

Evidence to support the hypothesis of tuberculosis as a cause of extreme osteonecrosis and osteomyelitis of the mandible in a West African population

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Abstract. Maxillofacial tuberculosis (TB) is rare. The cases of 19 patients showing extreme bony destruction in the mandible, collected over a 3-month period in West Africa, are presented. Clinical, radiographic, and histological evidence indicated *Mycobacterium tuberculosis* as a possible cause. Further studies are in progress.

Key words: osteonecrosis; tuberculosis; mandible; West Africa.

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The authors have previously reported 60 cases of extreme osteonecrosis of the jaw (ONJ) based on sporadically collected records over a 3-year period from the hospital ship m/v Africa Mercy, while it was serving in Liberia, Benin, and Togo in West Africa.¹ Many of the patients showed unilateral facial swelling, persistent sinus tracts, and destruction of the jaw bone. The degree of bony destruction was similar to that reported previously for conditions such as phossy or radium jaw. However, the pattern of destruction seen in the group of 60 patients was not the

same in all patients. Some patients had maxillary lesions, although the preponderance was for mandibular cases. Furthermore, it seemed that the osteonecrosis was of two different types. One type of defect produced extremely necrotic 'greyish' bone sequestra of the type associated with 'phossy jaw'. This manifestation occurred in both the maxilla and mandible. Patients with this type of necrosis did not have gross swelling and sinus tracts. The second type, by far the most common in the cohort of 60 cases, was characterized by unilateral gross facial swelling, frequently with

a draining fistula, either intraorally or extraorally.

In this study, the association between tuberculosis (TB) and the development of necrosis was examined in the mandibular samples of 19 additional patients from Liberia and Sierra Leone. The samples were collected over a 3-month period from outpatients who voluntarily attended the Mercy Ships Dental Clinic while the ship Africa Mercy was stationed in Sierra Leone for a period of 9 months and from outpatients voluntarily attending Trinity Dental Clinic in Liberia. The osteonecrosis

of these additional patients strongly resembled the second type of disease process described for the first group of 60 patients, both clinically and in the pattern of bony destruction of the mandible.

A potential link between TB and destruction of the jaw bones is suggested by three recent case reports describing patients with a tuberculous lesion in the condylar head of the mandible. In one case, a bone scan demonstrated an inflammatory destructive process in the condyle, ascending ramus, and angle.² This pattern of destruction has a notable resemblance to the anatomical location of the ONJ in the 19 patients included in the current study. The second and third case reports presented data in support of the conclusion that the condylar head lesion was a primary tuberculous lesion.^{3,4}

Methods

Patient population

The tissue samples of the 19 participants in this study were collected between March and June of 2011 from patients in Sierra Leone ($n = 17$) and Liberia ($n = 2$). The patients were voluntarily attending dental clinics for the treatment of pain and swelling in the facial region. All of the patients presented with unilateral gross facial swelling, frequently with a draining fistula, either intraorally or extraorally. The patients answered a brief questionnaire regarding their general health and occupation. They were subsequently photographed to document the

clinical appearance at the time of presentation.

Gross bony destruction was demonstrated by panoramic radiography and/or cone beam computed tomography (CBCT) in all but one of the cases. Facilities and logistics at the clinics limited the possibilities of chest X-rays and blood tests.

The patients all underwent a surgical debridement procedure as part of their treatment. After their surgical procedure was complete, and subsequent to obtaining informed consent from the patient, the discarded surgical debris was collected in 10% formaldehyde.

Specimen analysis

Micro-computed tomography (micro-CT)

High-resolution three-dimensional (3D) micro-CT scans (MicroXCT-200; Zeiss) were used to evaluate the degree and pattern of bony destruction in the condylar head of samples from four patients.

Histology and immunohistochemistry of soft tissue samples

Based on the limited amounts of soft tissue associated with the bony fragments, samples from four patients were selected for paraffin embedding, sectioning, and haematoxylin and eosin (H&E) staining and immunohistochemistry, following standard protocols. Sections of samples from two of the four patients were stained with antibodies against EMR-1 (PA5-33502; Thermo Fisher Scientific, MA, USA), a

marker for mature macrophages. In addition, immunohistochemical staining with antibodies (GWB-EF714E; GenWay Biotech Inc., CA, USA) against purified proteins derived from *Mycobacterium tuberculosis* was used to determine whether mycobacterial proteins were present in the soft tissue samples.

Results

Clinical characteristics

Clinical characteristics are summarized in Table 1. All 19 patients showed destructive lesions in the mandible.

The median age of the patients was 24 years. The oldest was aged 70 years and the youngest was 17 years (Fig. 1).

Seven patients reported pain elsewhere in the body. These areas included the neck, back, and 'body'. One patient reported bilateral hip pain in addition to back pain, and one patient reported chest pain while coughing. Eleven of the patients reported having fever and fatigue.

Nine patients showed lesions on the left side and four showed lesions bilaterally, but none had bilateral condylar lesions. Five patients had right-sided lesions. One patient had a lesion in the anterior body region. Thirteen of the patients had an actively draining extraoral fistula and one patient had a closed extraoral fistula. Thirteen of the patients had condylar lesions. Eight other patients had posterior body/angle/ascending ramus lesions.

Only one patient had an isolated anterior lesion, and further examination of his

Table 1. Characteristics of the patient population.

Patient	Sex	Age, years	Location	Specified location	Discharging extraoral sinus	Exposed bone intraorally	Additional signs and symptoms
1	M	28	Mandible	Bilateral angle/condyle	Yes	No	Multiple extraoral fistulae
2	F	22	Mandible	Left body	Yes	Yes	Large extraoral wound with necrosis
3	F	20	Mandible	Right ramus/condyle	No	No	Discharging intraoral wound
4	M	56	Mandible	Left body/angle/condyle	Yes	No	Multiple discharging extraoral fistulae
5	F	24	Mandible	Left body/angle/condyle	Yes	Yes	Discharging intraoral wound
6	F	23	Mandible	Left angle/condyle	Yes	No	Multiple discharging extraoral fistulae
7	F	18	Mandible	Left angle/condyle	No	No	Discharging intraoral wound
8	M	32	Mandible	Anterior body	No	No	Multiple mobile teeth
9	M	41	Mandible	Right ramus/coronoid	No	No	Closed extraoral sinus
10	M	23	Mandible	Left angle/ramus/condyle	No	No	
11	F	70	Mandible	Left body	No	No	Discharging intraoral wound
12	M	25	Mandible	Left body/angle/condyle	Yes	No	
13	M	42	Mandible	Right ramus/condyle	Yes	No	Discharging intraoral wound
14	F	22	Mandible	Right body/angle/condyle	Yes	No	Discharging intraoral wound
15	M	17	Mandible	Left body/angle/condyle	Yes	No	Multiple discharging extraoral fistulae
16	F	21	Mandible	Bilateral body	Yes	No	
17	F	27	Mandible	Bilateral body/condyle	Yes	No	Pain for 8 years; discharging intraoral wound
18	M	19	Mandible	Bilateral body, left angle/condyle	Yes	No	
19	F	30	Mandible	Right body	Yes	No	Discharging intraoral wound

M, male; F, female.

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