

A Giant Frontoethmoidal Osteoma: A Case Report with Review of Literature

Shruti Venugopalan¹, Paresh J Khavdu², Alpesh D Fefar³, Yash D Lavana⁴

ABSTRACT

Aim: To present a typical case of frontal and ethmoidal osteoma and its management.

Methodology/case description: A 45-year-old female presented with a complaint of swelling over the right supraorbital region medially associated with right-sided headache and decreased vision in the right eye. She was diagnosed with right frontoethmoidal osteoma (dense bony lesion of $49 \times 34 \times 26$ mm in both right frontal sinus and anterior ethmoid sinus. Defect in the superomedial orbital wall with intraorbital protrusion on right side) on CT PNS, which was then managed by bilateral endonasal sinus surgery with septoplasty with right frontoethmoidal osteoma excision—combined (endoscopic and external) approach with fascia lata grafting (inner table of frontal bone was dehiscent). No intraoperative or postoperative complications were seen.

Results: No complications or recurrence were seen at 1 year follow-up. Complete resolution of symptoms was achieved.

Conclusion: Osteoma of paranasal sinuses is amenable to surgery with excellent results and no recurrence.

Keywords: Endoscopic resection, External nasal surgery, Frontoethmoid osteoma, Howarth-Lynch incision.

Clinical Rhinology An International Journal (2019); 10.5005/jp-journals-10013-1358

INTRODUCTION

Osteomas are the most common benign neoforations of the nose and the paranasal sinuses, which are bosselated and sessile growths projecting from subperiosteal or endosteal surfaces of the bony cortex.

There are three variants depending upon the amount of fibrous tissue:

- Cortical (~30%)—slow-growing, lobulated, and ivory-like growth with bony lamellae in parallel layers.
- Cancellous (~20%)—rapidly growing spongy bone with fibrofatty marrow.
- Mixed—most common variant constituting nearly 50% of the osteomas.

They may remain asymptomatic throughout one's life but may have symptoms if large like:

- Mucocoeles
- Sinusitis
- Proptosis
- Diplopia
- Intracranial complications rarely

Most common sites are:

- Frontal
- Ethmoid

CASE DESCRIPTION

A 45-year-old female patient presented to ENT OPD of PDU Medical College and Hospital, Rajkot, with primary complaints of right supraorbital swelling since 3 months and right frontal headache and right-eye double vision since last 15 days.

The patient was relatively asymptomatic before 3 months. Then, the patient developed right supraorbital swelling limited to

^{1,2,4}Department of Otorhinolaryngology, Pandit Dindayal Upadhyay Medical College and Hospital, Rajkot, Gujarat, India

³Department of ENT, Head and Neck Surgery, H. J. Doshi Hospital, Rajkot, Gujarat, India

Corresponding Author: Shruti Venugopalan, Department of Otorhinolaryngology, Pandit Dindayal Upadhyay Medical College and Hospital, Rajkot, Gujarat, India, Phone: +91 9537969606, e-mail: shruti_92@rocketmail.com

How to cite this article: Venugopalan S, Khavdu PJ, Fefar AD, *et al.* A Giant Frontoethmoidal Osteoma: A Case Report with Review of Literature. *Clin Rhinol An Int J* 2019;12(1):38–43.

Source of support: Nil

Conflict of interest: None

the medial end of right eyebrow since 3 months, which gradually increased in size and involved half of the right eyebrow and pushed the right orbit inferolaterally. The increase in size was associated with double vision and constant, dull, boring type of right frontal headache for 15 days.

The patient had no history of trauma or significant medical or surgical comorbidities.

Fundoscopy was normal.

Nasal endoscopy revealed submucosal hard mass in the right nasal cavity.

Computed tomography of paranasal sinuses revealed a dense bony lesion of $49 \times 34 \times 26$ mm in both frontal sinus and anterior ethmoid sinus on right side causing indentation over right superior and medial rectus. Defect is noted in the superomedial orbital wall on either side with intraorbital protrusion of lesion on right side. Thinning with defect in the posterior wall of frontal sinus on right side was seen. No definite evidence of intracranial extension was seen. Polypoidal mucosal thickening was found in frontal sinus on either side, sphenoid sinus on either side, both maxillary sinuses

and ethmoid sinuses, suggestive of sinusitis. Polypoidal lesions were found in the nasal cavity suggestive of bilateral sinonasal polyposis (Fig. 1).

Bilateral endonasal sinus surgery was undertaken under general anesthesia for complete clearance of polyps from all the sinuses. Bony deviation toward right was found for which septoplasty was performed. Bony protrusion was identified in anterior ethmoidal air cell adjacent to the lateral process of crista galli. It was not attached to lamina papyracea. Right Lynch-Howarth incision was kept (Fig. 2).

Osteoma was identified after opening right frontal outer table and drilled out from right frontal and anterior ethmoid sinuses. Inner table of the frontal bone was found dehiscent. Dura was intact. The defect was covered by mucoperichondrial flap and right thigh fascia lata and superimposed with surgical. One drain was kept through the frontal sinus opening into the nasal cavity. Biopsies of osteoma and polyps were sent for histopathological examination (Fig. 3).

Histopathological examination of

- Drilled-out material revealed well-circumscribed, dense, ivory-like lesions of mature, bony trabeculae without fatty marrow spaces suggestive of cortical type of osteoma (Fig. 4).
- The excised polypoidal lesions were suggestive of inflammatory reaction.

Postoperatively, the patient was given nasal saline drops and betadine wash through the drain for 10 days. Drain was removed on 10th postoperative day.

No complications were found and complete resolution of symptoms was achieved.

On 1 year follow-up, no recurrence or complaints were noted.

DISCUSSION

Incidence

They are more commonly seen in second to fifth decades with male predominance of 2:1, more so because of greater occurrence of trauma and larger size of sinuses in males.¹⁻³

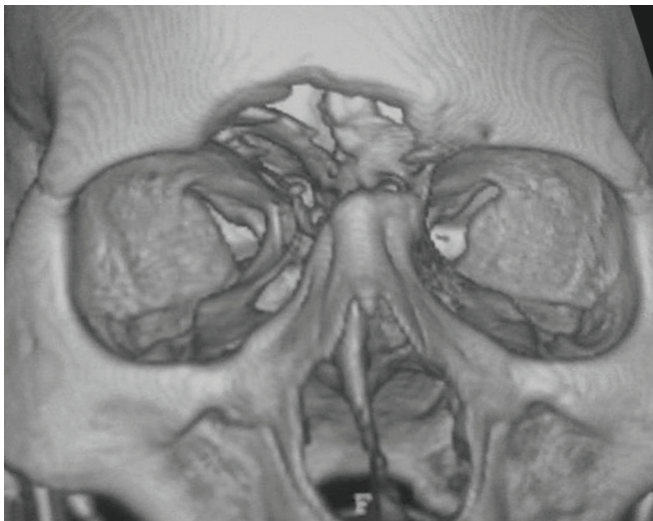


Fig. 1: Computed tomography of the osteoma

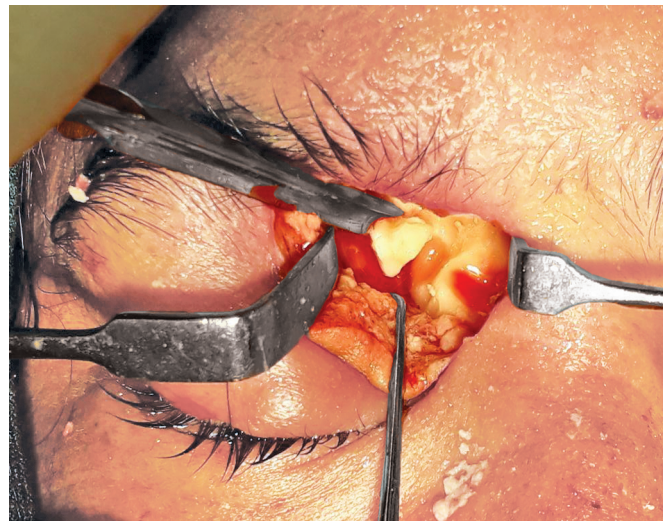


Fig. 2: Right Howarth-Lynch incision

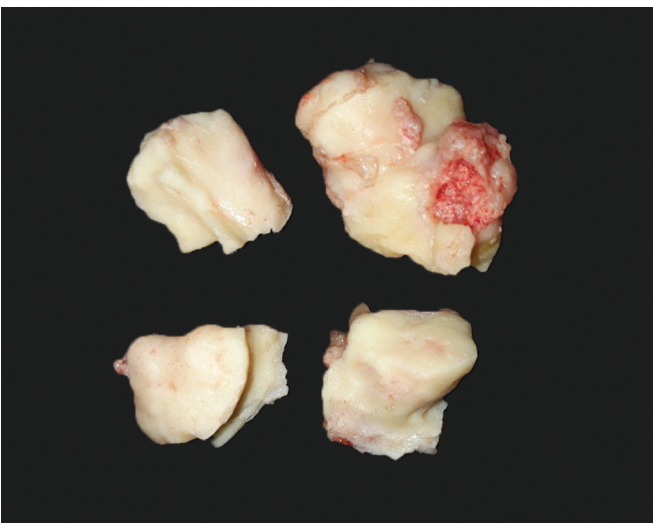


Fig. 3: Specimen of osteoma

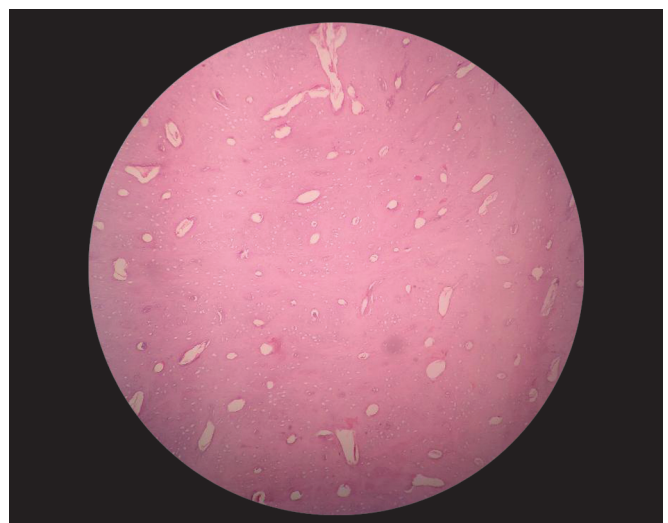


Fig. 4: Histopathological picture of the osteoma

The most common sites are (1) frontal and (2) ethmoidal.

Theories¹⁻⁶

- Embryological/developmental

Osteomas may arise in the frontoethmoidal junctions where the membranous and cartilaginous tissues meet during embryonic life.

- Traumatic

Osteomas may arise due to trauma especially during puberty.

- Infective

Sinusitis may induce osteoblastic proliferation within mucoperiosteal lining of sinuses that cause tumor formation.

However, mostly two etiological factors coexist and contribute to the neoformations.

¹Gardner's syndrome and ²fibrous dysplasia as etiological factors must always be kept in mind for occurrence of osteomas.⁴⁻⁶

Clinical Features

The most common complaint is headache or localized pain secondary to obstruction of sinus drainage.^{1-3,7-69}

Other symptoms are sinusitis, proptosis, diplopia, or epiphora.

In rare cases, further involvement by osteoma may cause facial deformity, periosteal orbital abscess, and orbital cellulitis.

Intracranial complications include spontaneous cerebrospinal fluid leaks, pneumocephalus, or meningitis.

Management

- Plain computed tomography—for delineating the extensions of the osteoma.
- Magnetic resonance imaging—for defining dural or soft tissue involvement, orbital extensions, and evaluation of roof of orbit.⁹
- Nuclear magnetic resonance—for suspected endocranial and orbital complications.¹
- Spiral computed tomography—for three-dimensional reconstructions.^{1,9}
- Radionuclide bone scan—for differentiating active-growing lesion from stable lesion.⁹
- Orbital venography—for demonstrating compression of superior ophthalmic vein.⁹
- Computed tomography densitometry.¹⁰
- Intralumbar injection of 1 mL of sodic fluorescein (5%) if lesion is attached to anterior skull base—for highlighting cerebrospinal fluid leaks.¹⁰

Prerequisites for Surgical Planning¹⁰

- Radiological delineation of anatomical features
- Anteroposterior diameter in relation to volume of frontal sinus
- Interorbital distance

Indications for Surgery^{1,3,7,12-50}

- Neuro-ophthalmological and endosinusal complications
- Mechanical complications like

- Ostial obstruction
- Facial deformity
- Proptosis
- Involvement of more than 50% of sinus volume
- Rapidly evolving osteomas

Exclusion Criteria for an Exclusively Endoscopic Endonasal Approach¹⁰

- Small anteroposterior diameter in relation to large volume of frontal sinus
- Erosion of the posterior wall of frontal sinus with large intracranial multilobulated osteoma
- Extension through anterior frontal plate
- Posttraumatic changes in frontal bone
- Lateral or superolateral orbital wall attachment

Grade I and II osteomas (medial to sagittal line passing through lamina papyracea)—amenable to endoscopic resection

Grade III and IV osteomas (lateral to sagittal line passing through lamina papyracea)—external or combined approach used.

Different Surgical Modalities Used According to the Site of Osteomas

- Small osteomas with frontoethmoid localization
 - Endoscopic endonasal approach,¹ the results of which can be improved with stereotactic localization.¹⁰

Endoscopic resection with intranasal drill (cutting and diamond) with 0° endoscope^{2,3,12-50} decreases the morbidity associated with the external approach even in osteomas with frontal involvement. If periorbital is preserved, the patient is protected against diplopia, enophthalmos, and facial deformity; hence, no reconstruction is required.¹⁰

As per Turri Zanoni et al.,¹⁰ the endoscopic endonasal approach requires anterior ethmoidectomy and Draf type II or III frontal sinusotomy.

Draf type III median drainage (Lothrop modified procedure) with partial removal of nasal septum helps to reach the contralateral nasal fossa so that the lesion in the far lateral recess with greatest angle of tilt can be approached and complete clearance obtained (two nostril, four-hand technique).^{3,8,10,36,42,43,46,51-69}

- Uncomplicated large osteomas
 - En bloc resection or curettage (preferably endoscopically)¹
 - Ogston-Luc fronto-orbital external approach¹
- Orbital complications^{1,9}
 - Anterior lesions: anterior orbitotomy
 - Posterior lesions: orbitocranial approach
- Extension into frontal and posterior ethmoid area (not a contraindication for endoscopic procedure¹¹)
 - Howarth-Lynch incision extended to Moure-Sebileau lateral rhynotomy^{1-3,8,10,12-69} (transcutaneous paranasal approach for protection of lacrimal apparatus) for osteo-plastic flap in addition to endoscopic clearance.
 - Bicoronal bifrontal osteo-plastic technique (avoided in osteomyelitis of frontal bone)
- Intracranial extension
 - Frontobasal craniotomy and craniofacial bone reconstruction¹⁰
- Intraorbital extension

¹ Syndrome consists of (1) intestinal polyps, (2) cutaneous fibromas, (3) epidermal cysts, and (4) impacted permanent or supernumerary teeth.

² Three forms: (1) monostotic, (2) polyostotic, (3) McCune Albright syndrome.

- Endoscopic approach using intraorbital extension as corridor¹⁰

The endoscopic drill cavitation technique is used to drill out the core of the tumor as thin, hollowed bony skull can be fractured easily and then removed transnasally to obtain clear margins.¹¹

Follow-up

All the patients were closely followed up by either nasal endoscopy or computed tomographic evaluation to check for

- Recurrence
- Residual lesion
- Frontal scar stenosis^{3,8,11,36,42,43,46,51–69}

For which repeat exploration is warranted.

Management of Surgical Complications

- Damage to peri-orbita—medial wall reconstruction¹¹
- Cerebrospinal fluid leak—repair in multiple layers
- Dural defect—in most of the cases, skull base defect was found over olfactory fissure with dural exposure but no cerebrospinal fluid leaks for which reconstruction using the mucoperiosteal free graft from nasal septum was done with the overlay technique over bony portion of defect extracranially after total stripping of nasal mucosa.¹¹

Recent Advances

Sonopet omni ultrasonic bone curette has been used for transethmoidal approach lateral to middle turbinate.⁷

Points to Remember

- The primary aim of the surgery should be to restore the physiological sinus function so that the adequate ventilation and mucociliary clearance are maintained. Hence, no fat obliteration should be done. By doing this, late complications of fat resorption and sinus superinfection can be prevented.¹⁰
- Subsequent herniation of the orbital content into ethmoid is uneventful as the periorbital layer is preserved; hence, diplopia, enophthalmos, and facial deformity are prevented.¹⁰
- Transient postoperative diplopia might occur, not from infiltration of oculomotor muscles but from displacement of eyeball.¹¹
- Dural tear can be avoided by¹¹
 - Wide surgical corridor
 - Cavitation of osteoma causing a thin tumor shell, which could be easily elevated off the dura.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

This article does not contain any studies with animals performed by any of the authors.

Informed consent was obtained from the participant included in the study.

LEVEL OF EVIDENCE

Outcomes research

REFERENCES

1. Vishwakarma R, Joseph ST, Patel KB, et al. Giant frontal osteoma: case report with review of literature. *Indian J Otolaryngol Head Neck Surg* 2011;63(Suppl 1):S122–S126. DOI: 10.1007/s12070-011-0170-5.
2. Singh M, Nagaonkar S, Kirtane MV. Giant frontoethmoid osteoma-naso-endoscopic resection using intra-nasal drill. *Indian J Otolaryngol Head Neck Surg* 2004;56(4):324–326.
3. Cheng KJ, Wang SQ, Lin L. Giant osteomas of the ethmoid and frontal sinuses: clinical characteristics and review of the literature. *Oncol Lett* 2013;5(5):1724–1730. DOI: 10.3892/ol.2013.1239.
4. Gleeson MJ. Wolfgang Draf—the frontal sinus. *Scott-Brown's Otorhinolaryngology, Head and Neck Surgery* 2008. 7th ed., vol. 2, part 13, ch. 118, p. 1521.
5. Fokkens WJ, Jones NS. Management of the frontal sinus. *Cummings Otolaryngology, Head and Neck Surgery*. 6th ed., vol. 1, part 4, ch. 5, pp. 797–798.
6. Imaging of nasal Cavities, paranasal sinuses, nasopharynx, orbits, Infratemporal fossa, Ptergomaxillary fissure and base of skull. *Ballenger's Otorhinolaryngology, Head and Neck Surgery*. 17th ed., part 11, ch. 41, pp. 198–506.
7. Trindade A, Shakeel M, Moyes C, et al. The evidence-based management of bilateral ethmoid osteomas: diagnosis, endoscopic resection and review of the literature. *West Indian Med J* 2010;59(2):188–191.
8. Humeniuk-Arasiewicz M, Stryjewska-Makuch G, Janik MA, et al. Giant fronto-ethmoidal osteoma-selection of an optimal surgical procedure. *Braz J Otorhinolaryngol* 2018;84(2):232–239. DOI: 10.1016/j.bjorl.2017.06.010.
9. Yucel A, Acar M, Haktanir A, et al. Orbital extension of A large frontal sinus osteoma associated with fibrous dysplasia. *Eur J Gen Med* 2004;1(4):74–77.
10. Turri-Zanoni M, Dallon I, Terranova P, et al. Frontoethmoidal and intra-orbital osteomas: exploring the limits of the endoscopic approach. *Arch Otolaryngol Head and Neck Surg* 2012;138(5):498–504. DOI: 10.1001/archoto.2012.644.
11. Pons Y, Blancal JP, Vérylaud B, et al. Ethmoid sinus osteoma: diagnosis and management. *Head Neck* 2013;35(2):201–204. DOI: 10.1002/hed.22945.
12. Olumide AA, Fajemisin AA, Adeloye A. Osteoma of the ethmoidfrontal sinus. case report. *J Neurosurg* 1975;42(3):343–345. DOI: 10.3171/jns.1975.42.3.0343.
13. Wilkes SR, Trautmann JC, DeSanto LW, et al. Osteoma an unusual cause of amaurosis fugax. *Mayo Clin Proc* 1979;54(4):258–260.
14. Malcolm WM, Haskell N. Transcoronal removal of an atypical orbitoethmoid osteoma. *Plast Reconstr Surg* 1983;72(6):874–877. DOI: 10.1097/00006534-198312000-00031.
15. Sternberg I, Levine MR. Ethmoidal sinus osteoma—a primary cause of nasolacrimal obstruction and dacryocystorhinostomy failure. *Ophthalmic Surg* 1984;15(4):295–297.
16. Mendelsohn DB, Hertzanu Y, Friedman R. Frontal osteoma with spontaneous subdural and intracerebral pneumatocele. *J Laryngol Otol* 1984;98(5):543–545. DOI: 10.1017/S002221510014705X.
17. Mugliston TA, Stafford N. A cranio-facial approach to large osteomas of the fronto-ethmoidal region. *J Laryngol Otol* 1985;99(10):979–983. DOI: 10.1017/S0022215100098030.
18. Bushan B, Watal G, Ahmed A, et al. Giant ivory osteoma of frontal sinus. *Australas Radiol* 1987;31(3):306–308. DOI: 10.1111/j.1440-1673.1987.tb01837.x.
19. Schwartz MS, Crockett DM. Management of a large frontoethmoid osteoma with sinus cranialization and cranial bone graft reconstruction. *Int J Pediatr Otorhinolaryngol* 1990;20(1):63–72. DOI: 10.1016/0165-5876(90)90335-O.
20. Lunardi P, Missori P, Di Lorenzo N, et al. Giant intracranial mucocele secondary to osteoma of the frontal sinuses: report of two cases and review of the literature. *Surg Neurol* 1993;39(1):46–48. DOI: 10.1016/0090-3019(93)90109-E.

21. Aldren CP, Soames JV, Birchall JP. Bony remodelling in an osteoma of the paranasal sinuses. *J Laryngol Otol* 1993;107(7):633–635. DOI: 10.1017/S002221510012393X.
22. Shady JA, Bland LI, Kazee AM, et al. Osteoma of the frontoethmoidal sinus with secondary brain abscess and intracranial mucocele: case report. *Neurosurgery* 1994;34(5):920–923. [PubMed] [Google Scholar].
23. Rappaport JM, Attia EL. Pneumocephalus in frontal sinus osteoma: a case report. *J Otolaryngol* 1994;23(6):430–436.
24. Brunori A, de Santis S, Bruni P, et al. Life threatening intracranial complications of frontal sinus osteoma: report of two cases. *Acta Neurochir (Wien)* 1996;138(12):1426–1430. DOI: 10.1007/BF01411121.
25. Hehar SS, Jones NS. Fronto-ethmoid osteoma: the place of surgery. *J Laryngol Otol* 1997;111(4):372–375. DOI: 10.1017/S0022215100137351.
26. Chang SC, Chen PK, Chen YR, et al. Treatment of frontal sinus osteoma using a craniofacial approach. *Ann Plast Surg* 1997;38(5):455–459. DOI: 10.1097/0000637-199705000-00004.
27. Manaka H, Tokoro K, Sakata K, et al. Intradural extension of mucocele complicating frontoethmoid sinus osteoma: case report. *Surg Neurol* 1998;50(5):453–456. DOI: 10.1016/S0090-3019(97)00162-6.
28. Nakayama Y, Tanaka A, Ueno Y, et al. Pneumocephalus associated with ethmoidal sinus osteoma. *Neurol Med Chir (Tokyo)* 1998;38(12):875–878. DOI: 10.2176/nmc.38.875.
29. Gossios K, Bai M, Psilas K. Giant aggressive osteoma of the frontal sinus. *Clin Radiol* 1999;54(3):193–196. DOI: 10.1016/S0009-9260(99)91018-8.
30. Goldenberg D, Gilboa M, Danino J, et al. A large ethmoido-orbital osteoma presenting with epiphora in an 11-year-old boy. *J Pediatr Ophthalmol Strabismus* 2000;37(4):238–240.
31. Koyuncu M, Belet U, Sezen T, et al. Huge osteoma of the frontoethmoidal sinus with secondary brain abscess. *Auris Nasus Larynx* 2000;27(3):285–287. DOI: 10.1016/S0385-8146(00)00063-8.
32. Summers LE, Mascott CR, Tompkins JR, et al. Frontal sinus osteoma associated with cerebral abscess formation: a case report. *Surg Neurol* 2001;55(4):235–239. DOI: 10.1016/S0090-3019(01)00344-5.
33. Bramley DC, Ghosh S. Tension pneumocephalus attributable to an ethmoid osteoma presenting as a stroke in evolution: an unusual presentation. *Emerg Med J* 2001;18(4):317–318. DOI: 10.1136/emj.18.4.317.
34. Johnson D, Tan L. Intraparenchymal tension pneumatocele complicating frontal sinus osteoma: case report. *Neurosurgery* 2002;50(4):878–880. DOI: 10.1097/00006123-200204000-00038.
35. Osma U, Yaldiz M, Tekin M, et al. Giant ethmoid osteoma with orbital extension presenting with epiphora. *Rhinology* 2003;41(2):122–124.
36. Naraghi M, Kashfi A. Endonasal endoscopic resection of ethmoido-orbital osteoma compressing the optic nerve. *Am J Otolaryngol* 2003;24(6):408–412. DOI: 10.1016/S0196-0709(03)00085-1.
37. Tsai CJ, Ho CY, Lin CZ. A huge osteoma of paranasal sinuses with intraorbital extension presenting as diplopia. *J Chin Med Assoc* 2003;66(7):433–435.
38. Selva D, Chen C, Wormald PJ. Frontoethmoidal osteoma: a stereotactic-assisted sino-orbital approach. *Ophthal Plast Reconstr Surg* 2003;19(3):237–251. DOI: 10.1097/01.IOP.0000062847.27980.CE.
39. Nabeshima K, Marutsuka K, Shimao Y, et al. Osteoma of the frontal sinus complicated by intracranial mucocele. *Pathol Int* 2003;53(4):227–230. DOI: 10.1046/j.1320-5463.2003.01459.x.
40. Akay KM, Ongürü O, Sirin S, et al. Association of paranasal sinus osteoma and intracranial mucocele. *Neurol Med Chir (Tokyo)* 2004;44(4):201–204. DOI: 10.2176/nmc.44.201.
41. Karapantzou I, Detorakis ET, Drakonaki EE, et al. Ethmoidal osteoma with intra-orbital extension: excision through a transcutaneous paranasal incision. *Acta Ophthalmol Scand* 2005;83(3):392–394. DOI: 10.1111/j.1600-0420.2005.00459.x.
42. Panagiotopoulos V, Tzortzidis F, Partheni M, et al. Giant osteoma of the frontoethmoidal sinus associated with two cerebral abscesses. *Br J Oral Maxillofac Surg* 2005;43(6):523–525. DOI: 10.1016/j.bjoms.2005.01.020.
43. Saetti R, Silvestrini M, Narne S. Ethmoid osteoma with frontal and orbital extension: endoscopic removal and reconstruction. *Acta Otolaryngol* 2005;125(10):1122–1125. DOI: 10.1080/00016480510029347.
44. Dispenza C, Saraniti C, Ferrara S, et al. Frontal sinus osteoma and palpebral abscess: case report. *Rev Laryngol Otol Rhinol (Bord)* 2005;126(1):49–51.
45. Benatiya Andaloussi I, Touiza E, Bhalil S, et al. Orbital osteoma: three case reports. *Bull Soc Belge Ophtalmol* 2006(300):73–79.
46. Gerbrandy SJ, Saeed P, Fokkens WJ. Endoscopic and transforix removal of a giant orbital-ethmoidal osteoma. *Orbit* 2007;26(4):299–301. DOI: 10.1080/01676830600991872.
47. Park MC, Goldman MA, Donahue JE, et al. Endonasal ethmoidectomy and bifrontal craniotomy with craniofacial approach for resection of frontoethmoidal osteoma causing tension pneumocephalus. *Skull Base* 2008;18(1):67–72. DOI: 10.1055/s-2007-993046.
48. Yiotakis I, Eleftheriadou A, Giotakis E, et al. Resection of giant ethmoid osteoma with orbital and skull base extension followed by duraplasty. *World J Surg Oncol* 2008;6:110. DOI: 10.1186/1477-7819-6-110.
49. Adeleye AO. A giant complex fronto-ethmoidal ivory osteoma: surgical technique in a resource-limited practice. *Surg Neurol Int* 2010;1:97. DOI: 10.4103/2152-7806.74489.
50. Sakamoto H, Tanaka T, Kato N, et al. Frontal sinus mucocele with intracranial extension associated with osteoma in the anterior cranial fossa. *Neurol Med Chir (Tokyo)* 2011;51(8):600–603. DOI: 10.2176/nmc.51.600.
51. Mansour AM, Salti H, Uwaydat S, et al. Ethmoid sinus osteoma presenting as epiphora and orbital cellulitis: case report and literature review. *Surv Ophthalmol* 1999;43(5):413–426. DOI: 10.1016/S0039-6257(99)00004-1.
52. Zouloumis L, Lazaridis N, Papadaki M, et al. Osteoma of the ethmoidal sinus: a rare case of recurrence. *Br J Oral Maxillofac Surg* 2005;43(6):520–522. DOI: 10.1016/j.bjoms.2005.01.014.
53. Blanco Dominguez I, Oteiza Alvarez AV, Martinez Gonzalez LM, et al. Frontoethmoidal osteoma with orbital extension. A case report. *Arch Soc Esp Oftalmol* 2016;91(7):349–352. DOI: 10.1016/j.oftale.2016.04.002.
54. Hazarika P, Zachariah PK, Victor J, et al. Frontal sinus osteoma: a difficult surgical decision in the era of endoscopic sinus surgery. *Am J Otolaryngol* 2011;32(6):611–614. DOI: 10.1016/j.amjoto.2010.08.005.
55. Zhuang A, Li Y, Lin M, et al. Ethmoid osteoma as a culprit of orbital emphysema: a case report. *Medicine (Baltimore)* 2015;94(18):e724. DOI: 10.1097/MD.0000000000000724.
56. Olés K, Strek P, Wiatr M, et al. Endoscopic treatment of giant skull base osteomas. *Otolaryngol Pol* 2011;65(6):410–413. DOI: 10.1016/S0030-6657(11)70732-6.
57. Strek P, Zagólski O, Składzień J, et al. Endoscopic management of osteomas of the paranasal sinuses – own experience. *Otolaryngol Pol* 2007;61(3):260–264. DOI: 10.1016/S0030-6657(07)70423-7.
58. Nagashima H, Aihara H, Tashiro T, et al. Brain abscess associated with ethmoidal sinus osteoma: a case report. *Interdiscip Neurosurg* 2014;1(4):97–100. DOI: 10.1016/j.inat.2014.09.004.
59. Savastano M, Guarda-Nardini L, Marioni G, et al. The bicoronal approach for the treatment of a large frontal sinus osteoma: a technical note. *Am J Otolaryngol* 2007;28(6):427–429. DOI: 10.1016/j.amjoto.2006.10.015.
60. Beitzke D, Simbrunner J, Mokry M, et al. Progressive intracranial mucocele associated with an osteoma of the frontal sinus causing seizures. *Eur J Radiol Extra* 2009;69:57–59. DOI: 10.1016/j.ejrex.2008.08.003.
61. Kamide T, Nakada M, Hayashi Y, et al. Intraparenchymal pneumocephalus caused by ethmoid sinus osteoma. *J Clin Neurosci* 2009;16(11):1487–1489. DOI: 10.1016/j.jocn.2009.01.016.
62. Torun MT, Turan F, Tuncel U. Giant ethmoid osteoma originated from the lamina papyracea. *Med Arh* 2014;68(3):209–211. DOI: 10.5455/medarh.2014.68.209-211.

63. Simsek E, Kaya Z, Gozeler MS, et al. A case of giant ethmoidal osteoma with orbital invasion treated via endonasal endoscopic approach. *Dicle Med J* 2014;41(4):743–745. DOI: 10.5798/diclemedj.0921.2014.04.0510.
64. Li XZ, Cai XL, Zhang L, et al. Bilateral congenital choanal atresia and osteoma of ethmoid sinus with supernumerary nostril: a case report and review of the literature. *J Med Case Rep* 2011;5:583. DOI: 10.1186/1752-1947-5-583.
65. Akmansu H, Eryilmaz A, Dagli M, et al. Endoscopic removal of paranasal sinus osteoma: a case report. *J Oral Maxillofac Surg* 2002;60(2):230–232. DOI: 10.1053/joms.2002.29833.
66. Maharjan R, Adhikari P, Pradhan B, et al. Ethmoidal osteoid osteoma with orbital extension in a 14 years old boy. *Electron Phys* 2012;4: 448–450.
67. Lodha JV, Dabholkar JP, Dhar H. Fronto-ethmoid osteoma: addressing surgical challenges. *J Postgrad Med* 2014;60(2):207–208. DOI: 10.4103/0022-3859.132355.
68. Ansari S, Hasin N, Ozair E, et al. Giant ethmoidal sinus osteoma with intraorbital extension: a case report. *Bangladesh J Med Sci* 2015;14(1):95–97. DOI: 10.3329/bjms.v14i1.20925.
69. Müslüman AM, Oba E, Yilmaz A, et al. Giant osteoid osteoma of the ethmoid bone with unusual large nidus. *J Neurosci Rural Pract* 2012;3(3):383–385. DOI: 10.4103/0976-3147.102637.