Teleautotomogram in Stereotactic Brain Operations

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Summary. By means of the pneumoencephalographic chair with multiaxial maneuverability, a teleautotomogram can be obtained in any position of the patient during preliminary air study for stereotactic brain operation. Lateral teleautotomogram taken at a posteriorly 45° tilted position outlines the third ventricle with a clear demonstration of the foramen of Monro, and the anterior and posterior commissures, without the interfering shadows of lateral air and with minimal magnification rate on a single film. Utilization of the same pneumoencephalographic chair as a stereotactic operation table affords identical teleroentgenograms with the same magnification as in the preliminary study. This saves calculation time and avoids possible calculation error during the stereotactic operation.

The result of stereotactic encephalotomy depends upon the accuracy of the production of lesions in the proposed locations. It requires clear demonstration of the reference points for target calculations in the preliminary radiological studies, and then their accurate transfer to the operative films. Thereafter, physiological and histological methods further increase accuracy in target location.

It has been well accepted that intracerebral reference points carry greater accuracy for intracerebral target calculations than do external skull reference points [8, 15]. Most commonly, the anterior and posterior commissures have been used as the internal reference points [9, 16]. However, because of frequent difficulty in demonstrating them by preliminary pneumoencephalography, more easily demonstrable reference points, such as the foramen of Monro [1, 5], pineal gland [3, 6], and mamillary body [10, 12] have been emphasized. Simultaneously, positive contrast medium, sometimes mixed with air, introduced directly into the ventricular system [7, 11, 13], or air injected under positive pressure [4], have been used for better demonstration of these reference points.

However, pneumoencephalography is still preferable as it avoids the unnecessary risks of ventricular puncture, plus the introduction and cumbersome maneuvering of positive contrast medium into the anterior third ventricle. Also, it is indispensable to obtain both intraventricular as well as extraventricular reference points such as the fourth ventricle, the interpeduncular fossa or the mamillary body for targets within the cerebellum, mesencephalon and pons [14], and a total air study can follow if desired. The common difficulty in pneumoencephalography, however, lies in clear demonstration of the anterior commissure for the following reasons:

1. The anterior commissure itself is not always prominent and may be a small structure;
2. difficulty in filling and keeping the air in the anterior third ventricle, especially in the sitting position employed in air injection; and
3. overlapping shadows on the film from air over both convexities and in the midline spaces which make identification of the third ventricle and anterior commissure impossible.

To solve these difficulties, Brackett and Clark [2] designed sophisticated laminographic instruments in the form of rectilinear planigraphy and reported their excellent results. They emphasized the advantages of laminograms in stereotactic operations as follows:
Resolution of anatomical landmarks would be improved; constant magnification could be achieved; and distortion would be eliminated since only a thin plane would be visualized.

Moreover, accurate calculations of radiographic target points require that films bear true size images or correction calculations for magnified images. For this reason, Talairach et al., [17] employed the method of teleroentgenography to minimize the image magnification and thus avoid time-consuming calculations and possible measurement errors.

In order to take advantage of both laminograms and teleroentgenograms, we have been using a simpler teleautotomogram performed on a modified Picker-Kermath pneumoencephalographic chair with excellent results for preliminary air studies. To maintain the same advantages in later main stereotactic operations, the same chair installed with a supporting apparatus of a stereotactic base ring has been used also as a main stereotactic operation table with excellent maneuverability and technical convenience.

**Apparatus**

A modified Picker-Kermath pneumoencephalographic chair is used for preliminary air studies as well as for the main stereotactic operation. As this chair can rotate 360° around the horizontal axis and swivel 230° around the vertical axis of the chair, both AP and lateral films can be taken in any position of the patient with one floor X-ray tube. A second X-ray tube mounted in the ceiling for the AP projection is eliminated. The chair can be rotated for autotomograms in any position of the patient, e.g., sitting, horizontal or oblique. For the preliminary air study, as for the main stereotactic operation, a tube-film distance of 352 cm is used to minimize tangential distortion (this distance should be ideally longer if room space is available), and a midsagittal plane-film distance of 22 cm. These distance relations offer a magnification rate of 1.067 on central beam.

**Procedure**

*(Figs. 1 and 2)*

A straight upright lateral teleautotomogram, following the initial injection of 10 ml of air, shows the fourth ventricle, aqueduct, and posterior commissure and occasionally the foramen of Monro. Then, the patient is gradually tilted 45° backwards and again a lateral teleautotomogram is taken following an additional injection of 10 ml of air. In this teleautotomogram, the fourth ventricle, aqueduct, third ventricle with the anterior and posterior commissures and foramen of Monro are nearly always clearly outlined. In case the anterior commissure is not clearly shown in this film, another tomogram is obtained in the horizontal position. In case both commissures are not visualized on one film, transfer of one commissure to the film with the other commissure can be done easily by superimposing the two films. Then, upright regular AP and Ruggles views are taken for laterality calculation.