

Unit 1 - History of Pre-Columbian and Inca Medicine in Peru

Reading

1. Peruvian Pre-Columbian cultures chronology

The population and civilization of the American continent began after the first appearance of Man, around 15,000 BC. Andean, pre-Hispanic or pre-Columbian civilizations developed along the western coast of America.

Pre-Columbian culture development can be divided in two periods

The first called “pre-ceramic” is the longest phase (15,000-2000 BC); it includes the lithic (15,000-7000 BC), early archaic (7000-4000 BC) and late archaic (4000-2000 BC) periods.

The second one began in 2000 BC, with the appearance and development of ceramics. This “ceramic” or formative period is divided into lower or initial, intermediate or middle, and upper or final ones (1).

Peruvian pre-Columbian cultures reached great territories, such that during the Inca Empire, they occupied lands of what are nowadays Peru, Colombia, Chile and Argentina. Hence, many of their traditions and worldview are quite similar. Pre-Columbian cultures reached a high and complex development in culture, politics, social, economic and religious aspects.

The Inca Empire is considered one of the most developed indigenous cultures, whose territory encompassed present-day Colombia in the north, the coasts of the Pacific Ocean in the west and part of current Chile in the south (2).

Inca culture developed on the coast of the Pacific Ocean in South America. Its territory extended from present-day northern Chile to Ecuador and southern Colombia, having its political capital located in Cuzco. In the Inca Empire, its maximum leader was Inca, who ruled the Tahuantinsuyo empire. The Inca culture developed in various areas, the main ones being agriculture, architecture, goldsmithing, sculpture and animal husbandry, such as llama, alpaca, turkeys and dogs. They also developed a mnemonic system based on knotted cords called Ayllu. They excelled in medicine thanks to the preservation of pre-Columbian medicine (3).

In pre-Columbian cultures, their cognition of disease and health was a state of perfect balance between body, soul and spirit.

The pre-Hispanic Andean worldview

The pre-Hispanic Andean worldview was intimately linked with nature, in which land, fire, air and water interacted (4). Regarding their worldview, the Incas thought the universe was divided into three planes or worlds that were permanently related: the divine world of the gods (Hanan Pacha), the present world inhabited by men (Kay Pacha) and the underground world of the dead (Uku Pacha) (4, 5).

This worldview of pre-Columbian cultures was reflected in Pre-Hispanic Medicine, in which the magical religious thought interpreted health and illness (6).

The knowledge of ancestral surgical techniques and wide variety of American plants used in Shamanic knowledge show us the advances that pre-Hispanic men reached in the treatment of their diseases in South America (7).

An important issue within the worldview common to pre-Columbian cultures was the consideration of life and death as part of a same process. Death was considered simply as a necessary step for the person to move to a different world, that is to say, they passed from one life to another. The idea for an eternal life implied carrying objects, food and other accessories; even -if he was noble- accompanied by his family and closest servants (2,4).

Among Peruvian pre-Columbian cultures, many stand out for the historical and cultural legacy that they have left to humanity. In table 1, their chronology is developed.

Table 1. Peruvian Pre-Columbian cultures chronology

<i>Pre-Columbian culture name</i>	<i>Chronology</i>	<i>Location Pre-Columbian culture</i>
Caral civilization	Approximately 5000 years ago	Northern central coast of Peru, near the actual town of Caral
Chavin culture	1000 BC – 200 BC	Ancash, at 3137 m.a.s.l.
Paracas culture	Paracas caverns (700 BC – 400 BC). Paracas Necropolis (400 BC – 100 BC)	Paracas peninsula
Mochica culture	100 AC - 700 AC	Northern coast of Peru
Nazca culture	100 AC – 700 AC	Nazca
Tiahuanaco culture	200 AC – 1000 AC	21 Km from lake Titicaca, Bolivia
Lima culture	100 d. C. – 800 d.	Lima
Wari culture	700 AC – 1200 AC	Ayacucho
Sican culture	750 AC – 1375 AC	Lambayeche
Chimu culture	1200 AC – 1470 AC	La Libertad
Chincha culture	1200 AC – 1460 AC	Central coast of Peru
Huanca culture	1000 AC – 1460 AC	Hydrographic basin of the Mantaro Valley, in the present provinces of Jauja, Huancaayo, Concepción (Junin) and part of Huancavelica
Aymara culture	900 hasta 1470 d. C.	Peru, Bolivia and Chile
Chachapoyas culture	900 hasta 1470 d. C.	Amazonas
Chanca culture	1200 d. C. - 1400 d. C.	The geographic territory occupied by the Chancas extended to Huancavelica, Ayacucho and the province of Andahuaylas
Inca culture	1150 d. C. - 1533 d. C.	Central western part of South America territories of Peru, Colombia, Chile and Argentina

With respect to the worldview and death, there is evidence of an important accompaniment of the deceased and veneration of the Inca mummies, which have been found in burial chambers placed on their haunches. The sarcophagi were anthropomorphic, monumental stone mausoleums (4).

On their worldview of health and disease, pre-Columbian cultures created their own medicine with special characteristics: it was magical, religious, empirical and rational (2, 6, 7).

Likewise, evidence of acute and chronic diseases in these ancient populations has been found. Ancient knowledge is still used in some Peruvian populations.

Currently, science continues to discover parts of their vast knowledge in ecosystems, medicinal plants, nutritional plants, minerals, animals, therapeutic methods, surgical techniques and mummification. Both pre-Columbian and Inca medicine arose in Latin America to relieve pain and prolong life during severe weather, sequels of war, suffering caused by disease and various health injuries.

Health was handled by healers (also known as Shamans), witches, sorcerers, and various other denominations according to the culture in which they operated (7). In pre-Columbian cultures of Colombia, Chile, Mexico and Peru, traditional medicine was empirical and based on magical religious rituals (7).

2. Definition of pre-Columbian medicine

Pre-Columbian cultures left evidence of their great medicine knowledge and existence. As sources, we find: writings, ceramics, bone remains and others (5).

Pre-Columbian Medicine: the original people who populated Latin America conceived the process of health and disease with a magical-religious thought. There were good gods who granted wellbeing (wealth, health and love) but also bad gods who attracted disease and cataclysms (14).

Inca Medicine: "Inca medicine was a mixture of magical-religious conceptions with an empiricism fundamentally given by the knowledge of the healing properties of medicinal plants, like other medicines from other pre-Hispanic cultures that preceded or co - existed with it throughout the continent" (5).

Characteristics of pre-Columbian medicine

Researchers analyzed various elements to determine the characteristics of pre-Columbian medicine, such as ceramics, textiles and other artistic expressions of magical-religious content preserved in pre-Columbian archaeological remains, testimonies of the so-called chroniclers, coprolites, mummy bone remain ceramics and others (5).

The testimonies of the chroniclers were fundamental; one of the most important chroniclers was Garcilazo de la Vega. He wrote about the several healings made by indigenous doctors and Shamans.

Another important resource to learn about pre-Columbian medicine has been the paleopathology of archaeological records, which provide much necessary evidence. Among the studies carried out by this discipline are the identification of markers present in the bone remains and the representations of diseases in ceramics, iconography and goldsmithing. All of these have given humanity the opportunity to acknowledge the various diseases to which Pre-Columbian settlers were exposed and their cures (10).

The Shaman healers

On Shamanic work, there is evidence that Shaman healers handled various pathologies in the pre-Columbian period, such as: epilepsy, tetanus, facial paralysis, bone disorders (e.g. Pott's disease), infectious diseases, war wounds care, syphilis, various surgeries as cranial deformation and cranial trepanations (8). Evidence of treatment for polyglobulia and headaches with the use of hemorrhages, they treated pain in the head by puncturing the jugular vein and bleeding between the eyebrows on the bridge of the nose (2) and several more medical procedures.

The ancient pre-Columbian settlers developed medicine based on respect for the knowledge of Shamans, Worth mentioning, many of the elements of this “worktable” are currently used in the rituals of the healers of Peru in that northern area, which would reveal the historical continuity of medicine of the Andes from those times (4).

Pre-Columbian medicine was based on Shamans or healers, chosen by tradition from generation to generation or by the call of deities. They guarded the physical, mental and spiritual aspects of the health.

3. The Evidence

Paleopathology

The most direct and verifiable source of information on pre-Columbian health lies in the human remains themselves (11), which were analyzed with various non-invasive diagnostic support tools such as radiography, tomography, and invasive ones such as DNA extraction, studies of markers, etc.

In an article on paleopathology in Andean South America, results of radiological studies of human remains from that time revealed that the pre-Columbian settlers from the Lambayeque culture suffered from gallstones, vascular calcifications, and cranial deformations with the presence of metal plates at the cranium temple, sternum and other parts of the body (11).

The study of bone remains showed rheumatoid arthritis, osteomyelitis and nutritional deficiency anemias (11). Bony prominences called “osteoma of the external auditory canal” were found in skulls. These deformations are usually found as a reaction to frequent infections of the external auditory canal (5). It should be noted that our ancestors were deep-sea shellfish collectors; therefore, these injuries were common in coastal towns or near large lakes. We can conclude a relationship with diving as a work activity and this type of disease existed (5).

The study of pre-Inca and Inca mummy bone remains also showed evidence of vertebral tuberculosis or Pott's disease. (11) The bones were analyzed by several radiological and molecular studies to confirm the diagnosis. Radiological and polymerase chain reaction (PCR) studies confirmed the diagnosis of vertebral tuberculosis or Pott's disease (11).

The study of mummies

Various studies of mummies' hair, which reveal consumption of medicinal plants, have been done. For example, cocaine and its metabolites have been found attributed to consumption of coca leaves in the

Peruvian Andes, in addition to nicotine from the use of tobacco. Likewise, remains of metabolites of alkaloids from the use of hallucinogenic plants were identified, but researchers also found evidence of chronic arsenism (12).

The study of coprolites

Research in coprolites has provided scientific results on health information and other aspects such as presence of intestinal parasites in the individuals, *Diphyllobothrium pacificum* eggs, *T. trichiura* eggs, *Enterobius vermicularis* eggs, *Ascaris lumbricoides*, and *Giardia lamblia* were found (5). Hence, analysis of the coprolites revealed that our ancient pre-Columbian and Inca settlers lived with intestinal parasites and that some medicinal plants were used to treat this parasitosis (13).

The study of ceramics

Another important source of knowledge on disease and medicine in pre-Columbian culture were ceramics. "After analyzing the figures in the ceramics, the existence of specific pathological entities during ancient Peru has been acknowledged, among other cultural appreciations. Researchers and medical historians agree in the recognition of diseases by the manifestations of externalized signs with those concurring to the semiological methodology in the medical sciences."

From the faces or facie of each ceramic icon (popularly known as "huacos") a retrospective collection of "the semiology of some modalities of the pathology of the Inca" can be formulated (14).

Pathologies that affected the Pre-Columbian peoples

In the analysis of pre-Columbian ceramics found in archaeological sites and museums, the representation of various pathologies that affected these populations has been observed. Among them the most frequently identified conditions were obesity, thyroid goiter, steatopygia, facial and trigeminal nerve pathologies, blindness, cleft lip, nasal deformations and destruction of congenital and acquired septum, exophthalmos, palpebral ptosis, facial syphilitic gum, uta, pinta, skin erosions, mutilated faces, cranial deformations, etc. (4,5,22).

Childbirth care has also been identified in many pre-Columbian and Inca ceramics, revealing that labor and birth were carried out with the mother in an upright position.

The Pre-Columbian ceramics also reveal medical or surgical practices and various diseases, such as: acromegaly, blindness, facial paralysis and pathological mutilations. These last were usually caused by diseases such as leprosy, sore, uta, syphilis, leishmaniasis, blastomycosis and lupus. Shaman healers treated many of these diseases from that time (16).

In Peru, there are several museums that keep important ceramic and goldsmithing collections. One of them is "Larco Museum", where we can find items that recall several infectious diseases in pre-Columbian America: Tuberculosis, histoplasmosis, leishmaniasis, Chagas, amebiasis, Peruvian wart Endemic, syphilis, tetanus and others.

Pre-Columbian cultures had to deal with Leishmaniasis, an autochthonous disease. "Leishmaniasis has a long history, dating to 2,500 B.C., with several primitive descriptions of the disease being found in ancient

writings and recent molecular findings from ancient archeological material" (17). Currently this disease is known as Carrion's disease. It causes hemolytic fever ("Oroya fever") with case-fatality rates as high as ~90% in untreated patients, followed by a chronic phase resulting in angiogenic skin lesions ("verruca peruana") for *Bartonella bacilliformis* (18).

An important concept in this unit is the existence of a disease called "Peruvian wart", which was endemic in Peru and caused many deaths in the pre-Columbian towns and later also. This motivated a young Peruvian medicine student named Daniel Alcidez Carrión to do research on the disease, sacrificing himself to further study the disease currently named after him. As part of his research, he was inoculated with fluid from a verruga lesion from a patient with the chronic form of the disease. He recorded the clinical features which developed, including fever, malaise, arthralgia, vomiting and anemia, and it became apparent that he had developed the anemic febrile acute phase of the illness (known as Oroya fever). However, his case did not progress to the chronic form of the disease, and he died few weeks later, on October 5th, 1885. His sacrifice served to establish that Oroya fever and verruga disease had a common etiology and his death stimulated further research into the cause, now established as the bacterium *Bartonella bacilliformis*. Carrion is considered a martyr of Peruvian medicine and October 5th has been designated as Peruvian Medicine Day in his honor" (5).

The study of the evidence of surgeries

In the study of pre-Columbian cultures, it is mandatory to explore their great advancements in surgery. Cranial surgery, amputation surgery, and cranial deformation practices were developed with great success.

Surgeons and Shaman healers used various medicinal plants to relieve pain, provide anesthesia and prevent infections. In pre-Columbian medicine a high percentage of patients with trepanned skulls recovered, possibly due to the use of medicinal plants to prevent infections and inflammation (2).

The procedure of trephinations consisted of extracting the affected area, covering the hole with gold plates and covering the surgical area with bandages of fine cotton wool, they used a surgical instrument the Tumi, among other instruments. The Tumi, which means "knife" in Quechua, is one of the most famous pieces of pre-Columbian art. It has an anthropomorphic face, with eyes like those of birds. Its body is made up of a thorax and legs of the same length. Its handle is rectangular or trapezoidal in shape. The archaeological results of trepanned skulls found in the Paracas and Nazca cultures demonstrated that the cuts were made with flint knives and metal Tumis (8).

The Cranial surgery - trepanations

Aside from Cranial surgery, the surgeon healers of the pre-Columbian medicine prevented the infection and inflammation of their surgeries with a series of plants (2), which could have led to their success after trepanations and surgeries, with skulls showing the impressive result of a frontal cranioplasty performed with gold plate, followed by perfect healing around the bone.

The trephination and cranial surgery were performed by abrasion, scraping, crosscut sawing, and drilling. "The ancient tombs, the human remains, mummies, skeletons, and their belongings, including war instruments, pottery, clothing, jewels, and surgical instruments, constitute the richest source of insight into the lives and activities of ancient cultures" (19).

Examination of several skulls reveals extensive craniotomies, “which preserved the trajectory of the dural sinuses and left behind protective bone bridges, thus demonstrating anatomic knowledge of these regions” (19) and some of the possible reasons for the trepanations were: trauma, fractures, epilepsy, diseases of the cranium, headaches, scalp and cranial infections and mental disease; on the other hand, an important observation related to skull surgeries in pre-Columbian cultures is related to the use of tourniquet which has allowed a perfect hemostasis during the surgeries (19).

The cranial deformations

Another practice found in pre-Columbian cultures was bone deformation. In Peru, there are remarkable pieces of cranial deformations. In some mummies the technique is still insinuated with remains of strongly tied slats. The pre-Columbian cultures developed important techniques of cranial deformation, it consists on the placement of flexible elements, which adjust to the skull in the first months of life and up to three years of age, to exert pressure in certain areas, directing the growth towards the areas of the skull with less pressure. (20) It is worth mentioning that skull deformations were carried out to identify people from different geographical or social origins (20).

Various studies showed beauty-related treatments, such as the use of necklaces, earrings, but also tattoos (15), besides the ones used in health or death rituals. (21)

Juanita Mummy

Finally, a great contribution from Peru is the famous Juanita Mummy, known as the Lady of Ampato, found on top of the volcano that carries her name. The Mummy is a key piece of archeology, which allows knowledge of the ritual customs of the ancient inhabitants of this area of Peru. She was found after 500 years on a mountaintop in Arequipa, Peru. She is considered one of the best-preserved mummies in human history in the world. The mummy died as part of a human in a ritual called "Capaccocha", in which children were offered to the “Apus” to appease the gods. The body of Juanita Mummy was discovered in the upper part of the snowy Ampato, in September 1995, by anthropologist Johan Reinhard and Miguel Zárate. The mummy has preserved all her organs, has been part of various local, national and international research: tomography, DNA studies, etc. (22, 23, 24).

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