Abstract

Objective: Access to the frontal sinuses is technically challenging. This study attempts to study the relationship of the first olfactory fiber to the frontal sinus posterior wall assessing its reliability as a surgical landmark during frontal sinus surgery.

Methods: Fifteen cadaveric specimens were studied obtaining measurements from CT scans. “AP median” was defined as the anteroposterior (AP) diameter measured just lateral to the inter-sinus septum, “AP paramedian” was measured 5mm lateral to the septum and “AP max” was the maximum antero-posterior diameter on axial images. Using a surgical navigation device we calculated the distance between the 1st olfactory fiber and the posterior table of the frontal sinus.

Results: The average median A-P diameter was 12.38±2.6 mm on the right side and 12.5±2.5 mm on the left. The maximum A-P diameter AP (max) was 14.02±2.3 mm on the right side and 14.1±3.0 mm on the left. The mean distance between the 1st olfactory fiber and the posterior wall of the frontal sinus was (4.03±2.7) mm on the right side and (4.2±2.9) mm on the left.

Conclusion: The 1st olfactory fiber was found to be an average of 4.0 mm posterior to the frontal sinus. The significant variability of this distance should be considered when using the 1st olfactory fiber to establish the posterior boundary of a frontal sinusotomy.

Introduction

Access to the frontal sinuses is challenging due to their extreme anterosuperior location, varying anatomy, proximity to the orbit and brain and the need to work in a constrained space with angled-lens endoscopes and instruments. The first olfactory fiber has been praised as an anatomical marker while performing a Draf type III frontal sinusotomy (modified endoscopic Lothrop procedure). Many have recommended identifying the 1st olfactory fiber to demarcate the position of the olfactory fossa (i.e. cribiform plate or anterior cranial fossa) and to ascertain the posterior limit of the dissection. This study ascertains the relationship of the first (1st) olfactory fiber with the posterior wall of the frontal sinus, assessing its reliability as a surgical landmark during frontal sinus surgery. Radiological measurements of the frontal sinuses were done in an attempt to assess if any measurement could be used to predict the position of the first olfactory fiber relative to the posterior table of the frontal sinus.

Methods and Materials

Fifteen cadaveric specimens were studied obtaining measurements from individual CT scans. Specimens with a radiological evidence of trauma or previous surgery were excluded from the study. “AP median” was defined as the anteroposterior (AP) diameter measured just lateral to the inter-sinus septum, “AP paramedian” was measured 5mm lateral to the septum and “AP max” was defined as the maximum antero-posterior diameter on axial images. (fig 1) An inverted U-shaped incision was made to identify the 1st olfactory fiber, starting anterior to the anterior attachment of the middle turbinate, crossing across the roof of the nasal cavity and extending to the nasal septum. The mucosa of the bone of the olfactory fossa was dissected to reach, identify and photograph the 1st olfactory fiber, as it exited its foramen at the cribiform plate. (fig 2) Using a surgical navigation device we calculated the distance between the 1st olfactory fiber and the posterior table of the frontal sinus. (fig 3)

Results

The average median A-P diameter was 12.38±2.6 mm on the right side and 12.5±2.5 mm on the left. The maximum A-P diameter AP (max) was 14.02±2.3 mm on the right side and 14.1±3.0 mm on the left. The mean distance between the 1st olfactory fiber and the posterior wall of the frontal sinus was (4.03±2.7) mm on the right side and (4.2±2.9) mm on the left. This distance strongly correlated with the maximum AP diameter of the sinus.

Discussion

Extended drainage of the frontal sinuses involves resection of the floor of the frontal sinus anterior to the ventral margin of the olfactory fossa. Thus the first olfactory fiber is identified as it exits from the cribiform plate as a landmark of the anterior margin of the olfactory fossa. This study found that the position of the first olfactory fiber was more variable than previously inferred. Thus exclusive use of this landmark could lead to CSF leak and damage of intracranial neurovascular structures. The combined use of anatomical landmarks and image guidance is ideal when removing the bone over olfactory fossa. A strong positive and statistically significant association was found between the maximum A-P diameter and the position of the first olfactory fiber. Drilling no further posterior than 6mm rostral to the first olfactory fiber was found to be safe in 80% of cases, whereas staying 7mm rostral would be safe in 91% of cases.

Conclusions

The 1st olfactory fiber was found to be an average of 4.0 mm posterior to the frontal sinus. The significant variability of this distance should be considered when using the 1st olfactory fiber to establish the posterior boundary of a frontal sinusotomy. Drilling 7mm rostral to the 1st olfactory fiber would be safe in 91% of patients.

References:

Contact: Ricardo L. Carrau, MD The Ohio State University Wexner Medical Centre Email: ricardo.carrau@osumc.edu