



## Case Study

## Tibial surgery in ancient Peru



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## ABSTRACT

This case study describes a unique anthropogenic modification of two individual skeletons excavated from the pre-Columbian site of Kuelap, Chachapoyas-Amazonas, in the northeastern highlands of Peru. While numerous examples of cranial trepanations using an adjacent drilling technique have been recovered from this site and region, this is the first example of such a surgical technique on a post-cranial element. Skeletal remains demonstrate that ancient Andeans were skilled and successful with many surgical treatments. Ethnohistoric documents suggest the Chachapoya shamans were known for their healing. In these cases, however, there is no evidence of long-term healing. This innovative medical procedure appears to have been an attempt at therapeutic intervention intended to treat an osteomyelitic infection of the distal tibial metaphysis.

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## 1. Introduction

Evidence of ancient surgery has been found on skeletal remains from various Andean cemeteries, and trepanation of the cranium was one of the most common types identified (Hrdlicka, 1939; Rocca, 1953; Verano, 2003; Weiss, 1953, 1961). Various surgical methods have been identified with surprisingly high success rates for such a potentially dangerous intervention. This paper presents two cases from the Chachapoyas region of Peru, in which a commonly used trepanation technique was applied to the leg (tibia), ultimately unsuccessfully, thus representing the first cases of such a medical practice identified in non-cranial remains. These cases of surgical innovation demonstrate that this application of a known, but invasive, treatment to another area of the body may reflect the practitioner's goal of providing care regardless of the risk of unknown outcomes (Tilley and Oxenham, 2011).

## 1.1. Andean skeletal pathology

In the Central Andean region of Peru, pre-Hispanic societies demonstrate a long history of significant achievements in social, technological and architectural innovations. They constructed large cities, developed elaborate artistic designs, established diverse

agricultural products, and built empires across a large region known for ecological extremes (Moseley, 2001; Rowe, 1946) (Fig. 1). The dry, desert coasts and high rugged Andean mountain chains of the area were major physical obstacles; however, these challenges were not overcome without leaving their mark on the lives, and the bones, of these ancient peoples.

Skeletal trauma is the most common type of lesion reported from numerous sites, commonly identified as cranio-facial injuries consistent with interpersonal violence (Andrushko and Torres, 2011; Tung, 2007) and post-cranial fractures that suggest individuals were subjected to various environmental and occupational hazards (Standen and Arriaza, 2000b; Standen et al., 2010). Few studies have attempted to assess trauma frequency or patterns at a regional level to explore the overall impact these would have had on lifestyle and survival (but see Arkush and Tung, 2013). Often focusing on the prevalence of healed antemortem fractures, previous trauma studies suggest that even with complex and multiple-element fractures, as well as comminuted fractures and dislocations, these individuals were being treated in a way that prevented death due to exsanguination or infection (Dettwyler, 1991). Other individuals exhibited osteological lesions consistent with surviving with advanced stages of a variety of chronic and infectious diseases (Allison, 1984; Allison et al., 1981; Friedrich et al., 2010; Klaus, 2014; Phillips and Verano, 2011; Standen and Arriaza, 2000a; Verano, 1997a,b). While this does not necessarily confirm that there were healing specialists among these indigenous peoples, it suggests that some medical knowledge was available and care given when possible.

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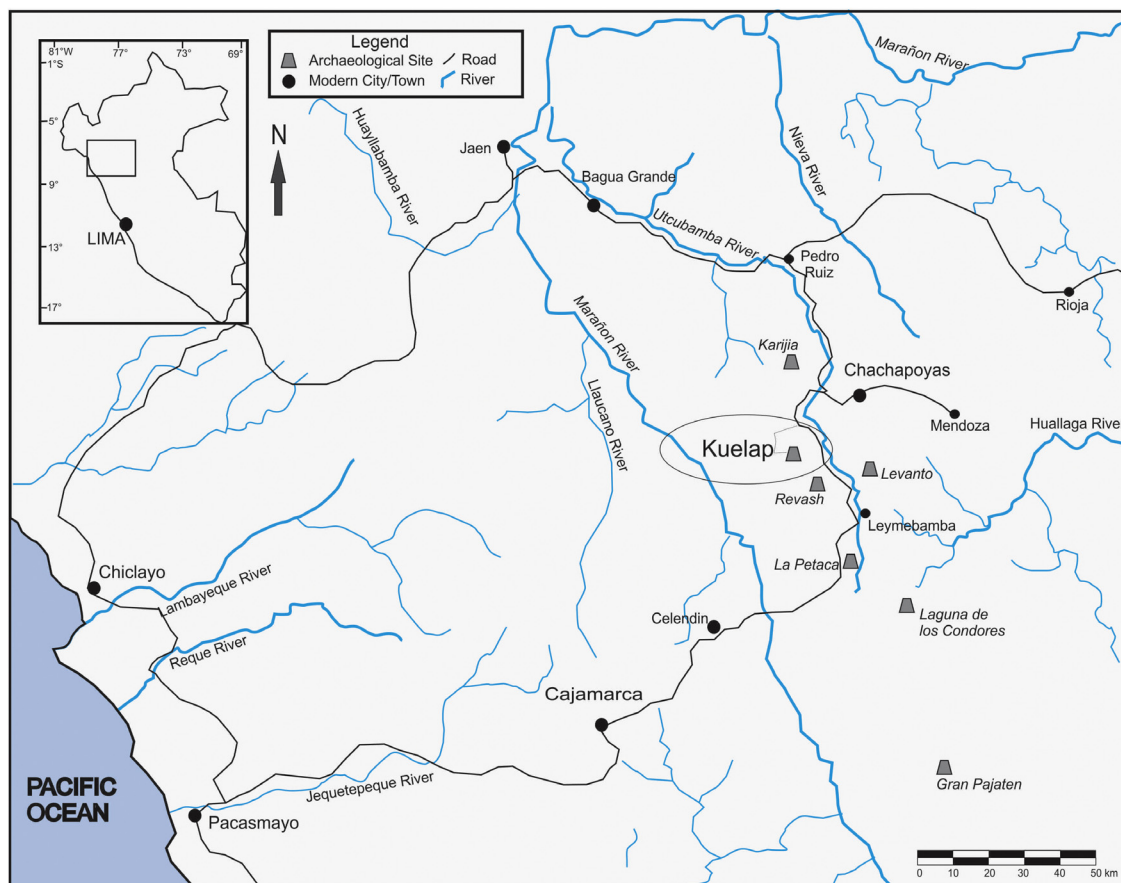


Fig. 1. Map showing the geographic location of the Chachapoya region in Peru with major archaeological sites including Kuelap (circled).

### 1.2. Ethnohistoric descriptions and archaeological evidence of surgery

Early written documents provide some information about pre-Hispanic medical practices, though perhaps from a biased European perspective. Nonetheless, these reports describe the considerable skill of indigenous healers and *curanderos* as specialists dealing with significant injuries, disease, and complex medical treatments based upon extensive knowledge of local plants and their medicinal properties (Cabieses Molina, 1993; Cobo, 1990 [1653]; Rowe, 1946). There is some suggestion that Cusco, as the center of the Inca Empire, was also the center of medical achievements, even hosting a medical school (Cabieses Molina, 2007; Lastres, 1951). Furthermore, the earlier Chachapoya people (A.D. 800–1470) in the northern highlands were reported to be proficient herb doctors and “sorcerers” with great healing skills (Arriaga, 1968 [1621]; Calancha, 1972 [1638]; Schjellerup, 1997).

Several archaeological examples of surgery<sup>1</sup> have been described by Verano et al. (2000) and Verano and Andrushko (2010) with specific examples of bone healing after substantial injury, amputation, or surgical intervention. The individuals from the coastal site of Huacas de Moche with lower leg amputations showing evidence of healing clearly reflect drastic procedures, although whether they were therapeutic or punitive interventions remains unclear (Verano et al., 2000). More generalized

<sup>1</sup> Surgery here is defined as specific invasive medical procedure used to provide alleviation of physical suffering, wherein the intent is to provide care for the individual patient.

descriptions of cranial surgery from Hrdlicka’s early Twentieth Century skull collection (Tyson and Dyer Alcauskas, 1980) and other Peruvian cranial examples described by Weiss (1961) and Rocca (1953) include trepanations and possible cauterizations. One can assume that these complex and presumably dangerous treatments could not have been successful without some knowledge of the intricacies of human anatomy and physiological processes as well as in the prevention of infection.

### 1.3. Trepanation techniques

Trepanation (or trephination, the modern method of drilling holes into bone) is, by definition, cranial vault surgery involving the removal of a section of vault bone. It has long been of interest to those studying peoples of the ancient Andes (Hrdlicka, 1939; Jorgensen, 1988; Moodie, 1919; Rifkinson-Mann, 1988; Trelles, 1962). Collections of trepanned crania abound in museums due to the fascination with these remarkable surgical procedures; many, unfortunately, have poor contextual information. The practice has a long history in the Andes and work by Verano (2003) explores how widespread it was, as well as the various methods used in different regions. Generally, four bone removal techniques have been identified, including scraping, incising (circular grooving), drilling, and cross-hatching (Fig. 2), using either stone or metal implements (Lisowski, 1967). There appear to be regional patterns in preferred methods; notably, most trepanations in the Chachapoyas region employ a drilling or boring method (Nystrom, 2007; Toyne, 2014), while scraping and circular grooving predominate in the southern Andean highlands (Andrushko and Verano, 2008; Kurin, 2013).

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