Preventing Work-related Injuries Among Sonographers

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Work-related musculoskeletal disorders (WRMSD) have been reported in a number of professions for several years, but have only been identified in the ultrasound profession in the last 10 years. Musculoskeletal disorders are the major cause of work place injury and have a significant economic impact on industries [(1).] WRMSDs account for 56% of work-related illnesses reported to OSHA, cause 640,000 lost work days, and account for most of Worker's Compensation costs[(2)]

A survey conducted by the Society of Diagnostic Medical Sonography and the Healthcare Benefit Trust of British Columbia revealed that 84% of the sonographers who responded were scanning in pain which they related to their work activities.[(3)] Twenty percent of those sonographers have had an injury severe enough to be career-ending, the impact of which has contributed to the current work force shortage in sonography. In countries other than the United States, Australia and the United Kingdom, ultrasound examinations are performed by physicians. A survey conducted by Magnavita, et. al. in Italy found that 80% of physician sonographers reported musculoskeletal symptoms. [(4)]

The areas of the body most often involved in injury within the profession of sonography are [(5)]:

- Shoulder (84%)
- Neck (83%)
- Wrist (61%)
- Back (58%)
- Hands (56%)

Risk Factors

The causes of WRMSD can be attributed to 3 groups of factors:

- Biomechanical factors – awkward scanning postures, excessive force used in performing an exam, workspace design
- Faulty work organization – infrequent breaks, overtime & on-call incentives, inadequate employee training
- Injury management – delayed injury reporting & diagnosis, improper injury management, returning the worker to an injury-producing environment

Work activities that contribute to injuries in the sonography profession are repetitive motions, forceful exertions or strain, awkward or unnatural positions, uncomfortable positioning of the upper extremities, static postures, overuse, and frequent reaching above shoulder level. (Fig.1)

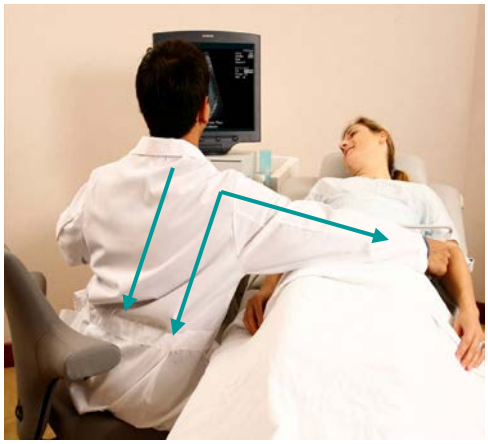

Fig. 1: The sonographer's chair is too low for the height of the ultrasound monitor. The patient is positioned too far from the sonographer causing him to twist his trunk and abduct his arm 90^{o} from his body in order to reach the patient.

Technical advances in ultrasound have contributed to the increase in MSD. Filmless storage allows the practitioner to move quickly between patients without sufficient rest periods. Narrow transducer casings require a tighter grip, which

causes excess stress on the fingers and forearm muscles. Conversely, extremely wide transducers cause over-extension of the fingers and strain on the muscles of the upper extremity. Chairs or stools and exam tables that are not adjustable result in excessive reaching and trunk twisting in order to reach the patient during an examination. An uncomfortable chair is the major cause of back pain. Increases in workloads due to downsizing and shortages of skilled practitioners, result in workers performing more patient examinations during the workday, often requiring more overtime hours and fewer work breaks.

Muscle physiology

Muscles and tendons are designed to be used regularly. However, when frequency and duration of loading exceed the ability of the muscles and tendons to adapt, inflammation occurs, followed by degeneration, microtears, and scar formation. Once a tendon is injured, the muscle to which it is attached must compensate by working harder to provide support for the extremity and joint. An increase in the demand on the muscle results in fatigue and strain. This type of stress is a function of the amount of transducer time used by a sonographer, particularly when performing the same type of examination, work pace, recovery time, and level of muscular effort.

Muscles require an adequate supply of oxygen to function properly. Oxygen is pumped into muscles and wastes are removed through the normal contraction of muscles during dynamic movement. Static postures prevent this process from occurring, resulting in decreased oxygen to the muscles and a build-up of lactic acid followed by fatigue and potential injury. Nerve damage results from arm abduction, flexion and extension of the wrist and/or fingers. These motions cause swelling of the soft issues which compress and entrap the nerves of the wrist or fingers.

Reduction of Risk

Treatment of work-related MSD has a poor outcome,[6] in part because workers are often expected to return to the same work environment that caused their injury initially. Since MSD is caused by multiple factors, injury prevention requires solutions from many sources by addressing the risk factors in the workplace through education and ergonomics.

Solutions for musculoskeletal injury can be broken down into three categories:

1. Engineering Controls
2. Administrative Controls
3. Work Practices

Engineering Controls reduce or eliminate the presence of risk factors in the workplace. This can be accomplished through design changes or appropriate specifications in the equipment that makes up the workstation, i.e., the ultrasound equipment, ancillary equipment, and adaptive equipment. Engineering controls can also be implemented with scanning technique modifications on the part of the worker. These control methods involve the ultrasound equipment, including the adjustability of the control panel and monitor, and the size, weight and design of the transducers and cables. The ease of portability of the equipment is an important in those facilities where patient examinations may be performed at the bedside.

Administrative Controls reduce the worker's exposure to risk factors. This involves changes in the schedule & workload, job rotation and task rotation of the worker in order to reduce the employee's contact with job hazards, and minimizing the number of bedside examinations. These control methods also include the type of ancillary equipment available in the examination rooms. Height-adjustable exam tables and/or examination room chairs allow workers to

achieve more neutral, comfortable positions with their scanning arm. Equipping each examination room with an external monitor for patient viewing allows sonographers and sonologists to position the ultrasound system's monitor directly in front of them.

Work Practices are a combination of engineering and administrative controls and, consequently, can both reduce the presence of risk factors and reduce the time and frequency of exposure to injury producing actions.

Sonographers and sonologists must learn what work postures cause pain and how those postures can be changed. Often, this can be done by using adjustable chairs or stools with backs, and by using height-adjustable exam tables. Taking the time to position the equipment and the patient close to the worker can significantly reduce reaching and trunk twisting. Attention should be given to arranging a patient's room during bedside examinations so that the practitioner can scan the patient comfortably without excessive reach or abduction of the upper extremities. (Fig.2)

Fig. 2: The exam room chair is properly positioned so that he can view the monitor without neck flexion. The patient is positioned closer to the practitioner, which eliminates his trunk twist and reduces his arm abduction to 30^{o}.

The simple practice of taking multiple “mini-breaks”, which consist of stopping to relax the neck and shoulder muscles, opening and closing the hand and resting the eyes, can make a significant difference in the level of muscle recovery.

Support cushions should be used by sonographers and sonologists during patient examinations to support their scanning arms and, thus, prevent the upper extremity muscles from supporting the entire weight and activity of the arm. Once the arm is extended more than 30 degrees from the body, muscle strain and fatigue occur since the muscles are “firing” 100% of the time to maintain this position. Supporting the arm allows the muscles to rest and minimizes muscle strain and fatigue.

Management of the transducer cable can also impact risk for occupational injury among ultrasound practitioners. The cable insertion into the transducer casing causes the transducer to be imbalanced and causes torque on the forearm of the ultrasound practitioner. To compensate for this, practitioners may either drape the cable around their necks or ,if they are standing to scan, trap the cable between their hips and the exam table. Both of these work practices can produce injuries of the cervical or lumbar spine. The cable should be draped in holders on the ultrasound equipment or managed with an armband that is worn below the worker’s elbow and entraps the cable in a Velcro® tab.

Ultrasound practitioners should also perform stretching and strengthening exercises designed to condition the shoulder, arms and hands. (Fig 3) Physical fitness and regular physical activity contribute to the reduction of musculoskeletal symptoms.[4]

Fig. 3: There are a number of stretching exercises that can be performed at the workstation throughout the day.

Ergonomic principles

Ergonomics is the "science" of designing a job to fit the individual worker. In ultrasound departments where a number of different practitioners are employed, this is best achieved by utilizing adjustable examination room equipment and furnishings and through the use of adaptive equipment while scanning. As ultrasound departments replace old equipment or purchase additional equipment, they will be able to choose products that have been designed with the sonographer's safety as a priority. Newer equipment designs incorporate ergonomic principles that may not be available in existing examination room equipment. Injury prevention is most effectively achieved through the purchase and use of ergonomically designed chairs, exam tables, and ultrasound equipment.

Work Postures

The ergonomic features of the workstation equipment are only effective if the sonographers and sonologists utilize them properly and if the sonographers also change work postures that could be injury producing. The ultrasound system should be positioned parallel to the exam table and close to the practitioner. This eliminates trunk twisting and reaching for the control panel. The monitor of the ultrasound system should be position directly in front of the practitioner and approximately an arm's length away. The height of the exam table and chair should be adjusted so that the practitioner can reduce the angle of abduction of his/her scanning arm to 30^{o} or less. The patient should be positioned close to the practitioner, which reduces reaching and bending. When seated, the sonographer or sonologists should have good foot support, which provides a

stable base for the trunk and shoulder girdle. When standing, the sonographer or sonologist should have his/her weight evenly distributed on both feet.

The ultrasound workstation, consisting of the ultrasound system, exam table, and chair, plays a significant role in reducing the risk for injury; however, work posture used by sonographers is the most critical injury risk factor. F. 4)

Fig. 4: The image on the left illustrates injury-producing work postures. The image on the right shows the practitioner in a more neutral, comfortable work position.

Conclusions

It is important to remember that work-related musculoskeletal disorders result from cumulative trauma caused at a cellular level by non-neutral body postures, sustained static positions, and repetitive motions. These work positions can lead to oxygen deprivation of the muscles, fatigue and subsequent injury. WRMSDs affect worker productivity and morale, as well as impacting the worker's leisure activities. By learning the causes of occupational musculoskeletal injury,

sonographers and sonologists can make changes in their work postures and in the set-up of their workstations in an effort to reduce their exposure to injury risks.

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