Vol. 2 No. 4 October-December 2002

DISABILITY MEDICINE

The Official Periodical of the American Board of Independent Medical Examiners

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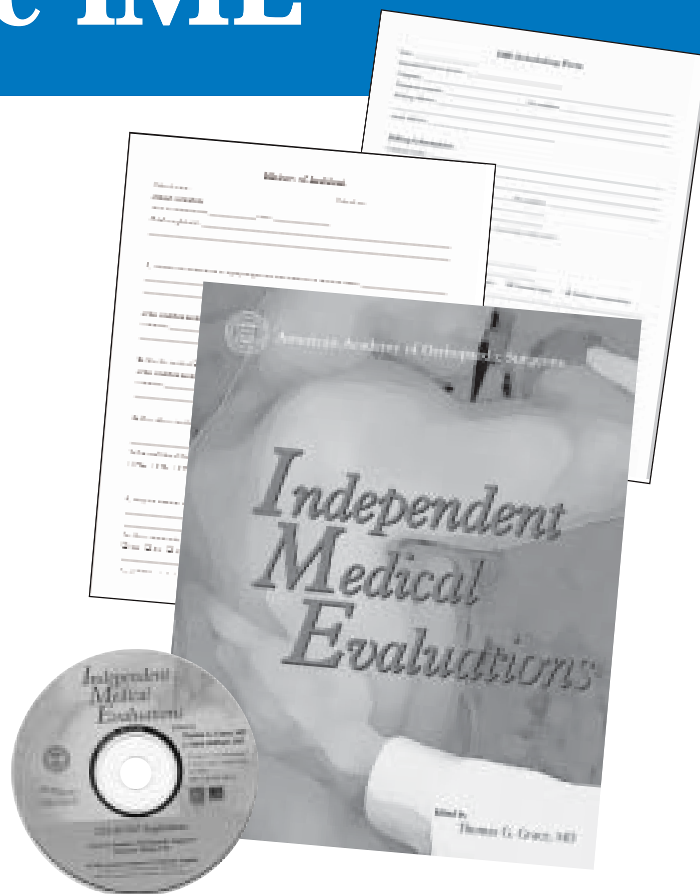

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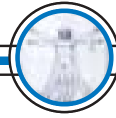

EDITORIAL: Trauma

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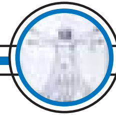
Trauma is the most common cause of death for people below the age of 35 in the United States. With trauma and injury having an ever-increasing impact on our society, the importance of the independent medical evaluation (IME) is greater than ever. Therefore, as medical examiners, we must be well informed and diligently perform the task of providing sound, up-to-date information to those who rely on us (third party payors, attorneys, government agencies, etc.) for information.

Independent medical examiners are asked to address a multitude of diverse questions and issues such as the patient's diagnosis based on medical records, history, and examination; the medical necessity of past evaluation and treatment; the need for additional evaluation to clarify diagnosis; maximal medical improvement (MMI); anticipated future medical care; potential for job retraining, rehabilitation, or return to work; the need for functional capacity evaluation (FCE); and determination of a percentage (%) whole person impairment rating (WPIR) based on the most current *Guidelines* for the appropriate jurisdiction. This could be the *AMA Guides to the Evaluation of Permanent Impairment or state specific or even system specific guidelines or schedule.*

By definition, an IME physician has no doctor-patient relationship with the examinee. In most instances with only one encounter with the examinee, we are expected to review medical records carefully, take a history, perform a detailed examination, and reach "expert" opinions on a number of important issues. We must all remember that the opinions we reach, sometimes, in a matter of hours may affect a claimant (and his or her family) for a *lifetime*. We must perform our task without fear or favor and must take into account that the people we evaluate, sometimes, may have to live with the consequences of our recommendations and opinions. We must practice objective compassion and remember that in some cases, we may be the last, and determinative, opinion in a prolonged, adversarial process. Experienced independent medical examiner realizes that this can, and often does, influence examinee behavior in an independent medical evaluation setting. Without the luxury of trust, a doctor-patient relationship, and repeated interviews and examinations, our greatest asset is knowledge. Our opinions should be grounded in an unassailable education, knowledge, and lack of bias.

The independent medical examiner bridges the gap between the art and science of the field of medicine and the requirements of the legal system. In order to accomplish the daunting task of providing reliable information on which others may base their decisions relating to workers' compensation issues, personal injury litigation, and personal disability insurance coverage, the independent medical examiner must have a comprehensive store of knowledge, both of medicine and of ancillary fields (e.g., FCEs, physical therapy, statistics, etc.). *The Journal of Disability Medicine* reviews frequently encountered, well-accepted topics, as well as controversial topics, from both a medical and a disability perspective.

In response to the growing demands to evaluate head trauma the journal has published several article in the past. This issue caries an



article by Herkov and Conger on neuropsychological assessment, which is the second of a two-part series. The first article dealt with theoretical and psychometric basis of neuropsychological testing. The focus of the 2nd paper is on the identification of the cognitive processes commonly the focus of neuropsychological assessment, some specific test measures involved in the assessment of these functions and the relationship of these findings to brain anatomy. The authors explore the assessment of cognitive processes of attention, memory and learning, motor, language, executive, and visual-spatial functioning. This excellent article concludes by offering a brief summary of the literature on neuropsychological findings associated with specific types of brain injury including closed head injury, anoxia, toxin exposure and drug use.

In response to readers need for good report writing skills the article in this issue by *Wilson* gives some good examples of how not to do things when writing reports. The goal of this article is to assist IME physicians in producing credible and quality reports. This article identifies some of the criteria used by IME reviewers. It also identifies certain practices that lead IME reviewers to question the credibility of reports or physicians. The author in his unique mix of anecdotal and case based approach has presented his own experience of review criteria and common Errors with case examples from over a decade of reviewing IME reports. The criteria and examples presented in this paper are intended to serve as "markers" which can be one of the way IME physicians can judge the quality of their own reports before they are submitted for use.

Our sincere hope is that our effort would lead to further dialogue and perhaps debate. Your input and feedback as a stakeholder is invaluable to our efforts to present comprehensive coverage of a range of subjects in a concise and comprehensible manner.

J. True Martin, M.D.CIME
Mohammed I. Ranavaya, M.D., M.S., FRCPI, FFOM, FAADEP, CIME
Editors

General Information – Disability Medicine, Volume 2, Number 4

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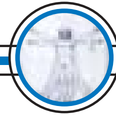

Neuropsychological Assessment: Cognitive Assessment

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ABSTRACT

This article is the second of a two-part series on neuropsychological assessment. The first article dealt with theoretical and psychometric basis of neuropsychological testing. The focus of this paper is on the identification of the cognitive processes commonly the focus of neuropsychological assessment, some specific test measures involved in the assessment of these functions and the relationship of these findings to brain anatomy. The authors explore the assessment of cognitive processes of attention, memory and learning, motor, language, executive, and visual-spatial functioning. The article concludes by offering a brief summary of the literature on neuropsychological findings associated with specific types of brain injury including closed head injury, anoxia, toxin exposure and drug use.

Introduction:

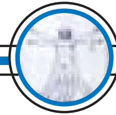
This article is designed to provide an overview of the major areas of cognitive functioning, the neuropsychological measures used to assess these abilities, and the common neuropsychological findings associated with a variety of brain injuries. To cover these topics in depth would likely require several volumes of a book and is beyond the scope of this paper. However, this paper, in conjunction with the previous article, will give the reader basic knowledge of what neuropsychological tests are, how specific tests are used and what common deficits are associated with various brain injuries. For a more complete listing of tests and research findings, the reader is referred to more general review books (e.g., Lezak, 1995 and Spreen & Strauss, 1998).

Cognitive Processes:

It is estimated that the human brain is composed of over 100 billion neurons. With each neuron having numerous axons, the interconnections between neurons and thus the complexity of the transmission of information is staggering. The cognition that we experience everyday is the result of this matrix of information processing. Thus, it is misleading to talk about specific cognitive processes as if they exist independently or in isolation (e.g., memory, executive functioning). Many cognitive tasks that seem simple, actually involve complex relationships between neurons. For example, having a person repeat a short paragraph read to them requires at minimum: 1) receptive and expressive language abilities; 2) attending to what the person says; 3) holding information in working memory for processing; and 4) association to past memories for context, meaning and recalling the story. Thus, calling such a task “memory” is overly simplistic in that a deficit in any of specific processes can lead to impairment in recall of that story.

The same is true of neuropsychological test measures. By necessity, tests are classified by the predominant function that they are believed to evaluate. However, successful completion of a particular test might rely on a host of cognitive abilities in which a breakdown at any point in the process can result in poor test performance. For example, a test such as the Wisconsin Card Sorting Test (see below) is typically thought of as a measure of executive functioning. However, ability to successfully complete this test relies on language functioning, attention skills, memory and learning as well as executive functions. Therefore, it is important to remember that the following organization of neuropsychological test measures is for heuristic purposes and does not imply that a deficit on any test is “proof” of impairment in that area of brain functioning.

We will now look at some of the major categories of neuropsychological functioning and the specific tests



involved in an assessment of these abilities. It is important to understand that the test list provided is not meant to be exhaustive or endorsing. There are literally hundreds of neuropsychological tests with varying degrees of validity and reliability and each has its own strengths and weaknesses. The provided list is only a small sample of the available tests and these were selected because of their frequency of use in neuropsychology.

Additionally, as noted in the previous article, some neuropsychologists employ a flexible approach to testing, while others use a fixed battery. The following article focuses more on the flexible approach with its listing of individual psychological tests. It is important to note that there are several neuropsychological test batteries that can also be used to measure many of these same functions in an integrated manner.

The most common neuropsychological test battery is the Halstead-Reitan Neuropsychological Battery. This valid and reliable test battery consists of a number of tests that measure six categories of neuropsychological functioning including input; attention, concentration and memory; verbal abilities; spatial abilities, abstract reasoning and concept formation; and output (Anderson, 1994; Reitan & Wolfson, 1985). These tests have excellent norms and test results can be summarized into an Impairment Index rating or a Neuropsychological Deficit Scale score that provides a composite measure of an individual's performance on the overall battery of subtests (Reitan & Wolfson, 1985).

The Luria-Nebraska Neuropsychological Battery has two forms consisting of a number of subtests that measure such things as motor functions, rhythm, tactile function, visual functions, receptive speech, expressive speech, writing, reading, arithmetic, memory, intellectual processes and intermediate memory (form II) (Anderson, 1994; Christensen, 1989). This battery is used less commonly than the Halstead-Reitan. While it has acceptable reliability and validity, it has been criticized as being insensitive to assessing deficits in high functioning individuals, and being less useful in the assessment of aphasia and complex visuomotor tasks (Anderson, 1994).

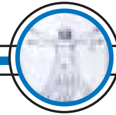
There are other neuropsychological test "batteries" (e.g., Michigan Neuropsychological Test Battery) that utilize combinations of existing tests with or without subtests specifically designed for their battery (Lezak, 1995). There are also test batteries for assessing specific brain injury conditions (e.g., NIMH HIV Core Neuropsychological Battery, Butters et al., 1990; Dementia Rating Scale, Mattis, 1988; etc.) These batteries may be appropriate when working with a specific population, (e.g., HIV, dementia, etc.).

Attention:

Attention is the building block of cognition. Information that is not attended to cannot be learned, processed or recalled. Examination of this construct indicates that it is a complex concept with several discrete processes including focused attention (ability to attend to one part of the environment while ignoring others), divided attention (capacity to share attention to different tasks), sustained attention (ability to maintain focus over a period of time) and cognitive flexibility (ability to shift attention) (Anderson, 1994; Lezak, 1995; Van Zomeren & Bouwer, 1987). Attention in the brain can be disrupted at both cortical and subcortical levels (Filley, 2002). Cortically, the prefrontal cortex has a number of structures and feedback loops important in attention (Fontaine et al., 1999; Lezak, 1995). Subcortical lesions in the thalamus and basal ganglia can also result in inattention (Exner et al., 2001; Ravizza & Ivry, 2001).

Neuropsychological testing generally evaluates attention as it relates to verbal, visual, or tactile stimuli and tasks. Most measures of attention, however, are multidimensional and do not discretely fit into the above categories. For example, in many cases, tests of attention also involve what is referred to as "working memory" or the capacity to temporarily hold information for processing (Spreen & Strauss, 1998). It is important to keep in mind that most, if not all, neuropsychological tests rely upon the individual's ability to sustain attention in order to complete each of the tasks and are, therefore, indirect measures of attention and concentration.

Table 1 lists the various measures of attention commonly used by neuropsychologists.



Memory and Learning:

Memory can be defined as the capacity to register, retain and retrieve information. Research indicates that short-term or working memory has a different structural basis from long-term memory (Spreen & Strauss, 1998) with short-term memory being much more susceptible to impairment in most brain injury cases. Memory can be further broken down into declarative (explicit) memory, that involves the conscious recollection of previous experiences, and procedural (implicit) memory, that involves the learning of skills. Declarative memory appears to be more susceptible to damage associated with the temporal limbic system than implicit memory (Spreen & Strauss, 1998). Most neuropsychological tests measure declarative memory by providing the patient with a list of words, geometric shapes or pictures or some other stimuli and then measure the patient's capacity to recognize or recall these items immediately (immediate recall) or after various periods of delay (delayed recall).

Memory tests are usually classified depending on whether they assess verbal (auditory) or visual memory. Neuropsychological tests for memory involve both batteries that measure a wide range of memory functions and individual tests that measure discrete memory abilities. Memory batteries have the advantages of assessing a number of different aspects of memory and also allowing for intersubtest comparisons of the various memory components. However, these batteries are time consuming and may not be relevant for the referral question in some settings (Lezak, 1995).

Memory can also be measured more indirectly or discretely through other tests that tend to focus on other cognitive functions. For example, the Category Test, which is usually thought of as a measure of executive function, contains a subtest that requires the person to remember previous response strategies. Likewise, the Tactual Performance Test includes a memory component even though its primary function is to assess other cognitive processes.

In learning tests, the patient is usually presented with multiple exposures to the pertinent material and later asked to recall the material. The patient's learning curve and recall can then be compared to a particular normative group. These tests can sometimes help delineate when memory problems are due to encoding (input of the information into the brain) or retrieval (locating adequately encoded material) difficulties.

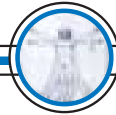
Although no true "seat" of memory has been identified through research, memory functioning is usually thought of as being primarily located in the temporal lobe and limbic system. The left temporal lobe appears to be most implicated in verbal memory impairment, while the right temporal lobe seems to be more involved in non-verbal forms of memory. Some structures such as the hippocampus also seem to be important in memory formation. Information storage, on the other hand, does not appear to be localized to any particular area. Instead, the specific type of memory (e.g., visual, auditory, etc.) appears to involve the association cortex of the particular areas of the cerebral cortex that are directly involved in the different sensory modalities (Lezak, 1995).

Table 1 list some of the common neuropsychological tests of memory.

Speech and Language

Speech and language functions involve the patient's capacity to communicate with their environment. Generally, the words aphasia (no speech) or dysphasia (impaired speech) are used to denote language problems. Classification of aphasia can usually be broken down into five general areas involving expressive, memory/retrieval, programming/ sequencing, comprehension and global difficulties. Deficits in expressive speech can involve prosody (rhythm and intonation), fluency (flow and quantity), naming (name objects on demand), repetition (repeating), grammar and syntax, and paraphasias (misspoken words). Expressive language functions may also include written expression (agraphia). Language difficulties may involve auditory (speech) or visual (reading) comprehension functions. Similar to memory functioning, speech and language functions can be assessed using either a battery of individual test approach.

Most speech and language difficulties arise out of left hemispheric lesions. While somewhat of an oversimplification, lesions in the premotor and motor association region



tend to disrupt speech production while leaving comprehension abilities relatively intact (Clark & Boutros, 1999). Lesions of the temporal lobe tend to involve language comprehension difficulties. However, as noted above, brain relationships are complex with discrete lesions causing a variety of problems. For example, temporal lobe lesions can result in verbal memory deficits in recalling words. This can result in seriously disrupted fluent speech (Lezak, 1995).

Table 1 lists the common speech and language neuropsychological tests.

Table 1 Neuropsychological Tests of Attention, Memory, and Speech and Language

Cognitive Ability	Neuropsychological Tests
Attention: Focused	Trial Making Test – Part A, Seasore Rhythm Test
Sustained	Continuous Performance Test (CPT)
	Paced Auditory Serial Addition Test (PASAT)
Divided	WAIS Letter-Numbering Sequencing
	Trail Making Test – Part B
Memory:	
Battery Tests	Wechsler Memory Scale – Third Edition (MMS – III)
	Wide Range Assessment of Memory and Learning (WRAML)
	Memory Assessment Scales
Individual – Verbal	California Verbal Learning Test (CVLT)
	Rey Auditory Verbal Learning Test (RAVLT)
Individual – Visual	Continuous Visual Memory Test
	Rey-Osterreith Complex Figure Test
	Benton Visual Retention Test
Speech and Language:	
Battery Tests	Boston Diagnostic Aphasic Examination (BDAE)
	Western Aphasia Battery
	Reitan ñ Indiana Aphasia Screening Test
Individual	Boston Naming Test
	Speech Sounds Perception Test
	Wide Range Achievement Test (Reading & Spelling)
	Peabody Picture Vocabulary Test
	Controlled Oral Word Association Test

Motor Functioning

Detailed assessment of motor functioning is more a part of a neurological evaluation than a neuropsychological evaluation. However, deficits in motor functioning can reveal information on brain functioning, especially involving issues of lateralization (Anderson, 1994). Neuropsychological assessment of motor functioning usually involves testing the speed and strength of fingers and hands. Most individuals demonstrate motor superiority in their dominant hand. However, there is considerable variation within the general population and diagnosis of cortical dysfunction based solely on these measures should be avoided.

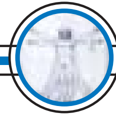
Neuropsychological tests of motor functioning involve assessment of the primary and secondary motor regions of the brain. For example, lesions to the premotor area can result in reduced grip strength and motor impersistence (difficulty in maintaining a motor act). However, most motor disorders do not correspond to damage in a particular brain region. Rather, lateralized motor dysfunction is usually associated with impairment to the contralateral cortex (Anderson, 1994).

Table 2 lists some of the common motor tests used by neuropsychologists.

Executive Functioning

The term executive functioning is used to summarize a number of cognitive abilities related to planning and initiation of behavior, problem solving and judgment, flexibility, and self-perception and regulation (Spreen & Strauss, 1998). These abilities serve a supervisory or "executive" function for the brain. Anatomically, executive function abilities are thought to be largely associated with the frontal lobes although deficits may occur with damage to other brain regions, including subcortical areas.

Deficits in executive functioning can be devastating to patients. These deficits can occur in the face of generally intact intellectual and memory abilities. Unfortunately, it is difficult to directly evaluate these abilities with standard



neuropsychological tests since standardized tests, by definition, usually give the person a brief, explicit and structured problem to solve. Executive functions in day to day living, on the other hand, are more expressed in situations that require the person to analyze, organize, and synthesize information in unstructured situations over time. While the assessment of executive functioning remains a challenge for neuropsychology, the individual's abilities, as reflected in test scores, can provide considerable information regarding general skill levels as well as areas of particular strengths and weaknesses. This is because neuropsychological tests developed to measure executive functioning do require cognitive flexibility, use of response contingent feedback, and suppression of certain behaviors.

A list of common tests that evaluate executive functioning is provided in Table 2.

Visual-Spatial Functioning

These groups of tests focus on the cognitive abilities of visual perception, spatial conception and construction. Common problems involve visual neglect (lack of awareness of stimuli), recognition (pattern matching) and organization (perception of fragmented or incomplete stimuli). The other set of tests in this section involve construction (ability to copy or produce an object) and require both perceptual and motor abilities.

Visual-spatial functioning usually involves posterior right hemispheric (parietal and occipital lobes) functioning, although lateralization is very much task dependent. For example, persons with right hemispheric damage tend to have difficulty capturing the gestalt of copying tasks. In contrast, persons with left hemisphere damage do better at producing the general drawing but lose many of the details. Parietal lobe lesions are most often involved in visuographic problems and other visuoconstruction tasks (Lezak, 1995).

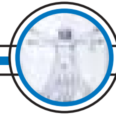
See Table 2 for a list of visual-spatial measures.

Neuropsychological Findings for Common Brain Injuries:

Neuropsychological testing, as indicated in the first article, is a sensitive measure of cognitive functioning and brain injury. However, because of the complexity of brain function, numerous mechanisms for brain damage and the relatively limited number of assessment domains, there are few conditions that result in a well defined pattern of neuropsychological deficits. Rather, brain injury, regardless of the source, leads to impairment in a wide variety of cognitive deficits. Some cognitive functions, such as attention and memory seem to be particularly

Table 2 Neuropsychological Tests of Motor Skills, Executive Functions and Visual/Spatial Skills

Cognitive Ability	Neuropsychological Tests
Motor Tests	Finger Tapping Test Grip Strength Test Grooved Pegboard Test Motor Impersistence Test
Executive Functions:	
Flexibility	Trail Making Tests
Concept Formation	Wisconsin Card Sorting Tests (WCST) Category Test
Maintaining Set	Stroop Color-Word Test
Planning	Porteus Maze Test Ruff Figural Fluency Test
Visual/Spatial:	
Neglect	Line Bisection Test
Copying	Bender Gestalt Test
Construction	WAIS Block Design
Perception	Hooper Visual Organization Test Judgment of Line Orientation Test Facial Recognition Test



vulnerable to brain injury with virtually all of the following categories of injury associated with deficits to these systems.

Closed Head Injury

Closed head injury (CHI) refers to conditions in which the brain is subjected to significant acceleration/deceleration forces. While there is no intrusion into the skull by some outside object, these forces can lead to brain damage through the shearing of neurons. Additionally, the brain may suffer contusion through its impact against the skull or through the compression of brain tissue associated with edema, bleeding or other fluid. Because of the lack of demonstrable organic pathology, neuropsychological testing can provide a sensitive measure of cognitive impairment associated with CHI even when standard medical tests result in "normal" findings.

CHI is frequently classified as mild, moderate or severe based on periods of unconsciousness, Glasgow Coma Scale ratings, length of associated with pre and post accident amnesia and other factors. However, no clear correlation of severity has been found between any of these factors and the actual extent of deficits obtained from formal neuropsychological testing.

Because of the variability associated with the injury site, there is no typical neuropsychological profile of CHI with both diffuse and focal injuries identified (Lezak, 1995). In cases of mild CHI it is common for individuals to experience deficits in attention (especially on tasks requiring complex or divided attention, e.g., PASAT, Trail-Making Test - Part B, Letter-Number Sequencing) and memory (CVLT, WMS-III) with less complaints involving language, visual-spatial or motor functioning. Frontal lobe functions may be especially vulnerable due to their location in the brain and many patients report an overall cognitive slowing and impairment in executive functions (e.g., WCST, Category Test). Patients with moderate or severe CHI can show deficits across cognitive domains, although attention, memory and executive functions appear to be most vulnerable.

Anoxia-Hypoxia

Anoxic or hypoxic injuries occur to the brain secondary to an absence or decrease of oxygen to the brain. These injuries can occur secondary to loss of consciousness, cardiopulmonary arrest, COPD, carbon monoxide or other toxin exposures as well as other conditions.

Neuropsychological test studies identify a number of cognitive deficits associated with anoxic-hypoxic events, especially in severe cases. However, the most severe and commonly noted deficits involve the ability to learn new information. This is likely related to the vulnerability of the hippocampus to oxygen deprivation and its essential role in the formation of new memory (CVLT, WMS-III, etc.). These learning deficits often occur in the presence of relatively intact long-term memory, speech, language and visual-spatial functions. Verbal IQ functions appear to be better preserved than Performance IQ, likely due to the fact that the Verbal IQ relies more on crystallized memory (Caine & Watson, 2000).

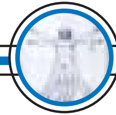
Toxic Exposure

Neurotoxins are typically classified into categories of solvents and fuels, pesticides and metals (Lezak, 1995). The cognitive effects and pattern of neuropsychological test results can vary considerably and are related to the particular agent involved and the level and length of exposure (Fiedler, 1996). Virtually all agents result in attention and memory deficits. However, these types of injuries also are commonly associated with changes in motor functioning (e.g., tests of reaction time). A number of specialized batteries have been developed to specifically assess cognitive changes in these individuals. Virtually all of these batteries include a measure of general intellectual functioning, memory, attention, motor speed and coordination, visual-spatial abilities and abstract reasoning (Hutchinson et al., 1992).

Substance Abuse

Use of drugs and alcohol can have a profound impact upon cognition and neuropsychological test performance. Thus, it is usually important that the evaluating neuropsychologist have information regarding the patient's substance use history. While chronic alcohol use can lead to a number of cognitive impairments including the gross memory deficit associated with Korsakoff's encephalopathy, most research indicates that mild social drinking does not have a significant impact upon long-term cognitive functioning (Parson & Nixon, 1998).

The impact of illicit drug use on neuropsychological functioning can be



profound and dependent upon the actual substance used as well as the chronicity of use. For example, synthetic drugs such as MDMA (Ecstacy) are highly neurotoxic and can have a profound impact upon memory functioning (Herkov, et al., 2000). Marijuana and cocaine also have been shown to significantly impair verbal memory and executive functioning (Bolla et al., 1998; Swolowij et al., 2002).

Conclusion

There are some processes that may result in more clearly defined, lateralized neuropsychological deficits (e.g., brain tumors, cardiovascular accidents). However, research has shown that the majority of injuries to the brain result in a more diffuse, variable picture of cerebral dysfunction that does not fit into clear patterns of test scores regardless of the etiology of damage. The effects of such damage can be identified effectively through the administration of neuropsychological tests that are designed to evaluate the integrity of the cerebral hemispheres. Often, the microscopic changes that result from the trauma are not identified through medical diagnostic procedures. In such cases, an experienced and qualified psychologist with specialized training in the field of clinical neuropsychology can assist in identifying cognitive deficits and areas of concern to assist in treatment planning for the injured individual. Even though it is not possible to fully replicate the cognitive demands that are placed upon individuals in their day to day lives, valid and reliable neuropsychological tests can provide considerable useful information for such planning.

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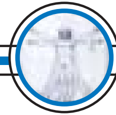

THE OFFICE DIAGNOSIS OF THORACIC OUTLET SYNDROME - A CLOSER LOOK

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Thoracic outlet syndrome (TOS) is a constellation of symptoms and signs including upper extremity pain, numbness, and/or weakness often arising about the junction of the neck, upper chest, and shoulder.[1] This relatively rare condition is usually due to intermittent compression of the brachial plexus in the thoracic outlet or costoclavicular space (neurogenic TOS).[2] In a small percentage of cases the complaints and findings are vascular in nature. The clinical presentation in vascular TOS is often acute, depends on whether the compression is arterial or venous, and is altogether different from neurologic TOS, the subject of this report. Because it is most often seen in young, otherwise healthy women[2,3] *she* or *her* will be used in this article.

The typical symptoms of TOS (upper extremity pain, numbness, and/or weakness in various distributions and intensity) develop predictably with repetitious use or elevation of the involved limb. They are relieved just as predictably (but more slowly) when the limb is lowered into a supported position, e.g., in the lap or on a table, and rested.

Pathogenesis

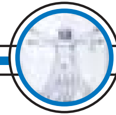
Two factors are required for intermittent compression of the brachial plexus in the thoracic outlet or costoclavicular space to result in clinical TOS. The first is an *anatomic predisposition* – the "susceptible individual" described by Roos.[3] The second is an *inciting incident* which triggers the process and from which the symptoms develop. The anatomic abnormalities consist of a narrowed costoclavicular space and/or congenital fibromuscular bands most commonly located beneath the brachial plexus in the thoracic outlet. The costoclavicular space can be narrowed by a congenitally low lying shoulder girdle as seen in patients with markedly sloping shoulders, or less often by bony abnormalities such as a cervical rib, callus around a clavicle fracture, or exostoses or tumors of the first rib or its anterior costal cartilage. The several types of congenital bands[5] described by Roos[3,6,7] are readily visible at surgery, and constitute the anatomic basis for most cases of TOS.

The inciting incident is most commonly an acute injury to the neck or upper extremity resulting in micro-hemorrhages, or repetitive activity involving these areas, with subsequent spasm of the middle and probably anterior scalene muscles. The symptoms of TOS come from intermittent, but repeated irritation of the brachial plexus compressed by scalene muscle spasm above and congenital fibromuscular bands or a narrowed costoclavicular space below. In the absence of further injury or with cessation of the symptom-producing activity, the scalene spasm should resolve with time and/or treatment. However, the presence of the anatomic abnormalities alone is apparently now sufficient to continue the brachial plexus irritation and resulting symptoms.

Issues in TOS

A considerable body of literature[5,8,9,10,11,12] has arisen as researchers have attempted address three issues in TOS. The first is the difficulty in *diagnosis*, the second, *treatment*, and the third *side issues* including the physical, psychosocial, and economic effects of prolonged disability due to TOS. There are many differences of opinion regarding these topics, particularly diagnosis and management.

Given an understanding of its pathophysiology, the resultant symptoms and physical findings, the differential diagnosis, and the ability to interpret x-rays of the chest and cervical spine, TOS is not difficult to diagnose. However, the subtle but important symptom differences that set it apart frequently go unrecognized. Diagnostic difficulties arise for three reasons. First, neck, shoulder, and/or arm pain are common complaints, and usually due to conditions other than TOS. Second, generally there are no objective findings in TOS; and there is no definitive



objective test upon which to base the diagnosis. Third, persons so afflicted consult or are referred to a broad range of providers including family practitioners; occupational and emergency medicine physicians; physiatrists; chiropractors; neurologists; orthopedic, thoracic, vascular, and neurosurgeons; and physical, occupational, or massage therapists.[2,4] Given the tendency for providers to diagnose what they see often, many TOS patients are misdiagnosed as having a more common condition such as cervical sprain/strain or disc disease, shoulder tendonitis, or carpal tunnel syndrome.

There are also three reasons for treatment difficulties. First, misdiagnosed TOS patients are frequently treated for conditions they do not have, and not surprisingly such therapeutic endeavors are usually unsuccessful. Second, even when the correct diagnosis of TOS is made, symptom relief with conservative therapy is usually slow in coming, incomplete, and frequently short-lived. Third, the results of surgery in TOS are difficult to quantitate and often poor.[2,13] Thus the search for more effective nonoperative therapy and surgical procedures continues, but further discussion of treatment is beyond the scope of this article.

When repeated office visits, testing, and treatment attempts fail to bring improvement, both the TOS patient and practitioner become disappointed and frustrated. Many patients embark on a prolonged, expensive, and confusing, medical journey trying to find out what is wrong, and are often still frustrated, and disappointed. Return to work appears out of the question even if they wanted to.[14] This "Odyssey of TOS Diagnosis and Treatment" occurs so often a composite description is reported below.

As implied, the foremost side issue in TOS is the often associated chronic disability; and its physical, psychosocial, and economic effects. Prolonged unsuccessful or delayed treatment places these patients at risk for losing their motivation, and subsequently ability, to function productively as spouse, homemaker, and/or breadwinner. Hence this condition affects not just the TOS patient, but also their families, co-workers, etc.

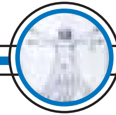
The Odyssey of TOS and Treatment

Although TOS can arise spontaneously, in most cases there is precipitating trauma.[3] The injury can be an automobile accident, fall, or other acute neck or upper extremity trauma. TOS can also result from repeated lesser trauma to the neck, shoulder, or arm at home or in the workplace, or from repetitive activity such as pushing, pulling, or lifting. Most patients have a fairly clear idea how and when their symptoms started, but don't know what has gone on inside their bodies.

Symptoms commonly begin in the neck, either following an injury, or repetitive prolonged cervical flexion. The neck pain and stiffness isn't "better the next morning" and requires a temporary change in daily routine (possibly including staying home from work). If the patient seeks treatment at this point it is generally in a hospital emergency room, or the office of her family physician or chiropractor. X-rays of the neck, if taken, are normal, although an occasional patient may be told there is "an extra rib," often without further comment. The diagnosis is commonly cervical sprain, strain, or subluxation. Treatment is usually symptomatic, e.g. muscle relaxants, analgesics, heat, cold, and/or spinal manipulation.

Continued neck pain prompts the patient to use home remedies, or return to the physician for medication refills or chiropractor for further adjustments. Symptom relief is temporary, but the neck pain slowly recedes. However, by now one or both arm(s) has started to ache and feel heavy and tired with use. The upper extremity symptoms are usually quickly relieved by dropping the limb(s) into the lap or at the side.

There is further diminution in the neck pain with time, but the upper limb symptoms increase. Numbness or tingling may now accompany the pain and/or weakness, often characterized as "my arm gives out", "it goes dead" or "my arm goes numb." These complaints now occur *every time* the limb is raised above horizontal or used for certain activities, and are commonly relieved when the symptom-producing activity is discontinued. At this point female TOS patients commonly cut their hair short or get a permanent because they are no longer able to wash, blow-dry, or set it. This behavior is almost unique to TOS[3] and of diagnostic value.



Eventually the neck pain resolves or is no longer a major complaint, being overshadowed by upper extremity symptoms now triggered by less activity. The aching lasts longer and doesn't resolve as rapidly with rest. "If I do too much with the arm during the day I'll pay for it that night."

Failure to make the diagnosis and initiate appropriate treatment at this point usually prompts a referral or the patient to seek help elsewhere on her own. Physicians commonly refer to an orthopedic surgeon or prescribe physical therapy. Given the failure of traditional treatment a patient may consult an alternative healthcare provider, particularly one thought to have the ability to treat what she believes she has. Regardless, diagnoses and treatment recommendations tend to be those typically made by the provider selected for patients with shoulder, arm, and perhaps residual neck pain. For example, a busy orthopedist's brief interview in an exam room might be followed by physical examination directed at the neck and shoulder, while the arm complaints and thoracic outlet are ignored. A TOS patient remarked, "If the symptoms aren't what the doctor is trained to treat, they act as if they don't exist." Treatment recommendations usually include additional medication, e.g., a non-steroidal anti-inflammatory drug, muscle relaxant, and/or analgesic, and physical therapy. The medications usually help temporarily, although aggressive physical therapy may worsen TOS symptoms.

Failure to improve usually results in additional testing such as MRI or CT scans of cervical spine and/or shoulder. These studies are usually normal, although one or more disc bulges, or even a herniation, may be evident. A TOS patient may be told the disc lesion(s) might explain her upper extremity symptoms. However, it is not unusual for the possible cause mentioned in the clinician's office to become the actual cause in the patient's mind by the time she gets home.

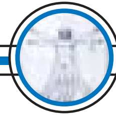
Continued and gradually worsening symptoms despite repeated doctor visits, testing, and treatment prompt increasing patient concern, frustration, and bewilderment. She recalls being told in various ways there is nothing seriously wrong, which was initially reassuring. However, the interviews and examinations have now become almost perfunctory; and one or more doctors have said the problem may be her "nerves." She begins to think and then expresses to friends "no one will listen to me" or "they don't believe me." Judgments are made about the practitioners involved, and the quest now is for medical validation.This growing sense of loneliness eventually extends from the provider's office to the patient's home, and she begins to wonder if even her family believes her. This further increases family tensions which initially arose due to her progressive difficulty with normal daily activities and need to rely on family members to perform them. Initially the family was concerned and helped gladly, but with passage of time have become skeptical and resentful, which accentuates her feelings of isolation. She increasingly resents that her disability is "invisible," and nobody knows what is wrong with her.

The failure of medications, manipulations, massages, physical therapy, and/or other treatments to provide anything more than temporary relief of symptoms and disability prompts a third stage of evaluation and treatment.

The patient is again caught up in a round of interviews and testing, perhaps by neurologists, neurosurgeons, or physiatrists. The interviews, examinations, and testing, while often more thorough, are once again directed towards the most common causes of neck/shoulder/arm pain seen in the provider's specialty.

Electrodiagnostic studies such as nerve conduction tests, electromyograms, or somatosensory evoked responses may be carried out. Vascular laboratory studies, e.g., positional plethysmography and arteriography, are frequently performed. A myelogram and post-myelographic CT scan may be ordered "to be complete." However, these expensive and sometimes invasive and painful studies are usually normal.

Treatment at this point may include further physical therapy or medication trials, perhaps including narcotic analgesics. It may involve various injections, trigger point, epidural steroid, or stellate ganglion blocks, typically performed by an anesthesiologist specializing in chronic pain. Because these treatments usually afford short-term relief they may be continued intermittently until the



patient tires of the time, effort, and expense involved.

Despite the ever-growing list of practitioners seen and treatments undertaken, the patient's complaints and disability continue to worsen. There are now few physical activities that don't cause symptoms. Thoughts about and desire to return to work tend to fade, and relationships at home are further strained as other family members carry an increasing share of household tasks. The repeatedly futile attempts to deal with the pain have made her more skeptical and distrustful of the healthcare system, and dulled her motivation to find and treat what is wrong. She may go to practitioner's offices almost mechanically, or cease treatment altogether. Situational depression develops, with social withdrawal, and perhaps suicidal thoughts, although the latter are usually not acted upon.

Patients in this situation are frequently referred for psychological consultation and testing, but these usually do not facilitate the diagnosis of TOS. Biofeedback may be added to the list of unsuccessful treatments. Counseling is frequently recommended, and tends to be continuing and open-ended. While most patients compliment their psychologist, the counseling provides little or no relief of physical symptoms. It may also foster their dependency needs, and delay return to work and a normal life once the TOS has been successfully treated.

Psychiatric referral is less frequent, but often reasonable since physically ill or injured patients are at higher risk for depression than the general population. In fact, 10-15% of cases of major depression are due to general medical illnesses or other conditions.[15] Such referral is also usually beneficial since most TOS patients seen by psychiatrists are reassured they have a physical rather than mental problem. This is important since patients with long-standing, undiagnosed TOS often briefly question their own sanity. By reassuring the patient it's not in her mind and wishing her luck in finding the cause of the problem, the psychiatrist can provide welcome support for someone whose complaints have been questioned by family, friends, providers, and even herself.

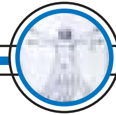
The fourth and final stage in the diagnostic-treatment odyssey occurs when someone, a provider or layperson, listens to the patient's complaints, recognizes the predominance of upper extremity symptoms, and considers TOS as a possible explanation. This may be a physician. However, more often the diagnostic impression comes from a friend, occupational or physical therapist, attorney, insurance adjuster or supplier of rehabilitation equipment who recognizes the complaints as similar to those of someone else found to have TOS. In either case, she is referred to a physician familiar with the diagnosis and treatment of TOS, often a thoracic or vascular surgeon. Following a variable delay, depending on patient circumstances, physician appointment backlog, third party payers, and other factors, a TOS-directed interview and examination are conducted; and the correct clinical diagnosis is established.

The apparent irony that an interested non-physician is more likely to make the presumptive diagnosis of TOS may be explained by how the patient's story is heard. It is difficult to describe the symptoms of TOS to an interviewer. Because medical histories are usually symptom rather than effect-oriented, they may not uncover the loss of ability to perform many activities of daily living. Thus when a patient is asked to describe her symptoms in detail, she may unintentionally withhold crucial functional information necessary for the physician interviewer to differentiate between the many causes of neck/shoulder/arm discomfort. However, when talking to a layman the focus is on functional problems resulting from the symptoms, i.e., what she cannot do. This permits the informed layman or therapist to better recognize the similarity between this person's complaints and those of another individual who had TOS.

Not every patient with TOS experiences all the stages of delayed diagnosis and ineffective treatment described here. All it takes is for someone to consider the condition. However, the unfortunate situation described here is not rare.

TOS Clinical Consultation

Interested physicians with an index of suspicion can diagnose TOS inexpensively and reliably (but not quickly) in their offices. Making the correct diagnosis then permits specific, appropriate, and reasonably effective treatment.



A successful work-up depends on several factors. The physician must be familiar with the various causes of neck/shoulder/arm pain, and keep in mind a complete differential diagnosis. TOS cannot be diagnosed unless it is *considered*. He or she must understand the pathophysiology, resultant symptoms, and natural history of TOS, both untreated and as altered by prior treatment. The doctor must know how to conduct a TOS interview and recognize the importance of informed listening, since most patients will give a good listener all the clues necessary for diagnosis. He or she must know how to perform and interpret an appropriate physical examination including a simple neurologic exam of the upper extremity. Most importantly, the physician must be aware of barriers to the correct diagnosis of TOS, listed in Table 1.

As indicated, two factors are required for intermittent compression of the brachial plexus to develop into clinical TOS, an *anatomic predisposition* and *inciting incident*. The purpose of the clinical consultation is to determine whether both factors exist and have in combination caused TOS. The inciting incident (if any), subsequent symptoms and disability, and course of the problem are defined during the interview. Underlying anatomic abnormalities can be suggested by physical examination and plain films of the cervical spine and chest.

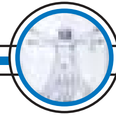
The evaluation can also assess whether the patient has a problem other than TOS or a co-existent condition. For example, cervical nerve root impingement due to a disc herniation or cubital tunnel syndrome could both cause symptoms similar to, and be confused with, TOS. Either might combine with concurrent brachial plexus compression to result in double crush syndrome. The entire clinical consultation, including a detailed interview, directed physical examination, interpretation of cervical spine and chest x-rays, followed by a discussion of diagnosis and treatment recommendations requires approximately two hours.

Patient Interview

The interview is potentially the most valuable part of the work-up of a patient with neck/shoulder/arm pain. If the correct questions are asked, and the examiner understands what is reported, the history will generally provide the clues necessary for a timely

TABLE 1
FACTORS DELAYING DIAGNOSIS OF NEUROGENIC TOS

1. Failure to
   - a. Listen to the patient
   - b. Perform a neurologic examination
   - c. Keep the differential diagnosis in mind and think of TOS
2. Failure to understand the
   - a. Clinical history of TOS (untreated and treated)
   - b. Wide variation in intensity of symptoms
   - c. Slowly progressive nature of symptoms
   - d. Primarily neurologic nature of TOS
   - e. Difference between inciting and anatomic causes of TOS
   - f. Significance of fibromuscular bands in the thoracic outlet
   - g. Psychological problems inherent in TOS
3. Reliance on Tests of Unproved Value
   - a. Adson and other positional vascular tests
   - b. Electrodiagnostic studies (EMG, NCV, SSEP)
   - c. Thermograms
   - d. Vascular laboratory studies (plethysmograms, arteriograms)
   - e. CT/MRI (except in differential diagnosis)



and accurate diagnosis. The four elements of this interview are a sequential history of the present illness, description of the current symptoms and activity limitations, evaluation of the illness' progression, and elucidation of its impact on the patient's life and emotions.

The initial interview is also an ideal time for the physician to gain the patient's confidence. Because TOS patients are so frequently misdiagnosed and treated inappropriately, and even dismissed outright by some, another new provider is often met with distrust and skepticism. "He probably won't listen or take me seriously either." These expectations may also be fostered by prior encounters with supervisors, company nurses, insurance adjusters, risk management personnel, case managers, independent medical examiners, attorneys, and the impersonal "system" in general. Hence confidence is not granted automatically, and must be earned.

Such negative feelings may be countered by an approach that is relaxed but appropriately respectful, and most importantly, conveys interest and empathy. Through questioning the physician must demonstrate the patient's complaints were heard and understood. "I know what you're going through." The patient must be given leeway to explain what she wants, but prevented from wandering too far afield. Finally, the physician must be rigidly non-judgmental regarding previous testing and treatment.

Seqential History of the Present Illness

During the sequential history, the physician obtains a general idea of the patient's mood and ability to communicate as he or she recounts important historical facts. The interviewer should learn the 4 W's: where, when, what, and who.

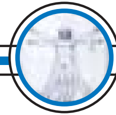
Where. The location of the chief physical complaint is determined first. Ask, "What is the main thing that is bothering you now?" or "Where is your problem?" Although neck, shoulder, and arm may all be involved, there is almost always one area most bothersome to the patient. In TOS this is usually the arm unless the inciting incident occurred recently.

When. The date of symptom onset and inciting incident are sought next. Most patients can explain when and how it all started and provide enough details for an astute examiner to determine if what happened could reasonably be the proximate cause for the subsequent symptoms. As indicated, in TOS the inciting incident is commonly an injury or repetitive activity involving the neck or upper extremity, with the former commonly being the sole area of initial complaint. The acute trauma may be a motor vehicle accident, especially rear-end collisions, a fall, or a direct blow to the neck, shoulder, or arm. Examples of repetitive activity known to produce TOS include pulling or lifting rolls of fabric in textile mills or carpet in carpet factories, jobs on automobile assembly lines, cutting up chickens in poultry plants, or computer data entry.

What. After determining where the problem is located, and when and how it began, the physician should ask, "Then what happened? What symptoms did you have immediately after the injury? When and where did you first seek treatment? What was done? What were the results of tests and treatment?"

Who. The patient is next questioned about the sequence of events following the first evaluation by listing, in order, the providers consulted for diagnosis or treatment. In each case, their name, diagnostic impression, and recommendations regarding further testing and treatment, and the results, are noted. Although CT scans, MRIs, electrodiagnostic tests, and vascular studies are unnecessary for the diagnosis of TOS, they can be of help in differential diagnosis and identify co-existing conditions.

It is unnecessary for the patient describe in detail the symptoms present at each prior consultation since it is unimportant in the ultimate diagnosis. Furthermore, doing so will cause the interview to bog down. The examiner should, however, determine if and when upper extremity symptoms developed. This may be difficult because in TOS arm complaints usually develop gradually following an injury that resulted in immediate neck or shoulder pain. Nevertheless, most patients can recall whether the upper limb complaints began a few days, weeks, or months after the inciting incident.



Current Symptoms

The patient is encouraged to discuss her current symptoms in her own way while the physician notes what is emphasized, and specifically any pain, weakness, or numbness in the neck, shoulder girdle, or more distal portions of the upper limb. Most patients have difficultly describing their complaints and communicating their feelings to a physician. However, if asked, what they can do clearly is describe the difficulties they encounter in daily activities.

Because certain activities predictably cause symptoms and are hence difficult for patients with TOS, proper questioning regarding limitations can lead to a presumptive diagnosis of TOS. Females typically have difficulty with hairstyling. Maintained elevation of the involved shoulder to wash or blow dry her hair or set curlers causes the limb to ache, become numb or tingle, grow heavy or tired, and give out. The affected extremity requires intermittent rest if she is to continue, which prolongs the time required for grooming. The patient may report doing her hair became such a hassle she had it cut short or "got a perm." While rotator cuff or other shoulder pathology may cause localized pain and weakness, and limit activities involving shoulder abduction and external rotation, this specific scenario is almost unique to TOS.

Other activities involving shoulder elevation are also problematic due to production of similar symptoms. These include hanging clothes, making beds, emptying the dishwasher, reaching up into cabinets, washing walls or windows, painting or changing light bulbs.

Driving is often problematic if holding the upper half of the steering wheel with the involved limb, prompting the patient to drive grasping the bottom of the wheel or with the affected extremity resting in her lap.

Activities requiring repetitive upper extremity motions such as vacuuming, mopping, or sweeping are also often difficult for TOS patients. As a result they often have to ask for help from their spouse or children, or cease these duties altogether.

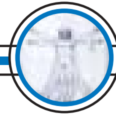
Females with TOS commonly report their bra strap on the symptomatic side slides outward toward the shoulder and must be repeatedly repositioned. This is a clue to trapezius muscle weakness that can be seen in TOS.

While TOS patients often report their arm feels "weak," they usually can't recall any specific weakness until asked about opening jars or bottle tops. Difficulty with these activities, the principal clinical expression of weakness in TOS, is uniformly acknowledged by such patients, and due to weakness of the ulnar innervated interosseous muscles of the hand which occurs early in the course of this condition. Interosseous weakness, particularly the first dorsal interosseous muscle, also causes difficulty cutting with scissors or slicing with a knife. Patients frequently report "things [cups, dishes, glasses] just drop" from their hands without warning, and are fearful of dropping their children. Despite intermittent pain complaints, husbands are often unaware of the difficulty with hairstyling and other functional limitations until affected themselves by the dropping and breakage of dishware (which costs money), and requests for help in performing household chores.

Not all TOS patients will be limited in each of the aforementioned activities, but most report problems doing their hair, driving, and opening jars and bottles. If she has no difficulty with these activities, TOS is unlikely; and a different cause for the neck/shoulder/arm pain should be sought.

By this point in the interview, TOS patients generally realize the examiner has asked about activity limitations which no one else brought up. They are amazed to have found someone familiar with their problem, and become more active participants in the history. The initial skepticism gives way to renewed hope.

The questioning now turns to conditions frequently associated with TOS. Reflex sympathetic dystrophy (RSD) may coexist with TOS and usually presents with a cold hand on the symptomatic side. The patient is asked about any temperature or color changes in the affected hand and whether it sweats more or less than the unaffected one. Abnormalities of sympathetic tone (coldness, bluish discoloration, skin atrophy, and hyperhidrosis) are common in neurologic conditions that result in muscle weakness or wasting; and RSD is seen to some degree in most cases of well-established TOS. Appropriate treatment of the TOS will usually also result in resolution of the



associated vasospastic condition. However, if the RSD is severe and constitutes a major part of the presenting complaints, it must be treated separately. A cervicodorsal sympathectomy needs to be considered at the time of any surgical treatment of the TOS.

The patient is next questioned about headaches, facial or jaw pain, and ear fullness. TOS patients with neck pain commonly have headaches which arise in the occiput then spread up and over the cranium to become global tension headaches. Less commonly, the cephalgia is hemicranial, and sometimes associated with unilateral facial pain, in both cases on the side of the TOS. Occasionally the hemicranial-facial pains are so severe they overshadow the upper extremity symptoms. While this makes accurate diagnosis more difficult, a careful interview will elucidate the associated arm pain.

Sometimes hemifacial pain that increases with sustained elevation or repetitious movement of the involved limb occurs without headaches in a TOS patient. Frequently these symptoms are attributed to sinusitis and prompt an increasingly aggressive course of treatment for the presumed infection. The predictable failure of such nonoperative therapy when the problem really is TOS has in some instances been followed by surgical drainage of the ipsilateral maxillary sinus, with similarly unsuccessful results. Some patients have been referred to temporomandibular joint specialists for the facial and jaw pain and learned to their dismay that TOS-induced discomfort does not respond favorably to either treatment for TMJ dysfunction or extractions of presumably painful teeth. Many TOS patients describe a feeling the ear canal is full or “stuffy” and needs to be cleaned out. Some even consult otolaryngologists because of this. Often the TOS patient’s headaches, facial or jaw pain, or ear fullness are relieved following successful treatment of the TOS.

The differential diagnosis of neck/shoulder/arm pain must also be considered when inquiring about current symptoms, and pertinent questions asked to rule in or out conditions with symptoms similar to TOS.

Symptom Progression

Since progression of symptoms despite appropriate nonoperative treatment is one of the indications for surgery in TOS, it is important for the physician to gain a sense of the symptom course to date. There is wide variation in the rate at which complaints increase or recede, and the degree to which they respond to conservative therapy. Although symptom plateaus lasting months at a time are common in TOS, invariably complaints eventually worsen if treatment is ineffective. Complaints which began as a minor intermittent nuisance may eventually become disabling and last into the night, disturbing sleep. Hence the patient is asked whether they are they getting better or worse, or staying the same. Obviously this progression cannot be measured objectively, and depends on patient perception. She may gauge progression in terms of arm pain, need for medication, or more commonly ability to perform activities of daily living.

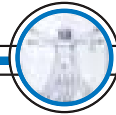
Emotional History

Most surgeons who treat TOS patients have only minimal training in psychology or psychiatry, and are unqualified to practice psychotherapy. However, it is essential to understand the long delay that frequently occurs before the diagnosis of TOS is made creates a rather characteristic emotional reaction. This commonly includes situational depression, which must be dealt with if treatment is to be successful.

As indicated, the TOS patient usually enters the initial interview by a TOS specialist with a skeptical, bewildered, and resigned mood, angry at the condition which has brought changes to her life, and with the healthcare profession which has not understood, properly diagnosed, or treated her problem.

The questions asked during this initial interview must demonstrate the physician’s insight into and empathy with the patient’s situation. Doing so sparks patient recognition she has finally found someone familiar with her problem, who confirms this isn’t all in her head, and that there really is something physically wrong.

This is hence an appropriate time for the physician to evaluate the emotional and social effects of TOS. Given the doctor’s demonstrated familiarity with this condition, she will likely candidly



discuss the problems TOS has caused in her life. Five questions that can bring out information useful to the physician include: 1) What effect has your problem had on you and your family? 2) Have you become angry or irritable? 3) Do people believe you? 4) Have you at times wondered if all this is in your head? 5) Have you become depressed? Discussion of these issues can be brief. Even so, allowing the patient to vent pent-up emotions can generate renewed hope and enthusiastic participation in the diagnostic and treatment plan.

Patient Examination

As implied, a presumptive diagnosis of TOS can be made based on the interview alone. If the differential diagnosis is kept in mind, the physical examination that follows can confirm or rule out the initial impression.

Blood pressure and pulse rate are measured in both arms and any significant differences noted. Often blood pressure is slightly higher in the right arm but a difference greater than 10 mm Hg is unusual.

The physician stands behind the patient for evaluation of the neck, back, shoulder girdles, and lungs. Observe the slope of superior shoulder girdles as a marked increase in this angle (from horizontal) indicates a low-lying shoulder girdle. his narrows the costoclavicular space, thereby predisposing the patient to TOS. A unilaterally elevated shoulder girdle suggests trapezius shortening or spasm. The lungs are auscultated.

Palpate throughout the neck, back, and shoulder girdles. Specifically look for percussion tenderness over the cervical and thoracic spinous processes with the neck somewhat flexed. Assess whether the trapezius and rhomboids are tender or contracted. Normally these muscles are nontender and feel uniformly firm but not tight. In TOS, paraspinal muscle tenderness, if present, rarely extends inferior to the tip of the scapula.

The physician now faces the patient. Inspection of the face may reveal slight flattening of the nasolabial fold on the symptomatic side if facial pain is part of the symptom complex. Following examination of the heart and lungs, the supraclavicular and infraclavicular fossae are examined for bruits and arterial pulsations which might indicate a subclavian artery aneurysm or elevation of the artery by a cervical rib or fibrous band attached to an incomplete cervical rib or elongated C7 transverse process.

Cervical motions are assessed, beginning with flexion. If the patient is unable to touch her chin to chest, note how many fingers can be placed between. In a young person the chin normally touches or comes within one finger breadth of the chest. Patients with TOS, cervical disc disease, or cervical sprain/strain frequently can't get the chin closer than two finger breadths to the chest.

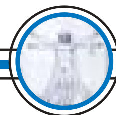
Limitation of cervical rotation and tenderness of lateral neck musculature can be seen in TOS, or cervical sprain/strain or disc disease. They are most commonly seen when cervical pathology coexists with TOS, and less so in fully developed TOS alone.

Lateral bending of the neck is often limited with cervical pathology and/or TOS. When the head and neck are tilted to the right, look and palpate for narrow, tender, asymmetrical fibromuscular bands within the trapezius on the left, and vice versa. These bands frequently contribute to the "shoulder pain" described by TOS patients.

Next the patient's neck is slowly extended, while the examiner looks for localized or generalized limitation of motion and listens for reports of pain. While still extended, the cervical spine is rotated, and this position held for a few seconds. This test commonly produces pain at the side or base of the neck in patients with cervical pathology, and pain and paresthesias radiating into the upper limb if there is concomitant nerve root impingement. The distribution of these radicular symptoms may suggest which root is compressed. These complaints do not occur in TOS alone.

With the patient sitting, the spine is axially compressed by downward pressure on superior head. Normally and in TOS this just causes a sensation of impaction or mild neck discomfort, without lateralizing symptoms. In cervical disc disease, arthritis, and/or foraminal stenosis, the axial loading may cause more severe neck pain, and perhaps radicular symptoms.

The examiner now palpates the lower then upper brachial plexus in each supraclavicular fossa. Deep pressure is



painful in all patients, but gentle pressure normally painless. However, gentle pressure sustained for five to ten seconds in a TOS patient usually causes increasing pain which may radiate up the neck to behind the ear, or distally behind the clavicle to the anterior axilla. Occasionally there will be associated paresthesias in the ulnar forearm, hand, or fingers.

The brachial plexus is now gently tapped on both sides using index and middle fingers. Under normal circumstances this is asymptomatic, but if the plexus is irritated by TOS, tenderness and distal paresthesias are common.

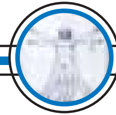
Gentle pressure is next applied above the brachial plexus on each side. Although this area (the band spot) is usually nontender in the conditions discussed, some observers have noted tenderness in patients later found at operation to have anomalous muscular bands between the C8/T1 nerves and subclavian artery. However, as a general rule tenderness between the anterior-superior trapezius and the upper brachial plexus suggests the patient may be overreacting to the examination.

Look for swelling and asymmetry in color, moisture, temperature, or venous distribution in the patient's hands. Normally palmar skin and nail beds are pinkish. Skin color changes are most commonly seen when RSD coexists with TOS and vary from splotchiness to bluish discoloration to the rarely occurring whiteness of ischemia. The skin should feel equally moist or dry. Hyperhidrosis of the symptomatic hand is occasionally seen in TOS with RSD, but is the least common of RSD findings noted with TOS. Hand temperatures are normally equal, but in TOS coolness of the involved extremity is common. Small temperature differences between hands can be detected by the following maneuver: The patient sits with their hands resting on thighs, palms upwards. While facing the patient the physician crosses his upper limbs, and places his palms on the patient's, making as wide and uniform a contact as possible. The physician's right hand is hence pressed against the patient's right, and vice versa. After six seconds the physician *rapidly* uncrosses upper extremities and places his right palm on the patient's left and vice versa.

Swelling and tightness of the arm and hand are common complaints in TOS but difficult to verify during a single examination because significant edema is rare. Nevertheless the examiner should look for watch or ring indentations, and measure upper extremity circumferences at comparable levels.

Tinel sign and Phalen test, involving median nerve percussion and compression, respectively, are performed to look for carpal tunnel syndrome (CTS). In Tinel sign, with the wrist in neutral and digits extended, the median nerve is firmly tapped at the volar wrist crease. Normally the patient senses only the tapping. A positive test is tingling, numbness, and/or pain (typically shooting in character) in the median nerve distribution, i.e., radial palm and palmar aspect of radial 3 1/2 digits (thumb, and index, middle, and radial ring fingers). In Phalen test, the wrists are maximally flexed for 60 seconds, for instance by asking the patient to press dorsal hands together. The patient with TOS may report aching in the wrist, but paresthesias or less commonly numbness or pain in the median distribution is indicative of CTS.

Upper extremity muscle strength is now evaluated. *Median nerve* function is assessed by testing the the thenar muscles, e.g., thumb opposition against little finger. The *radial nerve* controls and hence can be tested by resisted wrist and digit extension and thumb abduction. The *ulnar nerve* supplies most intrinsic muscles of the hand including those in hypothenar eminence and the interossei, and hence controls finger abduction and adduction, as well as thumb adduction. Because ulnar neuropathy is the most common in TOS, a more detailed description of testing for it follows. Finger abduction can be assessed by asking a patient to "hold your fingers spread apart" while the physician attempts to adduct them and/or palpates first dorsal interosseous to see if it contracts. Thumb adduction strength can be tested by having the patient compress the front and back of a 3 x 5 index card or sheet of paper between ulnar thumb and radial index finger while the examiner attempts to pull it distally. The patient with a weak adductor pollicis will compensate by flexing interphalangeal joint of thumb (Froment's sign). Finger adduction can be similarly assessed (interphalangeal card test). With the digits extended the examiner simultaneously tests adduction between index and middle fingers bilaterally by pulling cards distally and comparing the strength on



left and right. The procedure is repeated after placing cards between middle and ring, then ring and little fingers. Normally a firm equal pull is required to extract them.

Grip strength is measured bilaterally using a dynamometer. Absolute values are not as important as differences between the symptomatic and asymptomatic extremities. Grip on the dominant side is normally a little stronger. It is often diminished in TOS.

Although not evident until late in the course of neuropathy, muscle atrophy may also be seen. This is most readily apparent in thenar eminence (median nerve) or in the case of ulnar neuropathy, hypothenar eminence and first dorsal interosseous, the latter constituting the bulk of the dorsal first web space.

The biceps and triceps are also tested against resistance. In TOS, biceps strength is normal while the triceps may be weaker on the affected side. Serratus anterior muscle weakness is demonstrated by scapular winging. This is not seen in untreated TOS, but may be occur after transaxillary first rib resection if there was intraoperative injury to long thoracic nerve.

Biceps, triceps, and brachioradialis reflexes are tested and normal in TOS. Hence an abnormal reflex suggests another problem, e.g., cervical radiculopathy, exists or coexists. Sensory testing of ulnar, median, and radial nerves is performed. In TOS, pin sensation is commonly diminished in the ulnar distribution (medial forearm and hand plus ring and little fingers).

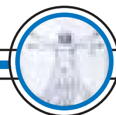
The shoulder girdle itself is then examined to rule out acromioclavicular or glenohumeral arthritis, subacromial bursitis, and bicipital or rotator cuff tendonitis or tear, all of which are more common causes of shoulder symptoms than TOS. Screening tests include palpation, asking the patient to put their hand into the back pocket, or dropping the limb rapidly from an overhead position. All are painful in inflammatory shoulder disease but asymptomatic in TOS.

To further assess the vascular system the examiner performs various provocative tests, looking for changes due to compression of the subclavian artery (diminution in or obliteration of radial pulse, onset of a bruit, pallor, or coolness) or subclavian vein (venous engorgement, etc.), or symptom onset in the limb (pain, numbness, tingling, weakness, etc.).[3]

Such provocative maneuvers include the Adson, Allen, costoclavicular (military brace), and elevated arm stress tests. In the Adson test[16], the examiner locates the radial pulse, extends and externally rotates the patient's shoulder, has the individual extend their cervical spine and rotate it to the side being tested, then deeply inspire and hold their breath. In the Allen test the examiner palpates radial pulse, abducts and externally rotates the shoulder 90 degrees, with elbow flexed 90 degrees, then has the patient rotate neck toward the opposite side. In the costoclavicular (military brace) test the examiner again palpates radial pulse, then has the patient retract and depress both shoulder girdles posteriorly and inferiorly, respectively. The examiner may assist with the positioning by using the non-palpating hand to pull posteriorly and inferiorly on the patient's hand. To perform the elevated arm stress test (EAST), aka the abduction external rotation (AER) or Roos test, the patient abducts and externally rotates shoulders 90 degrees, with elbows flexed 90 degrees and upper limbs just posterior to the frontal plane, (the "stick ëem up" or surrender position). He or she then repetitively flexes and extends thumbs and fingers (makes and opens a fist on both sides) for 3 minutes.

The primary indication of a positive result in the first three tests is decrease or obliteration of radial pulse, due to compression of the subclavian artery by the anterior scalene muscle or less commonly a cervical rib. However, TOS is primarily a neurologic rather than vascular problem; hence a negative result on these tests does not rule out TOS. While lacking sensitivity, these vascular tests are also nonspecific since the radial pulse diminishes or obliterates when the limb is elevated in over half of the normal adult population.[8] Hence palpation of radial pulse in various extremity positions is of limited diagnostic value.[3] Reproduction of symptoms, with either the first three tests or the EAST, is of greater diagnostic value.

Symptoms provoked while exercising a TOS patient with shoulders abducted and externally rotated often include aching (ischemic pain) in shoulder, arm, and/or forearm; tiredness, heaviness, or weakness of the limb, perhaps including



inability to keep it in the starting position; numbness or tingling in the distal extremity; and loss of coordination of the involved digits. The complaints typically worsen as the test proceeds. Following the EAST a TOS patient will often massage the affected limb with the opposite hand. Mild fatigue is considered a negative EAST. The normal patient may leave fingernail impressions in the palm, while these may be absent in TOS due to the weaker and slower finger flexion. Because this test frequently reproduces the TOS patient's symptoms, including pain lasting for several minutes (and sometimes into the night with accompanying sleep disturbance), it should be reserved for last. Although considered by some the most reliable test for TOS, the EAST is also nonspecific, positive results having been noted in 74% of asymptomatic controls and 92% of patients with carpal tunnel syndrome.[20]

Diagnostic Testing in TOS

TOS is primarily diagnosed by interview and physical examination, rather than imaging or physiologic studies.[17] However, some clinicians continue to search for an objective means to establish the diagnosis, pointing out that absent such a test the very existence of TOS should be questioned.[18] As a result, patients are frequently subjected to a variety of tests during the work-up for their neck/shoulder/arm pain.

Radiographic Testing

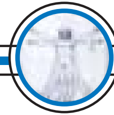
Of the clinical tests available, the most useful are cervical x-rays. Such films should include the first and second ribs since they may demonstrate abnormalities predisposing a patient to TOS. A complete cervical rib, when present, can be seen on AP and oblique views articulating posteriorly with the transverse process of C7 in a true joint. Anteriorly it may be connected to the superior surface of the first thoracic rib just posterior to the scalene tubercle, or articulate in a pseudarthrosis with a bony pedestal arising from the first rib. More often the cervical rib does not contact the first rib but instead continues anteriorly as a tight fibrous band (Roos Type I) which inserts onto first rib behind the scalene tubercle. A cervical rib indicates the presence of a curtain of middle scalene muscle of varying bulk surrounding the rib and its band (if present). While due in part to the rigid bone, the TOS in this case is caused primarily by this surrounding muscle mass, which can be quite large, and over which the subclavian artery and C8 and T1 nerves/brachial plexus are tightly tethered.

Absent a cervical rib, the physician should examine the C7 transverse processes, which normally extend about the same distance laterally as those of T1. If a C7 transverse process extends more than 1 cm. beyond that of the T1, its attached muscles may narrow the costoclavicular space. Additionally, an usually long transverse process will often cone down to a pointed end anteriorly and inferiorly, instead of having a normal rounded end. If this case a fibrous band (Roos Type II), accompanied by middle scalene muscle of varying thickness, will course downward, attaching to the first rib, and function clinically in the same way as a true cervical rib. Thus, the physician can differentiate between the Type I and II bands by examining the C7 transverse process.

A lateral view of cervical spine normally shows seven cervical vertebrae above the clavicle. However, in patients with TOS and markedly sloping shoulders eight or more vertebrae are often seen on this projection. On exam, they appear to have a long neck but actually have a lowered shoulder girdle, which narrows the costoclavicular space and predisposes them to TOS.

The neck films should also be examined for more common abnormalities such as disc space narrowing, uncovertebral or facet joint arthritis, foraminal stenosis, and straightening or reversal of the normal lordosis. If correlating with the patient's clinical presentation, bone, MRI, or CT scans with or without myelography may be warranted. However, such advanced imaging studies are not indicated for a patient with only symptoms and signs of TOS.

Chest x-rays are of value since several conditions predisposing to TOS can be seen or ruled out. Callus around a clavicular fracture may impinge on the brachial plexus, either intermittently (with upper extremity motions) or constantly. Tumors or exostoses of the first rib or its anterior costal cartilage can cause symptoms in the same manner. Superior sulcus tumors may present initially as episodic shoulder



and arm pain, and can be ruled out in most patients by the chest film.

Shoulder arthrograms or MRI scans are diagnostically useful for shoulder pathology, but not TOS, and should be used only when the former is suspected. TOS patients may develop shoulder stiffness due to chronic disuse. The diagnosis of TOS in this setting may be difficult, but usually can still be made by history and physical examination, without need for such imaging studies.

Electrodiagnostic Testing

It was hoped electrodiagnostic testing (electromyograms, nerve conduction studies, and/or somatosensory evoked potentials) would be an objective means to diagnose TOS.[1]. Unfortunately, despite the large experience accumulated by neurologists and physiatrists,[19] these studies have not been reliable in either diagnosis or treatment decision-making. Roos[3] attributed the disappointing results in part to anatomy of the thoracic outlet. The congenital fibromuscular bands which compress the brachial plexus are so deep and central it has been physically impossible to measure electrical impulse on either side of them. Additionally, intermittent compression of the brachial plexus may be insufficient to cause measurable neuropathic changes.

Vascular Laboratory Testing

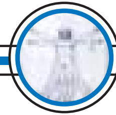
Since TOS is primarily a neurologic problem, plethysmography and angiography are not warranted unless there is evidence of vascular pathology such as subclavian artery aneurysm, bruit on the symptomatic side with the shoulder in a neutral position, distal emboli (persistent digital ischemia or localized gangrene) from an uncertain source, or subclavian vein thrombosis. Arteriography, for instance, frequently reveals variable narrowing of the subclavian artery at the thoracic outlet, with the shoulder in neutral or abduction. However, the stenosis often bears no relationship to the symptoms in TOS.

Differential Diagnosis

The physician evaluating patients with neck and/or upper extremity pain must keep the differential diagnosis in mind at all stages of the work-up. Table 2 contains a convenient classification of

TABLE 2
DIFFERENTIAL DIAGNOSIS OF NECK/SHOULDER/ARM PAIN

1. Cervical Spine Problems
    a. Sprain/Strain
    b. Disc Disease and/or Osteoarthritis
    c. Cervical Rib
    d. Elongated C-7 Transverse Process
2. Brachial Plexus Problems
    a. Static
        1) Plexitis
        2) Pancoast Syndrome
        3) Stretch Injury
    b. Dynamic - Thoracic Outlet Syndrome (with or without cervical rib)
3. Shoulder Problems
    a. Inflammatory Disease
        1) Bursitis
        2) Tendonitis
        3) Capsulitis
    b. Trauma
        1) Sprain/Strain
        2) Rotator Cuff Tear
        3) Clavicle, Scapular, or Proximal Humeral Fracture
4. Forearm/Hand Problems
    a. Peripheral Nerve Entrapment
        1) Cubital Tunnel Syndrome
        2) Carpal Tunnel Syndrome
    c. Tenosynovitis
5. Rare Causes
    a. Bony Abnormalities
    b. Spinal Cord Tumor
    c. Multiple Sclerosis
    d. Angina Pectoris
    e. Macromastia



possible causes of these symptoms. The conditions most commonly confused with TOS are cervical disc disease/arthritis, inflammatory shoulder disease, and CTS. A few comparative comments regarding these conditions will be helpful in the assessment of patients with possible TOS.

Patients with cervical disc disease and/or arthritis may have upper limb pain, but usually the primary complaint is neck pain increased by cervical motion. Coughing and sneezing sometimes increase or precipitate the neck and radicular pain. Decreased deep tendon reflexes are commonly seen with cervical pathology but not in TOS.

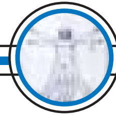
Patients with inflammatory shoulder disease (bursitis, tendonitis or capsulitis) often have more severe pain than those with TOS. The discomfort is usually localized about the shoulder, i.e., deltoid bursa, rotator cuff or glenohumeral joint itself. It increases with shoulder motions, especially elevation, remains as long as the elevation persists, and gets worse if the limb is dropped rapidly. By contrast, upper extremity pain in TOS tends to be less severe, develops gradually on elevation, is associated with heaviness and tiredness, and is relieved rather than exacerbated by dropping the limb, although the aching may linger for varying periods of time. Patients with inflammatory disease may develop severe shoulder pain when putting the involved hand into a back pocket, whereas no discomfort occurs with this activity in TOS. In a female patient the bra strap can be used as a rough diagnostic landmark, with pain lateral to the strap likely being of "shoulder" origin; whereas discomfort medial to the strap is usually due to cervical or brachial plexus pathology..

In carpal tunnel syndrome (CTS) entrapment of the median nerve at wrist usually results in pain, numbness, and/or tingling in the radial palm and digits, rather than the ulnar distribution commonly seen in TOS. CTS patients frequently report they are able to write normally for a time after which pain, numbness, weakness, and/or incoordination render their penmanship illegible or force them to stop writing altogether. Both TOS and CTS patients may awaken with the limb numb or tingling, although the sensory complaints are often more distal in CTS. In TOS, the awakening occurs primarily when sleeping with the shoulder elevated. CTS patients tend to be awakened by sensory complaints if sleeping with the wrist flexed. In CTS symptoms tend to radiate from hand up the limb vs. down the extremity in TOS; although patients may be unaware of the direction of radiation.

Short Course

The physician who evaluates patients with neck, shoulder, and/or arm pain for possible TOS must be committed to a proper work-up, including a detailed interview and physical examination, and interpretation of cervical and chest x-rays. As emphasized by Roos, there is no shortcut to proper diagnosis.[3] Unfortunately, the complete work-up requires about two hours, which most busy clinicians are unable to allot for a single patient.

Fortunately for both physician and patient, there is a common theme in the histories of TOS patients;, and this information can be obtained in a relatively brief time. This commonality consists of five elements: 1) *The symptoms are related to use of the limb.* No matter what other complaints are present, the patient with TOS will develop aching pain, weakness, heaviness, and/or tiredness of the affected extremity with the provocative activity, and vice versa. Complaints decrease and resolve with rest. 2) *The patient's symptoms are predictable and reproducible.* They occur every time the limb is used for the symptom-producing activity. If the arm becomes somewhat tired and vaguely uncomfortable only now and then with use, the diagnosis of TOS must be suspect. 3) *The patient's emotions are not "under control."* Delays in diagnosis of TOS, unsuccessful treatment, and the social and economic impact of inability to function as spouse, homemaker, or breadwinner extract a severe emotional toll on these otherwise healthy young adults. A common result is situational depression affecting all aspects of the patient's life. If the symptoms are of significant duration, personality changes are the rule in TOS. 4) *The condition is slowly progressive when appropriate treatment is not given.* The natural history of TOS is one of gradual rather than rapid worsening in the intensity and duration of symptoms. Despite episodes of temporary improvement due to activity restriction, therapy, or medication, by nature TOS relentlessly worsens as long as the



intermittent compression of brachial plexus continues. 5) *There is a unique pattern of difficulty performing certain activities of daily living.* TOS patients describe characteristic and reproducible difficulties with the affected limb when washing, blow drying, or setting their hair, driving with the affected hand high on the steering wheel, folding clothes, making beds, and opening jars or bottle tops. Things “just drop” out of their hand without warning, while a firm handshake seems to be retained.

While many physical abnormalities can be noted on examination of the TOS patient, the most important findings are: 1) An *asthenic build*. 2) *Sloping shoulders*. 3) The appearance of a *long neck* signifying a low-lying clavicle. 4) *Tenderness of the brachial plexus* in the supraclavicular fossa on the symptomatic side. 5) Unilateral *weakness of the interosseous muscles*. 6) *Hypesthesia in ulnar nerve* distribution. 7.) A *positive elevated arm stress test*.

The most important x-ray findings are more than seven vertebrae seen above the clavicle of on a lateral view of cervical spine, cervical rib, or elongated transverse process of the seventh cervical vertebra.

Even if the x-rays are normal, given the history and physical findings described, and if the differential diagnosis has been carefully considered, a physician can establish a clinical diagnosis of TOS with a high degree of confidence. Appropriate treatment can be recommended, and the patient can look to the future with renewed hope. Conversely, failure to diagnose and treat the entity early can lead to chronic pain and disability with their psychological sequelae as pointed out by Mailis.[13]

Summary

Thoracic outlet syndrome is a unique, uncommon, and usually neurologic condition generally seen in young adults, more commonly females. Its importance derives from the physical, social, and economic havoc it causes in the lives of these otherwise healthy people. TOS patients complain of pain, weakness and/or numbness in the neck and upper extremity brought on by use or elevation of the limb, and relieved when the extremity is lowered into a neutral position and rested. These symptoms are caused by intermittent compression of the brachial plexus in the thoracic outlet or costoclavicular space that develops when an inciting incident occurs in a patient harboring an anatomic predisposition to develop the condition. TOS is often initially misdiagnosed as one of several more common causes of neck/shoulder/arm pain, resulting in costly and painful delays in appropriate treatment. However, correct diagnosis is possible with an appropriate history and physical examination, permitting early and effective treatment.

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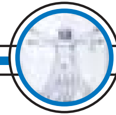


Will Your IME Report Be Considered Credible by those Who Read It?

Kendall L. Wilson, Jr., D.O., F.A.A.D.E.P.

In response to readers need for good report writing skills this article gives some good examples of how *not* to do things when writing reports. The goal of this article is to assist IME physicians in producing credible and quality reports. This article identifies some of the criteria used by IME reviewers. It also identifies certain practices that lead IME reviewers to question the credibility of reports or physicians. The author in his unique mix of anecdotal and case based approach has presented his own experience of review criteria and common Errors with case examples from over a decade of reviewing IME reports. The criteria and examples presented in this paper are intended to serve as "markers" which can be one of the way IME physicians can judge the quality of their own reports before they are submitted for use. (EDITOR)

Introduction:

An IME report is a legal document. The individual performing the examination is usually expected to give a reasoned medical opinion as to causality, degree of impairment, the permanent nature of the condition, the likelihood of progression at some point in the future, and a variety of other issues. A good IME report is expected to be a true and accurate reflection of the examinee's condition at the time of examination. However, IME reports may be "tailored" to the client and the client's needs provided that it is done within certain reasonable and ethical boundaries. An Administrative Law Judge once told this author "all reports are biased depending on who paid for the report."

The author of this article routinely reviews the IME reports of other doctors for a state Workers' Compensation Fund as well as doing consulting work for attorneys representing either the claimant or the employer. This article was written to assist IME physicians in producing credible, quality reports by familiarizing them with what happens to an IME after they write and submit it for use.

IME reports may be scrutinized by a variety of professionals including doctors, lawyers, nurses, claims managers, QA committees or judges. In this article, those who use and review IME's will be referred to as "reviewers." Experienced IME reviewers form opinions as to the quality of reports, and also, in some instances, they form opinions as to the honesty and accuracy of the writer. Reviewers frequently form these opinions based on the report's apparent credibility – i.e. which report best followed the AMA Guides, which showed the best documentation in support of the conclusions drawn by the examiner, which best documented that the examiner had reviewed and considered all of the evidence in the medical file, etc. Most cases are decided on the manifest weight of the evidence, and more weight is given to reports considered most credible.

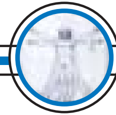
In order to assist Independent Medical Evaluators in producing reports that are considered credible, this article outlines criteria used by this reviewer. It also lists the Errors most commonly found in reports reviewed by this author, and provides example cases to illustrate these Errors. Finally, it discusses certain patterns that tend to cause reviewers to call into question the credibility of the report or evaluator.

Criteria For Assessing An Independent Medical Evaluation

Listed below are the some of the major and minor criteria that this author uses to assess both the accuracy and the credibility of those IME reports he is asked to review as a professional consultant in Impairment Evaluation.

MAJOR CRITERIA:

1. *Was the report completed and submitted in a timely manner?* No matter how good the report, the client must have a document to use by a given deadline in order for the report to be of any benefit.



2. Was a complete history of the presenting injury/illness recorded? This author has reviewed reports that stated, “Mr. Johnson was injured in a motor vehicle accident on the way to work on January 16, 2001.” Obviously this report needs to have considerably more detail about the mechanism of injury for the report to be considered credible. At the other end of the spectrum, the author has reviewed a 2 1/4 page report on “History of Chief Complaint” only to find that two-thirds of the information was not related to the condition for which the individual was being evaluated.

3. Was the physical exam appropriate to the condition being examined? The author once reviewed an IME report where the only injury to the person being evaluated was his right thumb. The IME physician submitted a ten (10)-page report including the fact that the man had no limp and had “hearing intact to normal conversation”. When reviewing the examination of the right hand, the evaluating physician measured and reported flexion/extension and abduction/adduction of the right thumb, but omitted right thumb opposition.

4. Were the AMA Guides followed? This category can present in a variety of ways and some common examples are included elsewhere in this article under “common Errors”.

5. Were other regulations/requirements (unique to client) followed? Most parties who request an IME for impairment evaluation have certain requirements unique to that client. These may take the form of state or federal statutes that must be adhered to, special rules or regulations used by the requesting party, special forms or diagrams, specific declarations from the IME physician, etc. The IME reports must be “tailored” to the needs of requesting party or else the report may be of limited value to that party. As has been stated above, this “tailoring” should be done within reasonable and ethical boundaries.

6. Are the impairment calculations correct? An IME report is considered not credible if the examining physician consistently makes errors in calculation – either through ignorance, carelessness or design – such that the final figures are not a true and accurate reflection of the facts of the case according to the *AMA Guides*.

7. Are the IME physician's conclusions supported by both the exam findings and by the AMA Guides or a reasonable extrapolation of the Guides? An example of this type of inconsistency is illustrated by the report reviewed by this author of an IME physician who not only documented that the examinee complained of pain in the right shoulder “which began after starting physical therapy”, but also reported “tenderness to palpation of the anterior portion of the right shoulder” as well as a decrease in flexion and abduction of this joint. The IME physician then concluded that the examinee had reached maximum medical improvement (MMI) and that the gentleman had only injured his neck and upper back in the fall.

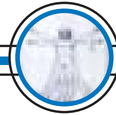
8. Did the report answer the specific questions asked by the client? Most parties who request an IME for impairment evaluation have certain questions unique to that client or case. Without answers to specific questions, an IME may not be useful to the client.

MINOR CRITERIA:

1. Did the report include a chronological summary of the medical record review? A good IME report should include a summary in chronological order of all the reports in the examinee's medical record. Those reading the report can then judge for themselves if the IME physician ignored important information.

2. Did the report indicate that x-rays had been reviewed and, if so, by whom? One example where this would be of importance is with evaluation of motion segment integrity. This author has reviewed IME reports that state, “There is no evidence of loss of motion segment integrity.” The IME physician failed to mention if that was his opinion or the opinion of the radiologist or if the examiner had personally reviewed and measured the changes on the x-ray or if the conclusion was based on negative information – i.e. the radiologist made no mention “loss of motion segment integrity” in the report.

3. Did the IME address any major inconsistencies (between the record review, history, physical exam, lab and other studies)? All too often, this author has reviewed reports wherein the IME physician has accepted and reported information and allegations obtained from the examinee during the history of the injury/illness, but failed to point out in the IME report that a review of the office notes from the treating physician (covering almost two years of medical



treatment) failed to support the examinee's current allegations. Identifying and addressing such inconsistencies lends credibility to the report.

4. *Did the report include photocopies of all work sheets, summary sheets and raw data (such as EMG findings)?* This information not only makes an IME report more credible, but also makes it easier for the reviewer to assess the accuracy of the report. Part of the instructions in the AMA Guides (Fourth Edition) state that the examiner is to photocopy and use certain non-copyrighted pages for their report.

5. *Were reports/forms signed and dated (original signature) with IME's name, address and telephone number included?* This final set of criteria puts the finishing touch on a professional IME report. On occasion, the author has reviewed reports that did not have original signatures and/or reports that did not use the IME physician's letterhead. Such omissions not only detract from the professional appearance of an IME report, but also may give the Erroneous impression that the writer of the report is trying to avoid legal responsibility for the content.

Common Errors In the Use Of the AMA Guides

ERROR #1: READING ONLY A FOOTNOTE OR A WORD AND NOT THE ENTIRE TEXT.

This is probably one the most common category of Errors that this author has found.

Example: THE VALIDITY TEST FOR LUMBAR FLEXION/EXTENSION: The sum of the sacral flexion (40 degrees) and the sacral extension (4 degrees) was 44 degrees. The tightest straight-leg-raising (SLR) was 25 degrees. The IME physician considered the results of the lumbar range of motion (ROM) *invalid* due to the fact that the straight-leg-raising on the tightest side was *not within 15 degrees of the total hip motion.*

THE ERROR: The IME physician cited section (d) from **Figure 75**, page 3/127 which states, "Straight-leg-raising angle on the tightest side should be within 15ſ of the total hip motionÖ" What the IME physician did not indicate in his "justification" were the last two (2) words in this statement – "**see text**." The full text states that the lumbar flexion/extension values are invalid only if the tightest SLR exceeds the sum of the sacral flexion and extension by *more* than 15 degrees. [Ref. **Figure 75** Two-inclinometer Measurement Technique for Lumbosacral Flexion and Extension, page 3/127, Number 5. *Validity Test*.]

THE CORRECT ANSWER: The lumbar flexion and extension measurements were VALID and should have been included in the total whole person impairment calculations.

COMMENT: There are many examples that the author has found where an IME physician has read only a part of an explanation and has failed to follow the complete instructions found elsewhere in the "Guides".

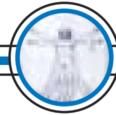
Example: RANGE OF MOTION (ROM) MODEL–TABLE 75, PAGE 3/113 (FOURTH EDITION): This author finds reports where the Range of Motion Model is used for the spine and the IME physician considered the impairment in only one region of the spine. Some reports even state that considering more than one region of the spine using **Table 75** is not allowed by the *AMA Guides, Fourth Edition*. This is inaccurate.

THE ERROR: At the bottom of the table is found a set of instructions. Item number one (1) states *"Identify the most significant impairment of the primarily involved region."* Some IME physicians read only this section and *incorrectly* infer that *only* the primarily involved region can be included the ROM Model.

THE CORRECT ANSWER: The complete set of instructions for using the Range of Motion Model can be found on pages 3/115 and 3/116. Item number one (1) again states *"Select the primarily impaired region, cervical, thoracic, or lumbar. . . .",* however, item number ten (10) on the following page states, *"Repeat steps 1 through 7 above for either of the other two regions with significant involvement related to the primary diagnosis."* This clearly directs the examiner to consider the other two regions of the spine provided there is "significant involvement".

ERROR # 2: READING ONLY A SINGLE CHAPTER WHILE NOT UNDERSTANDING THE GENERAL PRINCIPLES IN THE FOURTH EDITION OF THE "GUIDES"

Example: TWO CASES OF SEVERE CARDIAC IMPAIRMENT: The author has seen two (2) cases, both involving major trauma to the heart, wherein the



respective IME examiners – both respected cardiologists – failed to recommend the proper whole person impairment due to the fact that they *only* used **Chapter 6, The Cardiovascular System** and failed to consider general underlying principles that relate to all chapters of the "Guides". The first case involved a mechanic who had been in the process of removing a large truck tire from a split rim when it exploded, knocking the mechanic across the room. The second case was that of a law enforcement official who suffered a myocardial infarction while chasing a criminal and was without oxygen to the brain for more than four minutes. Both Independent Medical Evaluators correctly rated their respective claimants as qualifying for **Class 4: 50% - 100% Impairment of the whole person** using **Table 5**. Impairment Classification for Valvular Heart Disease (page 6/173). Neither claimant's status was "near death" when rated. Each examiner then recommended 100% Whole Person Impairment for the respective claimants.

THE ERROR: Page 2/8, **2.2 Rules for Evaluations**, clearly states, "In this book, a 95% to 100% whole-person impairment is considered to represent almost total impairment, a state that is approaching death."

THE CORRECT ANSWER: 75% Whole Person Impairment

COMMENT: When each of the cardiologists were contacted by telephone and were made aware of the statement from page 2/8, **2.2 Rules for Evaluations**, each submitted an addendum to their respective reports. In the first case the claimant also had other injuries of an orthopedic nature. In the second case the claimant also had impairment to the brain secondary to anoxia. The amended reports allowed for the other impairments to be combined with the primary impairment to the cardiovascular system.

ERROR #3: COMBINING BEFORE CONVERTING

Example: A CASE OF BILATERAL WRIST INJURY: This case was relatively simple. The claimant had a legitimate ten percent (10%) impairment of *both* wrists. This (10%) was REGIONAL impairment *not* whole person impairment. The examiner used the **Combined Values Chart**, page 322 to combine (10%) with (10%) for a total of (19%) and then converted to whole person impairment using **Table 3**, page 3/20. (19%) Upper Extremity Impairment converted to 11% whole person impairment.

THE ERROR: Page 3/66, **3.1o Summary of Steps for Evaluating Impairments of the Upper Extremity**, clearly states under part XI. "When both upper *extremities* are involved, derive the whole-person impairment percent for each and then combine both values using the Combined Values Chart (p. 322)."

THE CORRECT ANSWER: When the instructions are followed, (10%) Upper Extremity Impairment converts to 6% whole person impairment. Then the **Combined Values Chart**, shows that 6% combined with 6% equals **12% whole person impairment** – not the 11% that was originally recommended.

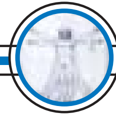
ERROR #4: ADDING INSTEAD OF COMBINING

Example: Decreased Range of Motion in the Hip and the Knee of the Left Lower Extremity: The examinee was found to have 74˚ of flexion in his left knee and 9˚ of ankylosis in flexion of his left hip. The IME physician reported that the 74˚ of flexion in his left knee equated to 8% Whole Person Impairment according to **Table 41**., Knee Impairment (page 3/78 of the *AMA Guides, 4th Ed.*) which shows "Moderate" restriction of motion (Less than 80˚). He then reported that the ankylosis of the hip equated to 15% Whole person Impairment according to **Table 46**. Impairment form Ankylosis in hip flexion. (page 3/79 of the *AMA Guides, 4th Ed.*) The IME physician then reported that the examinee had a "total of 23% WPI (knee + hip)."

THE ERROR: Page 3/75, **3.2 The Lower Extremity**, states "if the patient has several impairments of the same lower extremity part, such as the leg, or impairment of different parts, such as the ankle and a toe, the whole person estimates for the impairments are *combined* (Combined Values Chart, p. 322)"

THE CORRECT ANSWER: According to the Combined Values Chart, p.322, 15% *combined* with 8% equals 22%.

COMMENT: In general the *AMA Guides* recommends *combining* and not adding whenever there are different types of impairment in the same body part or when there is any impairment in different body parts (even when those body parts are in the same region). There are exceptions to this rule and the



Guides usually give special instructions to the reader when adding is recommended (see Error #6 below).

ERROR #5: COMBINING INSTEAD OF ADDING

Example: The Injured Thumb: The injured worker in question got his right thumb caught in a press. After three surgeries and an extensive recovery period, he was ready for an impairment rating. The IME physician correctly measured the various motions of the thumb and found the correct values for "thumb impairment" as follows:

IP Joint – Flexion of 10˚ is [6%] thumb impairment and Extension of 0˚ is [1%] thumb impairment for a total of [7%] thumb impairment for the IP joint.

MP Joint – Flexion of 20˚ is [7%] thumb impairment and Extension of 0˚ is [0%] thumb impairment for a total of [7%] thumb impairment for the MP joint.

CMC Joint – Radial abduction of 20˚ is [7%] thumb impairment. Adduction of 4 cm is [20%] thumb impairment. Opposition of 2.5 cm is [40%] thumb impairment. This gives a total thumb impairment of [67%] for the CMC joint.

The IME physician then combined the values for the different joints of the thumb as follows:

[67%] (CMC joint) w/ [7%] (IP joint) = [69%] w/ [4%] (MP joint) = [70%] TOTAL THUMB IMPAIRMENT. This converts to [28%] Hand impairment per Table 1, page 3/18. This, in turn, converts to (25%) Upper Extremity impairment per Table 2, page 3/19. This finally converts to 15% Whole Person Impairment according to Table 3, page 3/20.

THE ERROR: The IME physician combined instead of adding all of the joints of the thumb. This changed the final WPI.

THE CORRECT ANSWER: [78%] Thumb Impairment (67 + 7 + 4). This converts to [31%] Hand impairment which converts to (28%) Upper Extremity impairment, which converts to 17% Whole Person Impairment.

COMMENT: Photocopying and using **Figure 1** Upper Extremity Impairment Evaluation Record** – **Part 1 (Hand)**, page 3/16, as instructed on page 3/66, **3.1o Summary of Steps for Evaluating Impairments of the Upper Extremity** in the *AMA Guides (Fourth Edition)* is always useful to prevent this Error, even when only one digit is involved. While it is true that, in general, the Guides instructs the examining physician to combine impairment values from different joints, the thumb is a notable exception.

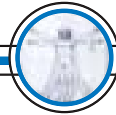
ERROR #6: "DOUBLE DIPPING"

Example: Flexion Contracture of the Hip: The gentleman being examined had developed arthritis of the left hip secondary to an old fracture of the acetabulum. The IME physician measured the flexion contracture at 30˚ from the table. The hip was able to move in flexion from the 30˚ position to 125˚. The IME physician recorded the impairment as 8% Whole Person Impairment due to the flexion contracture as found in **Table 40**. Hip Motion Impairment on page 3/78 of the *AMA Guides, Fourth Edition*. He then added an additional 2% WPI due to the fact that the total range of motion of the hip was less than 100˚ which is listed as "Mild" impairment of the hip, and is assigned 2% (5%) in the same table as was found the flexion contracture values. This was then reported as 10% WPI based on motion loss of the left hip.

THE ERROR: The physician was actually "double dipping". The flexion of the hip was normal at 125˚. The impairment was accurately reflected in the 8% WPI for flexion contracture. The physician was in error to have considered the hip flexion to be restricted.

THE CORRECT ANSWER: 8% WPI for motion loss of the left hip.

COMMENT: This is but one example of "double dipping". Other examples would include, but not be limited to the following: a) using both gait disturbance and range of motion (since Gait cannot be used with any other way of classifying impairment of the lower extremity), b) using both muscle weakness and range of motion (since both are a measure of function), and c) using a percentage for partial meniscectomy of the left knee from an earlier operation and then adding an additional percentage for a total meniscectomy (medial and lateral) of the left knee from a subsequent operation (since the percentage for the total meniscectomy would cover any impairment percent from the previous operation).



ERROR #7: FOLLOWING ONLY PART OF THE INSTRUCTIONS

Example: Taking 3 range of motion measurements, but not 3 *consecutive* measurements when using the ROM Model of Spinal Impairment: Not infrequently, the author reviews IME reports wherein the examining physician documents that he/she has taken 4 to 6 measurements using the ROM Model for evaluating spinal impairment, however, that physician has not used three consecutive measurements. The physician has, instead, used three non-consecutive measurements that "meet" the criteria that all three measurements are within 5˚ or 10% of the average of those three measurements.

COMMENT: It is helpful for physicians to take care to read and understand all of the instructions in each section of the AMA Guides.

ERROR #8: MISREADING THE FIGURE/TABLE THAT IS BEING REFERENCED

Example: TABLE 81, PAGE 3/128 AMA GUIDES (FOURTH EDITION) The author routinely reviews reports where the IME physician ignored the first column of **Table 81**. "Impairment Due to Abnormal Motion of the Lumbosacral Region: Flexion and Extension" found on page 3/128 of the *AMA Guides (Fourth Edition)*. This column lists three (3) choices for Sacral (hip) flexion angle. Depending upon the flexion angle of the sacral/hip, a "true lumbar spine flexion angle" of 40˚ will yield a *percent impairment of the whole person* of either 5%, 4% or 2%. It is important for the physician preparing the report to take notice of all of the information found in any table or figure before reporting the corresponding impairment.

Example: FIGURE 38, PAGE 3/43, AMA GUIDES (FOURTH EDITION) The IME physician correctly reported that the examinee demonstrated active range of motion of his right shoulder to 120˚ in Flexion and to 20˚ in Extension. He then reported that *"According to Fig. 38 on page 3/43, Mr. Brown qualifies for 4% Upper Extremity Impairment for the limitation in Flexion to 120˚."* From the same table, he qualifies for 24% Upper Extremity Impairment for limitation in Extension to 20˚." The physician then added 4% and 24% for a total of 28% Upper Extremity Impairment. He then converted the 28% Upper Extremity Impairment to 17% Whole Person Impairment using Table 3, page 3/20.

THE ERROR: The physician read the wrong line of the arc. He correctly used the "V" arc (measured angles of motion) for both the Flexion and the Extension measurements. He correctly used the next arc "I_F%" (impairment due to loss of flexion) to retrieve the correct value of 4% Upper Extremity Impairment. When he then followed the "V" arc back to 20˚ of Extension, however, he continued to use the **"I_F%"** arc instead of the **"I_E%"** arc. This Error caused him to record 24% Upper Extremity Impairment instead of 2% Upper Extremity Impairment for loss of motion in Extension.

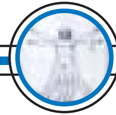
THE CORRECT ANSWER: 4% Whole Person Impairment. 4% (Flexion) + 2% (Extension) = 6%, not 24%, Upper Extremity Impairment. When 6% Upper Extremity Impairment is converted to Whole Person using Table 3, page 3/20, the final Whole Person Impairment is 4% and *not* the 17% that was originally reported.

COMMENT: It is easy to read from the wrong line of the arc of the figures calculating impairment of upper extremity due to loss of range of motion. The author routinely reviews reports where the IME physician inadvertently read the correct degree of motion of the body part only to read the wrong line of the arc (flexion instead of extension, abduction instead of adduction, etc. and thereby report an incorrect impairment value.

ERROR #9: RATING AN INDIVIDUAL BEFORE MMI IS REACHED

The IME physician documents *"acute muscle spasm"* and *"the claimant states he slipped yesterday and re-injured his back."* The physician should not have rated this individual, as the examinee is not at Maximum Medical Improvement (MMI). A general principle throughout the Guides is that *"An impairment should not be considered 'permanent' until the clinical findings . . . indicate that the medical condition is static and well stabilized."*

[NOTE: If one is using the ***Guides (Fourth Edition)***, one can rate using the Injury Model/Diagnosis-related Estimates (DRE) Model before MMI is reached, but not if using the Range of Morton (ROM) Model. If one is using the ***Guides (Fifth Edition)***, one cannot rate before MMI is reached using either the Injury Model/DRE Model or the Range of Motion Model]



ERROR 10: FAILURE TO PERSONALLY REVIEW COMPUTER AIDED MEASUREMENTS AND COMPUTER GENERATED REPORTS

Example: A CASE OF UNIFORMLY ANKYLOSED FINGERS: The injury involved trauma to the right hand and wrist. The "History" section of the report stated that the injured man had decreased motion and strength in his wrist and limited flexion of the first three fingers with normal motion in only the little finger. The range of motion values for the wrist and the thumb looked appropriate for the injury described. All of the fingers (including the little finger) were reported to have normal full motion in extension of the MP joints, but uniform ankylosis at the MP joint of all four fingers at twenty (20) degrees of flexion.

THE ERROR: It seemed most unusual to this medical reviewer that all of the MP joints on the left hand *identical* restrictions in flexion – especially given the information that the little finger had been spared from injury. Upon contacting the examining physician, this author learned that he used a computer to assist him in determining the "correct" range of motion measurements as part of his evaluations. With that information, it became clear to this author that either the examiner had placed the computerized measuring device on the examinee's fingers up side down. The computer read and recorded flexion for extension and extension for flexion. It then automatically made the "appropriate" calculations of the percent impairment, converted to hand, then regional impairment and combined those values with the other measurements to arrive an incorrect whole person impairment.

COMMENT: When this was pointed out to the IME physician, he readily admitted that reversing the sensor was the most likely the cause of the erroneous measurements. The examinee was called back to the IME physician's office, reexamined, and the correct measurements were obtained. An *Addendum* to the IME report was submitted.

Smoke and Mirrors

This author defines "smoke and mirrors" reports as being ones that deviate from either the letter or the spirit of the *AMA Guides to the Evaluation of Permanent Impairment*. These reports often contain one or a combination of the "common Errors listed above.

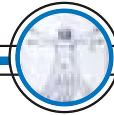
These reports vary in their apparent credibility; that is to say, taken on an individual basis, they might appear to be credible evaluations. When several reports from the same evaluator are reviewed and compared to others, however, often a common "trend" or "theme" can be found permeating each of the reports. Trends such as this may lead those using or reviewing the IME to question their credibility.

The following are examples of some of the "SMOKE AND MIRRORS" reports that this author has reviewed in the last five years.

EXAMPLE #1: THE "THRESHOLD" REPORT

The "Threshold" report is a specialized report that is most often requested by and prepared for the plaintiff's attorney. The main objective of any good "Threshold" report is to certify that the examinee has been found to meet a certain "threshold" of impairment – let's say an additional 2%. This may be needed for any number of reasons – to a) increase the monetary amount of an award in an insurance or Workers' Compensation claim, b) reopen a claim for additional disability benefits and/or treatment, or c) reach a specified percent whole person impairment which qualifies the examinee for a higher category of illness – i.e. Permanent Total Disability vs. Permanent Partial Disability. Meeting the goals and objectives of the particular threshold is not always easy if one performs an accurate examination and also faithfully adheres to the *AMA Guides*. It is usually necessary to take a few liberties with both the letter and the spirit of the Guides to accomplish one's objective in a "Threshold" report, since the examinee usually has already had one or more evaluation by one or more IME physicians. Often, those reports have already recommended the maximum impairment percent to which the individual is legitimately entitled.

A "Threshold" report is usually fairly easy to identify. These reports are notoriously vague. There are often no hard figures from which to compare the claimant's status to his former status or to the status reported in an earlier IME. "Threshold" reports are often lacking in a detailed history, review of medical records or reports of imaging studies. Work sheets and raw data are almost



never included in the report (see The "Missing Worksheet/Missing Raw Data" Report below). Often, when measurements are included in the report they are similar to those found in the "Dry Lab" report (below). Rarely does the report contain clear, unambiguous statements like "three consecutive measurements were recorded in accordance with the General Measurement Principles found in the *AMA Guides*" or "the motions were not curtailed due to a report of pain, fear of injury, or neuromuscular inhibition" or "the individual was examined in accordance with the technique found on page "xx" of the *AMA Guides*." More often, the report contains statements such as, "In my opinion, Mr. Jones is entitled to 35% whole person impairment" and "In preparing this report, I ëused' or ëfollowed' the AMA Guides" or *"according to the AMA Guides, Mr. Jones is entitled to 35% whole person impairment"* without ever citing a Figure, Table or page number where the statement can be verified. In general, "Threshold" type reports are the least credible and the most obvious of the "Smoke and Mirrors" IME reports unless they happen to be written by a "Kitchen Sink" (below) IME physician.

EXAMPLE #2: THE "DRY LAB" REPORT

Not infrequently, a random sample of a particular IME physician's reports will be targeted for review based on a letter of complaint form one or more examinees. These letters often report discrepancies in the report and the examination received.

One section of the *AMA Guides (Fourth Edition)* where physicians may be tempted to report data that was not actually measured (otherwise known as "dry labbing" the results) is on the spinal range of motion worksheets – **Figure 77** Cervical Range of Motion (ROM), **Figure 78** Thoracic Range of Motion (ROM), and **Figure 79** Lumbar Range of Motion (ROM) – found on pages 3/132, 3/133, and 3/134 respectively.

One of the requirements in the *AMA Guides* for using the Range of Motion Model in examination of the spine is that *"the examiner should select at least three consecutive measurements and calculate the mean or average of the three."* [p. 3/112] One might logically expect to see a slight progression in the three (3) to six (6) sets of measurements such that the last few measurements show a slightly greater ROM than the first or second. This is due to the fact that the first one or two active movements on the part of the examinee may loosen tight muscles such that the later attempts may yield a little greater ROM. This is not always the case, however, and any combination of ROM measurements can found – even identical measurements. A set of identical measurements in one or two planes of motion of a region of the spine is not uncommon. When a report contains three consecutive identical ROM measurements in every plane of motion in every region of the spine tested, a red flag is often raised in the IME user's mind. Either the examinee was not putting forth a full effort, or the examining physician was taking one set of measurements and "cloning" the values to make it appear that three or more sets of measurements were taken.

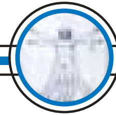
If six IME reports are reviewed from the same IME physician wherein the spinal ROM Model was used, and if only one measurement was actually taken, trends may become apparent. Such trends lead one to question the credibility of that report and other reports by the same IME physician.

One physician filled out the **Figure 79**. Lumbar Range of Motion (ROM) sheet in the following manner:

T12 ROM	100	—-	—-	—-	
Sacral ROM	25	—-	—-	—-	**X3**
True lumbar flexion angle	75	—-	—-	—-	
T12 ROM	25	—-	—-	—-	
Sacral ROM	5	—-	—-	—-	**X3**
True lumbar extension angle	20	—-	—-	—-	
T12 ROM	30	—-	—-	—-	
Sacral ROM	5	—-	—-	—-	**X3**
True lumbar right lateral flexion angle	25	—-	—-	—-	
T12 ROM	30	—-	—-	—-	
Sacral ROM	5	—-	—-	—-	**X3**
True lumbar left lateral flexion angle	25	—-	—-	—-	

EXAMPLE #3: THE "COOKIE CUTTER" REPORT

"Cookie Cutter" reports are defined as being virtually identical in the examiner's findings depending on the part of the body injured. Except for demographic information, there is very little variability among reports.



For instance, if the IME were for psychiatric/psychological impairment, every person examined "feels hopeless, *helpless and worthless*." Everyone's symptoms started on the day of the injury or within one week of the injury. Most have *"contemplated suicide"*, but none have formulated a plan. Also, no matter what the individual's past psychiatric/psychological history, or no matter what other "non-injury" related stressors are revealed in the history, the IME physician relates all or most of the person's symptoms to the injury.

f the IME were for musculoskeletal impairment, every injured person has a marked impairment of that body part compared to the contralateral part. Often, much of the report, including the examination findings of the unaffected body part, seem "boiler plate" – from a word processor template. This author saw one specific example of this when an examiner placed "slightly abnormal" findings in the template of his reports. A review of six (6) of his reports chosen at random revealed that 100% of the individuals he examined had *"mild peripheral cyanosis and skin coldness noted,"* *"peripheral pulses within low normal limits"* and *"Rombergs and Tandem walk were equivocal."* Every examinee showed "**Vibration:** normal to *tuning fork #256, no liberalization on forehead, elbows, wrists, knees, ankles and first toe."*

Not surprisingly, "Cookie Cutter" reports, like the "Threshold" reports are often lacking in history, review of medical records and imaging reports, work sheets and raw data. Active measurements are rarely mentioned (perhaps because they were not done).

Again, individually, these reports may seem credible, but if patterns are noticed by reviewers, this strains the credibility of the IME physician and his reports.

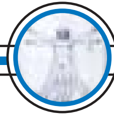
EXAMPLE #4: THE "KITCHEN SINK" OR "PILE ON" REPORT

In the "Kitchen Sink" or "Pile On" report, the examiner makes a concerted effort to include absolutely anything and everything that could be remotely related to the primary injury/illness (and in more extreme cases, things that could not be) in determining the final whole person impairment. These reports are particularly insidious because they are usually written by IME physicians with extremely high degrees of understanding of the AMA Guides. The calculations, therefore, are virtually flawless. The reasoning and extrapolations used in the reports is quite logical and will usually withstand the "reasonable man" standard. The report is quite extensive and detailed with respect to the history and physical examination and extremely well documented.

The thoroughness, the length of the report and the attention to detail are actually part of the *smoke and mirrors* found the "Kitchen Sink" a.k.a. the "Pile On" report. A reviewer's initial impression may be one of "he/she can't possibly have that much impairment." While the reviewer is distracted by looking for technical errors, which may account for the high impairment percentage, he/she overlooks some of the more subtle elements in the report. In these reports, the Devil is not in the details, but in the overall approach of including every ratable body part/system in the impairment percentage. For this reason, the "Kitchen Sink" report is usually the most credible of all of the "SMOKE AND MIRRORS" reports.

There are several tricks that may be used by the "Kitchen Sink" or "Pile On" evaluator. Quite often the examinee is found to have a total sacral (hip) motion (flexion plus extension) exceeding 55˚ if the examinee is a male or 65˚ if the examinee is female. This not only avoids the necessity of having to use the *validity test* in authenticating lumbar flexion and extension measurements, but also minimizes the true lumbar flexion/extension measurement. All of this can be easily accomplished with a little twist of the wrist while holding the inclinometer placed on the sacrum. The physician's assistant can even be present to record the findings.

Another trick is to include in the physical examination everything that the examinee complains about or believes is related to the primary injury/illness even if it is not likely related. An example of this would be finding a statement from the examinee in the History of Injury like *"when I fell, I also injured my (name your body part)."* The examiner then includes an evaluation of that extra body part (usually with ROM measurements) in the physical examination and in the impairment calculations. When one carefully looks at all of documentation in the medical records, one is likely to find that the extra body part was never accepted as a compensable condition in the claim. Further, there are often no treating physician's records where the



examinee ever mentioned this condition previously. Yet another piece of "soft" evidence would be a statement by the examinee during the IME that *"when I wore the cervical collar for my neck injury, my back stiffened up."*

When one includes internal organ dysfunction (e.g. undocumented erectile dysfunction in a back injury patient) and/or psychological sequele from an injury or illness to paradigm listed above, then it is easy to understand that "the sky is the limit" in a "Pile On" IME Report.

EXAMPLE #5: THE "MISSING WORKSHEET/MISSING RAW DATA" REPORT

A copy of the IME physician's worksheets or other forms of raw data are extremely important parts of any comprehensive IME report. It lends credibility to reports by documenting that the work was done according to proper protocol, and it allows others to verify the results of the examination. Often, however, IME reports are submitted without this important information.

There are a variety of reasons why an IME physician may not include worksheets photocopied from the AMA Guides or other raw data – pulmonary function test (PFT) recordings, nerve conduction studies (NCS) data or electormylogram (EMG) tracings, etc. Whatever the reason may be for not including worksheets and other raw data as part of the final IME report, one thing is true. Failure to include this important material will lessen the credibility of the IME report.

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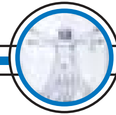

Social Circumstances of Recipients of disability Pension in Iceland

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[SUMMARY]

Aims: To compare the social circumstances of recently registered recipients of disability pension in Iceland with those of the Icelandic population.

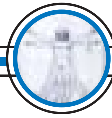
Material and methods: A telephone survey was carried out in the period January 1997 through March 1998. The interviewees were 967 recipients of disability pension. The questionnaire consisted of questions on the educational level, main employment, marital status, number of children, accommodation, and financial status. The results were compared to results of a national survey that the Social Science Research Institute at the University of Iceland did in 1997.

Results: Divorce was more common, there were more single households and fewer children and rented accommodation was more common in the study group than among the Icelandic population. Unemployment had been much more common in the study group than in the population.

Conclusions: The results of this study indicate that social circumstances have had an important impact on the outcome of disability evaluation in Iceland in 1997. In 1999 the basis of the disability evaluation was changed, with increased emphasis on medical determinants and a presumed diminished role of the social circumstances of the claimants. A further study on the social circumstances of recently registered recipients of disability pension after the change of evaluation method is indicated.

Introduction

Long-standing absence from work due to sickness can be based on medical, social and economical factors[1-5]. In Iceland, the working capacity of those who apply for disability pension is assessed by medical officers of the State Social Security Institute (SSSI). The SSSI grants three types of disability benefits based on the outcome of the assessment: Full disability pension, partial disability pension and rehabilitation pension. When this survey was carried out, the SSSI granted full disability pension to individuals aged 16-66 years suffering from prolonged disability to such a degree as to be incapable of earning a quarter of what people with full mental and physical health were able to earn in the same area, by work appropriate to their strength and skill and such as might reasonably be expected of them in the light of their upbringing and previous employment.[6] Individuals with at least 50% reduction in working capacity and those who were fully employed but had considerable extra expenses due to illness or handicap were entitled to a partial disability pension.[6] Rehabilitation pension was granted in cases where prognosis regarding disability was uncertain and when it is considered likely that work capacity



would be regained through rehabilitation.[7] The rehabilitation pension was the same monthly allowance as full disability pension, but was time limited to 18 months.

There is considerable information on the health condition of those receiving disability benefits in Iceland[8], but information on their social circumstances has been limited. For better understanding of determinants of disability a survey was therefore carried out on the social circumstances of those receiving disability pension. A part of the results of the survey, covering mainly educational level, main occupation after leaving school and current employment, have already been published.[9] In this article the focus is on other socioeconomic issues, such as marital status, number of persons and number of children in the household, nature of accommodation and previous unemployment and financial difficulties.

Material and methods

The survey was a joint project of the SSSI and the Social Science Research Institute of the University of Iceland. Employees of the SSSI carried out a telephone interview with a questionnaire on social circumstances, based on Nordic surveys on social and financial circumstances. The target group contained all those receiving for the first time disability benefits in the year 1997, as ascertained by the disability register at the SSSI, a total of 1196 people. However, when the survey was carried out (in the period January 1997 through March 1998) some of the disability pensioners had died, were not receiving disability pension any more or were to ill to respond. Thus, the survey included 967 recently registered disability pensioners. Satisfactory answers to the questionnaire were obtained from 671 or 69.4% of the pensioners which is reasonably good. In 95.4% of cases it was the invalidity pensioner who responded, but in 5.5% of cases a relative answered on behalf of the pensioner. The interviewers specified that this survey was purely for scientific purposes and the interviewees were free to skip questions or decline participation in the survey. It was also made clear that the answers would in no way influence decisions in the SSSI in the future. The questionnaire included 51 questions. This work is based on a subset of these questions.

Information about the national average is taken from two national omnibus surveys that the Social Science Research Institute at the University of Iceland did in 1997, each with a sample size of 1500 and a response rate between 65 and 70%. The respondents accurately reflected the national distribution on sex, age and place of residence. The omnibus surveys were done by telephone and consisted of questions about various issues that were both of practical and theoretical importance.

Statistical analysis was based on the chi-square test (10).

Results

The responders were 17 to 67 years of age with a mean age of 49 years and a SD of 13.6. There were 416 women (63.6%) and 238 men (36.4%). Thus, the percentage of women among the new receivers of disability pension was considerably higher than among the general population, where it was close to 50:50. According to information obtained from Statistics Iceland (the official Icelandic statistical bureau), the mean age of the nation was 35 years, i.e. 14 years lower than the mean age of the new receivers of disability pension. Receivers of full disability pension were 330 (49.2%), partial disability pension 119 (17.7%) and rehabilitation pension 222 (33.1%). Approximately 80% of the participants were positive towards the interview, 4% negative and 16% neutral, according to the interviewers. Two out of three said that it was very easy for them to answer the questions, 26% said it was rather easy, but only 3% felt that it was difficult. Approximately 97% said that they were willing to participate in a similar survey later. These answers show that the new receivers of disability pension were in general able to answer the questionnaire.

Table 1 compares the present marital status of the new receivers of disability pension (study group) to that of the general population. The difference between the two groups is statistically significant ($p<0.001$). The most marked difference is that divorce is more prevalent in the study group than among the nation in general. The marital status of the receivers of disability pension had changed in the last three years in 82 cases (12.2%). The changes are shown in Table 2.

Table 3 shows the number of persons in the household and Table 4 the number of children under the age of 17 years in

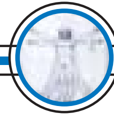


Table 1. Marital status of the study group (new receivers of disability pension) and the general population.

	Study group	General population*
Married	56.5%	52.5%
Cohabitation	10.9%	19.0%
Divorced	11.2%	4.3%
Widows/widowers	4.5%	3.0%
Single	16.9%	21.2%
Total	100%	100%
Number	668	2146

* Information on the marital status of the general population of Iceland was obtained from a national survey carried out in the year 1997 by the Social Science Research Institute at the University of Iceland

Table 2. Changes in marital status of new disability pensioners over the last three years.

	Number	Percentage
Divorce or breach of cohabitation	36	43.9
Loss of spouse	7	8.6
Marriage	21	25.6
Start of cohabitation	12	14.6
No reply	6	7.3
Total	82	100

Table 3. Number of persons in the household for the study group (new receivers of disability pension) and the general population.

	Study group	General population*
One	15.4	9.9
Two	31.0	24.7
Three	20.1	19.8
Four	15.8	22.7
Five	10.3	16.8
Six	4.2	4.8
Seven	1.1	1.0
Eight	0.4	0.2
Nine	1.4	0.1
Number	668	2088

* Information on the number of persons in the household of the general population of Iceland was obtained from a national survey carried out in the year 1997 by the Social Science Research Institute at the University of Iceland

the household for the study group and the general population. The difference between the two groups is in both cases statistically significant ($p<0.001$), with more single households and fewer children in the study group than among the general population.

Table 5 shows the nature of accommodation for the study group and the general population. The difference between the two groups is statistically significant ($p<0.001$), with rented accommodation being more common and living with parents or relatives less common in the study group than among the nation in general. In the study group 435 (65.6%) considered their present housing conditions good, 133 (20.1%) fair and 95 (14.3%) poor. Those who considered the housing conditions poor were asked which were the main drawbacks. The most common answer were “to small” (31.8), “poorly organized/stairs” (30.7%) and “to large” (27.3%). In 157 cases (23.4%) there had been a decisive change in the familyís housing conditions in the last three years, in 110 cases for the better and in 47 cases for the worse.

In the study group, 300 individuals (45.1%) had at some point in time been unemployed, whereas 365 (54.9%) had never been unemployed. When this was analyzed further, there was a statistically significant difference ($p<0.001$) according to age and previous branch of employment, but not according to gender, education or level of disability pension (Table 6). Unemployment had been relatively most common among the younger age groups, seamen, unskilled service

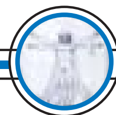


Table 4. Number of children under the age of 17 in the household for the study group (new receivers of disability pension) and the general population.

	Study group	General population*
None	59.4	46.9
One	16.4	21.8
Two	13.4	19.1
Three	7.5	9.8
Four	2.4	2.1
Five or more	0.9	0.3
Number	664	2085

* Information on the number of children under the age of 17 in the household of the general population of Iceland was obtained from a national survey carried out in the year 1997 by the Social Science Research Institute at the University of Iceland

Table 5. Nature of accommodation for the study group (new receivers of disability pension) and the general population.

	Study group	General population*
Own accommodation	73.5	75.8
Secured tenancy	0.9	0.7
Privately rented accommodation	11.6	8.6
Other form of rented accommodation	4.9	2.3
With parents or relatives	5.6	10.8
Other accommodation	3.5	1.8
Number	664	1241

workers, skilled craftsmen and unskilled workers. During the last five years 236 (35.2%) had experienced unemployment and 200 had received unemployment compensation.

The answers of the study group to the question whether they or their families had ever experienced difficulties in meeting daily expenses during the last 12 months are listed in Table 7. More than half had often or occasionally experienced such difficulties. The study group was asked whether they or their families had ever received financial support from the Social Services due to financial difficulties. In all, 21.7% had received such support at some point in time and 20.1% during the last five years.

Discussion

This study was carried out to determine some of the socioeconomic characteristics of recently registered recipients of disability pension in Iceland in the year 1997. The results show that the new recipients differ considerably in this regard from the general population of Iceland. In the study group a history of unemployment and financial assistance from the Social Services was common. No comparable data on the Icelandic population is available. However, in view of the fact that in the years 1992 to 1997 unemployment in Iceland was in the order of 3-5% of the labour force (11), an experience of unemployment during this same period among 35% of the study group indicates that unemployment was much more common in the study group than in the population. This is similar to the situation in Sweden.[4,12] Other indices of a difficult socioeconomic situation were also common among new disability recipients. Individuals in the study group were more likely to be divorced, living alone, living in a rented accommodation and they had fewer children than the population as a whole. Previously we have reported that educational level was considerably lower and unskilled workers overrepresented in the study group as compared with the population.[9] These results are in accordance with results from other countries.[2,13-15]

It is a well established observation in public health studies that there is an inverse association between socioeconomic level and risk of disease.[1,2] Our findings seem to confirm this. However, at the time of the study social circumstances of new applicants for disability pension had to be taken into account as well as physical and mental illnesses when the degree of disability was evaluated. In 1999 the Icelandic Social Security Act was

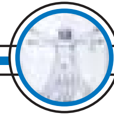


Table 6. Unemployment among new receivers of disability pension.

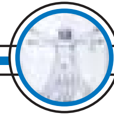
	Percentage		Number
	Yes	No	
Total	45.1	54.9	665
Gender			
Males	43.2	56.8	236
Females	45.6	54.4	412
Age in years*			
17-30	55.6	44.4	72
31-40	55.6	44.4	117
41-50	49.6	50.4	137
51-60	42.5	57.5	160
>60	33.1	66.9	172
Pension			
Full disability pension	42.8	57.2	318
Reduced disability pension	44.0	56.0	116
Rehabilitation pension	48.6	51.4	216
Level of education			
Primary and lower secondary education	46.3	53.7	369
Short vocational training	50.0	50.0	94
Vocational education	38.8	61.2	98
Higher secondary education (high school)	46.2	53.8	65
University education	31.3	68.8	32
Branch of employment*			
Specialists/administrators	23.5	76.5	34
Technicians/office workers	39.6	60.4	101
Service workers (unskilled)	54.2	60.4	120
Skilled craftsmen	48.0	52.0	75
Unskilled workers	48.1	51.9	189
Working at home	25.7	74.3	35
Farmers	28.2	71.8	39
Seamen	56.9	43.1	65

*Difference statistically significant ($p<0.001$)

changed and the British functional capacity evaluation (the "All work test") introduced as the sole basis for granting full disability pension.[16] From September 1, 1999, the social, financial and geographical situation of the claimant should no longer be taken into account in the disability evaluation. After the introduction of the new assessment method a considerable change occurred in medical and demographic characteristics of the group of new receivers of disability pension.[17] A study on the social circumstances of this group would be interesting in order to assess whether the intention by the new legislation of diminishing the effect of social factors as opposed to medical condition and functional capacity has come true.

Table 7. The study groupsí answers to the question "Have you or your family during the last 12 months ever experienced difficulties in meeting daily expenses?"

No	43.0%
Yes, often	32.4%
Yes, occasionally	18.8%
Yes, seldom	5.8%
Number	655



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When this survey was carried out the assessment of the working capacity of those who applied for disability pension from the State Social Security Institute of Iceland was based on the claimantís

( ) functional capacity
( ) medical condition
( ) medical, social, financial and geographical situation
( ) permanent medical impairment

The most marked difference in the present marital status of the study group (new receivers of disability pension) and the general population was that

( ) cohabitation was more prevalent in the study group than among the nation in general
( ) divorce was more prevalent in the study group than among the nation in general
( ) divorce was less prevalent in the study group than among the nation in general
( ) marriage was less prevalent in the study group than among the nation in general

A comparison of the households of the study group (new receivers of disability pension) and the general population revealed that there were

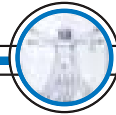
( ) fewer single households and fewer children in the study group than among the general population
( ) fewer single households and more children in the study group than among the general population
( ) more single households and fewer children in the study group than among the general population
( ) more single households and more children in the study group than among the general population

The nature of accommodation for the study group (new receivers of disability pension) and the general population differed in that

( ) own accommodation was more common in the study group than among the nation in general
( ) rented accommodation was more common in the study group than among the nation in general
( ) secured tenancy was less common in the study group than among the nation in general
( ) living with parents or relatives was more common in the study group than among the nation in general

Unemployment had been more common in the study group than among the nation in general. The difference was statistically significant according to

( ) age
( ) education
( ) gender
( ) level of disability pension



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Feb. 17	**Sydney, AU**	Advanced Topics**	**Embassy Suites**
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Oct. 18, 19	**Chicago, IL**	**Certification Review Course and Exam**	**Embassy Suites**
Oct. 20	**Chicago, IL**	Advanced Topics**	**Embassy Suites**

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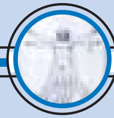

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