CASE REPORT ON RARE OSSEOUS METAPLASIA IN NASAL POLYPS AND LITERATURE REVIEW

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Abstract

The osseous metaplasia in nasal polyps is a rare but benign disease. The image of increased contrast inside the lesion can be seen on CT scan. The diagnosis is based on histopathological results. In this report, we present a case of a 63-year-old female patient with nasal polyps with very special bone growth forming a bone shell surrounding almost the entire polyp mass, which is rarely reported in the literature before. This report on "Rare bone growth in nasal polyps and literature review" aims to describe the clinical and paraclinical manifestations of a patient, and discuss some reports in the literature that have been encountered, which can help otolaryngologists pay attention and accumulate medical records that will be encountered about this special disease and can be studied further to contribute to better diagnosis and treatment, as well as help differentiate from other dangerous diseases.

Keywords: osseous metaplasia, heterotopic bone formation, metaplastic ossification new bone (in nasal polyp).

Overview

Brief introduction to nasal polyps

Nasal polyps are benign, painless growths in the nasal cavity formed due to fluid accumulation in the submucosal tissue of the Schneiderian membrane lining the nasal cavity and paranasal sinuses.

They typically appear bilaterally and originate from the mucosal lining of the nasal cavity and paranasal sinuses. Most polyps arise in the middle meatus, anterior ethmoid, posterior ethmoid, and sphenoethmoidal recess, and occasionally in the middle turbinate and nasal septum.

Nasal polyps can become irritated and enlarge. Small polyps have a teardrop shape, whereas larger ones resemble peeled grapes and may appear pink, yellow, or gray.

Nasal polyps affect approximately 4% of the population, with an increasing prevalence with age and a male-to-female ratio of 2:1.[1]

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They are associated with conditions such as asthma, chronic rhinosinusitis, cystic fibrosis, and Churg-Strauss syndrome.

Osseous metaplasia in nasal polyps

Definition

Osseous metaplasia is the development of normal bone tissue within soft tissue.

Heterotopic bone formation has been widely documented in gastrointestinal and uterine polyps; however, it remains an unusual finding in nasal polyps, with only around 10 reported cases in the English literature.

Previous reports have indicated that osseous metaplasia in nasal polyps may originate from the ethmoid sinus, middle meatus, middle turbinate, inferior turbinate, or nasal septum.

Pathological characteristics

Histopathological examination reveals the presence of metaplastic bone within the nasal polyp, without evidence of cartilage formation or endochondral ossification.

Pathogenesis

The exact mechanism remains unclear, but one hypothesis suggests that previous nasal surgery may contribute to the development of new bone from residual bony fragments. Another theory proposes that multipotent mesenchymal cells differentiate into osteoblast precursors under the influence of bone morphogenetic proteins (BMPs) and transforming growth factor-beta 1 (TGF-β1), subsequently forming osteoblasts and secreting bone matrix.[2]

Studies have shown that TGF-β1 is present in osteogenic cells at the periphery of ectopic bone formation, suggesting that it may play a key role in osteogenesis by inducing differentiation into osteoblasts and/or promoting bone formation.[2] TGF-β1 has also been reported to induce endochondral ossification in ectopic sites in animal models.[3] Additionally, TGF-β1 acts synergistically with BMP-7 to induce bone formation in the rectus abdominis muscle of primates.

BMP-2 has been detected in osteocytes integrated within newly formed bone islands. The presence of BMP-2 in these cells suggests its role in maintaining bone homeostasis in metaplastic bone formation within nasal polyps. In vitro studies have also shown that non-osteogenic mesenchymal cells, such as extramedullary adipocytes and myoblasts, can undergo osteogenic differentiation in the presence of BMP-2, which may act similarly on aberrant mesenchymal cells found in nasal polyps.[2,4]

A case report

A 63-year-old female patient presented with a sensation of throat discomfort. Apart from this symptom, which lasted for one week, she had no other complaints, including weight loss or nasal bleeding. A routine nasal examination revealed an abnormal mass in the right nasal cavity. The

patient was referred for an otolaryngology endoscopic evaluation.

She was diagnosed with acute sinusitis accompanied by a right nasal polyp (Figure 2.1). Additionally, the left middle turbinate was adherent to the nasal septum. The patient had a history of sinus surgery 15 years prior but no other significant medical conditions.

After three weeks of medical treatment with systemic and topical corticosteroids, there was no reduction in the size of the right nasal mass. A CT scan of the sinuses was performed, revealing mucosal thickening in the maxillary, ethmoid, and sphenoid sinuses, suggestive of chronic sinusitis. A space-occupying lesion was noted in the right nasal cavity, located between the inferior and middle turbinates and extending from the anterior ethmoid sinus (Figure 2.1).

The patient underwent surgery, and histopathological examination confirmed the presence of a nasal polyp with osseous metaplasia (Figure 2.3). At the six-month follow-up, there was no evidence of polyp recurrence.

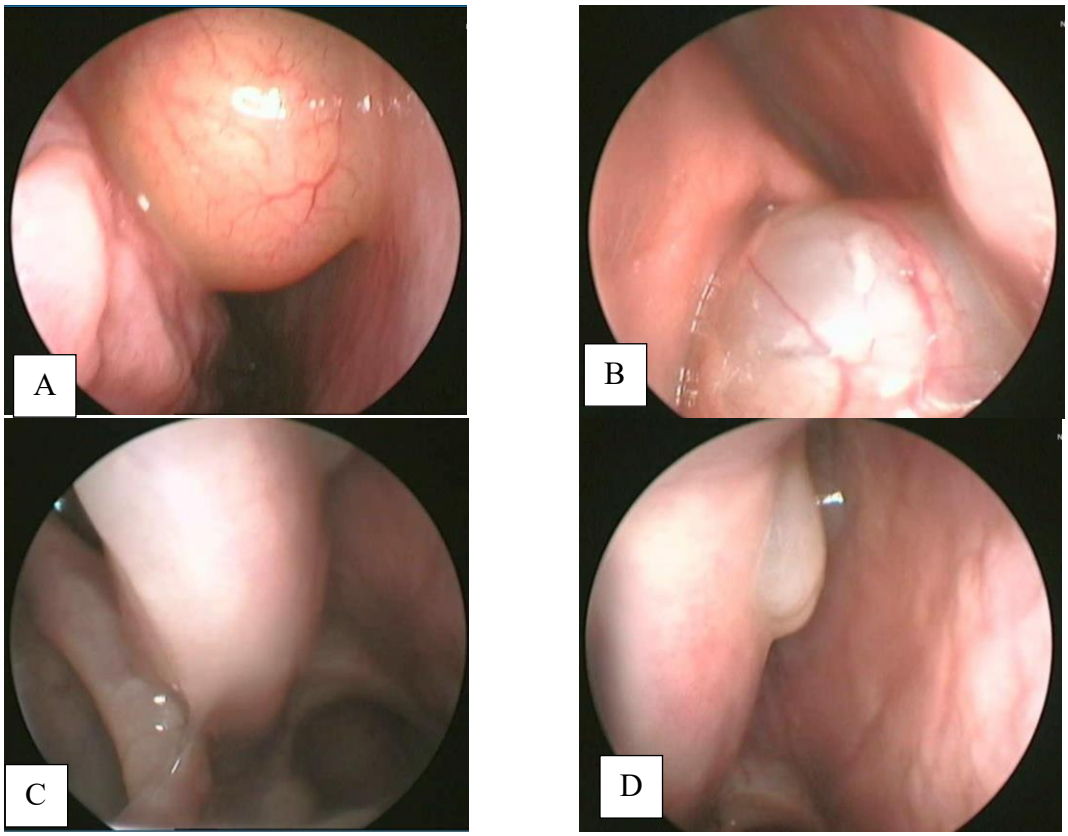

Figure 2.1: Right nasal polyp on endoscopy (Figures A, B) and the right maxillary sinus ostium, which was previously surgically enlarged (C), polypoid change of the middle turbinate (D).

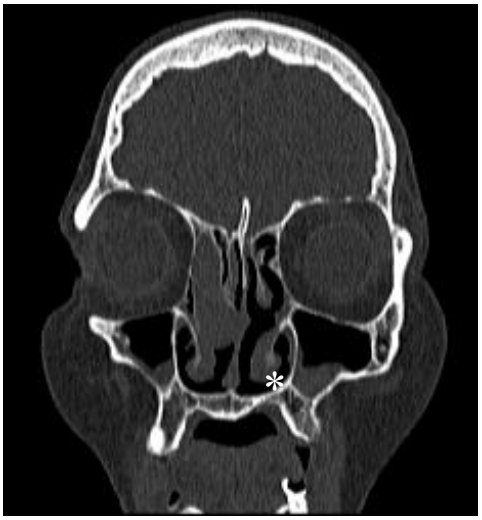

Figure 2.2: The CT scan images show a polyp originating from the roof of the anterior ethmoid sinus, extending between the right middle and inferior turbinates. The heterotopic bone arises from the anterior ethmoid and forms a bony shell that almost completely encases the polyp.

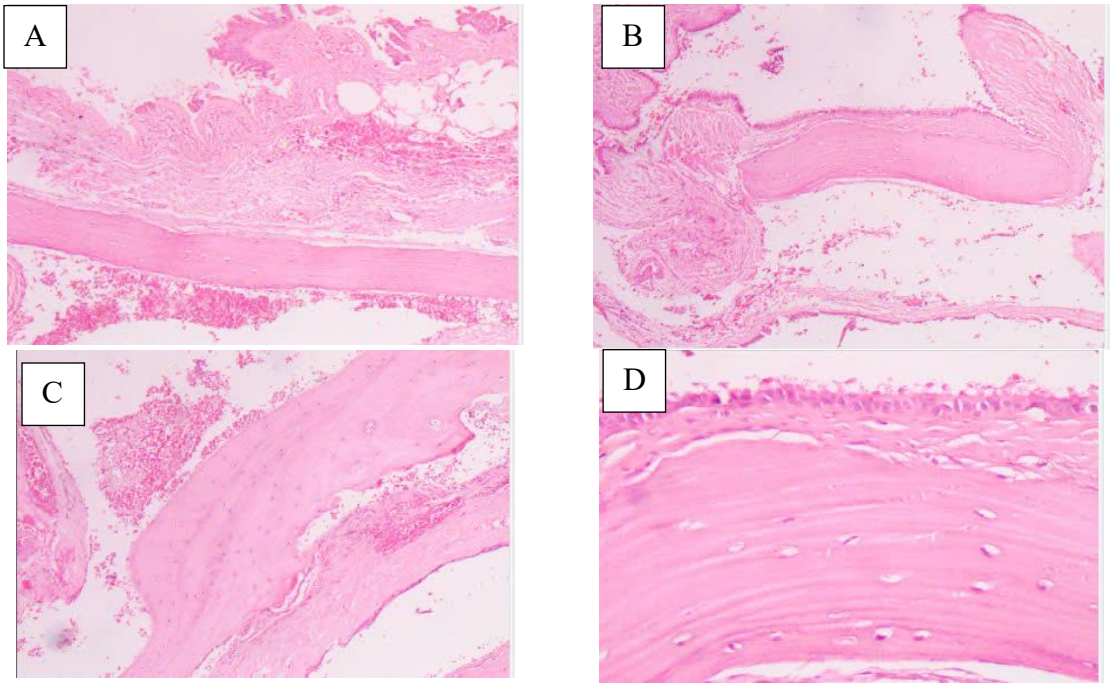

Figure 2.3: Histopathological examination reveals mature spongy bone within the stromal tissue of the polyp, covered by a respiratory epithelial layer. The stroma exhibits fibroblastic proliferation with numerous fibroblasts, vascular proliferation, edema, and a few inflammatory cells such as polymorphonuclear leukocytes, lymphocytes, and plasma cells (Figures A, B, C). The overlying epithelium shows mild, benign hyperplasia (Figure D).

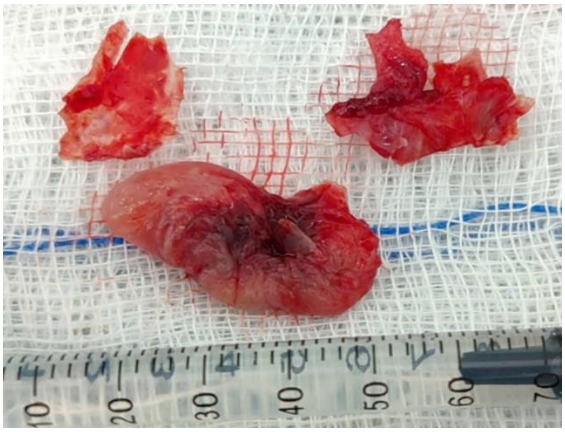

Figure 2.4: The polyp mass, along with the surrounding bony shell, was removed in the surgery

Review and discussion

Osseous metaplasia in nasal polyps is rare. While metaplastic ossification has been reported in polyps of the stomach, rectum, colon, and uterus, its occurrence in nasal polyps remains uncommon. Squamous metaplasia is more frequently observed in nasal polyps, while ossification is extremely rare. Some authors speculate that its low reported incidence may be due to underdiagnosis. [5]

Table 0.1: Some reported cases of nasal polyps with osseous metaplasia in medical literature

Author	Polyp Attachment Site	Surgical Method
De Vries N (1988) 6	Anterior and posterior ethmoid (L)	Endoscopic nasal surgery
Jacono AA (2001) 2	Nasal septum (L)	Endoscopic nasal surgery + Transoral polyp removal
Márquez Moyano JA (2007) 7	Maxillary sinus (R)	Endoscopic nasal surgery
Yilmaz M (2012) 8	Maxillary sinus (R)	Endoscopic nasal surgery
Lee DH (2013) 9	Nasal cavity (L)	Endoscopic nasal surgery
Shafii M (2013) 10	Inferior turbinate (R)	Endoscopic nasal surgery
Cho IY (2016) 11	Nasal septum (R)	Endoscopic nasal surgery + Transoral polyp removal
Promsopa C (2016) 12	Nasal septum (L)	Endoscopic nasal surgery + Transoral polyp removal
Mandal S (2019) 13	Maxillary sinus (L)	Endoscopic nasal surgery + Transoral polyp removal
Mat Q (2020) 14	Posterior ethmoid (L)	Endoscopic nasal surgery + Transoral polyp removal
Testa D (2020) 15	Lateral wall of the nasopharynx (L)	Endoscopic nasal surgery + Transoral polyp removal
Lê Đức Thành Nhân (2024)	Anterior ethmoid (R)	Endoscopic nasal surgery

The patient in this case had undergone sinus surgery 15 years earlier, supporting the hypothesis that prior nasal surgery might contribute to osseous metaplasia in nasal polyps. Previous case reports have consistently described unilateral involvement, and no recurrences have been reported.[2,6-15] However, in this case, the follow-up period was only six months, further observation is needed to assess the risk of recurrence.

The exact mechanism of osseous metaplasia remains unclear. However, reports from the United States indicate that mesenchymal cells in polyp stroma differentiate into osteogenic precursors and subsequently mature into osteoblasts under the influence of bone morphogenetic proteins (BMPs) and transforming growth factor beta-1 (TGF-β1). It has also been reported that mesenchymal cells within polyps can differentiate into osteoblasts when there is an increased local secretion of alkaline phosphatase. The effect of BMPs may be related to the regulation of increased type 1 collagen and osteonectin. In summary, ossification may result from the overexpression of BMPs and TGF-β1, which trigger osteogenic signaling in multipotent cells within the polyp stroma. These cells can then differentiate into osteogenic precursors. Additionally, there is a possibility that stem cells undergo dedifferentiation into multipotent cells before transforming into osteogenic precursors.

Differential diagnoses for high-density lesions on sinus CT scans include rhinoliths, fungal masses, inverted papillomas with calcification, chondromas, osteomas, fibrous dysplasia, and sinonasal carcinoma with osseous metaplasia (which is rare). However, in this clinical case, the osseous metaplasia was highly distinctive as it formed a bony shell almost completely encasing the polyp (Figure 2.4), a feature that has never been reported in the literature before.

Two key clinical signs that help differentiate this condition from malignant causes are the absence of nasal bleeding and the lack of bone destruction on CT imaging. MRI is recommended when there is suspicion of an inverted papilloma (which may show osseous hyperplasia, bone thinning, and lobulated masses on CT) or malignancy. Histopathological examination is essential for a definitive diagnosis of osseous metaplasia, characterized by inflamed and edematous stroma containing mature lamellar bone, covered by respiratory epithelium.

Currently, endoscopic sinus surgery remains the preferred treatment for nasal polyps with osseous metaplasia. For large tumors, piecemeal resection or a transoral approach may be required.

Conclusion

Although osseous metaplasia in nasal polyps is rare, awareness of this condition is crucial for differential diagnosis. Reported cases suggest that this pathology is benign and typically unilateral. The ectopic bone may develop inside or surround the polyp mass. Unlike conventional nasal polyps, it does not appear to have a tendency for recurrence after complete excision. Endoscopic sinus surgery is currently the recommended treatment. However, extensive osseous metaplasia can complicate surgical resection, potentially increasing the risk of postoperative complications.

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