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Anatomic Moment

Osseous Anatomy of the Orbital Apex

David L. Daniels, Leighton P. Mark, Mahmood F. Mafee, Bruce Massaro, Lloyd E. Hendrix, Katherine A. Shaffer, David Morrissey, and Charles W. Horner

The osseous anatomy of the orbital apex may be difficult to conceptualize because of the different shapes and orientations of the optic canal, superior and inferior orbital fissures, and foramen rotundum. However, knowing this anatomy is crucial to evaluate complex fractures, tumors, and inflammatory processes involving the orbital apex.

Evaluating osseous anatomy of the orbital apex with computed tomography (CT) requires knowledge of its three-dimensional appearance (1–8). The *optic canal* forms an angle of about 45° with the sagittal plane of the head, slightly tapers anteriorly, and is bounded medially by the body of the sphenoid bone, superiorly by the superior root of the lesser wing of the sphenoid bone, inferolaterally by the optic strut (that is, the inferior root of the lesser wing of the sphenoid bone), and laterally by the anterior clinoid process (Fig 1). Inferolateral to the optic canal and separated from it by the optic strut is the *superior orbital fissure*, a gap between the greater and lesser wings of the sphenoid bone that is somewhat comma-shaped, appearing bulbous inferiorly and thin superolaterally (Fig 1). The fissure's bulbous part is located anterior to the cavernous sinus. Just inferior and posterior to the superior orbital fissure is the *foramen rotundum*, a parasagittally oriented thin channel at the upper part of the base of the sphenoid bone, which has a trough-shaped posterior configuration (Fig 1). The foramen rotundum communicates posteriorly with the middle cranial fossa and anteriorly with the upper part of the *pterygopalatine fossa*.

The *pterygopalatine fossa* and the *inferior orbital fissure* have a unique relationship. The inferior orbital fissure, its long axis forming an angle of about 45° with the head's sagittal plane, is located between the lateral wall and floor of the orbit, with the zygomatic bone forming its anterior margin. Important anatomic relationships of the inferior orbital fissure are demonstrated when the skull is viewed laterally and slightly posteriorly (Fig 2). The sphenoid bone forms the lateral margin of the inferior orbital fissure and most of the posterior wall of the pterygopalatine fossa, the latter formed by the pterygoid plates, the base of the sphenoid bone, and a small part of the vertical plate of the palatine bone. The maxillary bone forms the medial margin of the inferior orbital fissure and together with the orbital process of the palatine bone, also the anterior wall of the pterygopalatine fossa. The obliquely extending inferior orbital fissure and the more medially positioned and transversely oriented pterygopalatine fossa together form a gently curving opening. The anterior part of the inferior orbital fissure appears bulbous. The posterior part of the inferior orbital fissure is best shown in coronal CT, appearing as a thin, obliquely oriented, and anteriorly tapering channel bounded laterally by the sphenoid bone and medially by the maxillary bone and communicating inferolaterally with the infratemporal fossa (Figs 5–8).

Important osseous landmarks facilitate the evaluation of the orbital apex in axial and coronal CT (Figs 3–5). These landmarks include the optic strut, which separates the optic canal from the superior orbital fissure, and the small segment of the sphenoid bone, which separates the superior orbital fissure from the foramen rotundum (Figs 3B and D). In addition, the uppermost part of the pterygopalatine fossa, having a flat posteromedial margin and a posterolateral corner where it communicates with the foramen rotundum, can be demonstrated on axial CT (Fig 4D).

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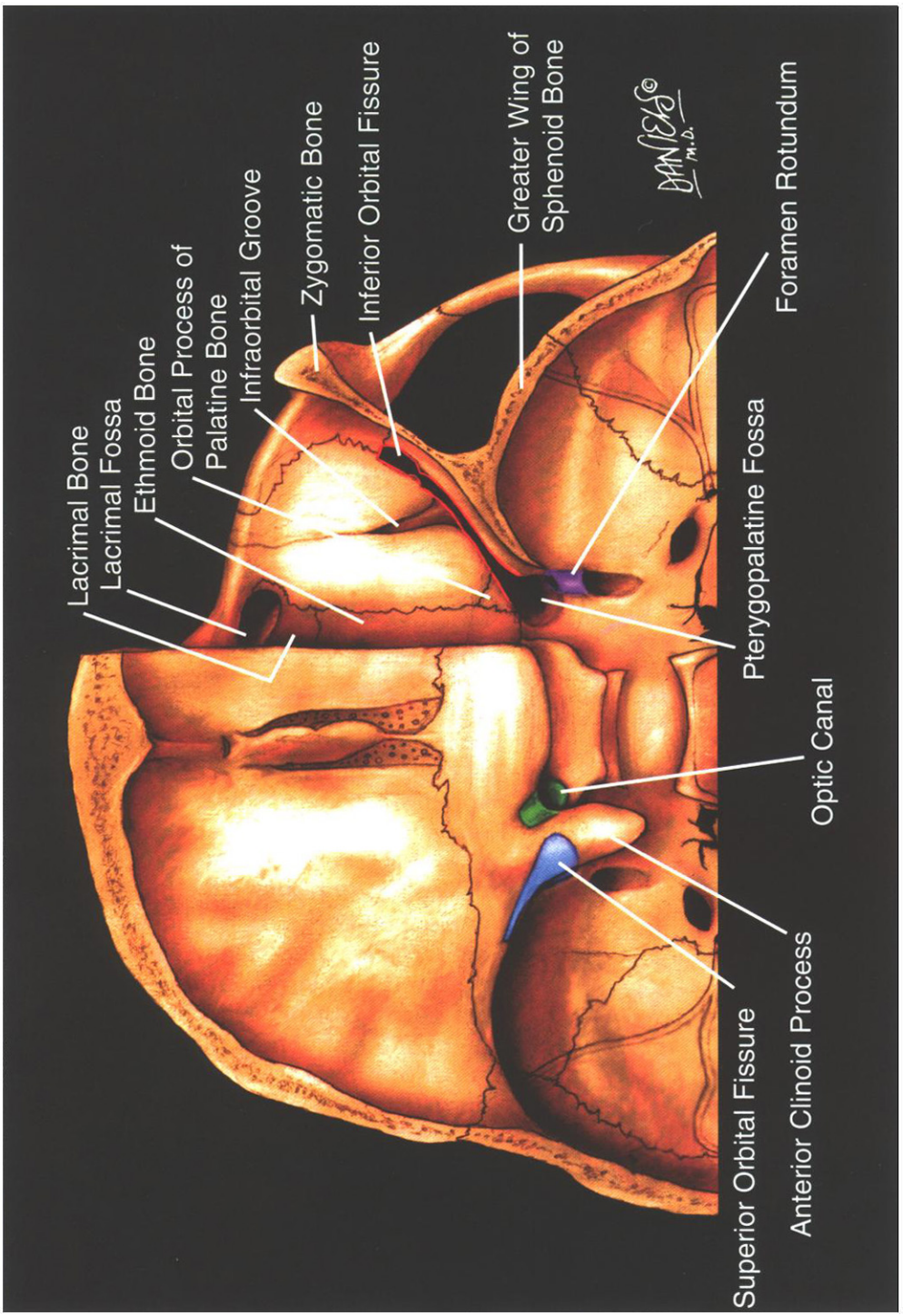

Fig 1. The orbital apices viewed from above. Dissected and intact orbital apices are drawn at slightly different angles to demonstrate optimally the superior orbital fissure and the opposite inferior orbital fissure. Shown is the comma-shaped contour of the superior orbital fissure. The superior part of the pterygopalatine fossa is demonstrated in continuity with the obliquely oriented inferior orbital fissure, and communicating with the middle cranial fossa via foramen rotundum. The gap formed by the inferior orbital fissure (*red margins*) at the orbital floor is illustrated.

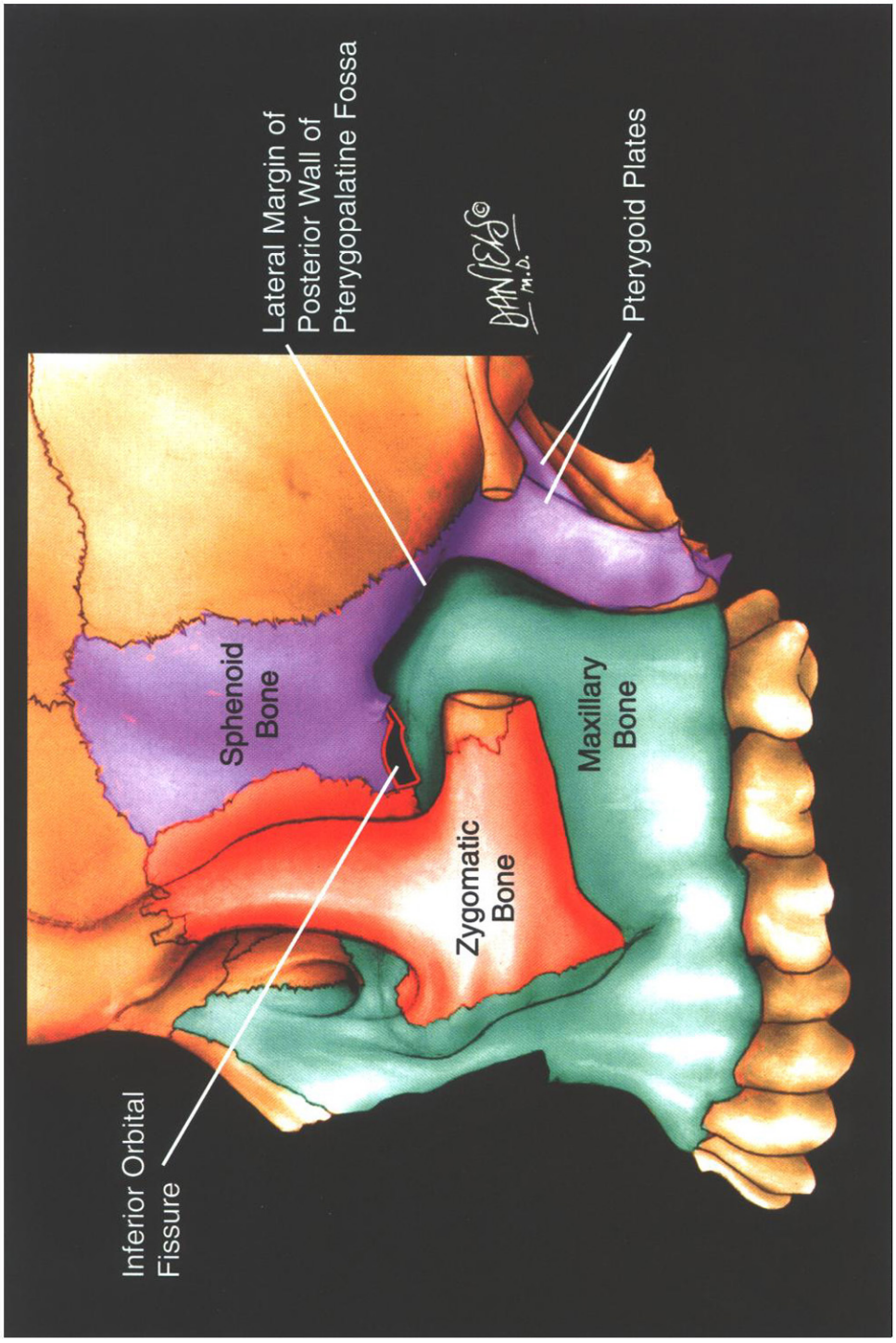

Fig. 2. View of the skull from the side and slightly posteriorly. Note the curving contour of the sphenoid and maxillary bones that form an opening consisting of inferior orbital fissure anteriorly and pterygopalatine fossa posteriorly. Labeled is the lateral margin of the superior part of the pterygopalatine fossa. The anterior part of the inferior orbital fissure with red margins appears somewhat bulbous and is nearly vertically oriented. The entire extent of the posterior part of the inferior orbital fissure is not shown (see Fig 5B).

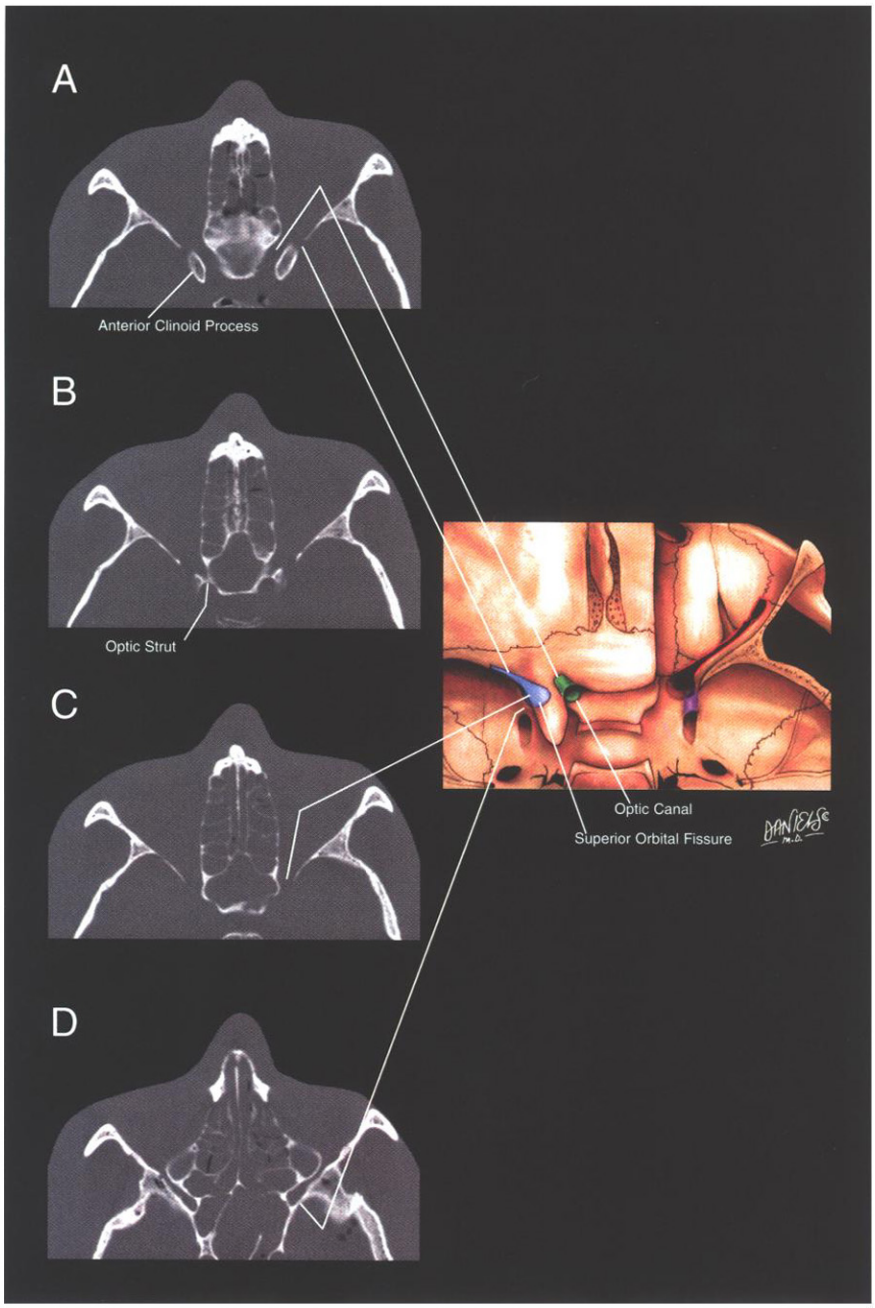

Fig 3. Osseous structures of the orbital apices on axial CT superiorly to inferiorly (*A–D*) are correlated with their three-dimensional appearances in an insert drawing from Figure 1. The comma-shaped superior orbital fissure has a thin part lateral to the anterior clinoid process (*A*) and a bulbous part inferior to the process (*C*).

B, The optic strut is shown defining the inferior margin of the optic canal.

D, The inferior osseous margin of the superior orbital fissure is demonstrated.

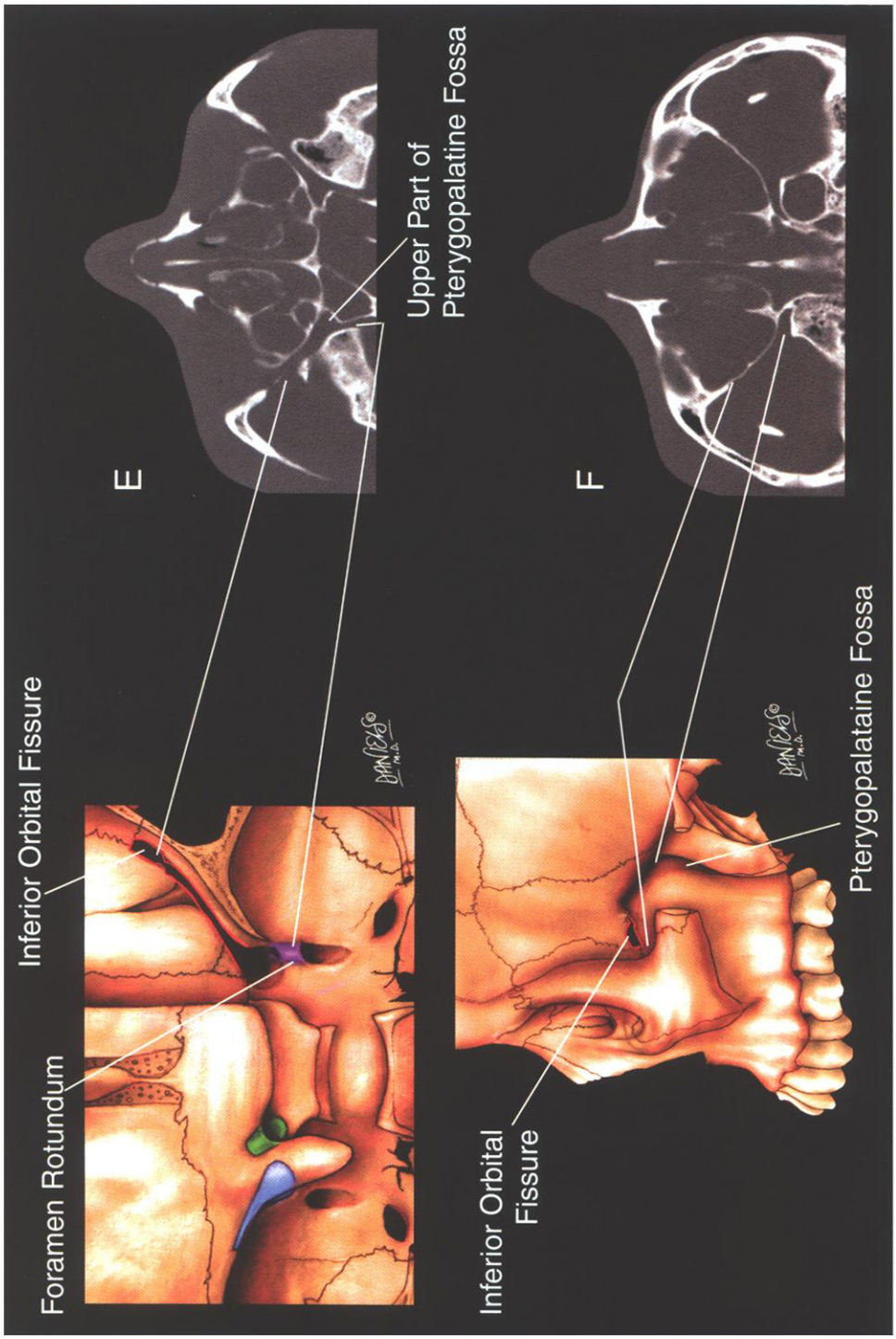

Fig 4. Osseous structures at and beneath the lower part of the orbital apices on axial CT (E and F continue more inferior than Fig 3) are located in drawings of the skull viewed from above and laterally.

E, The upper part of the pterygopalatine fossa has a flat posteromedial margin and communicates at its posterolateral corner with the foramen rotundum. Also, the lateral wall of the orbit has a gap correlating with the bulbous anterior part of the inferior orbital fissure.

F, At the level beneath the inferior orbital fissure, the zygomatic bone is now continuous with the maxillary bone. Evident is the curving contour of the anterior wall of the pterygopalatine fossa formed primarily by the maxillary bone and the sharp lateral edge of the posterior wall of the superior part of the pterygopalatine fossa formed by the base of the sphenoid bone.

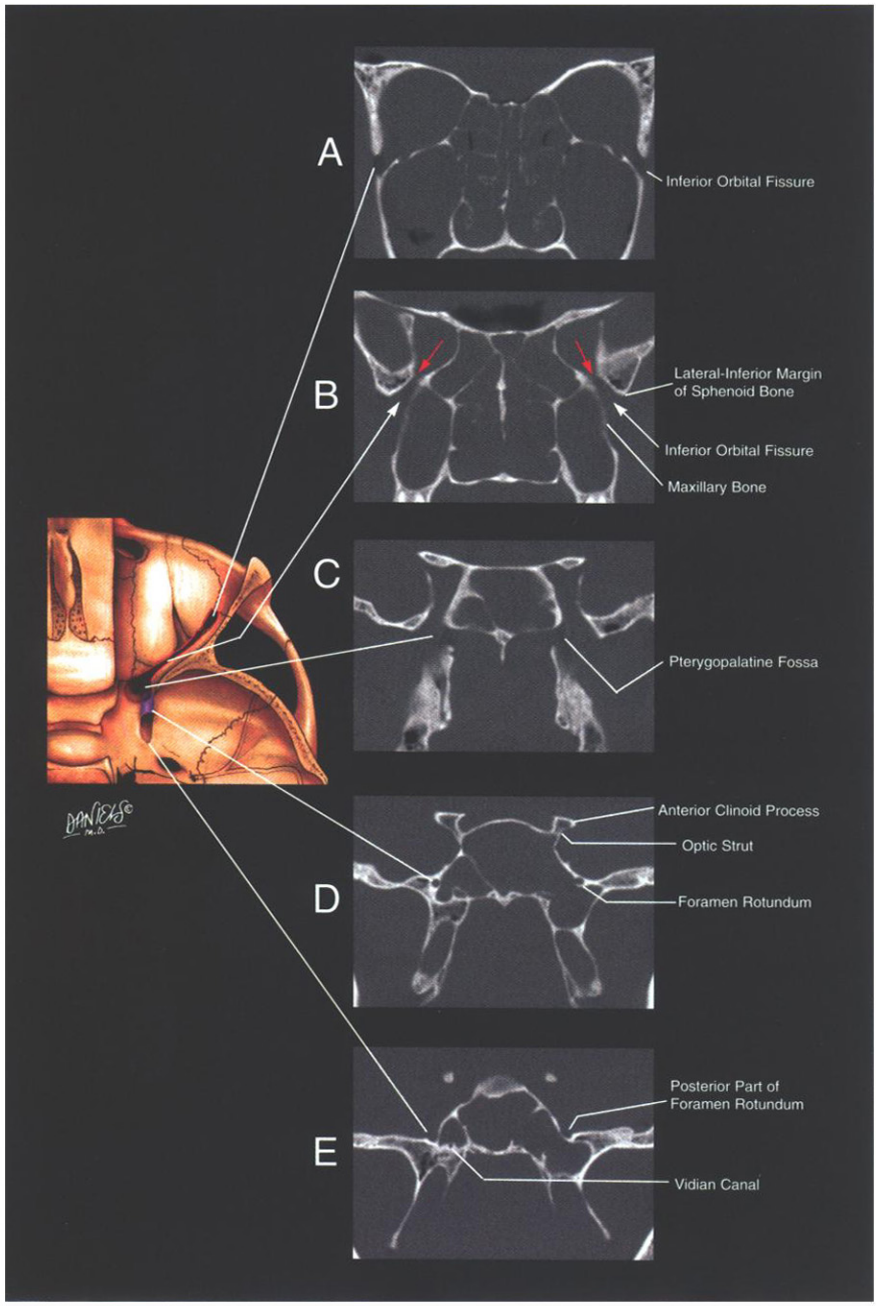

Fig 5. Osseous anatomy of the orbital apices and inferior orbital fissure on coronal CT anteriorly to posteriorly (*A–E*) and referenced to a drawing insert from Figure 1. The inferior orbital fissure's anterior part in A is more vertically oriented than its posterior part in B.

B, The inferior orbital fissure appears as an obliquely oriented thin channel formed by the maxillary and sphenoid bones and communicating superiorly with the orbit (*red arrow*) and inferolaterally with the infratemporal fossa (*white arrow*).

C, The pterygopalatine fossa has a somewhat angular configuration.

D, The optic strut separating optic canal from the medial margin of the superior orbital fissure and the osseous contour of the foramen rotundum beneath the superior orbital fissure are labeled.

E, The posterior trough-shaped part of the foramen rotundum is identified.

Acknowledgments

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