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Dates: Received: 27 April, 2015; Accepted: 21 May,
2015; Published: 23 May, 2015

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www.peertechz.com

ISSN: 2455-1759

Letter to Editor

Image Guided Frontal Sinus Mapping: Our Technique

Access to the frontal sinus is challenging and both external and endoscopic approaches are described in the literature. Where an external approach is indicated, a bicoronal osteoplastic flap procedure is generally preferred as this reduces fronto-ethmoidal recess stenosis and allows obliteration if required [1]. Precise demarcation of the anatomy of the frontal sinus is crucial when using this technique to avoid inadvertently entering the anterior cranial fossa. Various techniques for frontal sinus mapping have been described which

include: sinus trans-illumination, sinus probing and 6-foot Caldwell radiography with coin reference [2]. We describe a technique for frontal sinus mapping using the Brainlab® Surgical Navigation System (Munich, Germany). The technique is outlined below.

Re-formatted computed tomography (CT) sinuses images are uploaded onto the Brain lab® Navigation System pre-operatively.

Once the patient is on the operating table, the reference array is attached by a band to the patient's forehead. The facial contours are then scanned with a laser scanner. The facial contours are matched with the facial contours on the CT data on the image-guidance console. The relationship between the facial contours and the reference array on the forehead is crucial to the registration and function of the image guidance system. For the image-guidance probe to work the reference array must be in place on the patient, and registration of the facial contours must have been carried out.

The precise anatomy of the patient's frontal sinus is then mapped out using the handheld device and marked on the skin with a marking pen (Figure 1), from which an on lay template is created with sterile paper to be used intra-operatively to delineate the sinus. The reason we use a template is that the elevation of the bicoronal flap to access the frontal sinuses requires the reference array removed to allow the flap to be turned down. So the original registration cannot now be used - as the reference array is no longer there. If it is put back on the exposed forehead the facial contour landmarks are obscured by the turned down flap, and they may be altered anyhow with respect to the scan data as the brow positions may not only be obscured by the flap itself, but may actually have their positions altered. So registration cannot take place at this stage.

A standard bicoronal incision is then made and the flap raised in a standard fashion. Once adequate exposure is achieved, our



Figure 1:

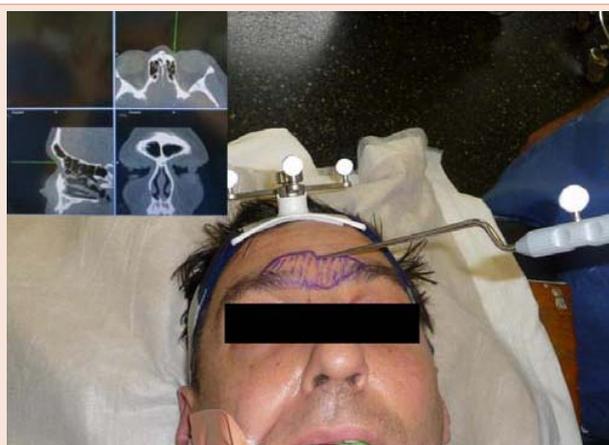


Figure 2:

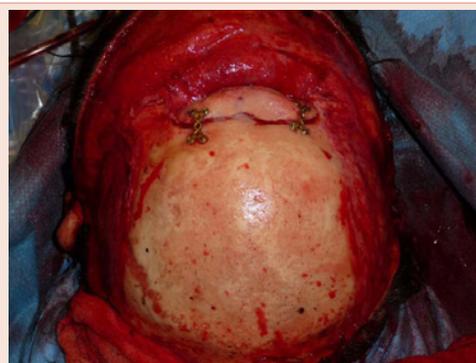


Figure 3:

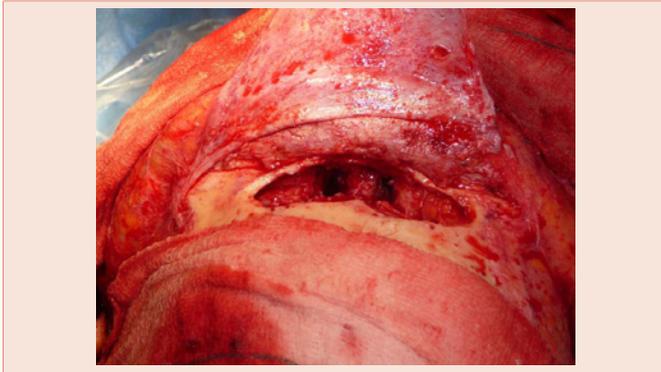


Figure 4:

onlay template is used to mark the frontal sinus on the skull with the inferior placement of this template based on the position of the orbital rims (Figure 2). The osteoplastic flap can then be accurately elevated (Figure 3).

Once surgery is complete, the osteoplastic flap is reposition using standard plating with screws (Figure 4).

In our case series of 6 patients over a 3 year period, this technique has proven to be reliable as it allows accurate delineation of the frontal sinus. We feel that as successful frontal sinus surgery is predicated upon the precise localization of osseous anatomy, the utilization of the Brainlab® Navigational system is a useful adjunct in enhancing the safety and accuracy of this procedure.

References

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