Day 020 to 3:00

9:00 - 1:00 "CLINICAL MANAGEMENT-WHAT IS KNOWN"

- | | | |
|---|---|---------------------------------------|
| 1 | The problems - early identification, labelling diagnostic criteria, prevention of progression, interventions, treatment | Mr T R C Davis
20+5 minutes |
| 2 | The perspective from general practice | Dr D Wheeler
15+5 minutes |
| 3 | The perspective from occupational medicine | Dr D D'Auria
15+5 minutes |
| 4 | The hand surgeon's perspective | Mr F Burke
15+5 minutes |
| 5 | The perspective from a physiotherapist | Mrs S Robertson
20 + 5 minutes |

11 - 11.30 am Coffee

- | | | |
|---|--|--|
| 6 | Open discussion | Professor J M Harrington
40 minutes |
| 7 | Overview | Dr C Cooper
20 minutes |
| 8 | Knowledge gaps and research priorities (a discussion) | Dr D Gompertz |

12.30 - 1.30 pm **Lunch**

"Research priorities"

- | | | |
|---|---|--|
| 1 | General discussion | Professor J M Harrington
40 minutes |
| 2 | Summing up and agreement of research priorities | Dr T Carter
20 minutes |
| 3 | Close | Professor J M Harrington |

Refreshments will be available from 3 pm

Annex 2

PARTICIPANTS LIST

Dr Peter J Baxter
Department of Community Medicine
University of Cambridge
Gresham Road
Cambridge **CB1 2ES**

Dr Peter Buckle
Robens Institute
University of Surrey
Guildford
Surrey **GU2 5XH**

Mr Frank Burke
Consultant Hand Surgeon
28 Midland Place
Derby **DE1 2RR**

Dr Tim Carter
Director of Field Operations
Health & Safety Executive
Daniel House
Trinity Road
Bootle **L20 7HE**

Dr David Coggon
MRC Environmental Epidemiology Unit
Southampton General Hospital
Southampton **SO16 6YD**

Dr Cyrus Cooper
MRC Environmental Epidemiology Unit
Southampton General Hospital
Southampton **SO16 6YD**

Dr Denis D'Auria
Chief Medical Adviser
Midland Bank plc
London **EC2P 2BX**

Dr Paul Davies
Health & Safety Executive
Rose Court
Southwark Bridge
London **SE1 9HS**

Mr Tirm R C Davis
Dept of **Orthopaedic &** Accident Surgery
University Hospital
Queen's Medical Centre
Nottingham **NG7 2UH**

Dr Ann Dawson
Department of Health
Wellington House
135- 155 Waterloo Road
London SE1 6EF

Dr Jack **Goadby**
Lucas Industries plc
Dog Kennel Lane
Shirley
Solihull B90 4JG

Dr David Gompertz
Institute of Occupational Health
University of Birmingham
Birmingham B15 2TT

Dr Richard **Graveling**
Institute of Occupational Medicine
8 Roxburgh Place
Edinburgh EH8 9SU

Dr Rod Graves
Human Factor Work Design
513a **Lanark** Road West
Edinburgh EH14 7DH

Dr Amanda **Griffiths**
Department of Psychology
Centre for Organisational Health & Development
University Park
Nottingham NG7 2RD

Dr Jon Hancock
Institute of Occupational Health
University of Birmingham
Birmingham B15 2T.I'

Professor J **Malcolm** Hanington
Institute of Occupational Health
University of Birmingham
Birmingham B15 2TT

Dr M Hotopf
King's **College** London
Department of Psychological Medicine
103 Denmark Hill
London SE5 9RS

Professor David A Jones
School of Sport & Exercise Sciences
University of Birmingham
Birmingham B15 2TT

Miss **Jacky** Jones
Epidemiology & Medical Statistics Unit
Health & Safety Unit
Magdalen House
Stanley Precinct
Bootle **L20 3QZ**

Dr **Colin** Mackay
Technology & Health Sciences Division
Room 251
Health & Safety Executive
Magdalen House
Bootle **L20 7HE**

Dr Richard **Mayou**
University Department of Psychiatry
Wameford Hospital
Oxford **OX3 7JX**

Dr Ron **McCaig**
Technology & Health Sciences Division
Room 251
Health & Safety Executive
Magdalen House
Bootle **L20 7HE**

Mrs Sunita Robertson
Senior Research Physiotherapist
Nuffield Orthopaedic Centre NHS Trust
OXFORD **OX3 7LD**

Dr Barbara **Silverstein**
Research Director for SHARP
Dept of Labor & Industries
P O Box 44330
Olympia WA 98504-4330
Washington DC USA

Dr Anne **Spurgeon**
Institute of Occupational Health
University of Birmingham
Birmingham **B15 2TT**

Dr **Allan** Toomingas
National Institute for Working Life
Department of Ergonomics
S171 84 Solna
Sweden

Dr Eira **Viikari-Juntura**
Finnish Institute of Occupational Health
Department of Physiology
Topeliusenkatu 41 a A
FIN-00259 Helsinki
Finland

Dr Simon Wessely
Dept of Psychological Medicine
The Maudsley Hospital
103 Denmark Hill
London SE5 8AZ

Dr D Wheeler
The Surgery
Townhead Road
Dalston
Carlisle CA5 7PZ

Dr Nerys Williams
Employment Medical Advisory Service
Health & Safety Executive
McLaren Building
2 Masshouse Circus
Birmingham B4 7NP

Professor C J Woolf
Dept of Anatomy & Develop of Biology
University College London
Gower Street
London WC1E 6BG

Dr C B Wynn Parry MBE
Devonshire Hospital
29-31 Devonshire Street
London WC1N 1RF