New frame for stereotaxic surgery

Technical note

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A new frame designed for stereotaxic surgery allows performance of a one-stage procedure without the need for mathematical calculation or the use of atlases or diagrams. This frame simulates the reference line in the center of the brain with two lines, one on each side of the head (on the frame) parallel and equal in length to the reference line and at equal distance from the midline. Lesions can be made easily and accurately on either or both sides in a one-stage procedure with use of precise data for the target through any specific or pre-existing burr hole.

KEY WORDS □9 stereotaxic frame □9 reference line □9 lesion □9 target □9 stereotaxic surgery

IN 1933, Kirschner1 introduced stereotaxic surgery in man for electrocoagulation of the Gasserian ganglion through the foramen ovale, and in 1947, Spiegel, et al.,2 used it for intracerebral surgery. Since then, many instruments and frames have been used for producing lesions deep in the brain and for electrostimulating or recording from subcortical structures. Most of those instruments as well as ours are modifications of Horsley and Clarke's original frame3 described in 1908, which they used in experimental animals for physiological studies. Other frames have been reported in the literature.1-5,8,18,21-25

In introducing another stereotaxic frame we are conscious of the many currently available models, but our method eliminates the need for complex mathematical calculation for radiological correction and simplifies localization of the target. The versatility also provides an approach through any specific or pre-existing burr hole. In addition, the procedure can be completed in one stage under local anesthesia, more than one lesion can be made at a time, and bilateral lesions can be made without the need to adjust the frame or to take repeat radiographs.

Technique

Simulation of the reference line by a bridge of radiolucent Lexan on each side of the head is the principle of the apparatus. The bridges are parallel and equal in length to the reference line in the third ventricle and situated at an equal distance from the midline. Lesions can be made easily and accurately on either or both sides in a one-stage procedure with use of precise data for the target through any specific or pre-existing burr hole.
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reference. The radiographic apparatus is no longer needed as the frame is fixed to the skull with the reference line exactly midway, parallel, and equal in length to the distance between the markers on each side of the frame. The markers are replaced by the bridges (h).

By knowing the coordinates of any target in relation to the reference line, the surgeon can easily locate this target by setting the sliding scales (j) on the Lexan bridges (h) with the protractor on the side of the lesion. The overhead arc (k) is fixed to the sliding scales by the screws (l), and all the screws (i) are tightened. The graduated sheath (m) for the electrode (n) is placed in the electrode holder (o) with the depth collar (p) at zero graduation. The overhead arc and the electrode carrier can be adjusted to be in line with a burr hole anywhere in the skull. When the electrode is advanced in its sheath with the depth collar at zero position, the tip of the electrode is exactly on target, and the target can be reached from any burr hole. The size of the lesion that can be made depends on the results of testing or on the surgeon’s past experience.

FIG. 1. a: Head-fixing screws and counter nuts (â). b: Skull fixation pins. c: Midline markers. d: Markers for anterior and posterior reference points. e: Knobs for moving the marker for the anterior reference point forward and backward (ê) and upward and downward (ë). f: Knobs for posterior reference point marker moving front and back (f) and up and down (f). g: Tightening screws for anterior and posterior reference point markers. h: Lexan bridges representing the reference line. i: Tightening screws. j: Sliding scales, protractor attached to one side. k: Overhead arc with electrode carrier (o). l: Screws for holding the arc to the sliding scales. m: Graduated sheath for the electrode (n) and depth collar (p). q: Special attachment to support the frame on a Mayfield headrest.

FIG. 2. Third ventricle superimposed with midline markers (white arrow); this confirms that the center of the frame is in line with midline structures in the third ventricle.
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References

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Fig. 3. Anterior commissure superimposed with anterior reference markers (white arrow).

When the setting on the sliding scales is changed, a different target can be reached. When the sliding scales are interchanged with the protractor on the other side, bilateral lesions can be made. The special attachment (q) supports the frame to the Mayfield headrest.

The frame and arc are made from aluminum 2024, and so are light in weight; all screws and moving and sliding parts are made from stainless steel 303, and markers and bridges are made from radiolucent Lexan.

Fig. 4. Posterior commissure superimposed with posterior reference markers (white arrow). Black arrows show the anterior markers as the center beam of x-ray film moved away.
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