Magnetic Resonance Imaging (MRI) Stereotaxis Using the Patil System.
A Technical Note

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Summary

Magnetic Resonance Imaging (MRI) scanning would prove useful for lesions that are not visualized on computed tomography (CT) scan or are better defined on MRI scan. The problem of reference marker visualization can be overcome by coating them with mineral oil or by placing paramagnetic fluid filled rods on them. The unique construction of the Patil System permits its use even in a strong magnetic field. The technique of MRI stereotaxis using this stereotaxic system without any modification is described.

Keywords: MRI, stereotaxy; brain biopsy.

Although several papers on computed tomography (CT) stereotaxis have been published in the past few years¹⁻⁶, ⁸, ¹⁰, ¹¹, MRI stereotaxis has not yet gained popularity. The reasons are threefold: firstly the number of centers possessing MRI scanners is limited; secondly, there are special problems involved in visualizing localizing markers used for coordinate determination and thirdly, the strong magnetic field of the scanner requiring the use of nonferromagnetic material in the construction of the stereotaxic system. The Patil Stereotactic System is constructed of non-ferromagnetic materials such as plastic, brass and anodized aluminium eliminating the third problem. The coordinate markers of this system are located on the base of the system making it easy to make them visible on MRI scan by coating them with mineral oil or by placing rods containing paramagnetic fluid as markers. This paper describes a technique for MRI stereotaxis using the Patil System.

Adaptations to MRI Scanner

The system has already been described in another publication¹⁰. The only modification since that publication being the location of the X coordinate marker being changed to a midline groove on the base platform. The top surface of the base platform serves as the marker for the Y coordinate. Both these markers are coated with mineral oil making them visible on the MRI scan. More recently and in describing the technique in this paper, we placed 5mm diameter manganese chloride containing rods as coordinate markers. On rod is placed lengthwise on the top surface of the base platform so that its inferior meniscus serves as a marker for the Y coordinate (perpendicular distance of the target from the base platform). Another rod is placed lengthwise in the midline groove to serve as a marker for the X coordinate (perpendicular distance of the target from the midline). Ordinarily there is no need to measure the Z coordinate (distance of the target from the base image) as using the laser positioning light and table indexing one can move the table to a position where the laser light could indicate the image on which the target is localized. The plane of the stereotactic system can then be aligned with the light. If the table indexing is inaccurate one end of the midline marker could serve as the zero reference of scanning (Fig. 1). This edge is aligned on the zero marking on the indicia which is marked on the sides of the base platform. The distance of the target from this point can be determined by counting the number of slices between this reference point to the target and multiplying it by the slice thickness. The X and Y coordinates can be measured directly (Figs. 2a and 2b respectively) using the cursor of the scanner. The scanner gives direct readout of the distances.

During the actual procedure the arc and the arc carrier are detached from the system. The system is
Fig. 1. Scout view in the sagittal plane showing the zero reference (thin line) for the Z coordinate. The thick line is the midline marker fitted on the top of the MRI table with the patient's head fixed by means of chromium plated brass pins. MRI scan is then obtained. Coordinates are measured, Z coordinate adjusted and the patient together with the system is moved to the operating room where the rest of the procedure is carried out.

**Accuracy Testing**

Using the centre of the superior surface of a 5 mm diameter gelatin capsule as the target accuracy could be reached within 1 mm in all three of the coordinates.

A Picker International MR VISTA 2055 Imager (manufactured by Picker International, Highland Heights, Ohio) was used for the procedure. A thirty centimeter diameter head coil was used for transmission and reception of signals. By calibrating the system to read the top surface of the midline marker as zero for Y coordinate, one can use coronal and sagittal images with this system.

**Coordinates Determination for Coronal Images**

The zero reference coronal image is started at the level of the midline marker on the base platform. Then multiplying the slice thickness by the number of images between the target image and zero reference coronal image would give the Y coordinate. A cursor can be put at the cephalad tip of the midline marker on the zero reference coronal image. With the cursor maintained at that position the required image with the target can be brought on the screen. The perpendicular distance of the lesion from the cursor would give the Z coordinate and the lateral from the cursor would give the X coordinate.

**Coordinate Determination for the Sagittal Images**

As the plane of this image would be in the midline it would not be necessary to determine the X coordinate. Using the cursor the perpendicular distance between