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Odontogenic keratocyst in Gorlin-Goltz syndrome

Gorlin-Goltz syndrome (known by a number of different names such as Gorlin's syndrome, nevoid basal cell carcinoma syndrome and basal cell naevus syndrome) is an autosomal dominant disorder linked to 9q22.1-q31 chromosome (2, 5). The syndrome has complete penetrance and variable expressivity with about 35% to 50% representing new mutations, thus these cases do not have a positive family history (7, 8, 12). Although rare, odontogenic keratocyst is one of the most common multifactorial anomalies that challenge dentists and maxillofacial surgeons (12). Clinical manifestations of the syndrome are exteremely pleomorphic (7). At present the diagnosis of the syndrome rests on major criteria which are: basal cell naevi on the skin, jaw cysts, calcifications of the falx cerebri and parakeratosis of the palms and soles. Minor criteria consist, among others, of facial dysmorphosis, costal abnormalities, spina bifida and kyphoscoliosis (3).

Odontogenic keratocyst is a developmental odontogenic cyst with a distinctive microscopic appearance that originates from the dental lamina (9). Although the lesion constitutes only 3% to 11% of all jaw cysts, it is often of great concern to clinicians because of its high recurrence rate, aggressive behavior, and association with the nevoid basal cell carcinoma syndrome as it is found in 75–80% of the affected patients (2, 4, 5, 6, 8, 11, 13). Therefore, the aim of the paper was the presentation of histological, clinical, and radiological features of odontogenic keratocyst in Gorlin-Goltz syndrome.

ODONTOGENIC KERATOCYST

Since the first description of odontogenic keratocyst was published in 1956, the lesion has been of particular interest because of its specific histopathologic features, high recurrence rate, and aggressive behaviour (10). It is the most frequent jaw cyst found in Gorlin-Goltz syndrome as it is discovered in approximately 75–80% of patients (2, 5, 6, 8, 11, 13). Multiple odontogenic keratocysts are frequently associated with the syndrome

(10, 12). They develop at an early stage of the disease, that is in the first decade of life and can be seen as early as 7 to 8 years of age, earlier than when they are found in isolation (2, 3, 5, 6, 8, 11, 13). The peak incidence of occurrence is in the second and third decades (3, 11). In 80% the first tumor occurs by the age of 20 (5). As the odontogenic keratocysts are easy to detect, they are of considerable diagnostic value in Gorlin-Goltz syndrome as they frequently form earlier than the basal cell naevi (3, 6, 11). However, they are known to be lacking in some cases of basal cell carcinoma (11).

Odontogenic keratocysts are found more commonly in the mandible than in the maxilla (2, 4, 10) and mandibular involvement occurs three times as often as that of maxilla (6). Moreover, the cysts are more prevalent in the posterior portions of the body and ramus of the mandible (8). They are of varying sizes, may be single or multiple and unilateral or bilateral (2).

HISTOLOGICAL FEATURES

The keratocysts in Gorlin-Goltz syndrome are identical to the isolated odontogenic cyst first described by Pindborg (12). They exihibit a characteristic histology, which consists of a thin layer of parakeratin (2), however keratinization alone is not a finding specific to the odontogenic keratocyst because other odontogenic cysts can produce keratin as well (4). Although the origin of the cyst has not been ultimately ascertained, most researchers believe that it forms from the dental lamina (12).

The underlying epithelium is almost universally eight cells thick with the most basal layer having polarized nuclei described as a "picket fence" or "tombstone" appearance (2, 4). There is a thin spinous cell layer that often shows a direct transition from the basal cell layer. The cells of the spinous cell layer frequently exhibit intracellular edema. Keratinization is predominantly parakeratotic and the keratin layer is often corrugated. The fibrous cyst wall is generally thin and usually uninflamed (4).

CLINICAL PRESENTATION

Odontogenic keratocysts are frequently symptom-free and found incidentally in a patient who is being treated for other dental problems (4, 10). This is consistent with the common belief that in the mandible the lesion tends to grow silently within the cancellous bone to a considerable size before any significant buccal or lingual expansion takes place to alert the clinician and the patient of the underlying pathology. However, due to the presence of the maxillary sinus and the relatively thin bone, in maxilla the lesion expands spherically and is found earlier. The cyst is frequently associated with an impacted tooth, in some cases with more than one impacted tooth (4).

Localized swelling appears to be the most frequent presenting sign. Spontaneous discharge or drainage of cyst fluid is also common (4, 9). There was described the presentation of odontogenic keratocyst as a nasal mass (1). Parasthesias and trismus are less frequent initial manifestations (9). Other clinical signs and symptoms include root resorption and dilaceration of adjacent dental roots as well as displacement of adjacent tooth germs (13). Odontogenic keratocysts may result in fractures as they grow (13).

RADIOLOGICAL SIGNS

Radiographically the odontogenic keratocyst may be unilocular with a thin sclerotic border in smaller lesions. Larger lesions tend to be multilocular (8, 9). The cysts present as well-limited, radiolucent areas clearly outlined by a thin border of condensed bone tissue. In some cases, especially after suppuration or perforation, this border is less distinct. Impacted or unerupted teeth in the radiolucent areas give the radiographic impression of a dentigerous cyst (4). Occasionally the teeth or roots are displaced or resorbed and when an odontogenic keratocyst is aggressive enough, it causes the radiographic appearance of "floating teeth" (8).

In Gorlin-Goltz syndrome the cysts frequently are multiple, bilateral, often contiguous, though distinctly separated from each other by partitions (Fig. 1). Sometimes the

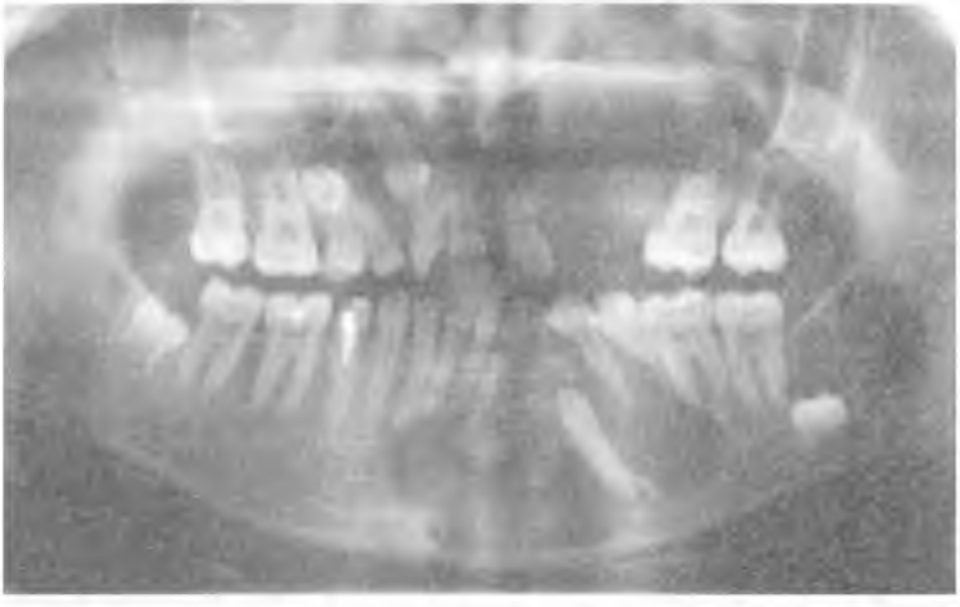

Fig. 1. On panoramic radiogram there are visible multiple, bilateral, maxillary and mandibular radiolucencies as well as retained lower right canine and third molar associated with the cysts. The cystic lesions proved to be odontogenic keratocysts

cysts are symmetrical. They may invade the maxillary sinus and involve the ramus or the body of the mandible (3).

Although a thorough review of radiographs may even reveal some of the more subtle features of jaw cysts, e.g. focal areas of perforation, only 50% or less of all odontogenic keratocysts are identified on the conventional films (14). Computed tomography (CT) studies are excellent for evaluating bony boundaries (Fig. 2) (8), can determine the ex-

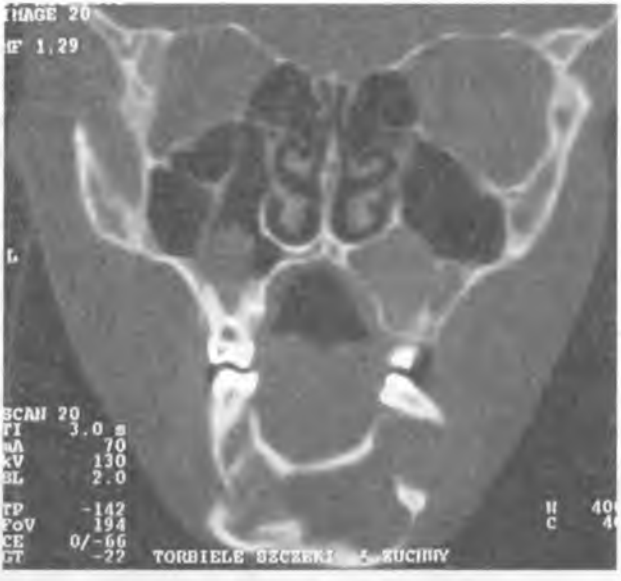

Fig. 2. Coronal computed tomography image very well presents bony boundaries of maxillary and mandibular cysts in the same patient. There is also visible a soft-tissue mass in the left maxillary antrum

tent of these lesions and identify the areas of critical breakthrough as well as involvement of the teeth (Fig. 3) (1). Yet due to relatively high radiation exposure, CT should be reserved for large lesions, particularly these involving the maxilla, where extension into the nasal cavity, orbit or pterygomaxillary space must be evaluated (9).

Soft tissue details and certain fluid features are well characterized by means of magnetic resonance imaging (MR). Usually in cases of suspected odontogenic keratocysts the MR examination consists of T1-weighted sequences in at least two planes, without and with contrast administration, as well as a T2-weighted sequence in a single plane. The MR finding of amorphous, isointense, non-enhancing mass within a jaw cyst suggests an odontogenic keratocyst. Together with a cyst wall which is usually non-enhancing, these imaging characteristics serve as the most significant differential diagnostic features. Thus the need of biopsy prior to definitve management is avoided and the risk of satellite cyst implantation is reduced (14). Moreover, MR overpasses CT especially in areas where CT

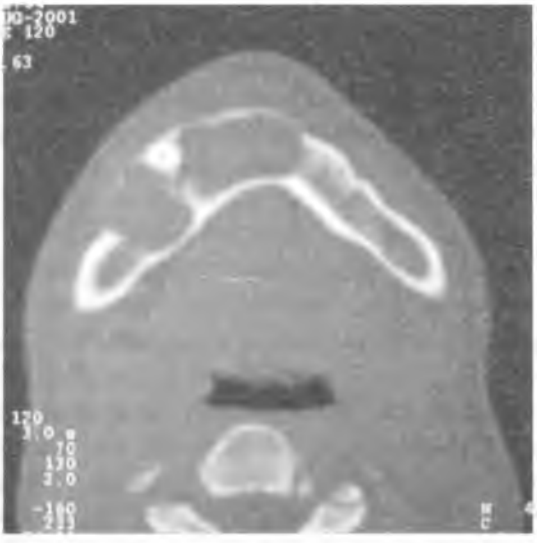

Fig. 3. Axial CT scan allows evaluation of relation of retained right lower canine to mandibular odontogenic keratocysts

images are degraded by metallic scatter or bone-hardening artifacts or where direct clinical examination of the marsupialized keratocysts is obscured (8).

Ameloblastoma, minimally calcifying odontogenic cyst, adenomatoid odontogenic tumor and ameloblastic fibroma should be taken under account in differential diagnosis (9). The preoperative distinction between these lesions typically is not possible by clinical or radiologic means. Since the majority of these lesions are treated in identical fashion, preoperative fine-needle aspiration biopsy remains controversial (9, 10).

RECURRENCE

The recurrence rate of odontogenic keratocyst ranges from as low as 3% to as high as 62.5% (4, 10, 12, 13) and is significantly higher (60%) in patients with basal cell naevus syndrome. Therefore, there is the need for more aggressive initial surgical management and closer follow-up in the population of patients with documented Gorlin-Goltz syndrome (9). It is believed that high recurrence rate is due to the presence of satellite cysts, budding of the cyst lining and the remnants of cyst epithelium remaining after enucleation (2, 4, 12).

Recurrence may occur 10 or more years after the first treatment (4). Appropriate follow-up for patients with primary odontogenic keratocysts following surgical therapy seems to be a yearly panoramic X-ray as the majority of recurrences is documented within a 5-year period (9).

Odontogenic keratocyst can also be locally aggressive and for example skull base penetration by such maxillary cyst has been described (9, 10). Additionally the odontogenic keratocyst has a rare but reported incidence of malignant transformation in the adult population with transformation to squamous cell carcinoma being the most common (9, 10). It may also rarely be transformed into ameloblastoma (13).

METHODS OF TREATMENT

Early onset of treatment may contribute to reduction of destruction of maxilla and mandible (13). Treatment of odontogenic keratocysts should reduce the potential for recurrence and keep morbidity to a minimum. The importance of reducing the incidence of recurrence means that careful removal of the entire cyst with minimal fragmentation of the specimen is crucial. The lining of the cyst is thin and makes removal very difficult (2). Among treatment modalities there are proposed: enucleation and curettage followed by application of Carnoy's solution – an alcohol-based tissue fixative, marsupialization, cryotherapy or *en block* resection (2, 12). More radical methods such as peripheral ostectomy with a bone bur or resection of the affected jaw have been advocated as means of lowering recurrence by removing remaining epithelium (10).

In conclusion, odontogenic keratocyst is often of great concern to clinicians because of its high recurrence rate, aggressive behaviour and association with the nevoid basal cell carcinoma syndrome. The presence of multiple odontogenic keratocysts should alert a dentist of the possiblity of recognition of Gorlin-Goltz syndrome.

REFERENCES

1. Al-Anazy F. H., Zazouk S. M.: Otolaryngological manifestation of Gorlin-Goltz syndrome. J. Lar. Otology, 111, 286, 1997.
2. Crean S. J., Cunningham S. J.: Gorlin's syndrome: Main features and recent advances. Br. J. Hosp. Med., 56, 392, 1996.
3. De Kersaint-Gilly A. et al.: Etude neuroradiologique de la naevomatose basocellulaire. J. Neuroradiol., 12, 200, 1985.
4. Hsun-Tau C.: Odonogenic keratocyst. A clinical experience in Singapore. Oral Surg. Oral Med. Oral Pathol., 86, 573, 1998.
5. Kimonis V. E. et al.: Clinical manifestations in 105 persons with nevoid basal cell carcinoma syndrome. Am. J. Med. Gen., 69, 299, 1997.
6. Lambrecht J. T., Kreusch T.: Examine your orofacial cleft patients for Gorlin-Goltz syndrome. Cleft Palate-Craniofac. J., 34, 342, 1997.

7. Lo Muzio L. et al.: Nevoid basal cell carcinoma syndrome. Clinical findings in 37 Italian affected individuals. Clin. Gen., 55, 34, 1999.
8. Lovin J. D. et al.: Gorlin's syndrome with associated odontogenic cysts. Pediatr. Radiol., 21, 584, 1991.
9. Meara J. G. et al.: The odontogenic keratocyst: A 20-year clinicopathologic review. Laryngoscope, 108, 280, 1998.
10. Myoung H. et al.: Odontogenic keratocyst: Review of 256 cases for recurrence and clinicopathologic parameters. Oral Surg. Oral Med. Oral Pathol., 91, 328, 2001.
11. Owens S. C. et al.: Gorlin's basal cell nevus syndrome. Arch. Otolaryngol. Head Neck Surg., 112, 773, 1986.
12. Posnick J. C. et al.: Maxillofacial considerations for diagnosis and treatment in Gorlin's syndrome: access osteotomies for cyst removal and orthognathic surgery. Ann. Plast. Surg., 32, 512, 1994.
13. Romero Maroto M. et al.: The role of orthodontist in the diagnosis of Gorlin's syndrome. Am. J. Orthodont. Dentofac. Orthoped., 115, 89, 1999.
14. Van Rensburg J. et al.: Correlating imaging and histopathology of odontogenic keratocyst in the nevoid basal cell carcinoma syndrome. Dentomaxillofac. Radiol., 26, 195, 1997.

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SUMMARY

Gorlin-Goltz syndrome is an autosomal dominant disorder characterized by exteremely pleomorphic clinical manifestations including multiple odontogenic keratocysts. These cysts constitute only 3% to 11% of all jaw cysts, but are often of great concern to clinicians because of high recurrence rate, aggressive behavior and association with Gorlin-Goltz syndrome as they are found in 75-80% of the affected patients. In the paper there were presented histological, clinical, and radiological features of odontogenic keratocyst in Gorlin-Goltz syndrome.

Torbiel naskórkowa w zespole Gorlina-Goltza

Zespół Gorlina-Goltza jest zespołem dziedziczonym autosomalnie dominująco, cechującym się różnorodnymi objawami klinicznymi, do których należy między innymi występowanie mnogich torbieli naskórkowych szczęk. W populacji torbiele te stanowią jedynie od 3 do 11% wszystkich torbieli szczęk, ale są ważne dla klinicysty ze względu na wysoką częstość wznowy, a także występowanie w zespole Gorlina-Goltza, jako że znajdowane są u 75-80% pacjentów z tym zespołem. W pracy opisano obraz histologiczny, kliniczny i radiologiczny torbieli naskórkowych w zespole Gorlina-Goltza.