A new instrument for improved accuracy of stereotactic depth electrode placement

Technical note

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STEREOTACTIC placement of flexible depth electrodes is widely used as a method of seizure characterization. Using a target-centered arc or other type of stereotactic frame, such as the Cosman-Roberts-Wells (CRW), the standard procedure consists of several stages. Initially, a hollow electrode introducer is directed toward the target. A wire electrode measuring the same length as the introducer is then inserted as far as the tip of the introducer, thus positioning the electrode at the exact target point. Then, as the introducer is withdrawn, the wire electrode is gradually fed downward until it can be gripped directly.

This last stage provides the setting for potential error as accurate electrode placement depends entirely on the ability of the surgeon to feed the wire downward through the introducer at exactly the same rate as the introducer is withdrawn. Any discrepancy will result in the electrode tip being advanced or retracted from its intended position.

Electrode Placement Device

A device has been designed, built, and used that eliminates this source of error. This device consists of a simple metal arm that can be affixed to the back end of the electrode introducer carrier on the standard CRW frame (Figs. 1 and 2). At the distal end of this arm is a spring clip that holds the electrode wire.

Once the introducer has been positioned at the target and the electrode passed through the introducer in the usual manner, the unattached end of the electrode, which

FIG. 1. Diagram of the electrode placement device showing its method of attachment to the introducer carrier and fixation of the electrode wire.
normally hangs freely, is clamped to the distal end of the electrode placement device (EPD) using the spring clip. The electrode is now anchored at exactly the correct position and the introducer can be withdrawn by simply “railroading” it over the electrode, with no risk of altering the electrode’s position, until the free electrode is exposed and can be gripped directly. The electrode is then released from the EPD (Fig. 3).

Results and Discussion

The prototype device illustrated has been successfully used to position a number of intracranial electrodes in patients on our neurosurgical unit as part of a comprehensive epilepsy program.

Depth electrodes can be either flexible or rigid, each type having advantages and disadvantages.1–5 Flexible electrodes possess less potential than rigid electrodes to cause cerebral injury by exerting fulcrum effects and, hence, the current trend is toward their use. The main disadvantage of flexible electrodes is the necessity of using a rigid stylet or introducer and the often-realized potential for electrode withdrawal as the introducer is removed, a problem that has yet to be fully addressed.4,5

A simple carrier such as that described should reduce to a minimum errors associated with the placement of depth electrodes. The “arm” must be as long as the introducer needle (160 mm for use with the CRW frame or 190 mm for use with the Leksell frame). Use of such a device need not be restricted to insertion of electrodes. Similar errors of placement occur in all manner of stereotactic procedures and this device could be used for improved accuracy in placing shunt catheters, brachytherapy wires, and drug delivery systems, as well as stimulating electrodes.

Disclosure

The authors have no financial interest in the instrument described, which is not yet in commercial production.

References


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