Design of an Ergonomic Workstation to Reduce Risk of Musculoskeletal Injury in Diagnostic Medical Sonographers

Background
A worksite study was conducted to determine the risk factors associated with musculoskeletal injury (MSI) in sonographers. The worksite study involved 27 sonographers from Greater Vancouver hospitals. Awkward and static postures were found to be the main risk factors associated with MSI when performing abdominal and cardiac scans. Results showed that the location of the monitor and the control panel, and the design of the ultrasound bed were key elements that determined a sonographer’s posture. In particular, sonographers twist their neck and back, lean to the side, and raise their arms out to the side and/or front for prolonged periods of time while scanning.

Laboratory Study
The School of Kinesiology at Simon Fraser University designed a laboratory study to examine the effectiveness of various workstation modifications on reducing risk factors for MSI, specifically during abdominal and cardiac scans. Sonographers from the B.C. Women’s Hospital and Health Centre participated in the laboratory study. The laboratory study revealed that:

1. Standing while scanning resulted in less strain on the neck and shoulder muscles of the sonographer than sitting while scanning.

2. Moving the monitor from the side of the bed to a position directly in front of the sonographer (over the head of the patient) reduced the strain on the neck and back muscles of the sonographer while scanning.

3. Moving the control panel from the ultrasound machine to a support stand close to the sonographer reduced the strain on the neck muscles of the sonographer while scanning.

4. Supporting the weight of the arm while scanning reduced the strain on the neck, shoulder, and back muscles of the sonographer during cardiac scans.

The results of the laboratory study suggested that there is very little flexibility in the design of standard ultrasound workstations. The monitor can be tilted and rotated slightly, but the height cannot be adjusted. The control panel is fixed to the mainframe; as a result, the sonographer must twist his/her back and neck and raise both arms while scanning. In addition, because the ultrasound machine is fixed at the side of the patient’s bed, it is not possible for the sonographer to transfer the transducer (scanning device) from one hand to the other.
during a scan. The transducers used during abdominal scans require a pinch grip which is more taxing on finger and forearm muscles than a power grip (full-hand grasp). Changing grip is also awkward because the transducer cable may interfere with the positioning of the sonographer’s hand while scanning. The researchers felt that modifications to current ultrasound equipment could be retrofitted and that this would reduce the risk of MSI to sonographers.

Workstation Design

SFU designed a new workstation as a result of the information gathered from the laboratory study and feedback from the sonographers. The new workstation consists of:

1. A height adjustable ultrasound bed with a cutout in the side to allow the sonographer to get closer to the patient, reducing awkward shoulder and back postures
2. A flat panel monitor positioned on a moveable arm above the ultrasound bed to reduce awkward twisting of the neck and back
3. A remote control panel positioned on a moveable arm attached to the side of the bed to reduce awkward reaching and twisting of the back
4. An overhead support and balancing system for the transducer and cable to reduce strain on the wrist and forearm
5. A sit/stand chair to allow the sonographer to change between sitting and standing to decrease the amount of static postures of the back and legs.

Worksite Intervention

A study to examine the effectiveness of the workstation on reducing risk for MSI began at the B.C. Women’s Hospital and Health Centre in July 2002 but was abandoned shortly after implementation due to technical problems with the remote control panel. These technical problems are currently being examined.

Two out of three sonographers who used the new workstation indicated that it was an improvement over the old workstation. They felt that most of the features of the new workstation resulted in a decreased risk for MSI but also felt that the functionality of some of the features could be improved.

What’s Next?

Future evaluations of the workstation may be considered once the technical problems have been addressed.

References
