Probe Holder for Stereotactic Surgery in the CT Scanner
A Technical Note

By
L. D. Lunsford, L. Leksell, and B. Jernberg

With 6 Figures

Summary

The necessity for intraoperative computer tomographic (CT) visualization of stereotactic probes and for the immediate assessment of the results of therapeutic intervention has brought about the integration of CT and stereotactic surgical sites. In order to perform intraoperative CT imaging, a simple mechanical device has been developed to hold a probe at the target. This device replaces the conventional semicircular arc that was used to guide the probe to the target during stereotactic procedures. Intraoperative imaging during a CT stereotactic procedure was accomplished without significant artifacts.

Keywords: Stereotactic techniques; computer tomography.

Introduction

All stereotactic systems developed for usage within the CT scanner have required new design features. Such features have included the following: construction with low-artifact producing material in the plane of the CT image; reference markers on the stereotactic frame that are easily identifiable in the CT image; and target determination using either unique computer programmes (Lunsford et al. 1982, Brown 1979) or software standard in commercially available scanners (Boëthius et al. 1980). The need to perform CT images of the patient with the stereotactic probe in position has become increasingly important in order to assess both target accuracy and results of therapy, as well as to recognize complications. A simple probe holder compatible with CT has been developed to allow low-artifact intraoperative CT images with the probe in position.
Methods and Materials

The Leksell stereotactic system (Model CT, A. B. Elekta Instruments, Stockholm, Sweden) was used (Leksell 1971). This instrument was modified for CT usage, but the simple geometric X-Y-Z coordinate system was retained. The target is placed at the centre of a detachable semicircular arc containing the probe guide, stop, and probe. The target can be reached from any anatomically appropriate trajectory. The frame was constructed of aluminium to reduce artifacts for CT imaging. The metallic coordinate scales were replaced by air-contrast engraving. Rigid skull fixation was provided by carbon fibre pins anchored in adjustable, low density plastic and aluminium sleeves. We used a GE CT/T 8800 scanner (General Electric Medical Systems, Milwaukee, Wisconsin, U.S.A.).

Application of the semicircular arc at the chosen co-ordinates invariably precluded subsequent intraoperative CT imaging. High atomic number material in the arc resulted in unacceptable degradation of the CT image when the probe was placed at the target. A CT probe holder was developed to hold the probe rigidly in position (Fig. 1). The instrument was constructed with two freely moveable (360°) arms attached to a gripping device, which in turn secured the probe guide. The CT probe holder was attached firmly at any point on the

Fig. 1. CT compatible stereotactic probe holder designed to anchor a probe securely at the target. Each arm can be rotated 360° for easy fixation.