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Case study

First probable case of scurvy in ancient Egypt at Nag el-Qarmila, Aswan

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ABSTRACT

To date there has been a lack of palaeopathological evidence for the presence of scurvy in ancient Egypt. In this paper we describe one of, if not the first, differentially diagnosed bioarchaeological cases of subadult scurvy in the region in the skeleton of a 1-year +/− 4-month old infant recovered from the Predynastic site of Nag el-Qarmila (c. 3800–3600 BCE) in Aswan, Egypt. Bony change was observed on the left maxilla and greater wing of the sphenoid bone, left and right mandibular rami, orbits, and zygomatic bones, as well as on the humeri, radii, and femora, all of which appear to be suggestive of scurvy. While the cause of this infant's probable scorbutic state is unknown, various circumstances such as diet and cultural behaviors may have contributed to the condition. Given the current lack of evidence of scurvy from ancient Egyptian contexts, this case study informs on the antiquity of ascorbic acid deficiency in the Old World.

1. Introduction

Scurvy is a metabolic disorder resulting from insufficient intake (<10 mg/day), increased requirements (i.e., during pregnancy), and/or malabsorption (e.g., by genetic predisposition) of ascorbic acid (vitamin C) (Halcrow et al., 2014; Jaffe, 1972; Stone, 1966). Scurvy is characterized by interruption of collagen and osteoid formation leading to various clinical symptoms including hemorrhage, elevation of the periosteum, hematoma formation, and inhibition of bone growth, that typically manifest when the body pool of ascorbic acid falls below 300 mg, which can occur as early as 6–10 months after cessation of ascorbic acid intake (Algahtani et al., 2010; Jaffe, 1972). Palaeopathological research has focused predominantly on subadult scurvy given the drastic changes associated with it in the developing skeleton compared to that of the adult (Cargill, 2014, 2015; Crist and Sorg, 2014; De Boer et al., 2013; Van der Merwe et al., 2010a,b).

Lesions believed to be indicative of subadult scurvy known as the 'Ortner criteria' (Brown and Ortner, 2011; Ortner, 1984, 2003; Ortner and Eriksen, 1997; Ortner et al., 1999, 2001) have been used to identify bioarchaeological examples of scurvy from around the world dating back to the Neolithic (e.g., Carli-Thiele, 1995, 1996; Papathanasiou, 2005; Schultz 1988, 1990). Few examples, however, have been reported from Egypt (e.g., Jardine, 2011; Nerlich et al., 2000, 2002; Nerlich and Zink, 2003; Wheeler et al., 2012) and to our knowledge none of them have been considered probable as they are based on either single element observations (rather than the Ortner criteria) or were never firmly assessed as scurvy. Thus, at present, little is known of the antiquity of scurvy in the region, and the question remains as to whether the condition was common in Predynastic Egypt.

Lesions consistent with the Ortner criteria were observed while analyzing the skeleton of a 1-year +/− 4-month old infant (hereafter NEQ individual) recovered from the Predynastic settlement at Nag el-Qarmila (3800–3600 BCE) in the Aswan region of Egypt (Gatto et al., 2009, 2010; Gatto, 2014). While this case represents only one probable diagnostic case of scurvy, it does provide some insight concerning the intersection of biology, culture, and environment in Predynastic Egypt and suggests that ascorbic acid deficiency has significant antiquity in the region, regardless of its fertile nature.

2. Materials and methods

Nag el-Qarmila is a small village located c. 15 km north of Aswan, Egypt (Fig. 1). The site (3800–3600 BCE) is part of the Predynastic Naqada culture (Naqada IC–IIB), with southern Nubian A-Group

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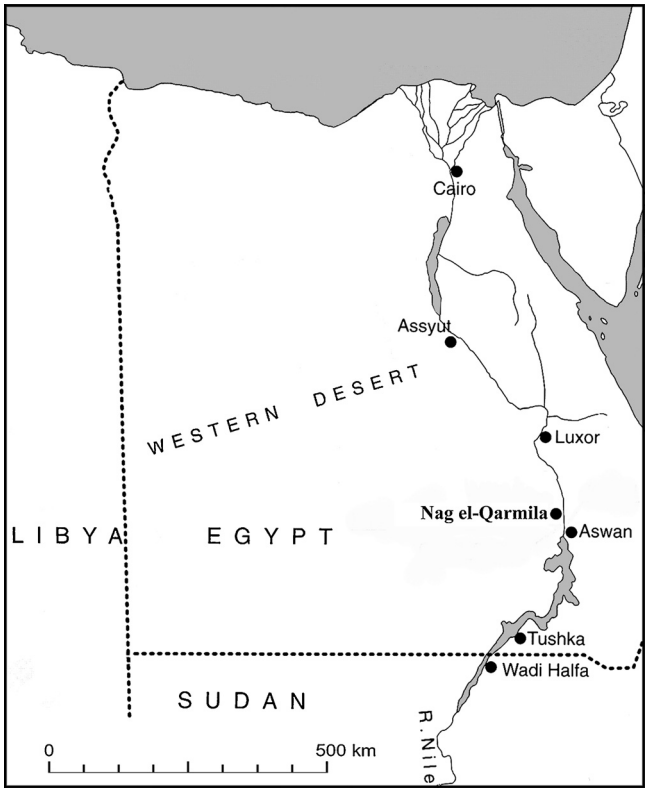

Fig. 1. Map showing the location of Nag el-Qarmila near Aswan, Egypt (Map from the Aswan-Kom Ombo Archaeological Project archive).

Fig. 2. Photo of the Nag el-Qarmila individual within the settlement area.

influence (Gatto, 2014). In 2009, the Aswan–Kom Ombo Archaeological Project's[1] excavations in the settlement area and cemetery of Nag el-Qarmila (MNI = 11) unearthed the remains of an isolated infant in a primary context. The infant was placed on its left side within the settlement (Fig. 2), in a semi-flexed position with the talon of a raptor found nearby. All skeletal elements were recovered, except for a few unfused epiphyses, and all were well preserved. Age was estimated at 1-year +/− 4 months using dental eruption, long bone length, and fusion of skeletal elements (Scheuer and Black, 2000; Ubelaker, 1989). No attempt was made to predict sex.

The remains, which are stored in the Egyptian Ministry of Antiquity's facility in Kom Ombo, were examined macroscopically using a hand lens, following Ortner's criteria (Brown and Ortner, 2011; Ortner, 1984, 2003; Ortner and Eriksen, 1997; Ortner et al., 1999, 2001). Specifically, abnormal porosity was identified as any penetration through cortical bone measuring 1 mm or less in diameter (Ortner and Ericksen, 1997). On long bones, such porosity had to extend >5 – 10 mm from the metaphysis (Ortner et al., 2001).

3. Results

Porosity was noted on the left maxilla and greater wing of the sphenoid bone, mandibular rami, orbits, and zygomatic bones (Fig. 3 and Table 1). The left maxilla (Fig. 4) presented abnormal porosity and new bone on its external surface, surrounding the infraorbital foramen, extending toward the nasal aperture, near the anterior nasal spine, and along the molar alveoli. Fine porosity was observed along the entirety of the ectocranial surface of the left greater wing of the sphenoid bone (Fig. 5). On the internal surfaces of the left and right mandibular rami abnormal porosity was observed extending horizontally along the angle toward the condyle (Fig. 6). Both orbital roofs exhibited bilaterally symmetric porosity and multiple radiating vascular impressions (Figs. 7 and 8) with patches of new bone formation being most pronounced along the anterior margins of the orbits. Porosity was recorded on the external surface of both zygomatic bones near the orbital margins and along the temporal processes (Fig. 9).

Proliferative new bone formation was observed on the humeri, radii, and femora (Fig. 3 and Table 1). New bone growth occurred on the proximal ends of both humeri, extending anterolaterally until midshaft (Fig. 10). Similarly, the proximal ends of both radii exhibited periosteal and rugose new bone formation (the left being more extensive) on the anterolateral surfaces (Fig. 11). Most severe was the periosteal and rugose new bone formation on the femora, located along the posterolateral surfaces, extending from the infratrochanteric region for more than 50% of the bone length (Fig. 12). No other individuals from the skeletal assemblage presented with similar pathological lesions, perhaps due to poor preservation.

3.1. Differential diagnosis

Likely causes for the lesions observed in the NEQ individual include normal growth, pseudopathology, rickets, infantile cortical hyperostosis (ICH), anemia, acute leukemia, malaria, hypertrophic (pulmonary) osteoarthropathy (HPOA), fluorosis, non-specific and specific infection, and scurvy (Table 2).

The degree and localization of the lesions in the NEQ individual suggest a pathological etiology rather than normal growth or pseudopathology (Table 2) (Halcrow et al., 2014; Ortner, 2003;

[1] The Aswan-Kom Ombo project is a Yale University and University of Bologna joint venture, directed by Maria Carmela Gatto and Antonio Curci.