Cholesterol Granuloma of the Maxillary Sinus

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Cholesterol granuloma is usually associated with chronic middle ear disease and is common in the mastoid antrum and air cells of the temporal bone. It has also been reported in other parts of the skull, such as the frontal and maxillary sinuses and orbit. Cholesterol granuloma is rare in the paranasal sinuses. We report a new case of cholesterol granuloma in the maxillary sinus of a 38-year-old man who underwent surgical excision. We also review the literature and discuss the mechanism of development for this lesion. The resected specimen showed fragments of respiratory mucosa with cholesterol clefts surrounded by multinucleated foreign-body giant cells. Some multinucleated foreign-body giant cells showed asteroid bodies. Hemorrhagic areas, hemosiderin-laden macrophages, chronic inflammatory cells, and dilated lymphatics vessels were seen as well. Increased intrasinus pressure due to drainage obstruction may affect venous and lymphatic drainage from the sinus cavity, leading to venule microhemorrhages while still allowing arterial blood into the sinus mucosa and further contributing to a large localized hemorrhage. Lymphatic drainage may be insufficient to completely remove the lipid components of the red blood cells, and the lipid accumulation may contribute to the formation of cholesterol crystals and their esters.


Cholesterol granuloma is a histopathologic term describing a large number of clefts present after cholesterol crystals have dissolved during processing, with surrounding foreign-body giant cells, foam cells, and macrophages filled with hemosiderin embedded in fibrous granulation tissue.1,2 Cholesterol granuloma is very rare in the paranasal sinuses. To our knowledge, only 44 cases have been reported since 1964, 12 of which were reported in the last 10 years.1–7 Cholesterol granuloma is seen associated with chronic middle ear disease, most frequently in the mastoid antrum and air cells of the temporal bone.8 It has also been reported in the skull (as an intradural lesion), the lungs, jaw, testis, kidney, lymph nodes, and breast papilloma. We report a case of cholesterol granuloma arising in the maxillary sinus and review the literature.

REPORT OF A CASE

A 38-year-old African American man presented with a history of severe sinus congestion and frequent headaches for 2 years. Initially, the symptoms were seasonal, but later they became persistent despite medical treatment. The clinical diagnosis was chronic sinusitis. Radiographic evaluation revealed bilateral ethmoid lesions and complete opacification of right maxillary sinus. Nasal endoscopy demonstrated bilateral enlarged inferior turbinates. The middle turbinates were enlarged and narrowed the access to the middle meatus. The preoperative diagnosis was chronic sinusitis with left maxillary soft tissue mass. Surgery was performed under general anesthesia. A bilateral functional endoscopic sinus surgery, bilateral middle turbinectomy, middle meatus antrostomy, anterior and posterior ethmoidectomy, sphenoidectomy, removal of right maxillary sinus mass, and bilateral inferior turbinectomy out-fracture were performed.

MATERIALS AND METHODS

Tissue specimens were fixed in 10% buffered formalin; sections were routinely processed and embedded in paraffin. Four-micrometer cross sections of tissue were stained with hematoxylin-eosin and Gomori methenamine-silver. The sections also were examined under polarized light.

PATHOLOGIC FINDINGS

Specimens from right and left ethmoid sinus, as well as right maxillary sinus contents, were submitted. Sinus contents consisted of 2 pieces of soft tissue measuring 3 × 2.5 × 0.7 cm in aggregate. One of the fragments was soft, covered by smooth pink-white-tan mucosa, and appeared to be firm. Histologic examination of the maxillary mass showed fragments of tissue lined by respiratory epithelium with a large number of submucosal cholesterol clefts (Figure 1). Many histiocytes and multinucleated foreign-body giant cells surrounded the cholesterol clefts (Figure 2); some giant cells showed asteroid bodies (Figure 3). Areas of recent and old hemorrhage, hemosiderin-laden macrophages, mucosal edema, dilated lymphatic vessels, lymphocytes, and plasma cells in the subepithelial connective tissue were also seen. The Gomori methenamine-silver stain for fungal organisms was negative. The histopathologic findings were consistent with cholesterol granuloma. Examination of the right and left ethmoid sinus specimens revealed mild chronic inflammation with rare eosinophils.

COMMENT

Granulomatous inflammation is a common tissue response to a wide variety of stimuli, including foreign bodies and infectious agents, as well as other substances. Thus, cholesterol granuloma is a foreign-body reaction to...
the presence of cholesterol crystals formed during the inflammatory process.2,4

Sinonasal cholesterol granuloma usually presents in patients with a history of rhinitis or sinus disease (or sinus surgery) with facial pain, headache, nasal obstruction, and nasal discharge.2-4 Radiologic features may suggest the diagnosis of cholesterol granuloma in the minority of cases. Cholesterol granuloma may appear as a cystlike expansion within the sinus cavity accompanied by expansion of the bony walls of the involved antrum.3 Bone erosion may be seen but is not the rule.2-4 The histologic appearance of cholesterol granuloma is diagnostic.1-6 Thus, all reported cases are similar: dense masses of cholesterol crystals appearing as clefts surrounded by foreign-body giant cells, plasma cells, foam cells, and lymphocytes.1-6 The intermixed cleftlike spaces represent cholesterol crystals that have dissolved due to alcohol used in the staining procedure.1-6 In our case, in addition to the characteristic elements previously described for cholesterol granuloma, we found multinucleated giant cells with asteroid bodies, pools of red blood cells, hemosiderin-laden macrophages, and dilated lymphatics. Asteroid bodies are stellate, acidophilic, cytoplasmic inclusions; they are a product of giant cell formation and are observed nonspecifically in other granulomatous reactions, such as sarcoidosis, tuberculosis, leprosy, histoplasmosis, and some foreign-body reactions.

Cholesterol granuloma is treated with radical surgical techniques and an endoscopic approach.6-9 Kunt et al recommended that pathologic examination should be performed on all specimens obtained from paranasal sinus surgery, because cholesterol granuloma in the maxillary sinus may be mistaken for chronic sinusitis. It has been suggested that the pathogenesis of paranasal cholesterol granuloma is due to 3 factors, namely, disturbed ventilation, impaired drainage, and hemorrhage into a bony cavity with subsequent hemolysis and accumulation of cholesterol from red cell membranes.3,7,10

Based on available clinical information and experimental studies, the key factors are prolonged inflammation and obstruction of a bony cavity that is normally aerated. In experimental work by Niho6 and Main et al,10 the isolation of a hemorrhage in a small area without ventilation was important in the pathogenesis of cholesterol grani-
lomas. Niho\textsuperscript{5} suggested that the cholesterol deposits were a fatty degeneration of the connective tissue in a cavity obstructed by inflammation.

It has been postulated that the process starts with hemorrhage.\textsuperscript{1} We believe that increased intrasinus pressure due to drainage obstruction may affect the venous and lymphatic drainage from the sinus cavity, leading to venule microhemorrhages while still allowing arterial blood into the sinus mucosa, further contributing to a large localized hemorrhage. In this circumstance, the lymphatic drainage may be insufficient to completely remove the lipid components of the red blood cells, and the lipid accumulation may contribute to the formation of cholesterol crystals and their esters. Additional studies based on an experimental model may improve our understanding of this entity.

References