Analysis of odontogenic cysts of the jaws

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Key words: granuloma, cystgranuloma, radicular and follicular cysts.

Summary. In this study 850 cases of odontogenic cysts of the jaws, treated in Kaunas University of Medicine Hospital during the period of 1986–2004, were analyzed in order to evaluate the incidence of these cysts and other aspects of clinical and therapeutic interest such as their clinical features, changes they caused in the facial and mandible structures, and the teeth that had caused the pathology. Case histories of 455 men and 395 women had been analyzed. The age of the patients varied from 4 to 87 years, with the average of 35.8. More than half of the diagnosed cysts (63%) were present in the maxilla, 37% of them – in the mandible. The common complaints of the patients were bump, swelling, pain, discharge leaking from the fistula or alveolus after tooth extraction, increased teeth mobility, paresthesia; changes in the maxillofacial system – intraoral or facial asymmetry, inflated bone with sensation of an egg shell cracking revealed under palpation, swelling at the mucofacial fold, mobile teeth and fistula. While comparing the causative groups of antagonistic teeth in the maxilla and mandible, we found the proportion to be (in order from the right to the left): molars – 1:1, premolars 1.3:1, fore teeth – 3.3:1, fore teeth 3.8:1, premolars 1.2:1, molars 0.7:1.

Odontogenic cysts may be present in both sexes; maxillary cysts are 1.5 times as frequent as mandibular cysts. The pathology may equally affect both sides of jaws, most cysts being diagnosed in the maxillary fore teeth area from tooth 13 to tooth 23. The following pairs of changes in maxillofacial system are frequently present: inflated body of bone or alveolus – increased mobility of teeth; the formed fistula – swelling at the mucofacial fold, swelling at the mucofacial fold – pain. The applied treatment of cysts was surgical – cystotomy or cystectomy.

Introduction
An overview of the newest medical publications in Lithuania has not revealed any studies being held, concerning odontogenic cysts of the jaws, therefore, data obtained from foreign authors’ publications are referred, which may vary from the results of this study. We expect that this study will broaden the knowledge about the pathology, which is being treated by the maxillofacial and oral surgeons.

According to the International Classification of Diseases (ICD-10), odontogenic cysts are classified into: radicular cysts, which further may be divided into apical, periapical, and residual, and embryogenic cysts, further classified into follicular and lateral periodontal. Cysts also may be classified according to the covering epithelium (1) (Fig. 1). They may develop from normal as well as from proliferated epithelium of jaws (gingival rests of Serres, rests of Malassez) (1, 2).

The formation of radicular cysts is associated with epithelial cellular inclusions in the apical area of the tooth root. These cysts derive from the remnants of embryogenic epithelium, so called Malassez cells, or epithelial debris (1, 2). The epithelial inclusions are being irritated by the periodontal inflammatory process, which results in their growth and proliferation, ending with formation of microscopic cavities, gradually filling with transudation. A cystgranuloma

Fig. 1. Schematic drawing of cyst
A – connective tissue wall forming the cyst capsule; B – various types of epithelium that can line the inner surface of the cyst.
forms as a reaction to the transudation-induced pressure increase. The volume of the cystic formation expands because of the pressure, inducing the resorption of cancellous and finally, cortical bone. The pressure of transudation may vary from 1.3 kPa (10 mmHg) to 10.7 kPa (80 mmHg), depending upon the intensity of the inflammatory process (1, 3).

The expanding of the cysts of the jaws depends on their preoccupied anatomic area. The expanding mandibular cyst displacing mandibular canal grows into the in-laying strand of nerves and vessels. If the third molar is involved in the process (38, 48), the cyst grows disrupting the ramus and angular region of the mandible. The maxillary cysts tend to displace the fundus of nasal cavity; if the maxillary sinuses, giving ground to the root apexes, are well developed, the cyst grows gradually into the sinus cavity, displacing its fundus. The growing cyst may not cause as well any facial deformations (4–6). According to the medical literature, the most common sources of the deforming cysts are teeth 16, 26, 15, 25, 14, 24, rarely teeth 17, 27, 13, 23 may be involved, as well as central and lateral incisors. The growth of the cyst causes the atrophy of the nerve and vessel strand, entering the root apex, which leads to the insufficient bloodsupply to the tooth pulp and finally pulp necrosis (1, 7).

Clinical findings. During the first stage when there are no visible deformations neither in the alveolar process, nor in the body of the maxilla, the cyst or cystgranuloma usually develops asymptomatically, thus the lesion may be diagnosed only radiographically (Fig. 2–5).

Radiographic findings may include a well-defined radiolucency in the focus of bone destruction (7–9). As the cyst grows, visible facial asymmetry may appear. A change in configuration of the alveolar process or body of the jawbone may be observed as a round prominence. The size of the prominence varies according to the development stage of the cyst ranging from a pea size to a size of an egg. Neither gingiva nor periosteum above the prominence is anyhow shifted (4). A sensation of an eggshell cracking may be felt under the finger pressure. As the atrophy of bone progresses, a window opens in the cortical part of the bone, with only periosteum and gingiva left above. For this reason a new symptom of fluctuation develops. Additionally, the roots of the adjacent teeth are

![Fig. 3. Radicular cyst in the orthopantomogram](image)
Destruction in the center of the mandible from tooth 33 to tooth 44; the filling of the root canal is observed to have leaked into the focus.

![Fig. 4. Residual cyst in the orthopantomogram](image)
Limited bone destruction of the mandible in the area of teeth 36 and 37.

![Fig. 5. Residual cyst in the orthopantomogram](image)
Bone destruction of the body and ramus of mandible.
displaced. The osteal rim of the periodontal pocket of the causative tooth is destroyed, thus it does not show in the radiogram (1, 4, 6). The puncture of the cyst reveals amber liquor with cholesterol crystals (5). In conclusion, the typical symptoms of the radicular cyst are: bone deformation, followed by the eggshell cracking symptom, fluctuation, specific puncture findings and divergence of roots.

In case of the infection of the cyst, additional symptoms appear: the blushing of the adjacent tissues, swelling, and infiltration. Bacteriologic examination often reveals cocci, Klebsiella, Gram-negative bacilli, Gram-positive microorganisms, and sporangium bacteria, Candida species, seldom obligate anaerobic forms of bacteria as well as bacteroids may be detected (1, 10).

The cyst suppuration may result from the infection in the tooth canal. The activation of the intracranial infection develops as a response to a general attenuation of the body. The factors that predispose this condition may be tooth trauma, stomatitis, gingivitis, fracture of jaws, sinusitis, the impairment of adjacent tissue integrity occurring during the operation, as well as incautious endodontic treatment. If the infection spreads into periostitis of jaws, the symptoms of this condition develop additionally (9, 10).

The follicular cysts are formed when the follicle cells proliferate forming the cystic tissue as a result of the impairment of germ tooth epithelium formation. A rudimentary, supernumerary or normal, fully or partly formed tooth may be detected inside the follicular cyst (1, 6, 7). Such tooth never germinates (i.e. it is found in the bone). The inner surface of the cyst is lined with stratified squamous nonkeratinizing epithe- lium (11). The predominant causative teeth are maxillary canines as well as maxillary and mandibular third molars. Sometimes the same person has a few follicular cysts. A presumption exists that it may be determined genetically (10).

Clinical findings. The symptoms of the follicular cysts are almost the same as those of the radicular cysts. A development of asymptomatic asymmetry of the body of the jawbone or alveolar process is typical for this lesion. There is a connection between anomalies of the teeth germination and the follicular cysts (6).

The typical radiological image of the follicular cyst is a round or oval well-delineated radiolucent defect of the bone, encompassing a part of an unerupted tooth or the whole tooth inside (Fig. 6, 7) (7). The results of the puncture are similar to those of the radicular cysts. The occurrence of the suppuration of the follicular cysts is even lower than that of the radicular cysts, and is connected with the gangrenous tooth (1).

**Fig. 6. Follicular cyst in the lateral radiogram of the mandible**
Bone destruction, encompassing the germ of tooth 45.

**Fig. 7. Follicular cyst in the orthopantomogram**
Cystic cavity, encompassing the germ of tooth 45, with persistence of tooth 85.

Differential diagnosis. Odontogenic cysts are to be differentiated from sarcomatosis, abscess, cystic form of adamantinoma, ameloblastic fibroma, periostitis, and osteomyelitis (1, 12).

The aim of this study was to analyze the cases of odontogenic cysts treated in the Clinic of Oral and Maxillofacial Surgery of Kaunas University of Medicine Hospital (KUMH) and to ascertain: 1) the sex, age and living place of the patients; 2) causative teeth and their groups; 3) changes in the mandibulofacial system associated with this pathology; 4) treatment applied.

**Material and methods**
The data, used in this study, were collected in the Clinic of Oral and Maxillofacial Surgery of KUMH. The case histories which included diagnoses of radicular (K04.8) and follicular (K09.0) cysts (according to the ICD-10) were analyzed. All the necessary information about the patients, such as demographic data, preliminary and final diagnoses, complaints, duration of treatment, causative teeth, size of the cyst, changes in maxillofacial system, operations, was found in their case histories (No. 003/a). Considering time, it was a
retrospective study, considering methods of gathering the material it is a duplication study, considering extent it is a longitudinal study, because it includes all clinical cases, treated in the department since 1986.

The statistic analysis of the data was performed with “SPSS 10” program package. Student's criterion (t) was used for parametric values and χ² was used for qualitative values in order to verify the hypothesis. The differences were considered statistically significant when p<0.05.

Results

We gathered 850 case histories, which included the diagnoses of radicular (K04.8) and/or follicular (K09.0) cysts (Fig. 8, 9). In 86.2% (n=733) of cases radicular cysts were diagnosed; 13.7% (n=117) of analyzed case histories included follicular cysts. Residual cysts comprising as much as 10.77% (79 out of 733) were also classified as radicular cysts.

The age of the patients varied from 4 to 87 years, with the average being 35.8 years (mode 33, median 34); 53.5% of them were men and 46.5% – women. The majority of patients as much as 72.5% (n=616) lived in towns and others (n=234) lived in villages. The distribution of patients according to the age groups, the proportion between men and women and the proportion between men and women from town/village are shown in Table.

Nearly three-fourths of all cases (63%, n=536) included maxillary cysts, 37% (n=314) included those in mandible. In 33 cases cysts were present not only in the body but also in the ramus of mandible. Cysts in right and left sides of the jaws distributed with a ratio of 1:1.1. While comparing the source groups of antagonistic teeth in the maxilla and mandible, we found the proportion to be (in order from the right to the left): molars – 1:1, premolars – 1.3:1, fore teeth – 3.3:1, fore teeth – 3.8:1, premolars – 1.2:1, molars – 0.7:1.

The common complaints of the patients were bump or swelling (48.71%, n=414), pain (41.6%, n=354), discharge leaking from the fistula or alveolus after

![Fig. 8. Distribution of odontogenic (radicular and follicular) cysts between both sexes](chart1)

![Fig. 9. Distribution of follicular cysts between both sexes](chart2)
tooth extraction (22.47%, n=191), increased teeth mobility (2.59%, n=22), paresthesia (2.35%, n=20); 13.29% (n=113) of the patients did not note any complaints.

The changes in maxillofacial system were as follows: extraorally – 37.41% (n=318) of patients had facial dissymmetry; intraorally – inflated bone and eggshell cracking symptom was present in 70.82% (n=602) of cases, swelling at the mucosal fold – in 60.23% (n=512), mobile teeth – in 17.64% (n=150), fistula – in 36.58% (n=311) and 53.17% (n=452) of patients complained of pain.

More than half of patients (n=490, 57.65%) were treated by odontologists in other institutions. The following procedures were performed: in 23.27% (n=114) of cases – extraction of causative tooth, in 29.79% (n=146) – incision, in 46.94% (n=230) – endodontic treatment of intracystic teeth.

The treatment of cysts was surgical: cystotomy or cystectomy (n=166, 19.53%). Other operations were performed together with elimination of the cyst, including the resection of the apex of the tooth root entering the cyst (n=401, 47.18%), extraction of causative tooth or its root (n=234, 27.53%), radical sinus operation, when the cyst overgrows the sinus (n=81, 9.53%). Some of the cystic cavities were filled with bone substitutes like Bio-oss. The following anesthetia was used in operations: combined – in 64.9% (n=550) of cases, general – in 23.8% (n=202), infiltrative – in 11.3% (n=96). Pharmaceutical treatment was used before and after surgical treatment. Less than one-fourth of patients (n=155, 18.24%) underwent antibacterial treatment; antiphlogistic and sedative treatment was administered to 11.17% (n=95) of patients, and 33.77% (n=287) of them underwent both antibacterial and antiphlogistic sedative treatment. The medium length of hospitalization was 8.21 days (median and mode 7, SD=4.8215).

**Discussion**

As this is a retrospective study, it has all the drawbacks, intrinsic to such kind of studies. It is not always possible to find the necessary data in the case histories; the control of the patients and the precision of the tests and examinations cannot be achieved. It is not possible to renew the lost information; besides, the interpretation of the data may be improper.

Odontogenic cysts were found in the patients with primary, mixed, permanent dentition or toothless. The mean age of patients was 35.8 More than two-thirds of the patients (68.2%, n=580) were of employable age (i.e. age varied from 20 to 60 years). A tendency in the ratio of affected men/women in different age groups was observed: in the age group of 20 to 50 years men were more prevalent in developing cysts than women. On the other hand women predominated among the patients younger than 20 and older than 50. The ratio of patients living in village to living in town in this study was 1:2.6.

Odontogenic cysts were more prevalent in the maxilla than in the mandible with the ratio of 1.5:1. This may be associated with the different bone structure of both jaws (1, 9). A very similar amount of cysts was diagnosed in both sides of the face. Comparing both sides of antagonistic teeth in the mandible and maxilla we found that there was no significant difference in molar and premolar teeth, this may be associated with the fact that the teeth of both of those groups are equally affected by caries, and that more follicular cysts were present in the mandibular premolars. A significant difference was observed in the assessment of frontal teeth, it may be associated with

**Table. The distribution of patients according to the age groups, the ratios of men to women, men living in village to town and women living in village to town**

<table>
<thead>
<tr>
<th>Age of patients (years)</th>
<th>Number</th>
<th>%</th>
<th>Ratio: men/women</th>
<th>Ratio: village/town men</th>
<th>Ratio: village/town women</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>170</td>
<td>20</td>
<td>1:1.2</td>
<td>1:2.5</td>
<td>1:3.1</td>
</tr>
<tr>
<td>[20–30]</td>
<td>162</td>
<td>19</td>
<td>1:0.8</td>
<td>1:2.2</td>
<td>1:1.7</td>
</tr>
<tr>
<td>[30–40]</td>
<td>195</td>
<td>23</td>
<td>1:0.7</td>
<td>1:2.1</td>
<td>1:4.0</td>
</tr>
<tr>
<td>[40–50]</td>
<td>119</td>
<td>14</td>
<td>1:0.6</td>
<td>1:2.3</td>
<td>1:4.8</td>
</tr>
<tr>
<td>[50–60]</td>
<td>103</td>
<td>12</td>
<td>1:1.0</td>
<td>1:4.7</td>
<td>1:4.7</td>
</tr>
<tr>
<td>[60–70]</td>
<td>69</td>
<td>8</td>
<td>1:1.3</td>
<td>1:2.0</td>
<td>1:2.3</td>
</tr>
<tr>
<td>&gt;70</td>
<td>32</td>
<td>4</td>
<td>1:1.3</td>
<td>1:2.5</td>
<td>1:1.6</td>
</tr>
</tbody>
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more frequent traumatism of frontal maxillary teeth: more follicular cysts were present in the canine area.

On the Student’s criteria (t) assessment the following correlations between the pairs of symptoms were estimated. If the body of the jaw bone is inflated, there is a 20.3% possibility that the teeth in that area will be more migratory (t=3.47); if the fistula is formed, in 66.2% of cases swelling at the mucofacial fold will be present (t=2.74), if the mucofacial fold is smoothened, there is a 61.9% possibility that the patient will feel pain (t=6.42).

As much as 57.65% (n=490) of all the patients, treated in the hospital for this condition were sent to the hospital after the unsuccessful treatment because of the recurrence of symptoms, suppuration of the cyst after the endodontic treatment, failing the alveolus to heal after tooth extraction. These conditions developed because of the doctors treating misdiagnosed complications (e.g. periostitis) and not the primary focus of the disease. Periostitis reappears after the incision if the cyst is not eliminated. Since cyst 0.5 cm in diameter may only be distinguished from granuloma in the histological examination, odontologists apply the endodontic treatment of the roots of the teeth and expect to attain the regenerative processes in the apical part of the focus (1). One more mistake in the treatment of cysts is the extraction of the causative tooth, which leads to alveolar failure or opening of the fistula. This results in the formation of the residual cysts, which comprised as much as 10.77% (n=79 of 733) of radicular cysts.

Conclusions

Odontogenic cysts were equally prevalent in both male and female patients. The cyst formation occurred without reference to patients’ dentition (primary, mixed, permanent); toothless patients might also be diagnosed with residual cysts.

Maxillary cysts were 1.5 times as frequent as mandibular cysts. The pathology may equally affect both sides of jaws. Comparing both sides of antagonistic teeth in the mandible and maxilla, most cysts were located in the area of maxillary fore teeth from teeth 13 to teeth 23.

The following pairs of changes in maxillofacial system were found to be characteristic: inflated body of the bone or alveolus – increased mobility of teeth; the formed fistula – smoothened (raised) mucofacial fold, smoothened (raised) mucofacial fold – pain.

The applied treatment was surgical removal of the cyst (cystotomy or cystectomy). The treatment is essential as the cyst has a potential to displace adjacent teeth or to cause the resorption of associated teeth root, besides it is a source of infection in the body; furthermore, pathologic fractures of jaws may occur.

Žandikaulių odontogeninių cistų analizė

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Raktažodžiai: granuloma, cistgranuloma, šakninė ir folikulinė cista.

fistulė – išsilyginusi (pakelta) pereinamoji raukšlė, išsilyginusi (pakelta) pereinamoji raukšlė – skausmas. Taikytas chirurginis cistų gydymas – cistotomija arba cistektomija.

References

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