

The problem is believed to be due to electrical currents induced, according to Faraday's Law, in all conductive materials exposed to the radio-frequency magnetic field used during imaging.⁵ While the body tissues undergo low-level distributed heating due to these induced currents,⁵ wires that form a part of a conductive pathway having a large enclosed area (and hence cutting many magnetic flux lines) have particularly strong currents induced in them. In addition to heating the wires themselves, the currents also produce localized heating in any tissue that completes an electrical circuit with the wire. As with electrocautery and other radio-frequency sources, capacitive and inductive coupling may allow large currents to flow through pathways that would be considered adequately insulated for prevention of shock from the 60-Hz power line.

Although detailed studies concerning the burn hazard in MRI have not been reported, first principles suggest the following as prudent precautions: 1) Keep all unnecessary conductors out of the bore of the magnet. 2) Place the pulse oximeter sensor as far from the imaging site as possible, *e.g.*, on a toe when the head is being imaged. 3) Do not allow any loops to form in wires or cables running into bore of the magnet, *e.g.*, in those of the electrocardiograph or pulse oximeter. 4) Make a braid of the slack portion of the wires connecting the individual electrocardiograph electrodes to the cable. 5) Use adult-type electrocardiograph electrodes when performing imaging in infants.⁹⁻¹¹ 6) Keep a thick layer of thermal insulation between any essential wires or cables and the patient's skin.

The burns reported above may have been avoided if the pulse oximeter sensor had been placed on the toe of the adult patient and if the cable leading to the infant patient's sensor had not been looped or taped directly to the skin. These cases illustrate that in order to give anesthesia safely in the MRI environment, it is essential that the anesthetist become familiar with *all* of the special hazards encountered there.^{3,7}

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Percutaneous Puncture of the Internal Jugular Vein Using Continuously Transduced Pressure

To the Editor:—Successful percutaneous internal jugular vein cannulation requires considerable skill and experience. Inadvertent arterial puncture is the most frequent complication (0-11%), and placement of a large needle or sheath introducer into the carotid artery may cause serious bleeding or postponement of elective operations,¹ may require surgical intervention, and can be lethal. The rate of complication is inversely related to operator experience.² The Raulerson syringe (Arrow International, Reading, PA), permits a one-step modification of the Seldinger technique, in which the guide wire is threaded directly through the syringe and needle. The technique promises to facilitate cannulation with less risk of contamination, trauma, guide wire misplacement, and air embolism,³ but even use of the Raulerson syringe may still allow insertion of a sheath introducer into an artery.⁴

Many techniques of internal jugular vein catheterization, including real-time ultrasonic guidance, have been described.⁵⁻⁷ In addition to being expensive, this method is not always accessible in most hospitals. In many instances, arterial puncture is recognized by the pressure and color of the blood, both of which may be unreliable signs. Arterial puncture may cause spasm of the vessel, which inhibits pulsatile flow.

When this happens, slow return of blood seems to render color an even more unreliable sign.

We have devised a technique of continuous pressure measurement for attempting to cannulate the internal jugular vein. A T-port extension set (Burron Medical Inc., Bethlehem, PA), with the rubber portion removed is placed in between the needle and syringe. The vein first is identified with the 22-G, 1½-inch finder needle. Then an 18-G, 2¼-inch thin-walled needle is connected to a T-port in-line with a 5-ml syringe (fig. 1), and internal jugular vein cannulation is reattempted. As soon as the vein is entered, a transduced central venous pressure is demonstrated on the screen. If present, inadvertent arterial cannulation is immediately evident. Even if arterial spasm is present, the pressure tracing is characteristically much higher than is the venous. The Raulerson syringe can be used with this technique and inadvertent cannulation of the artery can be avoided. However, the straight end of the guide wire should be used because the J end will flex before it passes the T-port. The negative pressure exerted by aspiration of the 5-ml syringe should not affect the calibration of the disposable transducers (Transpac II, Abbott Critical Care System, North Chicago, IL).*

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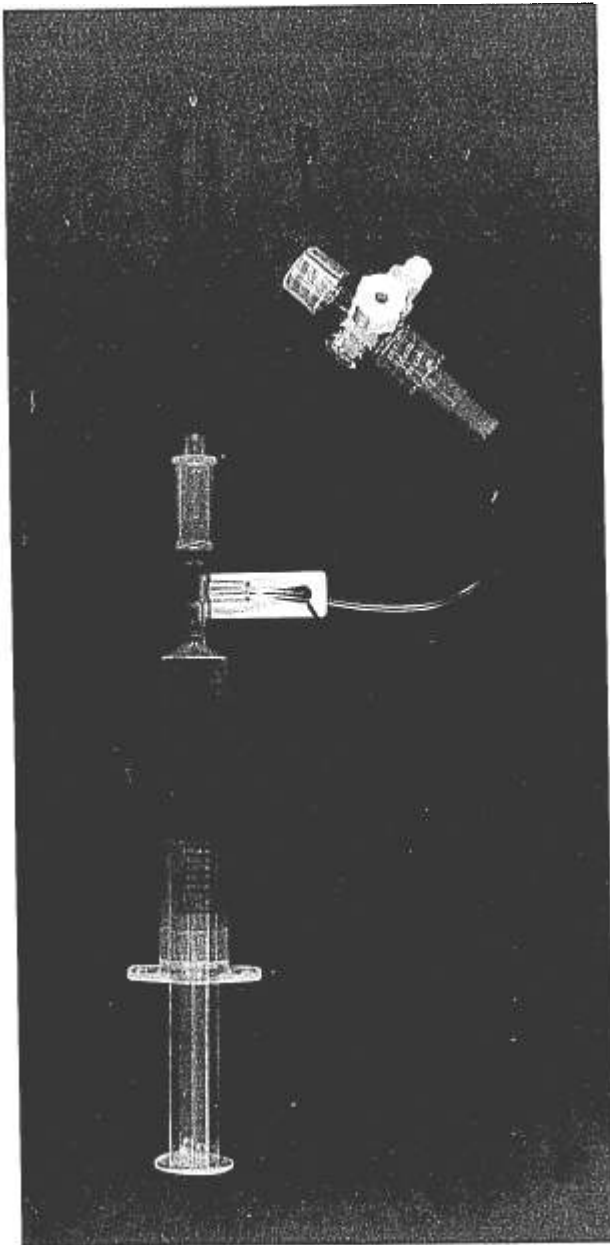


FIG. 1. Set-up for continuous pressure transduction during internal jugular cannulation. The T-piece inserted between the syringe and needle (A) and is available for continuous pressure monitoring (B).



We have found the use of continuous pressure transduction to be extremely useful and effective in avoiding accidental arterial cannulation. The T-port is readily available and adaptable. Its use may decrease the incidence of accidental arterial cannulation, especially in the hands of trainees or relatively inexperienced operators.

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