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Hyaline Ring Granuloma of the Mandibular Periosteum

Hiroataka Sato¹, Hiroki Miyate², Yoshiyasu Fukuta²
and Masanobu Satoh¹

¹*Department of Oral Pathology, School of Dentistry, Iwate Medical University
(Chief: Professor Masanobu Satoh)*

²*First Department of Oral and Maxillofacial Surgery, School of Dentistry,
Iwate Medical University
(Chief: Professor Harumi Mizuki)*

Abstract: Hyaline ring granuloma (HRG) is a comparatively rare inflammatory condition occurring mainly in the oral region, and is characterized by hyaline rings (HRs) formed in the granulation tissue. This study describes a case of HRG occurring in the mandibular periosteum of an 18-year-old male. Histopathologic, histochemical and electron microscopic studies were performed on surgically excised materials. Histopathologically, ovoid bodies (OBs) surrounded by thin hyaline walls and HRs showing pale-stained eosinophilic thick hyaline walls were both detected. Histochemical study revealed that the OBs contained many granules chiefly composed of starch. Ultrastructurally, the HRs presented a stratiform structure due to the accumulation of cross-banded collagen fibrils with a basement membrane-like lining containing cellulose microfilaments. These results suggest that HRs are formed as follows: the exogenous vegetable materials are encapsulated by collagen, then the component is gradually degraded; the residual cellulose fraction adheres to the inner surface of the collagenous capsules, and the continuous deposition of collagen at the outer surface of the capsules increases its thickness. Finally, thick hyaline walls of HRs are formed. The possible pathogenesis of this curious lesion is discussed for stomatologists.

Key words: foreign-body granuloma, hyaline substance, ultrastructure, periostitis

Introduction

Hyaline ring granuloma (HRG) is a rare cryptogenic inflammatory lesion, and histological ring-like structures in an inflamed fibrous tissue are characteristic and diagnostic¹⁻⁶. Although 68 cases of HRG have been reported in the English language literature since 1971⁷, only a single case¹ has been reported in Japan. HRG occurs especially in traumatized oral regions associated with denture flanges² and in surgical sites including

tooth-extraction wounds^{4,5,8}. Radiographically, the extraosseous peripheral lesion represents an erosion of bony surface with a sclerotic margin, whereas the central lesion of the jaw bone produces well-demarcated radiolucency^{4,9}. HRG presents as a single nodule that alternates between swelling and tenderness, and shows diverse clinical states from conspicuous symptoms to an asymptomatic long-term course⁹. Therefore, it is often difficult for stomatologists to give a definite diagnosis of HRG. Histopathologically, this lesion shows pale-staining and sometimes calcifying hyaline rings (HRs) surrounded by numerous giant cells within the chronic inflammatory granulation tissue^{4,10,11}. HRs have been suspected as the products due to a kind of foreign-body

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Requests for reprints: Hiroataka Sato, Department of Oral Pathology, School of Dentistry, Iwate Medical University, 19-1 Uchimarui, Morioka 020-8505, Japan, Phone: + 81-19-651-5111 (Ex: 3519), Fax: + 81-19-621-3321.

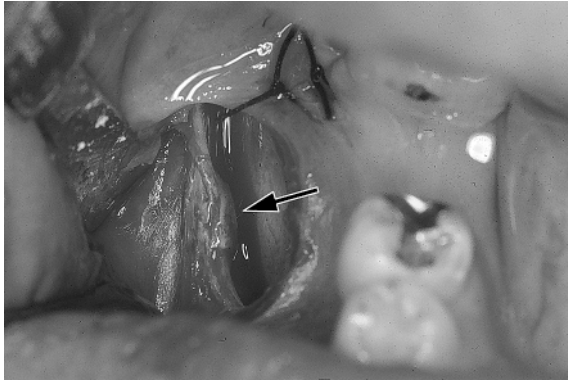


Fig. 1 Intraoral findings at operation: Clearly thickened buccal periosteum next to the defect of the lower first molar in the right mandible (arrow).

reaction^{7,10,12}. However, the precise nature of this lesion is not sufficiently determinative. This paper reports a case of HRG occurring in the mandibular periosteum of an 18-year-old male. To clarify the pathogenesis of this curious lesion in detail, histopathologic, histochemical and electron microscopic studies of this case were conducted.

Case report

An 18-year-old male first noticed a swelling on his right mandible 6 months prior to his arrival at the dental hospital of Iwate Medical University. This patient frequently suffered spontaneous dull pain. In an intraoral examination, an elastic, hard polypoid lesion (6 × 7 mm) was found, exhibiting a reddish surface. Radiographic examination was noncontributory. A mucoperiosteal flap was made on the right mandible under local anesthesia, and an incisional biopsy was performed. The buccal periosteum next to the first-molar tooth-defect due to the extraction of two years ago had clearly thickened (Fig. 1). The bone surface of the mandible attached to the lesion was rough textured. Antibiotics and antiphlogistics were administered for four days after surgery, then the postoperative course of two months was uneventful.

1. Methods

Formalin-fixed paraffin-embedded tissue in 4 μm sections was deparaffinized, then one section was stained with hematoxylin and eosin (HE) for histopathologic examination, and another section was stained with iodine solution for starch-testing: Lugol stain. Part of the paraffin-embedded specimen was deparaffinized by run-

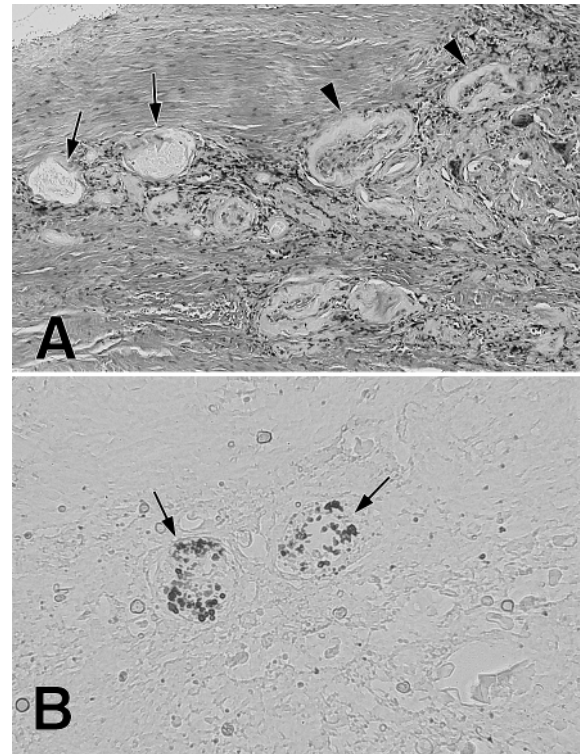


Fig. 2 Histopathologic findings: (A) OBs (arrows) surrounded by thin hyaline walls and HRs (arrow heads) presenting pale-stained eosinophilic thick hyaline walls. (B) OBs containing many iodine-stained granules (arrows). Original magnification: A, B, ×100.

ning it through xylenes to alcohols to phosphate-buffered saline. The specimen was minced into small tissue cubes, fixed with 2.5% glutaraldehyde, post-fixed in 2% osmium tetroxide, dehydrated through an ascending series of alcohols, and embedded in Epon 812. Ultrathin sections for electron-microscopy were stained with uranyl acetate and lead citrate, and examined with a HITACHI H-600A electron microscope.

2. Pathologic findings

Histopathologically, ovoid bodies (OBs) containing granular components and HRs were both detected in the heavily inflamed periosteal fibrous tissue. OBs were surrounded by thin hyaline walls, while HRs presented weak eosin-stained thick hyaline walls (Fig. 2A). Macrophages and polynuclear giant cells were found associating with OBs and HRs. Thus, a diagnosis of “hyaline ring granuloma” was made.

Histochemical analysis by Lugol staining revealed many iodine-stained granules in the OB (Fig. 2B) but

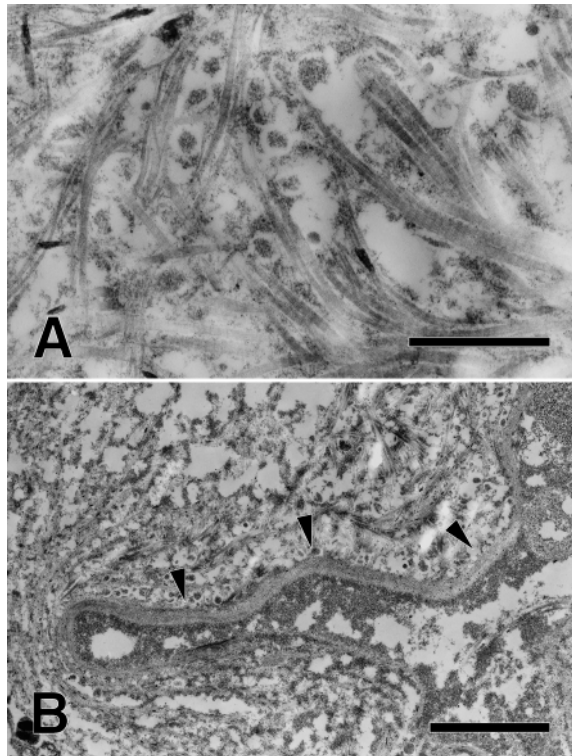


Fig. 3 Ultrastructural findings: (A) The hyaline walls around the OBs or stratiform structures of the HRs consist of an accumulation of 50- to 70-nm-interval cross-banded collagen fibrils of about 50 to 80 nm in diameter. Scale = 1 μ m. (B) The HRs lined with a basement membrane-like inner lining (arrow heads) containing compact microfilaments. Scale = 3 μ m.

not in the HR. Ultrastructurally, the hyaline wall around OB or the stratiform structure of HR represented an accumulation of 50- to 70-nm-interval cross-banded collagen fibrils of about 50 to 80 nm in diameter (Fig. 3A). The basement membrane-like inner lining of HR contained compact microfilaments (Fig. 3B).

Discussion

HRG is a rare inflammatory condition occurring mainly in the oral region. Histopathologically, HRs surrounded by giant cells within the granulation tissue indicate HRG^{1-3,8,9,13}. In current histochemical and ultrastructural observations, OB shows iodine-positive starch granules surrounded by a thin hyaline wall of collagen, while the HR presents a thick stratiform structure due to the accumulation of collagen fibrils with an inner lining containing microfilaments. HR has been regarded to be made of collagen histochemically^{5,11} and ultrastructurally^{6,14}, while being composed of cellu-

lose histochemically¹⁰ and ultrastructurally¹³. Although the major part of the HR in our study was thought to be composed of collagen, the microfilaments of the inner lining of the HR were consistent with the cellulose microfilaments whose diameter was about 10 nm in previous ultrastructural studies of seed plants¹⁵. Existence of starch and cellulose in the human tissue implies aberrant vegetable matter. Thus, we can assume that the characteristic HRs in this condition are as follows: OBs start to form via collagenous encapsulation around exogenous materials that contain starch and cellulose. After this, the component of the materials is gradually degraded. Subsequently, the residual cellulose fraction adheres to the inner surface of the collagenous capsules. The deposition of collagen at the outer surface of the capsules over a long period increases its thickness. Finally, the thick hyaline walls of HRs are completed.

HRG has been regarded predominantly as a foreign-body reaction against exogenous vegetable matter^{2,10,12}. In addition, *Torulopsis glabrata* (yeast-like fungus) infection¹⁶ and hyalinized blood vessels with giant cells⁵ have also been reported as the pathogeneses of this condition, though there was evidence of neither in this case.

One reason for the few reports on HRG in Japan may be the Japanese diet, which is different from that of other countries. Stomatologists' lack of experience of this lesion may lead to inaccurate diagnoses and confusion.

Acknowledgments

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