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EDITORIAL REVIEW

Troubled Times for TLVs?

The year 1988 marked both the fiftieth anniversary year of the American Conference of Governmental Industrial Hygienists (ACGIH) and the opening of an ongoing heated debate over their "Threshold Limit Values" or "TLVs". In March of that year, Vernon Carter (Chairman of the ACGIH) gave an address in the monthly journal, *Applied Industrial Hygiene* (now renamed *Applied Occupational and Environmental Hygiene*), published by a subsidiary of ACGIH. Carter advised that another journal, which he did not name, was about to publish what he termed "an unfair attack on the Threshold Limit Values (TLVs) for Chemical Substances and the process whereby they are established". Carter, having been Chairman of the ACGIH Chemical Substances TLV Committee during 1980 to 1985, was particularly upset by this "unfounded attack on the professional ethics of committee members and consultants".

The article that Carter had found so objectionable was soon published in May, 1988 in the *American Journal of Industrial Medicine* (Vol. 13, No. 5) as "Corporate Influence on Threshold Limit Values" and proved to be a blockbuster opening salvo in what has been an ongoing war of words over TLVs. The authors, Barry Castleman ScD and Grace Ziem MD, noted that the ACGIH had established a Committee on Threshold Limits which began issuing annual reports in 1946 (initially recommending "Maximum Allowable Concentrations" or "MACs" for 144 substances). In 1948, MACs were renamed Threshold Limit Values and the TLVs recommended by ACGIH over the years became widely adopted throughout the world as workplace exposure standards for hazardous substances. In the U.S., the Occupational Safety and Health Act (OSHA) of 1970 made most of the 1968 ACGIH TLVs enforceable. The convenient pocket-sized ACGIH booklet *Threshold Limit Values and Biological Exposure Indices* is promoted as a handbook of ACGIH guidelines to conditions under which nearly all workers may be repeatedly exposed day after day without adverse effect. It has become familiar to engineers, industrial hygienists, physicians and nurses and has achieved venerated status.

In their *AJIM* article, Castleman and Ziem critically examined the documentation offered as the scientific basis for the ACGIH TLVs. They began with the most recent issue of *Documentation of the Threshold Limit Values and Biological Exposure Indices* (5th edition, 1986), which is published in a loose-leaf binder form by ACGIH. The authors found "a total of 104 substances for which important or total reliance was placed on unpublished corporate communications" and concluded, "The unavailability of unpublished corporate "documentation" precludes scientific scrutiny of the primary basis for nearly one sixth of the "documented" TLVs."

In their article, Castleman and Ziem also raised the specter of a conflict of interest among consultants on the TLV committee, claiming that a compromising pro-industry stance led to TLVs being adopted that unduly reflected corporate interests. In some cases, TLV committee members were responsible for assessment of the TLVs of products marketed by the corporations that employed them. Moreover, according to the authors, "only occasional token efforts were made to get a union industrial hygienist on the TLV committee".

Castleman and Ziem's provocative assertions were accompanied by nine letters to the editor in the same issue of *AJIM*. In general, the commentators concluded that the unsatisfactory way that TLVs were produced was better than no standards at all and represented an imperfect pioneering approach to standard setting for workplace exposures. During 1988, *AJIM* published over twenty letters and commentaries responding to Castleman and Ziem and describing various other international efforts at setting exposure limits, e.g. hygienic limit values or HLVs in Sweden, maximum concentrations at the workplace or MAKs in the Federal Republic of Germany, maximum allowable concentrations or MACs in Yugoslavia and the U.S.S.R., permissible exposure limits or PELs in the U.S. (OSHA), and control limit indices or CLIs in Japan.

All such systems faced problems of incomplete data bases in assigning exposure limits but the issue of corporate interference in the ACGIH TLVs evoked dismay. For example, William Morton asked, "Is the problem demonstrated by Castleman and Ziem only an insensitive oversight persisting from an earlier era? Or is it the sum of a series of unethical acts in a corporate world that values the bottom line of the ledger far more than the safety of its workforce?" Elihu Richter felt that "Castleman's documentation of systematic defects in the decision-making process leading to the setting of TLV levels compels us to ask whether this pocket bible may be a golden calf."

On the other hand, in an *AJIM* "letter to the editor", Herbert Stokinger, a TLV committeeman for 26 years, characterized Castleman and Ziem's work as "a union-handed webwork, guesswork, conjecture, and surmise". He argued that "throughout

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all the more than 40 years of existence of threshold limit values, there has been no instance of serious health effects, provided exposures were kept at or below the TLVs". Geraldine Cox of the Chemical Manufacturers Association (U.S.) accused *AJIM* of dropping its standards and stated that "it was logical for industry professionals to serve as consultants to the TLV committee. It was also logical, and more efficient, for them to work on their own companies' products, as these were the individuals with the data and the expertise."

In a candid letter to *AJIM*, Hervey Elkins (who had immediately preceded Vernon Carter as chair of the TLV committee) said, "Having defended the committee against many of Dr. Castleman's charges, I must admit that his major premise, that the bias of some of the industry consultants on the committee affected its recommendations, has some validity. I have no specific knowledge, or do I accuse anyone, of concealing or falsifying data. There were a few incidents, however, to which the word "chicanery" might be applicable."

Just before the dust began to settle on the first round of debate, Ziem and Castleman issued another volley from Baltimore, published in the November, 1989 issue of the *Journal of Occupational Medicine* as "Threshold Limit Values: Historical Perspectives and Current Practice". In this article, the authors noted that in 1989, OSHA had adopted new Permissible Exposure Limits (PELs) for 376 substances based on the 1987 ACGIH TLVs and "the many TLVs just adopted as OSHA standards are a legacy of an earlier era". Ziem and Castleman argued that the flaws inherent in the TLVs were again being legislated by OSHA as PELs. One of the flaws they identified in the TLV process was the fact that "Initially, not a single physician was on the TLV committee; at most, physicians comprised only a small minority of the committee members. Never had the chairman of the TLV committee been a physician (this would not happen until 1985 [Ernest Mastromatteo])." They noted that the TLV committee relied heavily on animal data and failed to search the available international medical literature for human data. "The result was a list of exposure limits produced almost entirely by hygienists, chemists, and toxicologists, most of whom lacked the necessary training, let alone clinical experience with humans."

Furthermore, Ziem and Castleman said that "corporate representatives were given primary responsibility for developing TLVs on more than 100 substances between 1970 and 1988, including at least 36 classified as carcinogens by official bodies".

The authors also identified recently published studies for 23 compounds in which they found evidence of adverse effects from exposures **below** the TLVs. Thus they considered that, contrary to ACGIH claims, TLVs did **not** establish a level below which nearly all workers may be exposed day after day without adverse effect. Moreover, the TLVs were **not** based on the best available information and a false sense of security was being given to nonmedical personnel. "Workers have been ill served by having critical decisions about their health delegated to engineers carrying TLV booklets."

In an *AJIM* commentary, Ray Sentes offered a Canadian perspective on the role of the ACGIH in Canada, noting that in Newfoundland (Reg 104-79), Prince Edward Island (Reg 180-87), and Nova Scotia (Reg 76-1510), "the ACGIH enjoys the status of an official standard-setting agency. This is due to the fact that when the regulations were first enacted they referred not only to the ACGIH publication for a specific year but also to any subsequent revision." In New Brunswick (Reg 77-1) and Manitoba (Reg 53-88), only the publication for a specific year was mentioned in the regulations. Alberta (Reg 8-82), British Columbia (Reg 585-77), Saskatchewan (Reg 567-81), Ontario (Reg 654-86), and Quebec (AC 3169-79) adopted the actual values recommended by the ACGIH but in these provinces "the ACGIH has no statutory standard-setting function".

Recently, the TLV debate has received added fuel from a 1990 *AJIM* article by Roach and Rappaport (University of California, Berkeley) titled, "But They Are Not Thresholds: A Critical Analysis of the Documentation of Threshold Limit Values". In this heavily-referenced article, the authors examined the 1976 and 1986 ACGIH *Documentation* for sources providing **both** the incidence of human adverse effects and the corresponding exposure levels. They found 158 pairs of data for the 1976 set and demonstrated that most studies showed an incidence of adverse effects at the TLV (100% incidence in 8 cases). There was no correlation between the ratio of measured exposures/TLVs and the percent adversely affected by the exposures. However, there was a highly significant correlation between the measured exposures and the TLVs which were adopted for these substances. Since TLVs have generally been lowered over the years, the authors repeated the process for 1986 finding 72 pairs of data and correlations similar to those of 1976. Overall, they found that 17% of employees exposed to a concentration **at or below** the 1976 TLVs were adversely affected and 14% of employees exposed to a concentration **at or below** the 1986 TLVs were adversely affected.

According to Roach and Rappaport, "Three striking results emerged from this work, namely, that the TLVs were poorly correlated with the incidence of adverse effects, that the TLVs were well correlated with the exposure levels which had been reported at the time the limits were adopted, and that interpretations of exposure-response relationships were inconsistent between the authors of studies cited in the 1976 Documentation and the TLV Committee." They concluded, "TLVs for chemical substances are a compromise between health-based considerations and strictly practical industrial considerations, with the balance seeming to favor the latter. In other words, most TLVs may represent guides of levels which have been achieved but they are not thresholds."

In January of 1990, Eileen Tarlau (New Jersey State Department of Health) wrote a guest editorial in the *American Industrial Hygiene Association Journal* titled "Industrial Hygiene with No Limits," contending that "This scandal leads to the inescapable conclusion that the ACGIH TLVs are tainted and unreliable." She said, "The time has come for all responsible industrial hygienists to stop using PELs and TLVs. We must realize that every time we use them we are actually endorsing them."

In a follow up letter to *Am Ind Hyg Ass J* (April, 1990), Zach Mansdorf defended the TLVs, "I would suggest the TLVs do not represent acceptable risk, but they do give an indication of what is not generally acceptable (above the TLVs) in terms of discernable adverse effects." In the May issue, Robert Peck added a sarcastic rebuttal to Tarlau, "Come on - you vegetative industrial hygienists of the world! This came off a New Jersey government computer! How can you question it?"

In May, 1990, Dennis Paustenbach wrote an extensive guest editorial in *Am Ind Hyg Ass J* defending occupational exposure limits in general and TLVs in particular against Tarlau's call to abandon exposure limits. He argued against reinventing exposure limits, claiming that "it would require at least 25 years to reestablish limits for the 700 chemicals which now have PELs." "Why abandon a set of criteria whose acceptance has only increased, rather than lessened, even though they have undergone nearly 50 years of scrutiny?" Paustenbach concluded that occupational exposure limits are here to stay so why throw the baby out with the bathwater?

No doubt the TLV debate is far from over. I hope this brief outline gives our readers a sense of the contours in this current "battlefield" of viewpoints. According to Robert Sass (*AJIM*, 1988), "Standards are the ground upon which the hygienist stands." As you can see, there's a lot of controversy over that venerated and now troubled terrain.

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INTRODUCTION

As the petroleum industry expands its exploration and marketing boundaries, more employees are required to travel and work in foreign lands. Being medically fit to travel and to do the required job overseas is becoming a workplace issue.

Fitness to work means being able to do the tasks involved effectively and without risk to one's own, or to others' health and safety (Edwards, 1988). Regarding fitness to work, the major concerns are that the employee's health status may limit, reduce or prevent the worker from performing the job well; may be made worse by the work involved; may make it unsafe for the employee to do the job; may make it unsafe for other employees; or may make it unsafe for the community at large. In short, fitness to work is concerned with the employee's health status, the job tasks and the conditions of work.

To assess these aspects, the employee's skill level, physical and mental capacity, and sensory acuity needed to safely perform the work must be considered. As well, the adverse aspects involved in the work must be addressed. Health and safety implications of the employee's medical condition are considered: in short, it is the matching of the employee with the job and its safety requirements as illustrated by Guidotti, Cowell and Jamieson, 1989 (see figure).

Thus, the medical examinations to determine fitness to work are job specific.

With regards to international travel, assessment of fitness to work must include a variety of considerations. The employee's health status, the type of job to be done, and the workplace conditions are areas to be addressed. Fitness to travel may require considerably more concern for the workplace environment and the hazards that it contains than one would consider for other workplace situations.

International travel brings with it many hazards. These hazards will be explored in relation to fitness to work and some management strategies presented.

TRAVEL HAZARDS

Biological

Travel to foreign countries exposes the worker to disease risks that are not common in Canada. These include communicable diseases, parasites and amebic infestations, fungi, malaria, yellow fever and schistosomiasis. Animal, snake, and insect bites are also biological risks. In addition, poor sanitation and substandard medical services can compound any medical problem.

To combat these risks, employees are encouraged to have immunizations appropriate for the country of destination. Also, malarial suppressant therapy may be recommended. The use of water filtration systems to make water potable is encouraged. Pre-travel briefings on medical and public health concerns are provided to the employee in an attempt to reduce possible deleterious exposures.

In this area, employees who refuse, or are unable to tolerate immunizations or anti-malarials would be considered "unfit" to travel. In fact, without a medical briefing, the employee really is compromised and could be termed not suitable for international travel.

Chemical

Work safety standards may be lower in foreign lands. Also, air and water pollution are likely to be a problem. The employee must be advised to be cautious and to not take for granted that chemical exposure levels will be kept below a "safe" level. Possible exposures could include petrochemical products and byproducts, solvents, and heavy metals.

Depending on the work and the chemicals involved, the employee's suitability for the job should be assessed. For example, gas plants that handle mercury would not be suitable places for employees with high blood mercury levels, or for pregnant/nursing women.

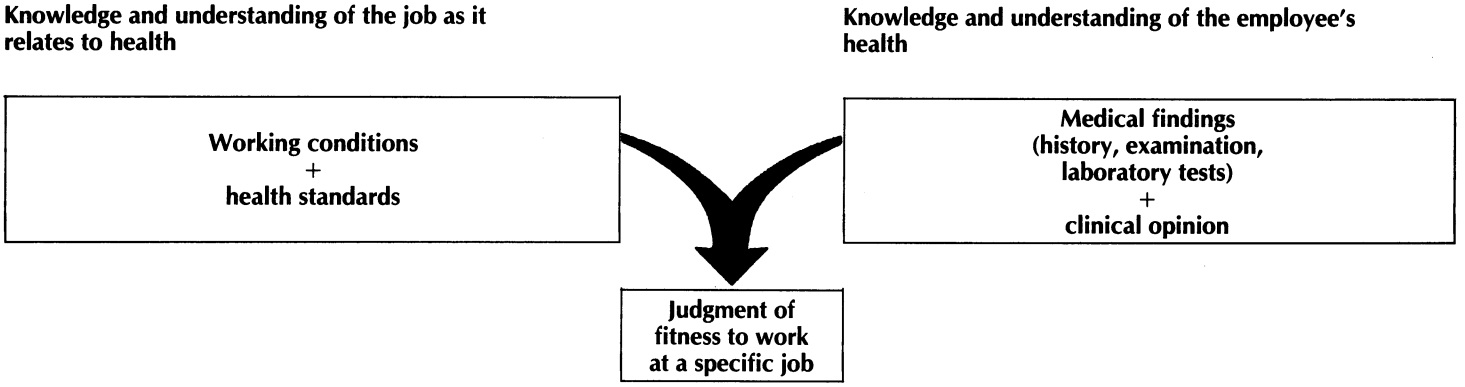
Physical

Acclimatization (heat, cold, altitude) takes time. Some workers are exposed to extreme climatic changes and are expected to make quick adjustment. Age, or an existent health condition, could be factors determining fitness to travel.

Jet lag, a transient disorder of the sleep-wake cycle, occurs once the traveller is exposed to the discrepancy between the external geographical time and the internal biological time. Symptoms such as fatique, disorientation, confusion, reduced physical/mental ability, bowel/bladder dysfunction and loss of appetite can occur. This may be reduced if the worker has been briefed on jet lag and how to lessen its effects. It can be minimized by planning to take a flight which arrives at a time closest to one's regular bedtime, adequate eating and drinking enroute, and exercising while flying. Also the person needs to be aware that personal performance will be substandard for 7-10 days. Age and level of knowledge about jet lag could be determinants of fitness to travel.

Trauma, due to violence, terrorism, or accident, is a major concern. Evacuation insurance is a must. In additon, it is advisable for the person to know their blood type, drug sensitivities/allergies, and existent medical conditions. Lack of evacuation insurance and knowledge about personal health could put the employee at a definite disadvantage.

SCHEME OF PROCESS FOR DETERMINING FITNESS TO WORK



From Guidotti, Cowell and Jamieson, 1989

Psychological

Isolation, acculturation, shift work, work-related stress, loss of familial/social supports, and the stress of flying and travelling are the psychological exposures that the worker must face. In addition, international governments often make entry demands, have volatile political climates, and have substandard health care, all of which can upset travellers. Worker reaction to unforeseen stressors and catastrophic events should be explored for the worker and company safety.

TRAVEL HAZARD MANAGEMENT

1. Pre-Travel Medical Assessment
   Prior to travel, the employee should be medically assessed to establish a baseline health status and to identify any personal health risks, or conditions, that may require medical interventions (Csokonay, 1988a). This would include a health history and a physical examination. Depending on the traveller's destination, blood group or HIV-1 testing may be necessary. For example, to obtain a working visa in Columbia, individuals are required to have a certificate of health stating he/she is free of communicable diseases. Also, workers requiring a drivers permit in countries like Burma must show proof of their blood type to qualify for the license.

2. Immunizations
   Many foreign destinations ask for proof of immunization against yellow fever as part of their entry requirements. As well, the worker is advised to have current protection against tetanus, diphtheria and polio (immunizations are recommended every 10 years for adults). For individuals born since 1957, measles, mumps and rubella vaccine is suggested if they have not been immunized previously, nor had these diseases. Employees should be encouraged to avail themselves of these core vaccines as these diseases are endemic in the developing world.

   Depending on the country of destination and the type of travel to be undertaken (urban versus rural), special vaccines such as typhoid, immune serum globulin, meningococcal and Japanese encephalitis virus may be recommended. Often it is best for the worker to attend an international travel clinic to have individual immunization needs assessed and the appropriate vaccines administered.

3. Anti-malarials
   Malaria is endemic to many tropical countries. Travellers to such areas are urged to practice good protective measures against night-biting mosquitoes. These include remaining in screened areas after dusk, the use of insect repellent (DEET preferably), wearing light-colored clothing to cover-up most of the body, avoidance of perfumes/body colognes and the use of sleep-nets. In addition, malaria suppressive therapy is recommended. The recommendations for malaria prophylaxis depends on the country of destination and the area of travel within that country. Malaria prevention is an instance where the workplace conditions cannot be changed, but the worker's resistance to the biological hazards can be fortified through health education and malaria prophylaxis.

4. Travel Kit Preparation
   Workers should carry with them a travel kit that contains medications tailored to their personal needs and travel demands. Ideally, such a kit would contain first aid items, sterile needles and syringes, antidiarrheals, anti-nauseants, antihistamines, headache tablets, a broad spectrum antibiotic, sleeping tablets, laxatives and cold remedies. As well, each traveller should be briefed on the kit contents and their proper use. In addition, water filters could be recommended so that unsafe water can be made potable.

5. Health Insurance
   Extra health insurance coverage is a must for occupational travellers. Organizations such as SOS International, Global Assist and Asian Emergency Assistance offer local medical assistance, evacuation assistance, referrals to appropriate medical centers, help with local communication problems and hospital deposits/guarantees. For the foreign worker, access to medical care can be crucial and these organizations can facilitate that accessibility.

6. Country Admission Regulations
   Employees need to be aware of the entry requirements for their country of destination. These may vary from proof of a current yellow fever vaccination, to a negative HIV-1 antibody testing result. Being detained at a port of entry is time consuming and very frustrating. Luckily, this can be avoided through pre-travel counselling and planning.

7. Country-specific Briefing
   By providing employees with information about the health hazards associated with the country of destination, it is hoped that they will be able to make informed decisions while abroad. Topics that should be discussed are the selection of safe food and water, 'safe sex', ways to enhance acclimatization, coping with jet lag, care of insect/snake/animal bites and accessing available medical services.

8. Post-Travel Medical Assessment
   A post travel medical is recommended for all long term travellers (away for more than 3 months) to screen out any gastrointestinal parasites, malaria, or other illness contracted while travelling (Csokonay, 1988b).

LEGAL AND ETHICAL CONCERNS

"Fitness to work examinations are objective assessments of the health of employees in relation to the specific job they hold, or intend to hold" (Guidotti et al, 1988, p. 209). The occupational health professional must be fair to the employee and employer. Having performed a fitness to travel assessment, the occupational health professional should counsel both the worker and management clientele on the degree of risk associated with the planned travel.

Since the occupational health professional is being asked to give a medical opinion about the worker's health and functional capabilities within a foreign workplace, the results could affect the worker's/employer's rights and obligations (Guidotti et al, 1989). Thus, fit to travel examinations should be done by qualified occupational health personnel who are familiar with international working conditions and the tasks to be undertaken. As well, both the employee/employer need to feel comfortable and confident with the results of the assessment. Lastly, the medical data must be kept confidential with the employer receiving only the bottomline report: "fit to travel", "fit to travel with limitations" or "not fit to travel". In all cases though, the occupational health professional should act as a consultant to both clients and avoid making the final decision of whether the worker can travel or not. It is best for the employee and/or employer to arrive at such a conclusion jointly once they have been provided with expert medical advice.

CONCLUSION

Educational and preventative practices are needed to prepare employees for high risk international travel. To be well prepared, travellers need valid and current information about their area of destination, the specific hazards, and the precautionary measures to protect and maintain their health while travelling. In addition, they need to know what their health risks are so that they can adequately cope with a foreign assignment.

As well, the employer should be informed of the degree of risk associated with employee travel. Employers are just as responsible for employees and their well-being in foreign countries as they are here at Canadian worksites. Illnesses and injuries can be an unwanted cost of doing international business for employers and employees.

Through counselling and advice, occupational health services can help employees and employers manage the health risks of occupational travel.

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There are many specific injuries that fall under the rubric of RSI. The more common ones will be described.

TENSION NECK SYNDROME (TENSION MYALGIA)

This common condition is characterized by a persistently stiff, aching neck often accompanied by a headache. It is thought to be predominantly a result of static, sustained muscle contraction, accompanied by local spasm of the trapezius and other neck muscles. Whether nodules or trigger points are associated with the condition is controversial. It is reported to occur frequently among typists, keypunch operators, cashiers, small parts assembly workers, packers, and others who must maintain a restricted posture with activity of their forearms while bracing at the shoulder. Tension neck syndrome is treated conservatively. Relaxation exercises, application of heat, fitness training, and a soft cervical collar may help. Consciously altering posture, being aware that the chin is kept tucked in, and stretching exercises frequently help.

CERVICAL SYNDROME

This condition resembles the tension neck syndrome in some patients but also involves pain radiating to one or both arms and may be associated with numbness or paresthesias in the hands. Range of motion of the neck is usually restricted by pain and there may be reduced power in the deltoid, triceps, and biceps, although this may be difficult to document. Cervical syndrome is not infrequent among individuals who must repeatedly flex or hyperextend their necks and assume awkward positions for long periods, including painters, decorators and dental surgeons. The process appears to be one of disc degeneration with age and aggravation of the weakened vertebral joint by exaggerated positions. Overt cervical osteoarthritis may be present radiographically but patients may complain of all the symptoms without bony abnormalities. Bony changes can often be seen on neck films, including spondylosis or osteophytes. Conservative treatment, including ice or heat, and massage may provide marked relief, as may ultrasound. A cervical collar, initially soft and then progressing to hard if necessary, can provide substantial symptomatic relief.

THORACIC OUTLET SYNDROME

A neurovascular condition, thoracic outlet syndrome occurs when the nerves of the brachial plexus and the brachial artery and its branches are compressed between the muscles of the neck and shoulder. The result is numbness, ischemia, and pain in the distal upper extremity, especially in postures in which the shoulders are thrown back and the hand is raised. A clinical test for this (the Adson maneuver) is to hyperextend the shoulder, in the manner of a military order to "stand at attention", with the chin thrust forward. A weakened pulse and reproduction of the symptoms strongly suggests the thoracic outlet syndrome.

The symptoms of the syndrome may also occur in the presence of atherosclerosis of the brachial artery, in which case the test may not be effective but pain, numbness, and weakness may appear on working with the arms. It may also occur in individuals with congenital cervical ribs or abnormal muscle placement and insertions. It is usually found in occupations requiring frequent reaching above shoulder level, prolonged carrying of relatively heavy loads (such as suitcases) at the side of the body, the wearing of a knapsack or other straps around the shoulder, or bracing with the shoulders while carrying a stretcher or similar load in a fixed position at waist level. Occupations at risk include grinders, overhead assembly workers, auto repair mechanics, cashiers, musicians, operating room personnel, truck drivers, stockroom and shipping workers, and letter carriers. Initial treatment by short-wave diathermy and transcutaneous neural stimulation (TENS) may provide symptomatic relief. In advanced or severe cases, major surgery may be required.

TENDONITIS, TENOSYNOVITIS, BURSITIS

Tendons are generally encapsulated in a synovial sheath (except in the shoulder) and cushioned at points of stress and leverage by bursae. Inflammatory conditions of these structures are very common and can affect virtually any part of the body given sufficient repetitive loaded motion. For mechanical and loading reasons, however, they are most common in the upper-extremity in occupational medicine, although they are not infrequently seen in the lower extremities among athletes. Tendonitis results when the muscle-tendon connection is repeatedly tensed and the tendon begins to fray or tear apart. Unless allowed to recover fully, the tendon may become weakened through repeated reinjury. The tendon sheath may develop an effusion and inflammation (tenosynovitis), particularly in the hand. Where the tendon lacks sheaths, as in the shoulder, the injured tendon may calcify. When the sheath becomes thickened, it may constrict movement of the tendon, causing a stenosing tenosynovitis such as de Quervain's disease (see below). Another common example is "trigger finger" (stenosing tenosynovitis crepitans), in which attempts to flex a finger are impeded—the tendon "gives" abruptly in a jerking movement, like a knotted string being pulled through a hole in a piece of cardboard. These conditions are most common in the hand, where the muscle and tendons are mechanically weak, but also occur at the elbow and shoulder (and contribute to "tennis elbow" and related conditions).

These conditions are common whenever there is repetitive motion on the job and are particularly a problem when hand tools are used. They are frequently encountered among grinders, machine tool operators, assemblers, sewing workers and cutters, musicians, packers and meat packers. Treatment is conservative with physiotherapy for range of motion exercises. Braces or splints may be useful depending on the part affected. Local injection of steroids should be minimized to avoid weakening the tendons permanently.

SUPRASPINATUS TENDONITIS (ROTATOR CUFF TENDONITIS)

This condition is an inflammation of the tendon of the supraspinatus muscle, which is the muscle involved in initially abducting the humerus from neutral position under the acromion and in an elevated position pushes against the acromion painfully when inflamed. It is common among workers who must maintain a position of shoulder abduction with the elbow extended under conditions of load, including welders, painters, aluminum siding and awning installers, riveters and construction workers. Characteristic pain with abduction at the shoulder from 70 degrees to 100 degrees is the principal diagnostic feature. This is a specific sign because it corresponds to the angle at which the inflamed tendon abuts the acromion as the arm is raised. Treatment is often unsatisfying because the condition waxes and wanes and frequently returns with reuse. Rest, heat, antiinflammatory medications and physiotherapy help and it is important to maintain range of motion exercises in order to avoid developing a frozen shoulder syndrome (see below). Local injection of steroids is used by some but has not been convincingly shown to be of benefit.

BICIPITAL TENDONITIS

Bicipital tendonitis is often associated with supraspinatus tendonitis, but may also occur in isolation. This condition is similar to supraspinatus tendonitis, involving pain with movement of the glenohumeral joint and pain over the bicipital tendon as it passes over the bicipital groove and under the acromion. The condition is very common among workers who must reach up over their heads, such as assembly workers, cleaners and window washers, construction workers and stock-

room and shipping clerks. Treatment is similar to that for supraspinatus tendonitis.

FROZEN SHOULDER SYNDROME (ADHESIVE CAPSULITIS)

This is a condition of contracture in the soft tissues surrounding the glenohumeral joint. Thickening of the tendons and bursae result in fixing and severe pain with motion. It typically results from prolonged immobilization after shoulder injury and is a complication common to many soft tissue injuries involving the shoulder. It presents as progressive chronic pain and stiffness developing over several months and results in loss of active and passive range of motion at the shoulder. It is difficult to treat but can be prevented by physiotherapy and range of motion exercises during recovery from shoulder injuries. Because of the extent of injury leading up to the frozen shoulder syndrome, it is often associated with degenerative joint disorders.

ACROMIOCLAVICULAR SYNDROME

This is a condition similar to the forms of tendonitis mentioned above but is distinguished by local pain over the acromioclavicular joint. Its presence can be confirmed by having the patient push downward against resistance and percussing the clavicle: the pain should be reproduced. This syndrome occurs as a result of repeated movement with loaded stress on the joint at waist level, as might occur in grinding, packing, assembly and construction work. Treatment is conservative; local injection may help.

EPICONDYLITIDES

Two forms of epicondylitis are commonly named for their counterparts in sports: "tennis elbow" (lateral epicondylitis) and "golfer's elbow" (medial epicondylitis). They are both inflammatory conditions of the tendonous origins of the muscles of the fingers. Both arise from repeated and forceful rotation of the forearm with the wrist bent, the different locations reflecting different patterns of stress at the elbow. Pain over the lateral epicondyle with palpation and during extension of the fingers and wrist against resistance with the elbow straight suggests lateral epicondylitis. Pain over the medial epicondyle and with flexion of the fingers and wrist against resistance with the elbow flexed suggests medial epicondylitis. The conditions are common in jobs requiring repeated arm and elbow motions such as small parts assembly, musicians, construction and woodworking. Treated conservatively and with local injections and range of motion exercises, these conditions often take months to resolve.

de QUERVAIN'S TENOSYNOVITIS

The most common stenosing tenosynovitis, de Quervain's disorder involves the extensor tendons of the thumb and are most characteristic of those workers using hand tools in repeated motion. The key diagnostic feature is a "trigger" effect or popping sensation when the thumb is extended and abducted, resulting from nodules in the tendon surface slipping through fibrosed parts of the tendon sheath.

CARPAL TUNNEL SYNDROME

A nerve entrapment condition, the median nerve is compressed along its path in the narrow channel in the wrist defined by the radius, the flexor retinaculum, and the tendons of the muscles for flexion of the hand. This causes paresthesias and numbness in the distribution of the median nerve, including the volar aspects of the first four digits and thenar area of the palm and the distal dorsal aspects of digits II, III and (partially) IV. If it progresses untreated, atrophy of the thenar muscles may also occur and fine motor movements may become difficult to execute. The pain and tingling often disturbs sleep. The condition is usually associated with repeated forced hand movements as occurs among cashiers, assembly workers, grinders, typists, key punch operators, sewing workers and cutters, musicians, packers, and bricklayers.

Diagnosis is not usually difficult; this is one of the few RSIs to have become widely recognized. Tingling paresthesias with percussion over the median nerve at the wrist (Tinnel's sign) is strongly suggestive and can be confirmed by nerve conduction studies showing slowed nerve impulses, although this tends to occur relatively late when the entrapment is far along. A relatively specific clinical test is Phalen's maneuver, in which the wrists are passively flexed by pressing the flexed hands together dorsum-to-dorsum for one minute in an effort to elicit the pain and paresthesias. Conservative treatment, including a splint, often fails to provide relief; surgery to release the entrapped nerve is usually effective.

ULNAR NERVE ENTRAPMENT

The ulnar nerve passes behind the medical epicondyle at the elbow and is in a position that makes it vulnerable to repeated minor trauma. The forearm may be rested on a hard arm-chair or work bench. In time, the injured nerve may become entrapped by local swelling and tissue hypertrophy and becomes even more susceptible to minor trauma of this type. Preceding signs are similar to carpal tunnel syndrome except that the paresthesias are felt over the ulnar side of the hand and over digit V. Diagnosis is like that for carpal tunnel except that Tinnel's sign can be demonstrated over the epicondyle. Treatment is also similar.

EVALUATION OF RSI

RSI is to be distinguished from non-occupational rheumatologic conditions, temporary pain from sprains or muscle strain, psychological disorders (including compensation neurosis), abnormalities of bony structure, and single-event injuries. In the United Kingdom, the Industrial Survey Unit of the Arthritis and Rheumatism Council concluded that persistent or recurrent musculoskeletal pain without immediate traumatic cause within the previous six weeks suggests the diagnosis.

RSI is often considered to develop through three stages:

Stage 1 is a condition of fatigue characterized by aching and tiredness increasing during the work shift, usually reversible with overnight rest.

Stage 2 is persistence of the discomfort into the next day and earlier onset of fatigue during the workday.

Stage 3 is chronic aching, fatigue, and weakness which persists despite rest of the affected part.

These stages are, of course, generalizations. Each of the specific disorders discussed has its own natural history. Some generalizations are possible, however. Because the symptoms are mostly subjective and gradual in onset it can be difficult to obtain a satisfying history for these conditions. Initial treatment is usually conservative, which in this context involves rest, initial cooling with ice followed later by local heat, and antiinflammatory medications, as appropriate to the condition.

More effective than treatment in controlling the problem is prevention by changing the nature of the operation or the tools or layout of the workplace to modify or eliminate the offending action. In every case, RSI is much easier to prevent than to treat. Effective prevention requires attention to the actual movements conducted by the worker in a given workplace and the ergonomic redesign of the job to minimize the hazardous movement patterns. This is often possible by rearranging the work station, changing tools or changing the pace of the work. Unfortunately, these measures are too often considered only after a number of cases have been identified and a relatively serious problem is recognized.

(References available on request)

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NOTICE TO OUR READERS

The Alberta Occupational Medicine Newsletter will be published less frequently until we are able to obtain a new source of funding. We appreciate the past support of Alberta Occupational Health and Safety.