

## Fossa Navicularis Magna

Alberto Beltramello, Giovanni Puppini, Gassan El-Dalati, Massimo Girelli, Roberto Cerini, Andrea Sbarbati, and Paolo Pacini

**Summary:** A notchlike bone defect in the basiocciput due to a prominent fossa navicularis was incidentally discovered in a patient referred for radiologic evaluation of sinusitis. MR images showed that the osseous defect was filled with lymphoid tissue of the pharyngeal tonsil. The occurrence of this anatomic variant is discussed, with reference to ancient anatomic works.

The fossa navicularis, containing the smaller pharyngeal fossa and giving origin to a characteristic notchlike bone defect in the basiocciput (if prominent), may be an incidental finding at radiography of the skull. While demonstrating lymphoid tissue inside, MR imaging can be helpful in ruling out other bone-destructive lesions of the skull base.

### Case Report

A 33-year-old woman was referred to the department of radiology for evaluation of sinusitis. Radiographs of the skull showed a notchlike round defect, 8 mm in diameter and 6 mm in depth, outlined by regular cortical margins in the basiocciput (Fig 1A), which was confirmed by CT (Fig 1B). A 3D surface-rendering CT scan (Fig 1C) and a reformatted image in the sagittal plane (Fig 1D) were helpful in localizing the indentation in the esocranial portion of the basiocciput. MR images in the sagittal plane (Fig 1E and F) showed that the osseous defect was completely filled with lymphoid tissue of the pharyngeal tonsil.

### Discussion

The clivus develops by enchondral bone formation. Chondrification begins in the second month of fetal life, the first cartilaginous foci appearing in the mesenchyma of the skull base at the level of the basiocciput on each side of the notochord (parachordal cartilages); the latter fuse, at about the end of the seventh week, around the notochord (1) (Fig 2). The position that the notochord may occupy in relation to the cartilaginous parachordal plate is variable: commonly, the notochord lies inferior to the base of the skull, on the caudal side of the parachordal plate (Fig

2) in the region of the developing part of the occipital bone (2). Here it is attached to the endoderm forming the roof of the primitive pharynx; with subsequent growth of this region, the notochordal attachment draws out an angled recess of the endoderm (the pouch of Luschka), which forms the pharyngeal bursa and gives origin to a characteristic marking on the esocranial aspect of the basiocciput, the pharyngeal fossa, being anterior to the pharyngeal tubercle and lying inside the wider fossa navicularis (3) (Fig 3). This rare finding, well known to the anatomists of the end of the last century, was reported by Rossi (4) in 55 (1.5%) of 3712 dried skulls, by Romiti (5) in nine (0.9%) of 990 skulls, and by Rizzo (6) in seven (2.1%) of 335 skulls. The pharyngeal fossa was usually reported as oval in shape with the major axis in the sagittal plane (Fig 4A and B); less frequently, it was perfectly round (Fig 4C and D), as in our case. In the reported cases, the length varied from 7 mm to 13 mm, the width from 5 mm to 8 mm, and the depth from 2 mm to 5.5 mm. Exceptionally, a double pharyngeal fossa was found (4).

This anatomic variant must be differentiated from the persistence of the chordal canal (canalis basilaris medianus) whose anterior and posterior openings can sometimes be responsible for a characteristic hole-shaped incisura, or foramen, usually discovered on lateral radiographs of the skull at the base of dorsum sellae (7), or for a delta-shaped or keyhole defect, rarely noted in the anterior rim of the foramen magnum (8) on submental-vertical projections.

### Conclusion

In the present case, in our opinion, a prominent bursa or related notochord remnant in the roof of the pharynx prevented complete ossification of the basiocciput taking place, giving origin to a prominent bone defect (which we called the "fossa navicularis magna") filled with lymphoid tissue of the pharyngeal tonsil. Radiologic findings are quite characteristic and can easily differentiate this developmental anomaly from other bone-destructive lesions of the skull base.

Received July 30, 1997; accepted after revision December 15.

From the Institutes of Radiology (A.B., G.P., G.E.D., M.G., R.C.) and Anatomy and Histology (A.S.), University of Verona, Italy; and the Department of Anatomy and Histology, University of Florence, Italy (P.P.).

Address reprint requests to A. Beltramello, MD, Service of Neuroradiology, Verona City Hospital, Piazzale Stefani, 1, 37100 Verona, Italy.

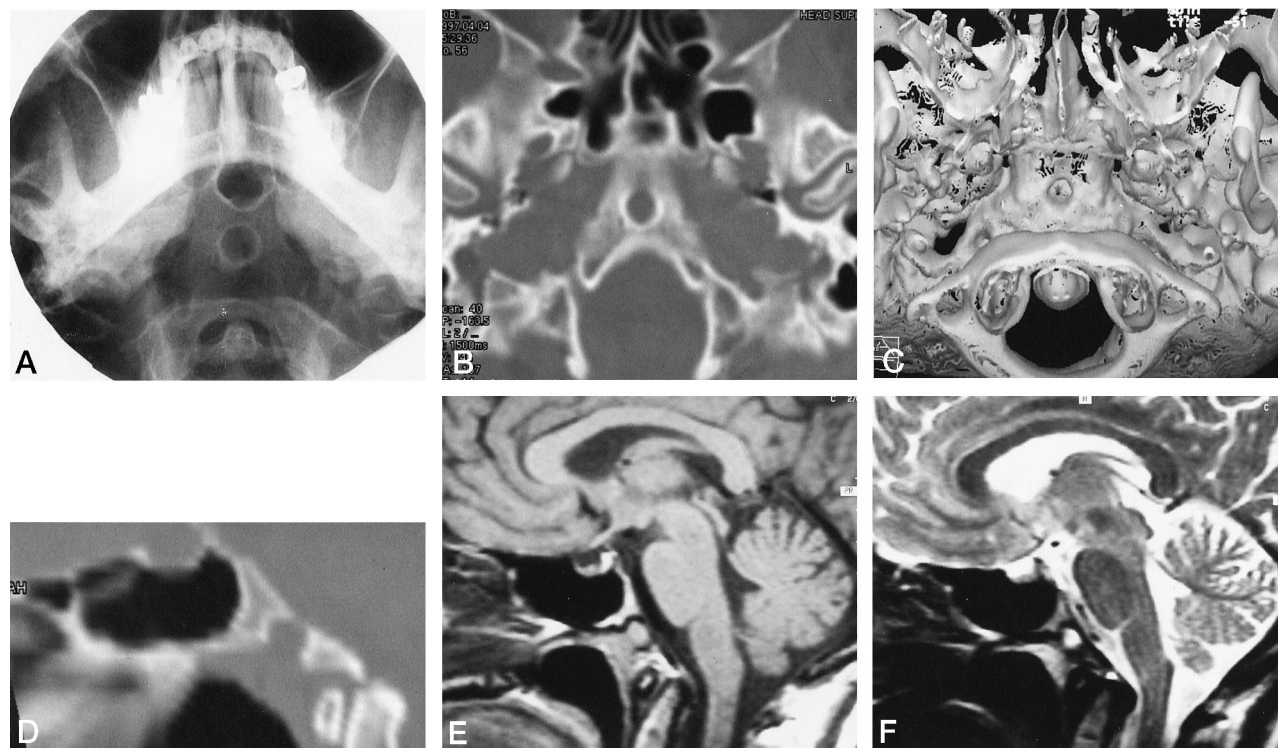


FIG 1. 33-year-old woman referred for evaluation of sinusitis. A-F, Radiograph of the skull, submental-vertex projection (A), shows notchlike defect in the basiocciput, confirmed at axial CT of the skull base with bone algorithm (B) and 3D surface-rendering (C) scans. Reformatted scan in the sagittal plane (D) shows the bone defect lying in the esocranial portion of the basiocciput. Midsagittal T1-weighted (E) and T2-weighted (F) MR images show that the osseous defect is filled with lymphoid tissue.

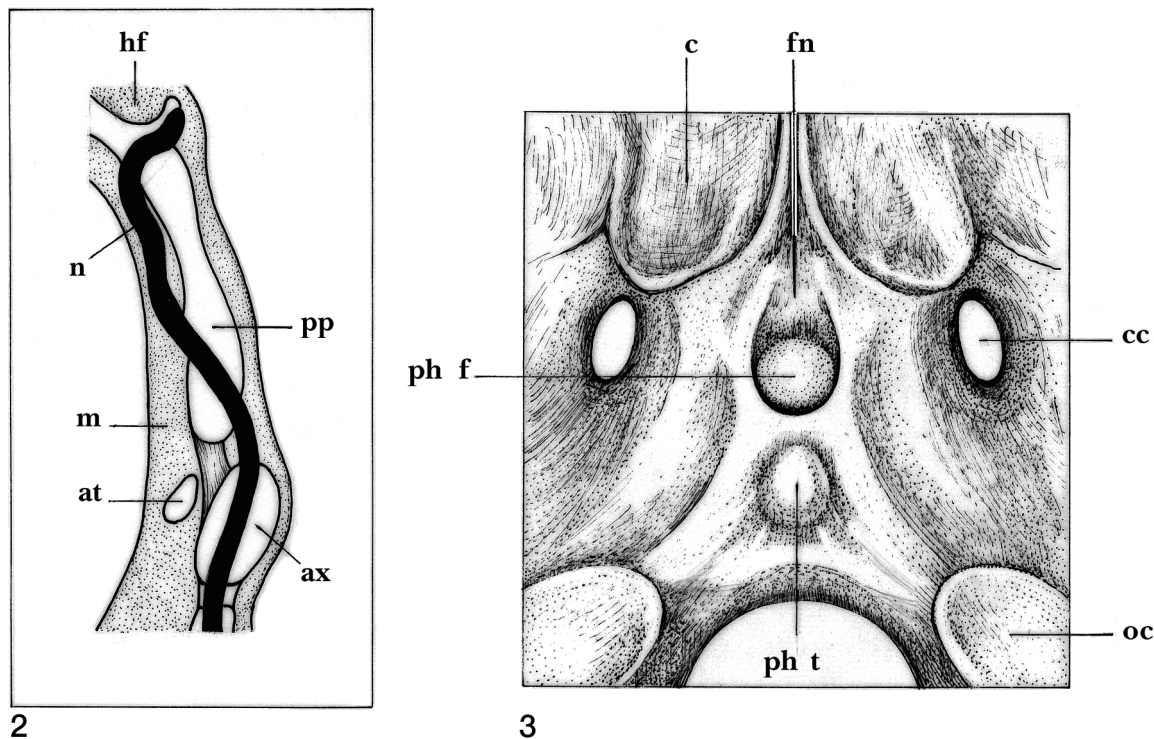


FIG 2. Schematic drawing of the relationships between notochord and parachordal plate in the basiocciput (modified from [8]). *at* indicates atlas; *ax*, axis; *hf*, hypophyseal fossa; *m*, mesenchyma; *n*, notochord; *pp*, parachordal plate.

FIG 3. Schematic drawing of the basiocciput with a prominent fossa navicularis, containing the smaller pharyngeal fossa, in a dried skull base (modified from [1]). *cc* indicates carotid canal; *c*, choana; *fn*, fossa navicularis; *oc*, occipital condyle; *ph f*, pharyngeal fossa; *ph t*, pharyngeal tubercle.

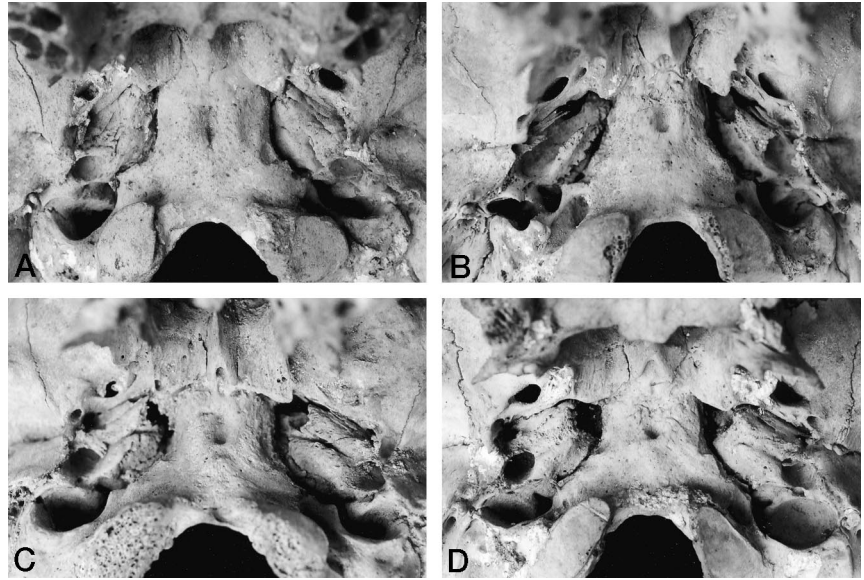
FIG 4. Close-up view of four different dried skull bases (from the collection of the Anatomic Museum, Florence, Italy.)

A, Skull #920: oval fossa navicularis; length, 10 mm; width, 4 mm; depth, 2 mm.

B, Skull #634: oval fossa navicularis; length, 11 mm; width, 6 mm; depth, 5 mm.

C, Skull #776: round fossa navicularis; diameter, 6.5 mm; depth, 5 mm.

D, Skull #948: round fossa navicularis; diameter, 5.5 mm; depth, 4 mm.



### References

1. Testut L, Latarjet A. *Traité d'anatomie humaine*. 9th ed. Paris: G. Doin; 1948
2. Di Chiro G, Anderson W. **The clivus.** *Clin Radiol* 1963;14:211-223
3. Fischer E. **Neue befunde am vorderrand des foramen occipitale magnum.** *Fortschr Roentgenstr* 1963;99:805-808
4. Rossi G. **Il canale cranio-faringeo e la fossetta faringea, ricerche antropologiche.** *Monogr Zool Ital* 1891;2:117-122
5. Romiti G. **La fossetta faringea nell'osso occipitale dell'uomo.** *Atti Soc Toscana Sci Nat* 1890;11
6. Rizzo A. **Canale cranio faringeo, fossetta faringea, interparietali e preinterparietali nel cranio umano.** *Monogr Zool Ital* 1901;12: 241-252
7. Koehler Zimmer. *Borderlands of Normal and Early Pathological Findings in Skeleton Radiography*. 4th ed. Stuttgart: Thieme; 1993: 324-326
8. Pendergrass EP, chaeffer JP, Hodes PJ. *Head and Neck in Roentgen Diagnosis*. 2nd ed. Springfield, IL: Thomas; 1956;2