Horizontal Curvature Patterns of the Cavernous ICA: Surgical Implications for the Endoscopic Endonasal Transcavernous Approach

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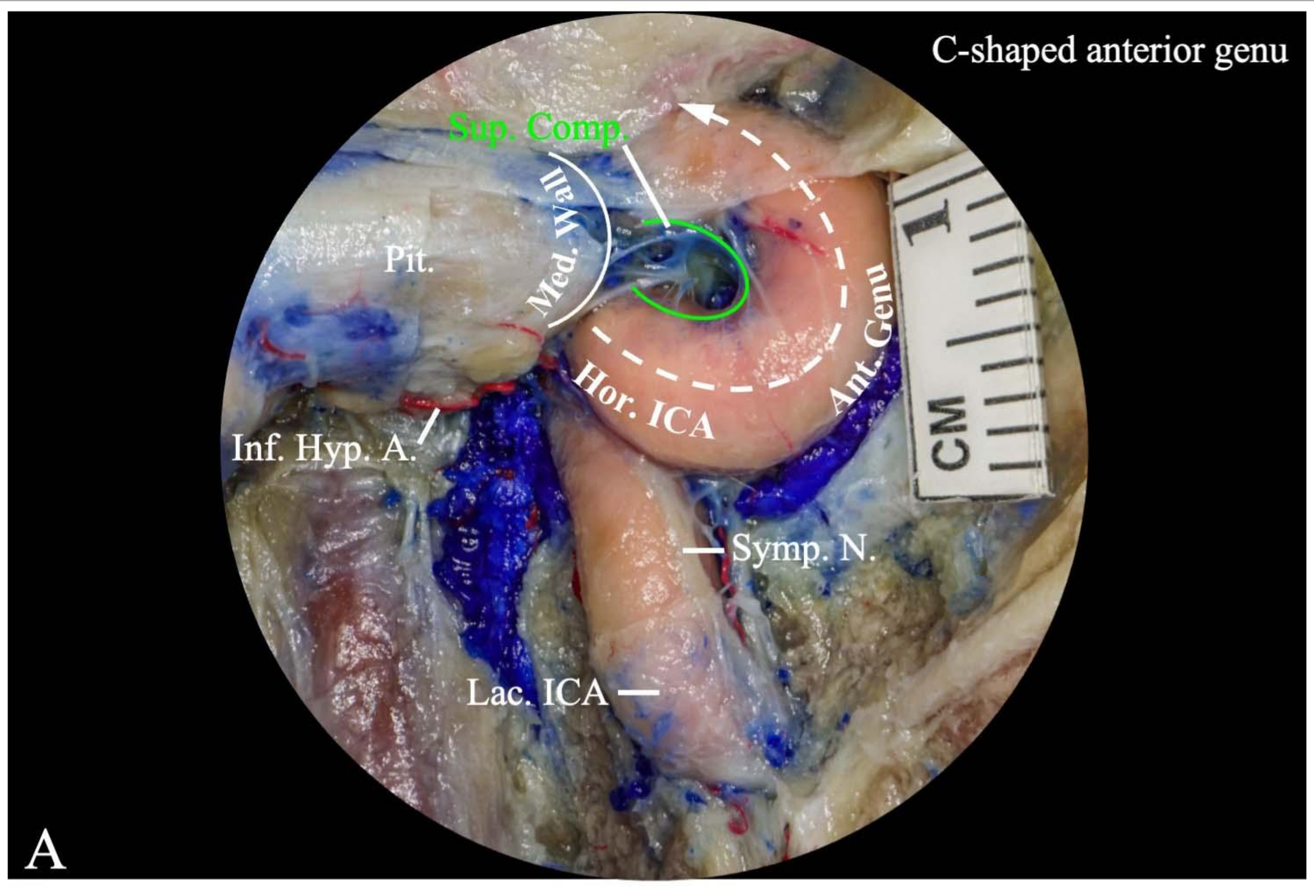
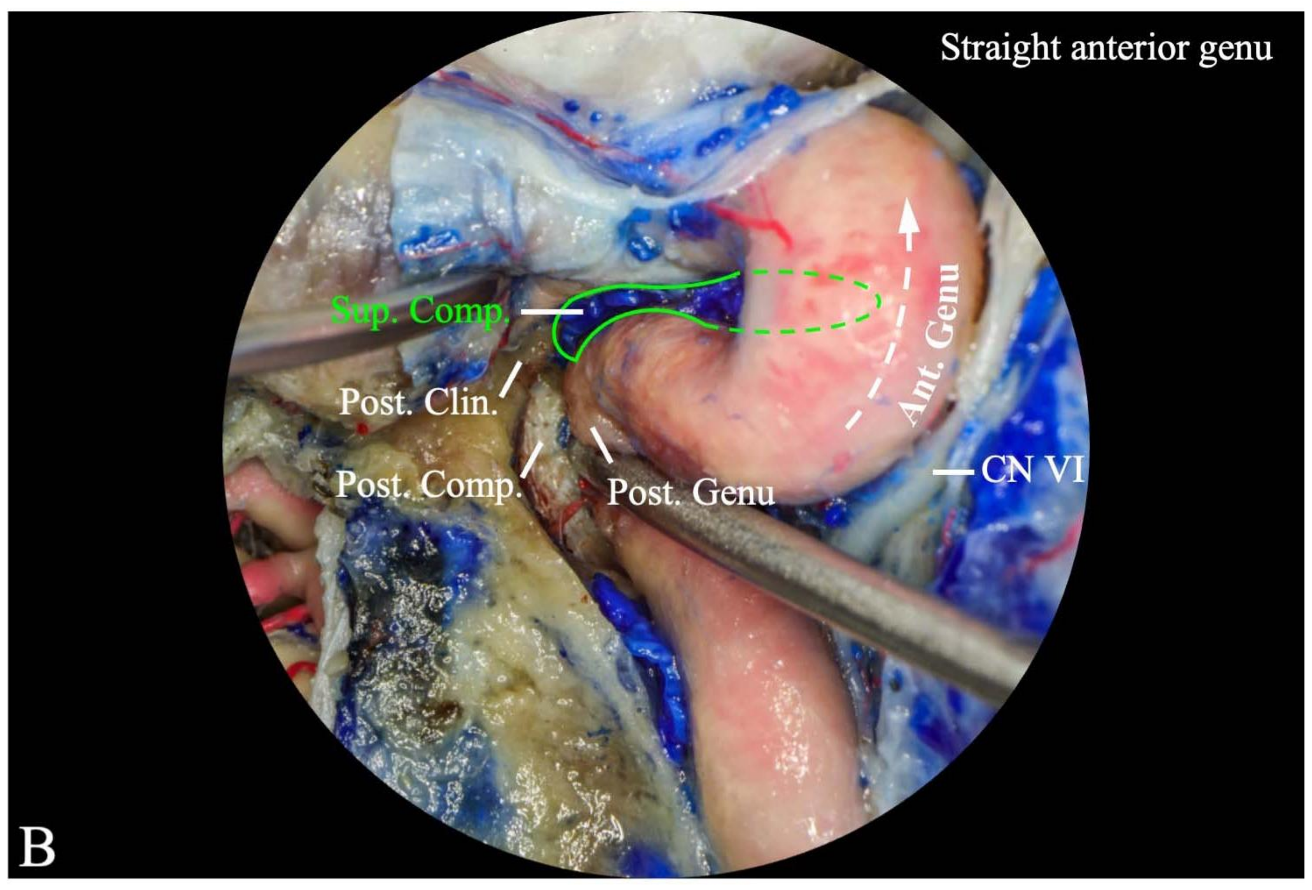
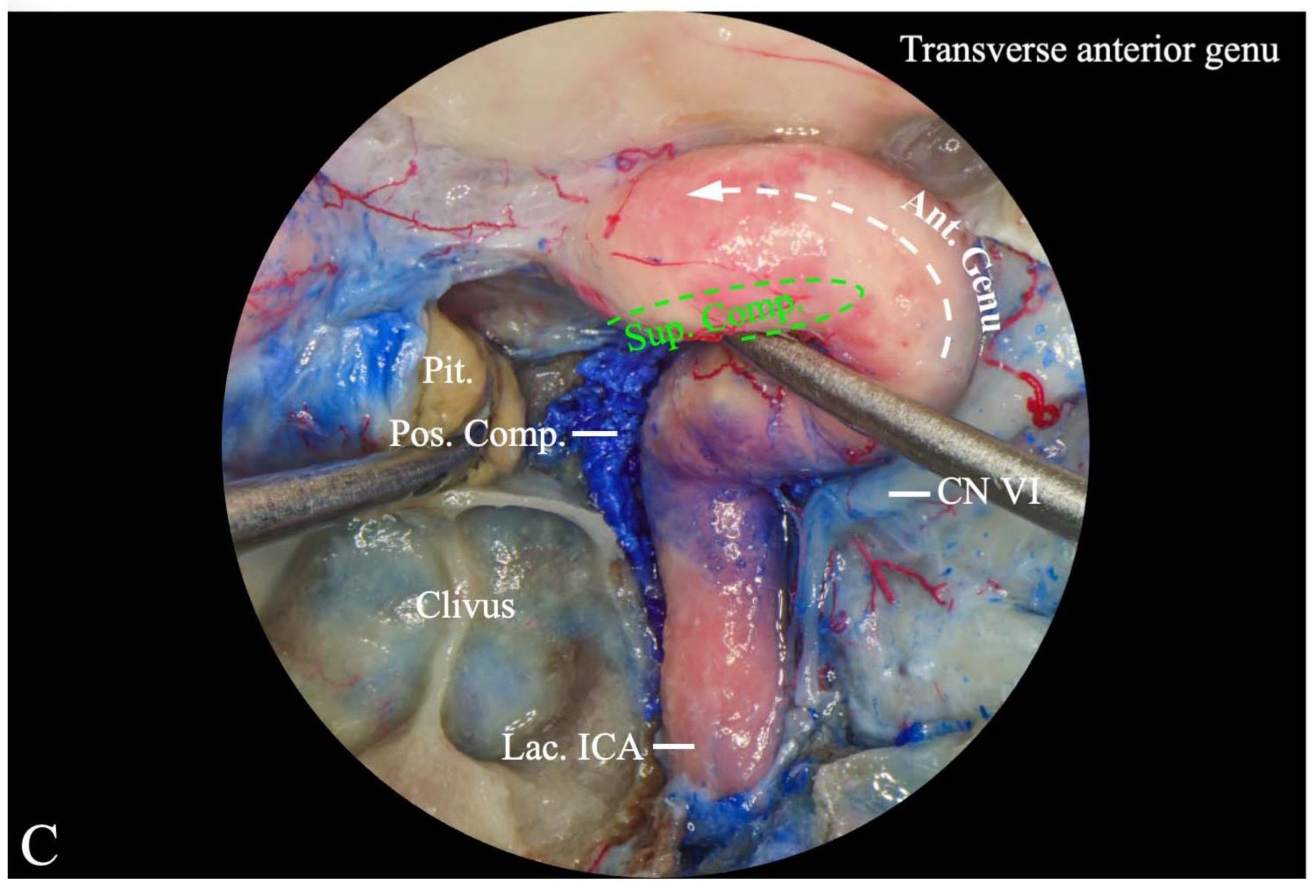
OBJECTIVE

The anatomical variability of the cavernous internal carotid artery (ICA) carries critical implications for endoscopic endonasal surgery (EES). However, horizontal curvature, particularly at the anterior and posterior genu, remains under-characterized in spite of its potential impact on transcavernous techniques. To classify horizontal curvature patterns of the cavernous ICA and evaluate the extent to which they necessitate tailored techniques in endoscopic endonasal transcavernous surgery.





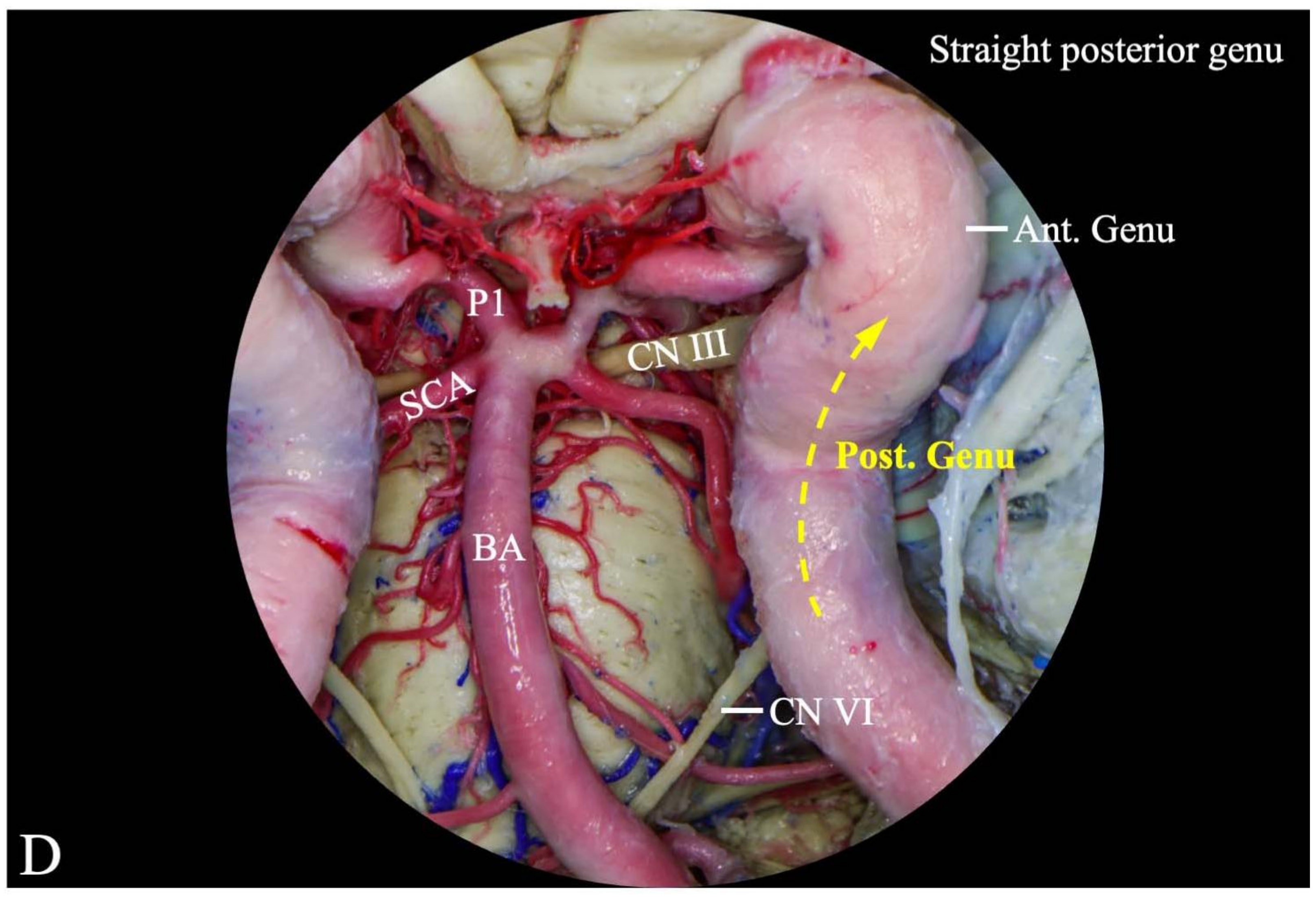


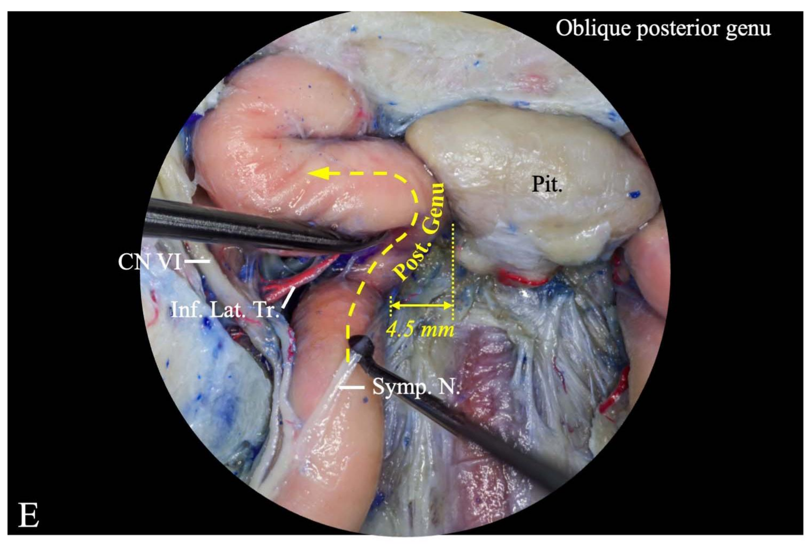
METHODS

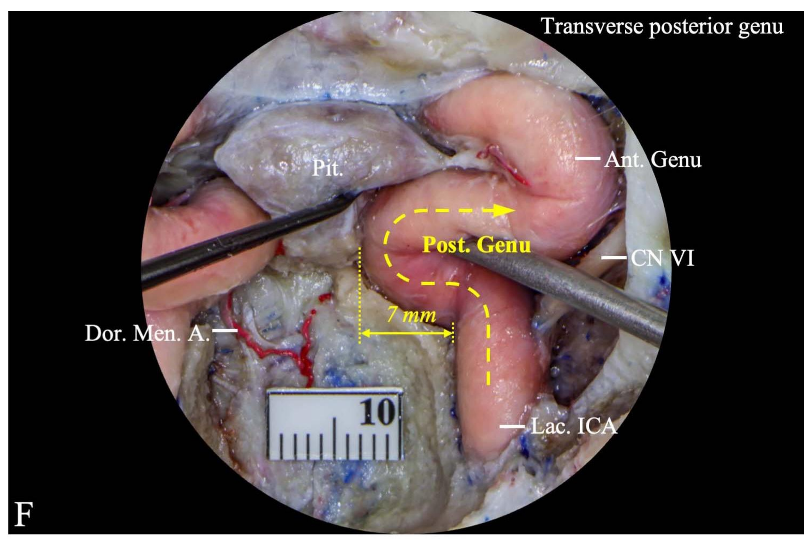
Forty-eight silicon-injected cadaveric heads (96 sides) underwent endoscopic endonasal transcavernous dissection. Horizontal curvature patterns of the anterior and posterior genu were classified and quantitatively measured. Their impact on surgical corridors, exposure, and technical nuances was systematically assessed.

RESULTS

The cavernous ICA exhibited curvature in two sub-segments: the anterior and posterior genu. Anterior genu: Pattern I (C-shaped, 30.2%, Fig. 1A) curved laterally then superiorly, forming a C-shaped course that provided full access to the superior compartment of the cavernous sinus (CS). Pattern II (Straight, 59.4%, Fig. 1B) ascended vertically with minimal curvature, allowing exposure to most of the superior compartment but partially obscuring its anterolateral aspect. Pattern III (Transverse, 10.4%, Fig. 1C) followed a horizontal, medially directed trajectory that compressed the medial wall of CS and completely blocked access to the superior compartment. Posterior genu: Pattern I (Straight, 52.1%, Fig. 1D) showed minimal horizontal deviation (<1 mm), creating a safe corridor for lower medial wall resection and posterior clinoidectomy. Pattern II (Oblique, 32.3%, Fig. 1E) displayed medial deviation (1–5 mm), reducing surgical freedom for accessing the posterior compartment. Pattern III (Transverse, 15.6%, Fig. 1F) significant transverse medial curvature with horizontal deviation exceeding 5mm, which severely limited access to the posterior clinoid and posterior compartment, posing the greatest challenges to transcavernous approaches.







CONCLUSION

Horizontal curvature patterns of the cavernous ICA significantly influence the feasibility and safety of endoscopic endonasal transcavernous approaches, particularly in distorted configurations that require tailored surgical strategies.

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