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STATEMENT ON THE SAFE USE, AND POTENTIAL HAZARDS OF DIAGNOSTIC ULTRASOUND

Ultrasound is now accepted as being of considerable diagnostic value. There is no evidence that diagnostic ultrasound has produced any harm to patients in the four decades that it has been in use. However, the acoustic output of modern equipment is generally much greater than that of the early equipment and, in view of the continuing progress in equipment design and applications, outputs may be expected to continue to be subject to change. Also, investigations into the possibility of subtle or transient effects are still at an early stage. Consequently diagnostic ultrasound can only be considered safe if used prudently.

Thermal hazard exists with some diagnostic ultrasound equipment, if used imprudently. A temperature elevation of less than 1·5°C is considered to present no hazard to human or animal tissue, including a human embryo or fetus, even if maintained indefinitely. Temperature elevations in excess of this may cause harm, depending on the time for which they are maintained. A temperature elevation of 4°C, maintained for 5 minutes or more, is considered to be potentially hazardous to a fetus or embryo. Some diagnostic ultrasound equipment, operating in spectral pulsed Doppler mode, can produce temperature rises in excess of 4°C in bone, with an associated risk of high temperatures being produced in adjacent soft tissues by conduction. With some machines colour Doppler imaging modes may also produce high temperature rises, particularly if a deep focus or a narrow colour box is selected. In other modes, temperature elevations in excess of 1°C are possible, but are unlikely to reach 1·5°C with equipment currently in clinical use, except where significant self-heating of the transducer occurs.

Non-thermal damage has been demonstrated in animal tissues containing gas pockets, such as lung and intestine, using diagnostic levels of ultrasound (mechanical index values of 0.3 or more). In view of this, it is recommended that care should be taken to avoid unnecessary exposure of neonatal lung , and to maintain MI as low as possible when this is not possible. In other tissues there is no evidence that diagnostic ultrasound produces non-thermal damage, in the absence of gas-filled contrast agents. However, in view of the difficulty of demonstrating small, localised, regions of damage in vivo, the possibility of this cannot be excluded. The Mechanical Index, if displayed, acts as a guide to the operator. The use of contrast agents in the form of stabilised gas bubbles increases the probability of cavitation. Single beam modes (A-mode, M-mode and spectral pulsed Doppler) have a greater potential for non-thermal hazard than scanned modes (B-mode, Colour Doppler), although the use of a narrow write-zoom box increases this potential for scanning modes.

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