EVALUATING THE SAFETY OF FRONTAL SINUS TREPHINATION

Grant S. Gillman, MD, Annie S. Lee, MD and Barry M. Schaitkin, MD
Department of Otolaryngology, University of Pittsburgh Medical Center, Pittsburgh PA

ABSTRACT

INTRODUCTION

Over the last few decades, functional endoscopic sinus surgery (ESS) has been accepted as the procedure of choice for the surgical treatment of chronic sinusitis. However, because of the unique and complex anatomy of the frontoethmoidal recess and its anatomical relationship to adjacent vital structures, the treatment of the frontal sinus diseases still remains a challenge.

Frontal sinus trephination was initially a procedure intended for treatment of complications of acute frontal sinusitis. With the advent of safer and more accurate instruments, this procedure is now commonly used in the treatment of chronic frontal sinusitis as well. Trephination of the frontal sinus and irrigation through the frontoethmoidal recess can be a useful technique for conservative evacuation of the frontal sinus. Also, trephination of the frontal sinus provides a way to accurately localize the ostium, which then allows the enlargement of the outflow tract to be performed more safely.

The literature suggests that 10mm from the midline at the level of the cranial margin of the orbit is the ideal location for the frontal sinus trephination. However, there is a paucity of literature evaluating this teaching critically. The goal of this study is to identify the safest location for frontal sinus trephination by measuring sinus depth at three different distances from the midline on axial tomographic sections.

METHODS

Of patients seen in the Department of Otolaryngology at UPMC-Shadyside Hospital between October 2003 and May 2007 who had undergone a CT scan of the sinuses, two hundred scans were randomly selected and reviewed for this study. Patients under 16 years old were excluded from the study.

CT scan images were analyzed in the axial plane. The first axial slice above the orbit where no orbital contents could be visualized was selected for the measurements. The midline was established as a straight line passing through the crista galli. Frontal sinus depth was measured as the distance between the outer-most aspect of the anterior table and the most anterior point of the posterior table at points 5, 10 and 15mm from the midline on each side (Figure 1).

Those patients who lack frontal sinuses were excluded from the study. Also, for those patients with unilaterally hypoplastic frontal sinus, only the sinus with measurable depth was included in the study. Some of the remaining sinuses were underdeveloped, with the depth at one or more points measuring zero. These sinuses were still included in the study as long as the frontal sinus was deemed "trephinable." Finally, for each patient, the two frontal sinuses were considered separately.

RESULTS

Of the total of 200 patients in whom CT scans were reviewed, 86 (43.0%) were male and 114 (57.0%) were female. The patients ranged between 17 and 86 years of age, with the mean age of 45.4 ± 14.7 years (Table 1). Sixteen patients were excluded from study for having bilaterally hypoplastic frontal sinuses, leaving a total of 184 patients available for analysis (80 males, 104 females). Of the 368 frontal sinuses analyzed, 22 sinuses were hypoplastic and therefore non-trephinable. This resulted in 346 frontal sinuses to be analyzed in this study.

The mean depth of frontal sinus at 5mm, 10mm and 15mm from midline were 11.45mm (SD = 3.79), 11.48mm (SD = 2.13), and 11.48mm (SD = 2.13), respectively (Table 2). Males had significantly larger frontal sinuses than females at all measurement points (p<0.001). The measured depths at 5mm, 10mm and 15mm from midline showed no statistical difference. The trend held true when males and females were considered separately.

Trephination set used by the authors (Medtronic®) is designed for maximum depth of penetration of 7mm from the base of the soft tissue incision. On review of all patients, 85% of the sinuses measured could be trephined safely using a system with a depth of penetration of 7mm. Regardless, it is apparent from this study that routine trephination of the frontal sinus without careful review of the CT scans may result in an inadvertent penetration of the posterior table up to 15% of the time. It is vital that all CT scans be reviewed preoperatively to determine the optimal distance from the midline for a safe frontal sinus trephination.

CONCLUSIONS

The frontal sinus trephination is a safe procedure that is a useful tool in the armamentarium of techniques for treating the frontal sinus. A careful pre-operative review of the CT images allows a surgeon to assure safety during the procedure by avoiding trephination sites that are too shallow for the instruments. Also, with an increased availability of computer navigation, an ultra-precise determination of sufficient sinus depth can be made. However, this technology should not replace a careful pre-operative planning. Provided that the inter-sinus septum is in the midline and the frontal sinus is well developed laterally, the sinus can be successfully trephined at 5mm, 10mm, or 15mm in majority of patients.

REFERENCES


CORRESPONDENCE

Grant S. Gillman, MD
Department of Otolaryngology
University of Pittsburgh Medical Center
Pittsburgh, PA 15232
gillman@pitt.edu