Stereotactic suboccipital transcerebellar biopsy under local anesthesia using the Cosman-Roberts-Wells frame

Technical note

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Previously reported suboccipital transcerebellar stereotactic biopsy methods, performed with the patient in the prone position, have required general endotracheal anesthesia. A technique is described for performing such biopsies with the patient in the lateral decubitus position, under local anesthesia. Phantom planning and routine computerized tomography graphics allow the selection of a safe entry point and intra-axial trajectory to the lesion. The time required for data acquisition and the operative procedure itself compares well with that of more routine biopsy techniques.

KEY WORDS: stereotaxis • biopsy • transcerebellar approach • Cosman-Roberts-Wells frame

COMPUTERIZED tomography (CT)-guided stereotactic biopsy of lesions in the posterior fossa has become a standard diagnostic procedure.7-3,3,6 The transfrontal approach is often employed to reach brain-stem targets.3,4,6 This route, however, is not appropriate for lesions placed far laterally within the brain stem or in the cerebellum. For targets in these areas, the transcerebellar approach has several of the elements required for an ideal stereotactic trajectory: it is short, traverses relatively noneloquent brain tissue, and crosses only one pial surface.1,3,7 Its main limitation has been the need to place the patient in the prone position, which almost invariably requires general anesthesia to avoid patient apprehension and assure adequate airway control.1,3,4,6

We describe our technique for performing transcerebellar biopsy under local anesthesia, with the patient in the lateral decubitus position, using the Cosman-Roberts-Wells stereotactic frame.

Operative Technique

Standard parts of the Brown-Roberts-Wells system in combination with the Cosman-Roberts-Wells arc are used. The base ring is applied to the patient’s skull under local anesthesia. The ring is placed as low as possible in the nuchal area (its upper lip at or below the level of the foramen magnum). The anterior part of the ring is directed toward the patient’s ear on the side of the lesion (Fig. 1). The actual position of the patient’s face in relation to the ring is irrelevant to the stereotactic localization procedure, as the position of any point within the stereotactic space is referenced only to the frame. The posts are placed to allow clear access to the suboccipital region on the side of the lesion.

Contrast-enhanced axial CT scans are obtained through the area of interest. Once the lesion is visualized, a target and a suitable entry point are selected on the same CT slice. This may require realignment of the scanner gantry. An entry point clearly below the transverse sinus is chosen, allowing a safe trajectory to the target. For brain-stem targets, this requires passing through the middle cerebellar peduncle. Computerized tomography coordinates of the target and entry point, as well as those of the nine fiducial points (Fig. 2), are obtained in the usual fashion.

In the operating room, the patient is placed in the lateral decubitus position, with the side of the lesion uppermost. The base ring is fixed to the Mayfield adaptor. Target and entry point Cartesian coordinates are obtained with the hand-held calculator. The Cosman-Roberts-Wells arc is mounted in the sagittal position (Fig. 3); this allows a plane-of-target (horizontal) entry point. With the arc placed in the standard frontal position, a horizontal entry point would not be feasible since the arc rotates around hinges that limit the lateral
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Fig. 1. Placing the patient in the lateral decubitus (L.D.) position requires that the anterior part of the Brown-Roberts-Wells base ring be directed over the patient's ear on the side of the lesion, which is uppermost. In this manner, the posterior part of the ring can be connected to the Mayfield adaptor, so that the patient's head is secured to the operative table.

Displacement of the probe-holder to 27° above the horizontal plane.

In the Cosman-Roberts-Wells arc-compatible phantom, the pointer is set at the target coordinates. The Cosman-Roberts-Wells arc is applied to the phantom, and a biopsy probe is advanced to corroborate the accuracy of the settings. The phantom pointer is then repositioned to the entry-point coordinates. The target settings of the arc are left unchanged. The arc is now rotated into a horizontal position on the entry-point side, and the probe-holder is displaced along the arc as needed so that the biopsy needle shaft touches the phantom pointer (entry point) at a 90° angle. The angular values for the arc (collar angle) and the probe (arc angle) are read, and the positions secured (Fig. 4). In this manner, it is assured that the probe will traverse the desired entry point and reach the desired target point. The arc is now applied to the base ring. The skin of the nuchal area is prepared for surgery; the entry point is marked on the skin and a small stab wound is made. The nuchal muscles are bluntly dissected by slowly advancing a 2.7-mm (½-in.) drill bit, which then perforates the bone and pierces the dura. The biopsy needle is advanced to the target and the procedure is continued in the usual fashion. The wound is closed with a single skin stitch.

Fig. 2. Stereotactic computerized tomography (CT) scan is obtained through the area of interest and the scanner gantry is reangled if necessary, so that a suitable target within the lesion as well as a safe entry point can be marked on the same CT slice. The entry point should avoid penetration of mastoid cells and the transverse or sigmoid sinus. Definition of target coordinates alone usually suffices to accomplish biopsy with the Cosman-Roberts-Wells frame. For a transcerebellar biopsy, however, the exact predefinition of an intra-axial trajectory is critical to avoid transgression of the cerebellopontine angle or the floor of the fourth ventricle.

Fig. 3. With the anterior part of the base ring directed laterally, a horizontal (plane-of-target) entry point through the suboccipital area is made possible by mounting the Cosman-Roberts-Wells arc in the sagittal position.
Stereotactic biopsy with the transcerebellar approach is suitable for targets in the lower midbrain, pons, and upper medulla, which may be reached through the middle cerebellar peduncle. It is also useful for the occasional cerebellar lesion not requiring open surgery (as in the case illustrated in Fig. 2).

The Cosman-Roberts-Wells frame has several features that facilitate this particular application. First, the large arc allows extremely low placement of the base ring and clear access to suboccipital entry points. Second, the gantry-independent CT localizer allows rean- gulation of the scanner gantry until a plane is found that incorporates ideal entry and target points. Third, the arc can be detached from its base plate and reapplied in an orientation that allows a horizontal trajectory from virtually any entry point.

The technique described for the posterior fossa biopsy through the transcerebellar route is rapid and precise. Avoidance of general anesthesia may significantly reduce the time and potential complications of the procedure, contributing to a faster postoperative recovery. The surgeon's choice between a transfrontal or transcerebellar approach may now be based exclusively on the location and characteristics of the lesion, without other considerations.

References