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Checking for Electrical Shock Hazards

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The array of electronic devices from which the anesthesiologist may choose to monitor his patient exposes him and the patient to many sources of electrical shock hazards. Papers published over the past few years have done much to alert the physician and the instrument manufacturer to these dangers.[1, 2]

Paramount to all prevention protocols is the establishment of a true electrical ground for all instruments connected to a particular patient. When powerline-operated electrical apparatus is employed in direct contact with the human cardiovascular system, 60-Hertz (Hz) leakage currents of 15 to 20 microamperes can cause ventricular fibrillation. The ohmic resistance of the intact skin provides a measure of protection, and the threshold for ventricular fibrillation in this instance is approximately 0.1 ampere. These concepts, though understood, often do not readily permit translation into practice when the physician attempts to determine whether a particular interconnection of electronic monitoring devices, electrocautery unit,[3] etc., is safe from electrical shock hazard.

Recently, a new, compact instrument has been marketed † which permits a rapid and quantitative evaluation of 60-Hz leakage current. In concept, it resembles the scheme described by Starmer,[4] wherein the voltage drop is measured across a fixed 1,000-ohm resistor connected between a known ground and the electrical device under test. The 1,000-ohm resistor substitutes for the patient in the contemplated equipment–patient interconnection. A meter readout then indicates the amount of ground leakage current which would flow if the patient actually were connected to these electrical devices. Overall instrument sensitivity permits measuring currents of less than one microampere. Using the guidelines for maximum safe current levels previously mentioned, the relative safety of a particular apparatus may be evaluated. Leakage currents in excess of 10 microamperes, measurable with this device, are considered to indicate inadequate machine grounding.[4]

Suspect equipment interconnections can now be tested with ease in regard to their electrical safety. Routine maintenance check-ups should also be performed on all patient-care electrical equipment used by the anesthesiologist. Such safety surveillance should not be limited just to the equipment the anesthesiologist uses. However, since he does expose himself and his patient to a variety of electrical devices in the operating room, recovery room, and intensive-care unit, every effort should be made to minimize the shock hazard in these high-risk areas. A test device such as that described can prevent or identify hazards before human injury occurs.

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† CAMSAFE, manufactured by the Cambridge Instrument Company, Inc., 73 Spring Street, Ossining, N. Y.

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