A simple, inexpensive technique for accurate mass localization by computerized tomography

Technical note

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A simple wire template is placed on the patient's head during computerized tomography scanning, and the results of the scan are later reproduced on the scalp prior to surgery. Measurements of the distance between the wires and the relationship of the mass provide the key to accurate localization of the mass on the scalp surface.

KEY WORDS • computerized tomography scan • tumor localization

Several authors have recently described techniques for using the computerized tomography (CT) scan to aid in the stereotaxic localization of intracranial tumors. Nevertheless, the need still remains for a simple, inexpensive method to pinpoint the external surface region overlying a small intraparenchymal supratentorial mass visualized by CT scan, without the use of x-ray films. We have recently encountered patients with small strategically located intraparenchymal lesions who exhibit no neurological deficits. Our experience has prompted the design of a technique to approach such lesions. We have devised a system that can be made simply, does not require x-ray study, and is applicable to a patient of any age or size.

This system successfully localized tumors 2 cm in diameter and as deep as 4 cm to the cortical surface. In each instance, the mass was encountered on the initial pass of an exploratory needle introduced on the shortest trajectory toward the lesion, thus eliminating unnecessary dissection and searching in critical areas.

Technique

A template with two diverging "wires" that can be demonstrated on CT scanning is placed on the patient's scalp. The apparatus consists of a plastic tube, 1 mm in diameter, into which seven No. 32 steel wires are inserted. Sufficient wire should be used to allow visualization but not enough to cause scatter artifact on the CT scan. The wires are joined by tape in such a manner that the junction is applied at the anterior border of the tragus on one side. The path of the two wires is directed over the vertex so that the wires diverge a few centimeters in front of and behind the tumor, as estimated on a prior CT scan. If the presence of the tumor is not known but suspected, wires are placed over the parietal boss and coronal suture. The distance between wires is usually 10 to 14 cm at the apex. The wires are again joined on the opposite side by tape just anterior to the tragus. The template is placed directly on the scalp and next to the skin. If hair is abundant, then it should be clipped before placement. The wires are joined firmly under the chin with tape, which helps to minimize movement during the scan. Before and after the scan, a flexible steel tape measure is used to ascertain the distance from the nasion to the most anterior wire (Fig. 1); the distance between the wires is also measured and recorded. These measurements eliminate the need to measure the angle between the two wires. Rechecking these measurements after the scan insures that the wires have not moved.

The CT scan image showing the midpoint of the tumor is then selected (Figs. 2 and 3). The distance from the inner table of the skull to the mass (A), the
distance between the wires (B), and the distance from the midline anterior skull surface to the mass (following the perimeter contour of the skull with a string) is then measured (C). All measurements are multiplied by the CT scan minification correction factor to give real-life size.

At the time of surgery, the template is replaced on the patient’s shaved head, using the identical landmarks and measurements calculated at the time of the CT scan. A marker pen is used to indicate the position of the wires on the scalp, and the template is then removed. If appropriate, the scan can be performed on the day of surgery with the head already shaved, and the pen marker used immediately after wire placement. The level on the scalp where the wires are

FIG. 1. Views of the scalp with the wire template in position. The wires are joined anterior to the tragus. A is the distance from the nasion to the anterior wire, and B is the interwire distance measured in the midline sagittal plane.

FIG. 2. A computerized tomography scan slice representing the midportion of the tumor is shown with appropriate measurements (see text).

FIG. 3. Uninfused computerized tomography scan demonstrating wires encompassing a right frontoparietal infiltrative process.
CT technique for accurate localization

At surgery, the wire template was repositioned on the scalp according to the landmarks and distances described in Fig. 1. The interwire distance was corrected distance B' in the orbitomeatal plane, as shown in Fig. 4. While maintaining this plane, the distance C' was then measured from the midline, thus identifying the site on the scalp overlying the tumor. At surgery, the tumor was encountered at a depth of 5.7 cm.

Discussion

We have employed this technique in 10 cases involving small mass lesions that were not visible on the cortical surface. The method has proved accurate, has provided a degree of confidence in dealing with small lesions located in strategic areas, and has enabled us to minimize manipulation of the cortical and subcortical regions. For lesions occurring near the vertex, the anterior limb of the template should be within approximately 2 cm of the tumor, inasmuch as wire placed too far forward may not be included in the vertex cut of a CT scan.

Admittedly, this technique will not allow for exacting localization in true stereotaxic form. Although an estimate of the plane of the CT scan slices can be erroneous, the deviation is negligible if at surgery the wires are placed on the scalp with the patient supine and the head flexed as if it were in the head holder used for the scan. Once the scalp is marked, the patient may be turned as desired for the surgical approach. Although estimation of the plane of the CT scan slices when drawing line B' (Fig. 4) may cause an error, in our experience this error has been less than 0.5 cm, and has caused no failure in taking a biopsy of the mass.

Illustrative Case

A patient was found on CT scanning to have a tumor located as shown in Fig. 3. A wire template was placed on his scalp so that the distance from the nasion to anterior wire was 10 cm (A), and the interwire distance was 11 cm (B) (Fig. 1). Using the CT scan slice that demonstrated the maximum tumor area, the distances shown in Fig. 2 were measured as follows: A = 1.7 cm, B = 2.2 cm, C = 4.0 cm. The magnification factor for our computer scan is 3.39, making the corrected numbers as follows: A' = 5.7 cm, B' = 7.5 cm, C' = 13.5 cm.

References


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