



Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

International Journal of Paleopathology

journal homepage: www.elsevier.com/locate/ijpp



Research article

Possible prostate cancer in northern Peru: Differential diagnosis, vascular anatomy, and molecular signaling in the paleopathology of metastatic bone disease

Haagen D. Klaus ^{a,b,c,*}

^a Department of Sociology and Anthropology, George Mason University, United States

^b Museo Nacional Sicán, Peru

^c Museo Nacional de Arqueología y Etnografía Hans Heinrich Brüning de Lambayeque, Peru

ARTICLE INFO

Article history:

Received 11 July 2016

Received in revised form

19 September 2016

Accepted 25 November 2016

Available online xxx

Keywords:

Neoplasm

Venous plexus of Baston

Caleta de San José

Zarpán

Eten

Lambayeque

ABSTRACT

This paper describes four possible cases of metastasized prostate cancer in archaeological human skeletons from the north coast of Peru spanning the Middle Sicán to Colonial eras (roughly A.D. 900–1600). Varying combinations of exuberant abnormal new bone formation and some abnormal bone loss affecting lumbar vertebrae and the bony sacrum were observed in these individuals. Detailed lesion descriptions are followed by a differential diagnosis that systematically eliminates pseudopathology, infectious diseases, sclerosing bone disorders, and most metastatic processes. However, metastasized prostate cancer cannot be rejected and is highly consistent with the observed lesions. Metastasized pancreatic, bladder, or carcinoid tumors represent additional, though far less likely, diagnostic options. Anatomical and molecular signaling factors further validate this differential diagnosis. The paravertebral venous plexus of Baston plays an anatomical role in the metastatic seeding of lumbar vertebra from prostate cancer. Further, abundant molecular signaling mechanisms upregulate multiple bone-forming mechanisms in prostate metastases, though initially such lesions may originate as lytic phenomena. These multiple lines of evidence help demonstrate a multi-level framework for explanation in paleopathology and especially to help better elucidate the complexities of ancient neoplastic diseases.

© 2016 Elsevier Inc. All rights reserved.

1. Introduction

The skeleton is a primary target of metastatic cancers, and clinical data illustrates that skeletal metastases generate the greatest suffering and morbidity for afflicted individuals (Coleman, 2006; Clines, 2013). The potential antiquity of cancer in humans appears quite deep, with the earliest definitive case of metastatic disease in the bioarchaeological record extending back 4500 years BP (Lieverse et al., 2014). The evolution of fixed *Homo*-specific homeobox retro-oncogenes such as NANOGP8 likely arose before or with the last common ancestor with Neandertals (Fairbanks et al., 2012), and among hominins, the earliest osteosarcoma has been identified in australopithecine fossil material dating to approximately 1.7 million years ago (Odes et al., 2016).

The extent of bone destruction and bone formation in various cancers tends to be quite dramatic (Ortner, 2003). While the topic garners considerable interest, cancer has received relatively limited attention in paleopathology and bioarchaeology (Micozzi, 1991). Questions involving the evolution of cancer, prevalence patterns, and the roles of behavior, economy, and ecology in relation to cancer predisposition over time and space remain thoroughly unresolved. Fuller evaluation of these key issues are impeded by the fact that cancer is infrequently observed in archaeological skeletons while the confident identification of suspected metastatic abnormalities represents a technically daunting task (Ortner, 2003; Brothwell, 2012).

Today, one of the most commonly encountered types of cancer in modern clinical practice is prostate cancer. Among men, it is the most prevalent non-dermatological cancer (Coleman, 2006). While likely cases have been identified in the paleopathological record (Ortner, 2003), ancient prostate cancer is only rarely described, especially in Andean South America. This paper describes four archaeological skeletons from northern Peru that feature a suite of specific skeletal abnormalities that bear strong similarities to

* Correspondence address: Robinson Hall B, Room 305, George Mason University, MSN 3G5, Fairfax, Virginia 22030-4444, United States.
E-mail address: hklaus@gmu.edu

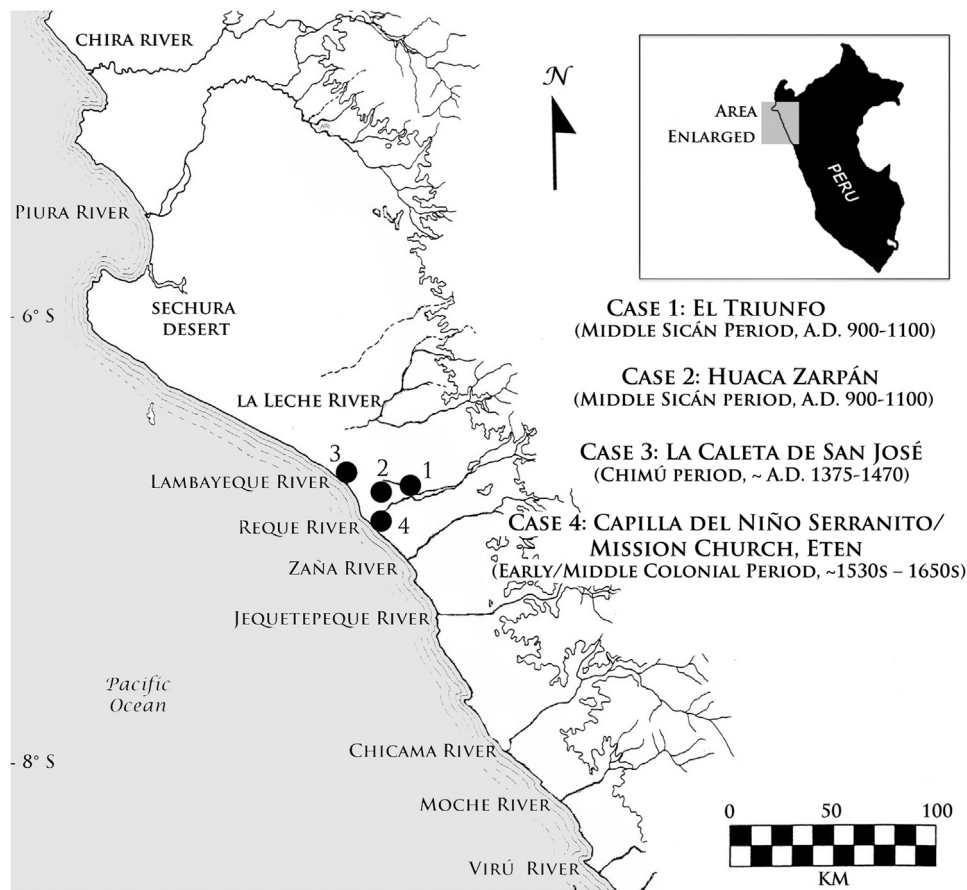


Fig. 1. A map of the north coast of Peru displaying the locations in the Lambayeque River Valley Complex where Cases 1, 2, 3, and 4 were excavated. Map by Haagen Klaus.

modern clinical expectations of metastatic prostate cancer. Following lesion description, multiple differential diagnoses are evaluated and are further considered in terms of both anatomical and molecular signaling factors that underscore cancer dissemination to the skeleton that leads to new questions in the paleopathology of cancer in Peru.

2. The archaeological setting

The arid Lambayeque Valley Complex is located approximately 750 km north of the Peru's modern capital of Lima (Fig. 1). This expansive five-river valley system was a center of independent and influential pre-Hispanic societies, including the Cupisnique, Moche, and Sicán (or Lambayeque) cultures that rose and fell in the region from ca. 1500 B.C.–1375 A.D. (Alva and Donnan, 1993; Shimada 1994, 2000; Klaus, 2008). Between A.D. 1375 and 1532, the Chimú, Inka, and Spanish sequentially conquered Lambayeque, with each imperial power drawn to the area's large population, strategic location, and economic productivity (Ramírez 1990, 1996). Under the surface of all late pre-Hispanic and Colonial developments was an ethnic group known as the Muchik, who emerged out of a process of ethnogenesis that created a social identity that persisted well beyond the decline of the first millennium A.D. Moche culture (Bawden, 2001; Klaus, 2014a).

In 2003, the Lambayeque Valley Biohistory Project initiated a long-term, regional, and multidisciplinary study of the region from the Formative to Colonial eras (2600 B.C. to 1750 A.D.). Complex paleopathological patterns have come to light, especially following European conquest (Klaus and Tam, 2009, 2010; Klaus et al., 2009; Klaus and Alvarez-Calderón, in press). Pathological conditions observed in the region span multiple non-specific markers

of biological stress (Klaus and Tam, 2009), tuberculosis (Klaus et al., 2010), treponemal disease (Klaus and Ortner, 2014), and ritual violence (see chapters in Klaus and Toyne, 2016). Neoplasms are perhaps the most rarely encountered abnormality. Baraybar and Shimada (1993) described one likely example of metastasized prostate cancer in a Middle Sicán individual (A.D. 900–1100). An incomplete postcontact subadult in Eten likely was affected by acute childhood leukemia (Klaus, 2016). Other neoplastic formations observed in the Lambayeque bioarchaeological record included identification of a large ovarian teratoma (Klaus and Ericksen, 2013) and possible benign dermoid inclusion cysts (Klaus and Byrnes, 2013). Beyond these examples, tumor-like processes are unobserved in skeletons in this valley and along the north coast of Peru in general. Moreover, cancer is not a particularly well-defined focus within Andean paleopathology (Verano, 1997; Klaus, 2016) despite the considerable growth of bioarchaeological approaches in the region over the last 20 years.

3. Materials and methods

3.1. Case 1: El Truinfo Tomb 7

In 2015, archaeological excavations by the Museo Tumbas Reales de Sipán at the site of El Truinfo in the mid-Lambayeque Valley complex documented extensive evidence of a 3600-year long occupational sequence from the Formative to the Middle Sicán eras (Bracamonte, 2015). The Moche period findings were particularly valuable to clarify aspects of local Moche chronology, architecture, and metallurgy. Among the ten funerary contexts documented at this site, El Truinfo Tomb 7 contained the remains of a robust adult individual. This person dated to the Middle Sicán period (A.D.

Download English Version:

<https://daneshyari.com/en/article/6554770>

Download Persian Version:

<https://daneshyari.com/article/6554770>

[Daneshyari.com](https://daneshyari.com)