Quantitative Identification of the Supraorbital Nerve in Supraorbital Transciliary Keyhole Approach: Accuracy Analysis and Surgical Implication of the Medial Supraorbital Triangle

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Introduction

The supraorbital keyhole approach (SOKA) provides a safe and efficient corridor for accessing the anterolateral skull base. The transcilliary incision commonly used in this approach set the supraorbital nerve (SON) as the medial limit. Despite the well-tolerability of the nerve sacrifice in the long-term, preventing early postoperative paresthesia and numbness is worthwhile.[1,2] There is a lack of valid intraoperative landmarks or reliable tools to precisely locate the nerve and avoid inadvertent injury.[3,4] The objective of this study is to define a quantitative intraoperative method to predict a safe zone for creating the skin incision and ensuring early preservation of the SON.

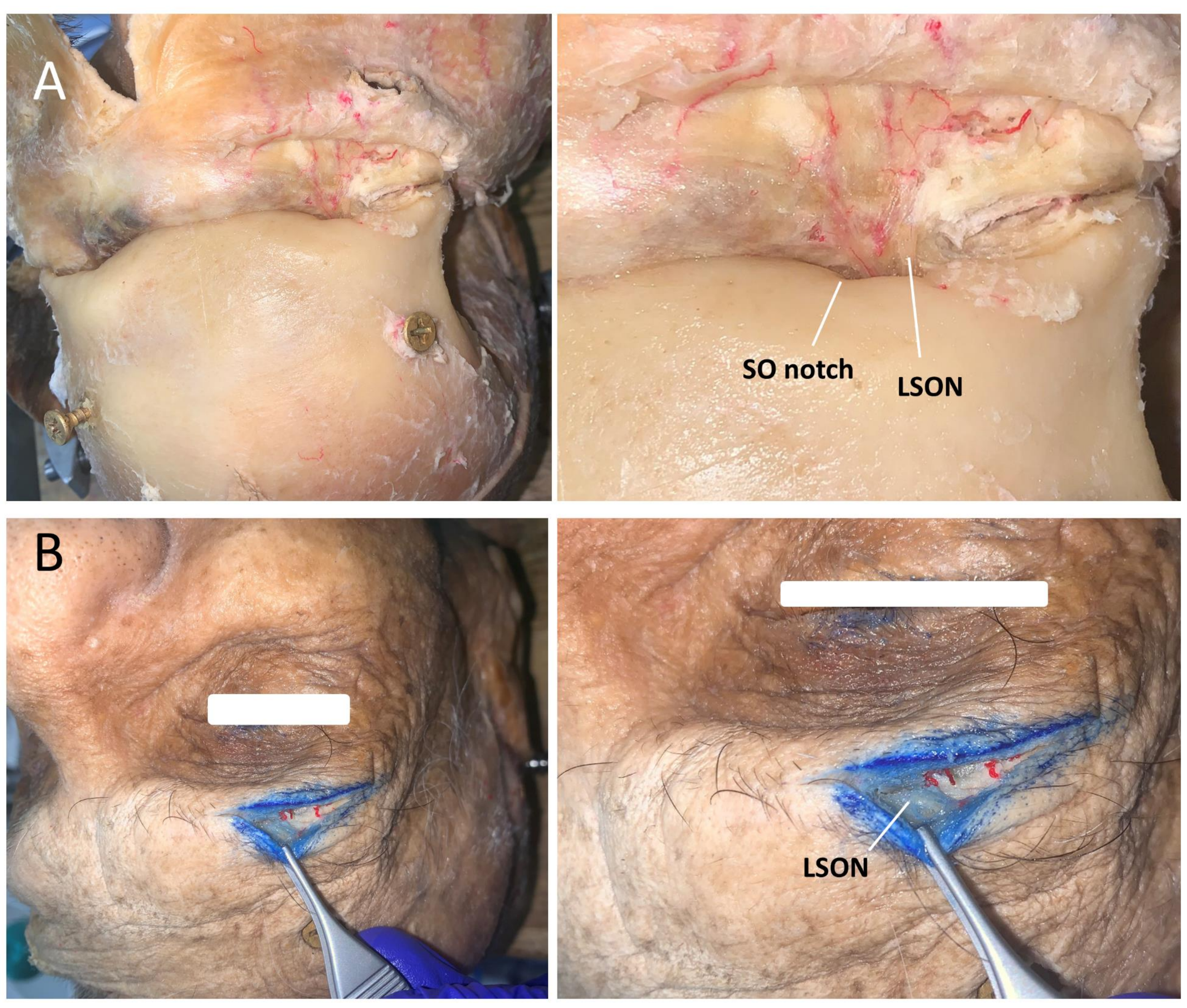


Figure 1.

Methods and Materials

Seven silicon-injected cadaveric heads (14 sides) were used. A large bicoronal skin flap was initially created and retracted inferiorly along with the pericranial flap (Figure 1). Under navigation guidance, the gross location of the supraorbital foramens/notch was confirmed, and the lateral ramus of the supraorbital (LSON) was subsequently dissected free until the entrance to pericranium. After repositioning the pericranial flap, a transciliary incision was fashioned and the lateral ramus of SON was identified and protected. Reference points were defined, and relevant measurements were compared using Friedman test and Student's t-test.

Results

The SONs were preserved in all heads. Three reference points were targeted: (1) the medial canthus (MC); (2) the lateral ramus of the supraorbital nerve (LSON); and (3) the midpoint of the glabella (MG). The mean lengths of MC-MG, MC-LSON, and MG-LSON line were 27.87 ± 1.88 mm, 28.19 ± 2.01 mm, and 28.47 ± 1.47 mm, respectively. There were no significant differences between the MC-MG, MC-LSON, and MG-LSON lengths in both overall and side-specific measurements ($p>0.05$ in all analyses). No statistically significant differences were also found between right and left sides (Table 1). The LSON could be located in a counter-clockwise order by first measuring the MC-MG distance (MC-MG line), creating an equal length horizontal line extending medially from the MG (MG-LSON line), and then confirming the location of the LSON by completing the equilateral triangle with MC-LSON line. The safe zone for performing the transciliary incision is thus the area just lateral to this triangle, which we have termed the "medial supraorbital triangle" (Figure 2)

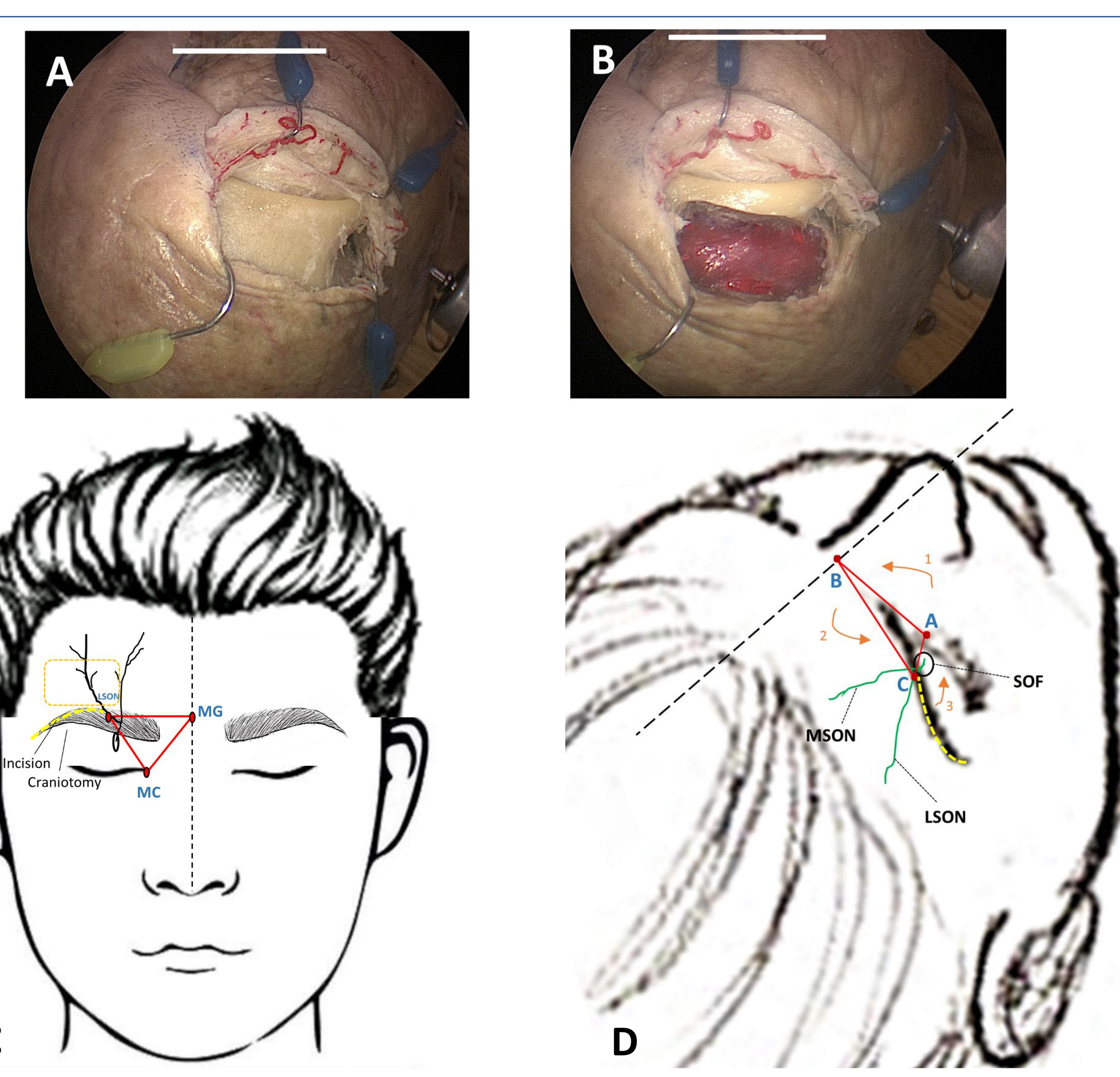
Lengths / Lines	Overall Mean ± SD (mm)	Side Mean ± SD (mm)		*P-value*
		Rt	Lt	
MC-MG	27.87 ± 1.88	27.87 ± 2.18	27.88 ± 1.71	***0.641***
MC-LSON	28.19 ± 2.01	28.24 ± 2.34	28.14 ± 1.81	***0.433***
MG-LSON	28.47 ± 1.47	28.58 ± 1.31	28.35 ± 1.72	***0.624***
P-value	***0.057***	***0.202***	***0.176***	

Table 1

Conclusions

A safe zone for avoiding inadvertent encounter with supraorbital nerve during supraorbital keyhole approach is defined. The LSON typically locates at the medial angle of the medial supraorbital triangle. The transciliary incision is thus best initiated just lateral to this point. The MC-MG line inferomedially, the MG-SONL line superiorly, and the SONL-MC line inferolaterally form the sides of this triangle. Once the LSON is protected in the depth of the field, the incision can be further expanded medially depending on the size and depth of the lesion.

Figure 2



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