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치의학석사 학위논문

Radiologic features caused by  
cholesterol granuloma  
in jaw bone

악골 병소 내의 콜레스테롤 육아종에 의해  
야기된 방사선학적 특징

2013 년 11 월

서울대학교 대학원

치의학과

최 상 보

Radiologic features caused by  
cholesterol granuloma  
in jaw bone

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Abstract

Radiologic features caused by  
cholesterol granuloma  
in jaw bone

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**Objectives:** The present study was carried out to investigate the radiologic features of the jaw lesions which were accompanied by cholesterol granuloma and to find out their correlation with histopathological findings.

**Materials and Methods:** CT and panoramic images of 40 patients that were histologically diagnosed as cholesterol granuloma in the jaw bone from 2003 to 2013 were reviewed retrospectively. Of the 40 cases, there was no available radiograph for 6 cases, 3 cases were found in the maxillary sinuses, and 4 cases showed insufficient

microscopic slides for investigation. Finally 27 cases were selected. They were classified into 3 groups (low aggressiveness, moderate aggressiveness, high aggressiveness) according to the radiographic features, such as external root resorption, cortical perforation, septa within the lesion or scalloping margin, and abrupt expansion. Then the histopathologic features were reviewed to investigate the existence of cystic structure of cholesterol granuloma, its location, the area ratio of cholesterol granuloma and the degree of severity of inflammation. The relationship between the histopathologic features and the radiographic aggressiveness were examined.

**Results:** According to radiographic impression, 27 cases were composed of 5 cases of dentigerous cyst, 6 cases of periapical cyst, 3 cases of ameloblastoma, 6 cases of keratocystic odontogenic tumor, 1 case of myxoma, 1 case of incisive canal cyst and 1 case of residual cyst. While, by histopathologic examination, they were revealed as 7 cases of dentigerous cyst, 8 cases of periapical cyst, 8 cases of cholesterol granuloma, 1 case of simple bone cyst, 1 case of periapical abscess, 1 case of incisive canal cyst and so on.

Concerning the location of the cholesterol granuloma, when cholesterol granuloma was located in the cavity, even though the size of cholesterol granuloma was big in the specimen, the radiographic impression showed low aggressiveness. When cholesterol granuloma was located in the cystic wall, the area occupied by cholesterol granuloma showed positive relationship with the radiographic aggressiveness. High aggressiveness group, moderate aggressiveness group and low aggressiveness group showed 75, 38, 10 unit area on

average, respectively. However, the analysis on the relationship between severity of inflammation and the radiographic aggressiveness did not show statistically significant correlation.

**Conclusion:** With cholesterol granuloma growing up in the cystic wall of the jaw lesions, their radiographic impressions show more aggressiveness.

**keywords :** cholesterol granuloma, dentigerous cyst, periapical cyst, radiographic impression

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# Introduction

Cholesterol granuloma is a histopathologic term describing a large number of clefts present after cholesterol crystals have dissolved during processing, surrounded by foreign-body giant cells, foam cells, and macrophages filled with hemosiderin embedded in fibrous granulation tissue. The pathogenesis of cholesterol granuloma is still unclear. Especially it's rarely reported that cholesterol granuloma are found in jaw bone.<sup>1-2)</sup>

From surveying the literatures, R.M. Browne reported some cases of cholesterol granuloma had been found in odontogenic cyst.<sup>3)</sup> Hirshberg et al. reported a cholesterol granuloma of the mandible, which manifested as a solitary round radiolucent lesion in an edentulous area.<sup>4)</sup> And JH lee et al. reported a cholesterol granuloma of the mandible which was located in the wall of dentigerous cyst.<sup>1)</sup> Kim et al. reported a cholesterol granuloma with no cystic wall which showed radiographic expression of ameloblastoma.<sup>2)</sup> The author demonstrated that the wall must be disappeared by cholesterol granuloma. Shin et al. reported 3 cases of which radiographic expression were ameloblastoma, keratocystic odontogenic tumor and odontogenic benign lesion respectively. But all of them were just cholesterol granuloma histopathologically. These studies show some cases which were tentatively diagnosed as keratocystic odontogenic tumor or ameloblastoma but were revealed as cholesterol granulomas histopathologically.

The present study was carried out to investigate the radiologic

features of the jaw lesions which were accompanied by cholesterol granuloma and to find out their correlation with histopathological findings.

## Materials and methods

CT and panoramic images of 40 patients that were histologically diagnosed as cholesterol granuloma in the jaw bone from 2003 to 2013 were reviewed retrospectively. Of the 40 cases, there was no available radiograph for 6 cases, 3 cases were found in the maxillary sinuses, and 4 cases showed insufficient microscopic slides for investigation. Finally 27 cases were selected.

To define the aggressiveness of each case, 4 factors were considered: ① external root resorption ② missing or perforated cortical perforation ③ septa within the lesion or scalloping margin ④ abrupt expansion. ① and ③ were evaluated by CT scan and panoramic images, ② and ④ were evaluated by CT images. ④ was considered, when swollen corticated margin was almost perpendicular to neighboring corticated margin in CT scan image. And then each case was classified into 3 groups by the frequencies of above 4 factors (Table 1). All of these were estimated with a oromaxillofacial radiology specialist.

Microscopic examination had been carried out to investigate 4 features: ① existence of cystic structure of cholesterol granuloma ② its location ③ the area ratio of cholesterol granuloma ④ the degree of severity of inflammation. Fig. 1 shows the cases with cystic structure and without cystic structure. Fig. 2 shows the location of cholesterol granuloma. It's classified into i) in the cavity ii) both in the cavity and wall iii) in the wall. The area occupied by cholesterol

granuloma was approximated as an ellipse and computed manually.(Fig. 3) The degree of severity of inflammation was estimated as i) mild, ii) moderate iii) severe by the number and distribution of inflammation cells. Above all were estimated by a oral pathology specialist and the tissue specimen was chosen as the biggest cross section of the lesion.

## Results

According to radiographic impression, 27 cases were composed of 5 cases of dentigerous cyst, 6 cases of periapical cyst, 3 cases of ameloblastoma, 6 cases of keratocystic odontogenic tumor, 1 case of myxoma, 1 case of incisive canal cyst and 1 case of residual cyst. While, by histopathologic examination, they were revealed as 7 cases of dentigerous cyst, 8 cases of periapical cyst, 8 cases of cholesterol granuloma, 1 case of simple bone cyst, 1 case of periapical abscess, 1 case of incisive canal cyst and so on (Fig.4). In the Table 2, histopathologic examination of case #1 showed no presence of epithelial cells in the lesion, case #2 had cavity structure but no cystic wall and case #3 showed no cystic evidence. These three cases are in high aggressiveness groups.

Concerning the location of the cholesterol granuloma, the photomicrograph revealed that when cholesterol granuloma was located in the cavity, even though the size of cholesterol granuloma was big, 2 cases(66%) showed low aggressiveness. This means that the location of cholesterol granuloma can be a factor which affects the aggressiveness of lesion.(Fig.5)

When cholesterol granuloma was located only in the wall of cyst, the area occupied by cholesterol granuloma was computed. High aggressiveness group, moderate aggressiveness group and low aggressiveness group showed 75, 38, 10 unit area on average

respectively. The amount of cholesterol granuloma in the specimen was in positive proportion to the radiographic aggressiveness.

From Fig.6 to Fig.8 showed the representative radiographic features and histopathologic features. Fig.6 showed the features of high aggressiveness group. It was tentatively diagnosed as typical ameloblastoma. Fig.7 showed the features of moderate aggressiveness group and Fig.8 showed the features of low aggressiveness group

With regard to severity of inflammation, high aggressiveness group showed 0.75, moderate aggressiveness showed 0.65, low aggressiveness showed 1 on average. Correlation analysis between severity of inflammation and the aggressiveness did not show statistically significant results(Table 3).

## Discussion

With the present result, comparing the result with the preexisting literature, in Browne's study, he showed the greater incidence of cholesterol in periapical cyst and dentigerous cyst compared with the keratocystic odontogenic tumor.<sup>3)</sup> Shear demonstrated that the incidence of cholesterol crystals was reported as highest in inflammatory cysts, particularly in radicular cysts, while the lowest incidence was reported for cysts of non-inflammatory origin such as keratocystic odontogenic tumor.<sup>5)</sup> While in Iqbal MF's study proportionately more cases with cholesterol clefts was elicited among dentigerous cysts as compared with radicular cyst and keratocystic odontogenic tumor.<sup>6)</sup> The present result agrees with Browne's and Shear's. The result can be explained that the epithelial cells of dentigerous cyst and periapical cyst degenerate but one of keratocystic odontogenic tumors undergo maturation to form keratin. The inflammatory reaction is rare in keratocystic odontogenic tumor so the pathogenesis for cholesterol granuloma is not easy.<sup>3)</sup>

Concerning the discrepancy between radiographic impression and histopathologic diagnosis, Choi SH demonstrated that histopathologic diagnosis and radiographic impression could be different, because of epithelium losing its own entity by decompression or inflammation. some mistakes to get proper tissue specimen in biopsy and difficulties to examine all section.<sup>7)</sup> Kim et. al. reported a case that radiographic

impression was ameloblastoma but histopathologic diagnosis was cholesterol granuloma.<sup>2)</sup> Shin et al. reported similar 3 cases as Kim.<sup>8)</sup> In current study, you can see the difference between radiographic impression and histopathologic diagnosis in total 27 cases of table 2. It was shown that 5 cases were histopathologically diagnosed as lesser aggressive lesion than the radiographic impression like that radiographic impression was ameloblastoma but histopathologic diagnosis result was dentigerous cyst.

In Browne's study, he showed that cholesterol clefts were more frequently present in the wall(84.7%) than cavity(51.4%).<sup>3)</sup> In this study, cholesterol clefts were present in the wall(77.8%) and cavity(55.6%). Browne also reported that the 3 cysts which contained cholesterol clefts only in the cystic cavity, did not show inflammatory changes. In this study the 3 cases of cholesterol granuloma only located in the cavity, even though the size of cholesterol granuloma was big, 2 cases(66%) showed low aggressiveness. This means that the location of cholesterol granuloma can be a factor which affect the aggressiveness of the lesion.(Fig.5)

In the current result, the amount of cholesterol granuloma is in positive proportion to the radiographic aggressiveness. The aggressiveness of cystic lesion can be affected by inflammatory reaction induced by the amount of cholesterol granuloma. Cholesterol granuloma is associated with foreign body reaction which prolongs the inflammatory process in cyst walls,<sup>5)</sup> So the epithelial linings often disappeared because of inflammation.<sup>9)</sup> The formation cycle of

cholesterol granuloma repeats and the expanding mass results in bony erosion.<sup>10)</sup> Kim et al. also explained that the cystic wall was disappeared with formation of cholesterol granuloma in the reported case.<sup>2)</sup>

In conclusion, the current study found out some similar results with previous studies. And we can get some new results that cholesterol granuloma is growing up, lesions in a jaw bone can show more aggressive radiographic impression. Consecutive studies are needed to understand these phenomenon.

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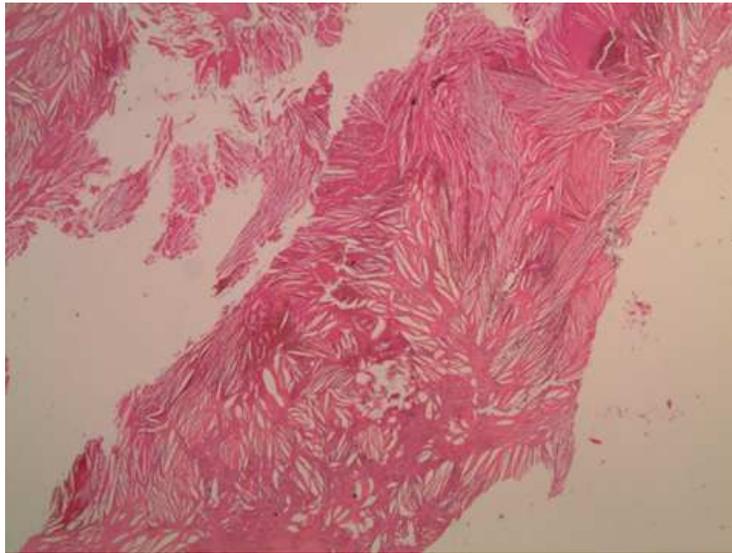
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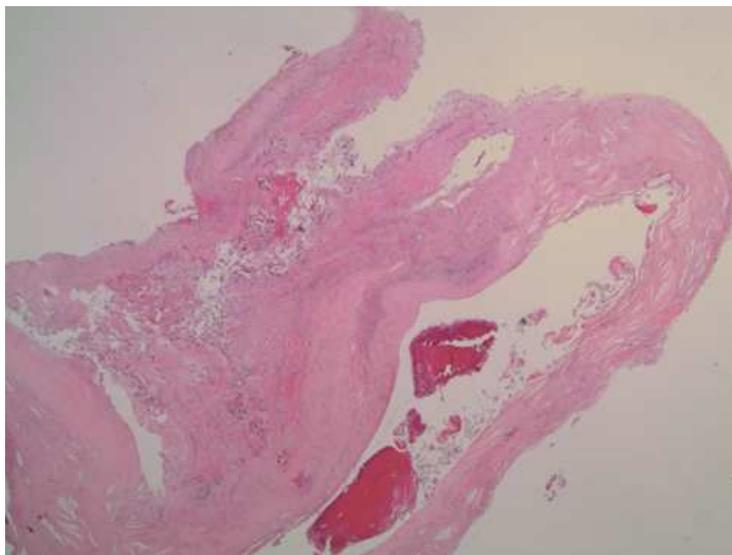
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**Table 1.** Classifying radiographic aggressiveness

| Low aggressiveness group | Moderate aggressiveness group | High aggressiveness group |
|--------------------------|-------------------------------|---------------------------|
| 0                        | 1                             | above 2                   |



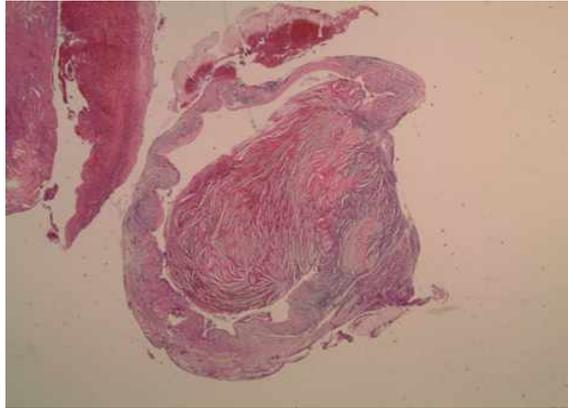
(a)



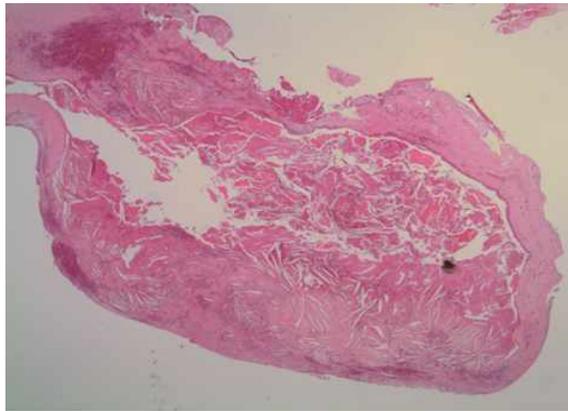
(b)

Fig.1 Cholesterol granuloma and cystic structure. (a) without cystic structure, (b) with cystic structure

(a)



(b)



(c)

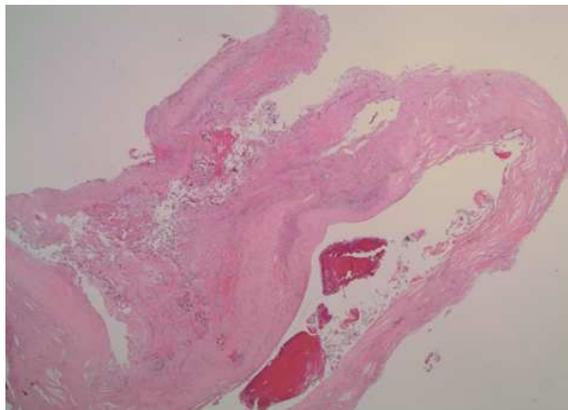


Fig.2 Classifying the position of cholesterol granuloma. (a) In the cavity, (b) Both in the cavity and wall, (c) In the wall

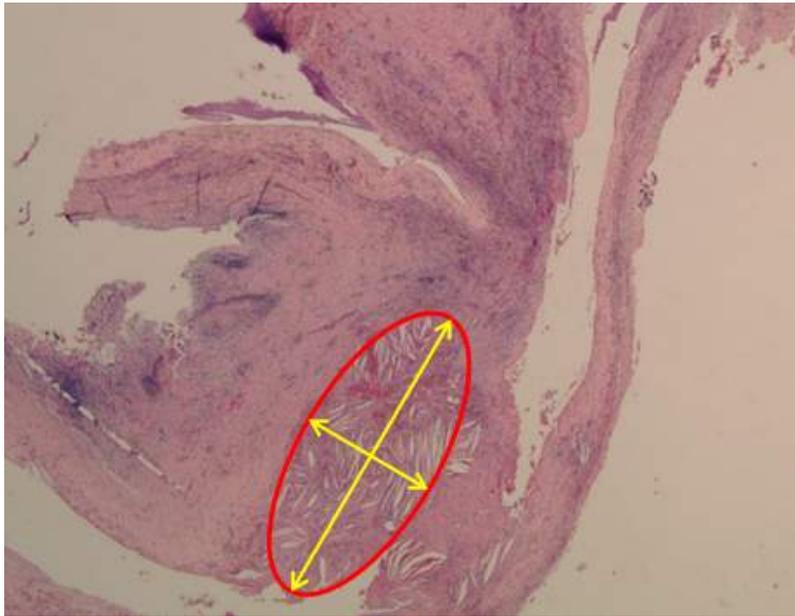


Fig.3 Computing the area of cholesterol granuloma

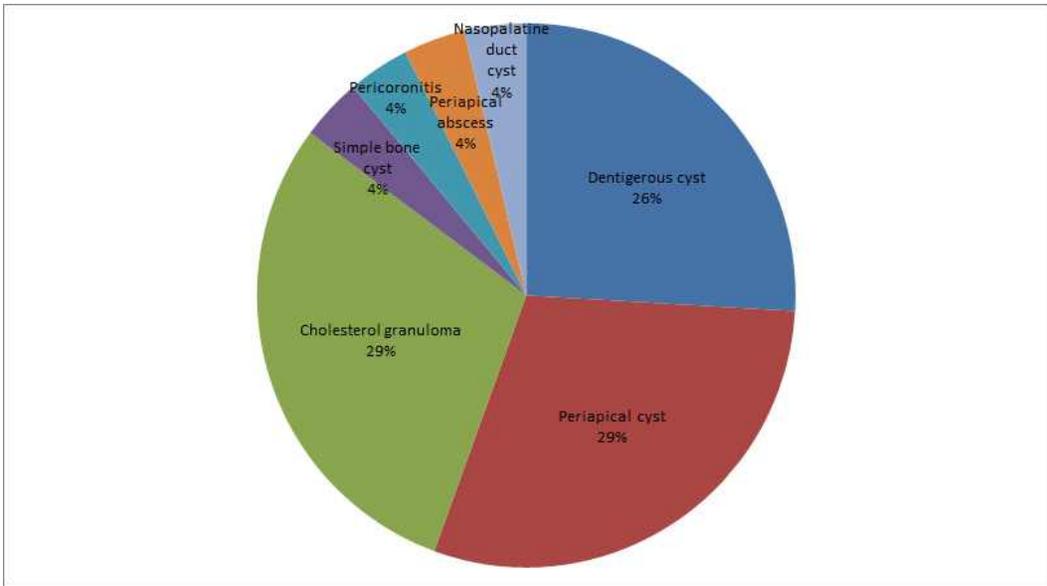
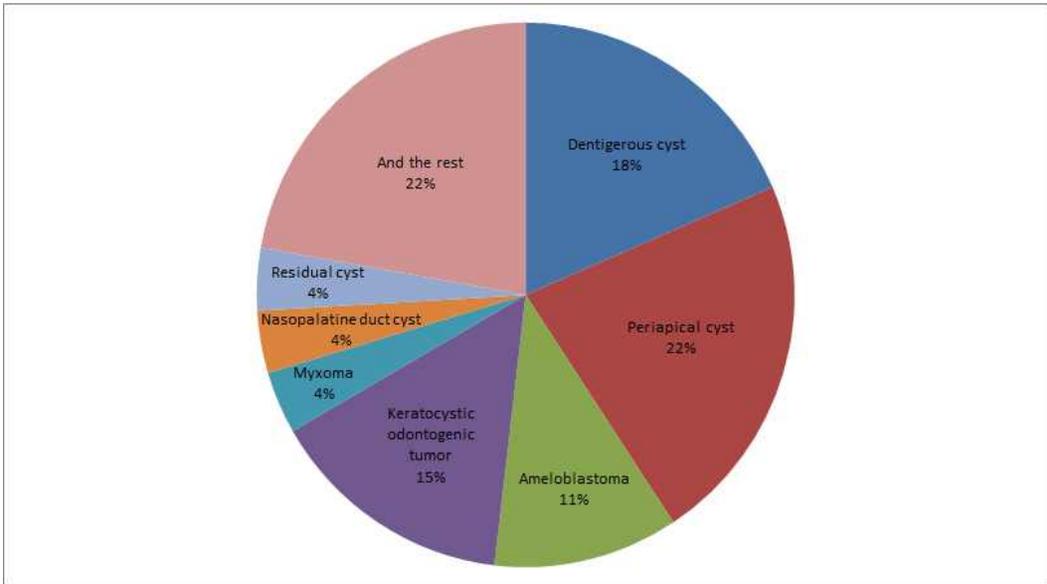


Fig.4 In 27 case, radiographic impression(above) and histopathologic diagnosis(below)

| No | Radiographic aggressiveness | Radiographic impression     | Histopathologic diagnosis                              |
|----|-----------------------------|-----------------------------|--|
| 1  | High                        | AMB                         | Cholesterol granuloma                                  |
| 2  | High                        | AMB                         | Cholesterol granuloma.                                 |
| 3  | High                        | KCOT                        | Cholesterol granuloma                                  |
| 4  | High                        | KCOT                        | Inflamed odontogeniccyst with cholesterol granuloma    |
| 5  | High                        | Periapical cyst             | Periapical cyst with cholesterol granuloma             |
| 6  | Moderate                    | Dentigerous cyst            | Fibrous tissue with cholesterol granuloma              |
| 7  | Moderate                    | Myxoma                      | Simple bone cyst with cholesterol granuloma            |
| 8  | Moderate                    | KCOT                        | Dentigerous cyst with cholesterol granuloma            |
| 9  | Moderate                    | AMB                         | Dentigerous cyst with cholesterol granuloma            |
| 10 | Moderate                    | Periapical lesion           | Periapical cyst with cholesterol granuloma             |
| 11 | Moderate                    | Odontogenic benign tumor    | Cholesterol granuloma                                  |
| 12 | Low                         | Periapical cyst             | Periapical cyst with cholesterol granuloma             |
| 13 | Low                         | KCOT                        | Dentigerous cyst with cholesterol granuloma            |
| 14 | Low                         | Periapical cyst             | Periapical cyst with cholesterol granuloma             |
| 15 | Low                         | KCOT                        | Dentigerous cyst with cholesterol granuloma            |
| 16 | Low                         | Nasopalatine duct cyst      | Incisive canal cyst with focal cholesterol granuloma   |
| 17 | Low                         | Dentigerous cyst            | Inflamed granulation tissue with cholesterol granuloma |
| 18 | Low                         | Dentigerous cyst            | Dentigerouscyst with cholesterol granuloma             |
| 19 | Low                         | Residual cyst               | Periapical cyst with cholesterol granuloma             |
| 20 | Low                         | Periapical cyst             | Periapical cyst with cholesterol granuloma             |
| 21 | Low                         | Periapical cyst             | Periapical cyst with cholesterol granuloma             |
| 22 | Low                         | PA lesion                   | Cholesterol granuloma                                  |
| 23 | Low                         | Dentigerous cyst            | Dentigerous cyst with cholesterol granuloma            |
| 24 | Low                         | Periapical cyst             | Periapical abscess with cholesterol granuloma          |
| 25 | Low                         | Pericoronitis               | Chronic pericoronitis with cholesterol granuloma       |
| 26 | Low                         | Benign fibro-osseous lesion | Cholesterol granuloma.                                 |
| 27 | Low                         | Dentigerous cyst            | Dentigerous cyst with cholesterol granuloma.           |

Table 2. In 27 cases, comparing radiographic impression with histopathologic diagnosis



(a)

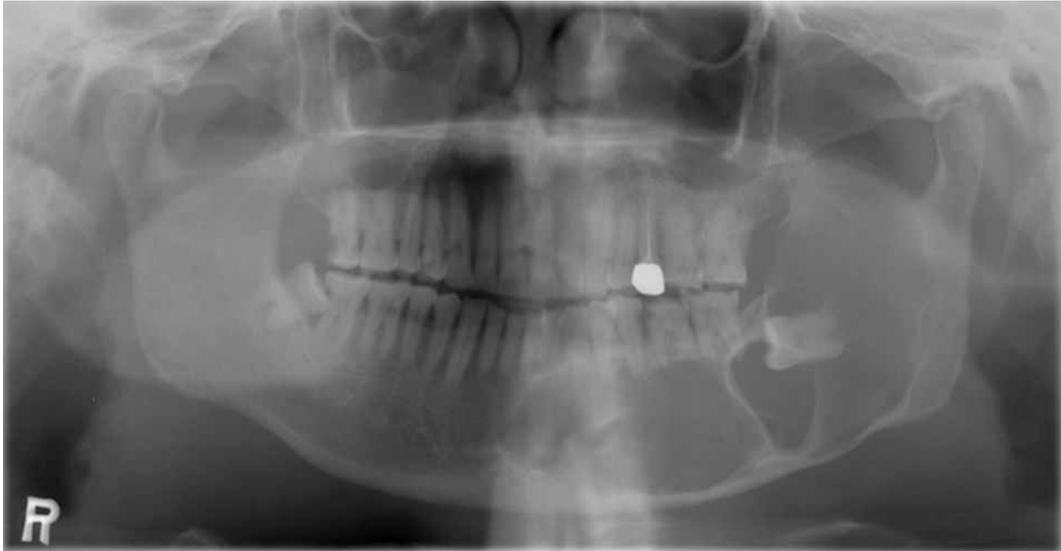


(b)



(c)

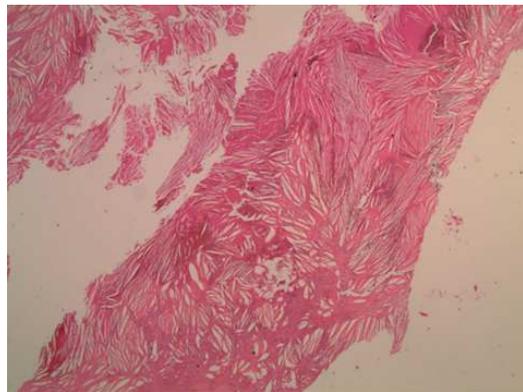
Fig.5 showed the low aggressiveness when cholesterol granuloma is within the cavity. (a) panoramic view, (b) CT scan image, (c) histopathologic photomicrograph(x15)



(a)



(b)



(c)

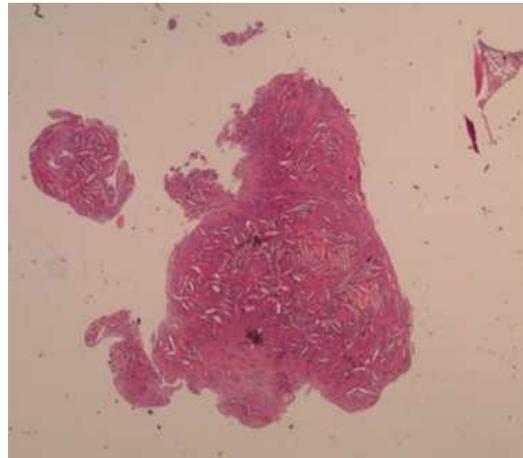
Fig.6 High aggressiveness group (a) panoramic view, (b) CT scan image, (c) histopathologic photomicrograph(x15)



(a)



(b)



(c)

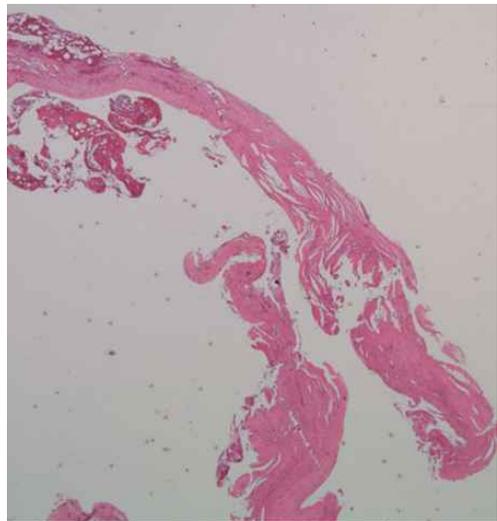
Fig.7 Moderate aggressiveness group (a) panoramic view, (b) CT scan image, (c) histopathologic photomicrograph(x15)



(a)



(b)



(c)

Fig.8 Low aggressiveness group (a) panoramic view, (b) CT scan image, (c) histopathologic photomicrograph(x15)

**Table 3.** Comparing average of area ratio of cholesterol granuloma and average of inflammatory severity with radiographic aggressiveness

| Group                   | No. of cases | Average of area ratio of cholesterol granuloma | Average of inflammation severity |
|-------------------------|--------------|--|----------------------------------|
| high aggressiveness     | 5            | 75   | 0.9                              |
| moderate aggressiveness | 6            | 38   | 1.08                             |
| low aggressiveness      | 16           | 13   | 1.27                             |

## 국문초록

# 악골 병소 내의 콜레스테롤 육아종에 의해 야기된 방사선학적 특징

### 1. 서론

콜레스테롤 육아종은 이물질 거대 세포, 거품 세포, 헤모시데린에 의해 둘러싸인 콜레스테롤 크리스탈의 형성에 의해 육아종성 변화가 야기되는 병소이다. 콜레스테롤 육아종의 발병원인은 아직 완전히 밝혀지지 않은 상태로 악골에 발생한 콜레스테롤 육아종은 매우 드문 것으로 알려져 있다.

본 연구의 목적은 병리학적으로 악골 병소로 진단된 증례들 중 콜레스테롤 육아종을 동반한 병소들의 방사선학적 특징을 규명하는 것이다. 이를 위해 조직시편에서 나타나는 콜레스테롤 육아종의 병리학적 특징을 살펴보고 이것이 악골 병소의 방사선학적 특징과 어떤 관련성을 가지는지 알아보하고자 하였다.

### 2. 방법

2003년 1월부터 2013년 7월까지 서울대학교 치과병원에 내원하여, 병리학적으로 콜레스테롤 육아종을 동반한 악골의 병소로 진단된 40증례 중 방사선학적 소견이 없는 6증례, 상악동에 콜레스테롤 육아종이 발생한 3증례와 조직슬라이드가 불완전한 4증례를 제외한 27증례를 대상으로 하였다. 각 병소들의 방사선영상에서

치근 외흡수 유무, 피질골 변연의 소실 및 천공 유무, 내부 중격 혹은 변연의 scalloping 유무, 마지막으로 급격한 팽윤 유무 이렇게 네 가지 방사선학적 특징의 빈도를 각각 조사하였다. 이러한 방사선학적 소견의 빈도가 높을수록 그 병소가 더 공격적이라 정의하였으며, 이 네 가지 공격적인 방사선학적 특징이 각 병소에서 몇 개씩 관찰되는 지에 따라 높은 공격성, 중등도 공격성, 낮은 공격성의 세 군으로 나누었다.

또한 콜레스테롤 육아종의 조직병리학적 양상이 위에 언급한 공격적인 방사선학적 소견의 원인이 될 수 있다는 가설 하에 조직시편에서 나타나는 콜레스테롤 육아종의 낭 구조 여부, 낭 구조를 가진 경우 콜레스테롤 육아종의 위치, 콜레스테롤 육아종의 면적비와 염증의 정도 등을 각각 조사하여 방사선학적 특징과 서로 비교해 보았다.

### 3. 결과

27증례들을 방사선학적 소견에 따라 분류한 결과 함치성낭은 5증례 치근단 낭은 6증례, 범랑모세포종은 3증례, 각화낭성치성종양은 6증례, 점액종이 1증례, 절치관낭종이 1증례, 잔류낭이 1증례로 나타났고 조직병리학적 진단에 의해서는 함치성낭이 7증례, 치근단 낭이 8증례, 콜레스테롤 육아종이 8증례, 단순골낭이 1증례, 근단주위농양 1증례, 절치관낭 1증례로 나타났다.

조직 슬라이드에서 콜레스테롤 육아종의 분포와 위치를 중심으로 한 병리학적 소견과 세 등급으로 나뉜 방사선학적 공격성과의 관련성을 비교한 결과 콜레스테롤 열개의 위치가 낭 안에 있는 3증

레 중 2증례에서 콜레스테롤 육아종이 큰 경우에도 낮은 공격성이 나타났다. 콜레스테롤 육아종이 낭 벽에 분포하고 있는 경우만을 비교한 경우, 세 군의 콜레스테롤 육아종이 차지하는 면적을 비교한 결과 높은 공격성의 군은 평균 75 단위면적, 중등도 공격성의 군은 38 단위면적, 낮은 공격성의 군은 10 단위면적으로, 공격성이 높은 군에서 콜레스테롤 육아종의 면적이 유의하게 크게 관찰되었다. 하지만, 조직병리학적인 염증 소견과 방사선영상에서의 공격적인 양상은 유의성 있는 관련성은 나타나지 않았다.

주요어 : 콜레스테롤 육아종, 함치성낭, 치근단낭, 방사선학적 소견  
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