

The Development of Neurosurgery during the pre-Inca - and Inca periods - Ancient Peru and the Neurosurgical Arts



Mural of Trephination Scene @ Machu Picchu
Exhibited in Physical Anthropology Hall,
Museum of Natural History, Smithsonian Institution

Among the more notable attributes within the human record I believe, is man's unreserved operative concern towards the survival and well-being of one another. Man's inflexible resolve in his quest to effectively manage this fearful injury of head trauma is a fascinating story, as told from ancient times to present. From my own experience, this injury presented challenges that I found at times to be near impossible to overcome.

Pictured at the top of this page is artist, Alton Tobey's rendering of what an actual trephination may have looked like, as performed at Machu Picchu during the time of the Inca Empire. Mr. Alton Tobey painted the mural in 1964. Trephination is the act or instance of perforating the skull with a surgical implement. The word trephination is derived from the Greek word *trypanon*, meaning to bore.

Following man's heightened conviction, ideology and economy, it happened over time that medicine and surgery had become enriched and so wonderfully empowered by science. Today's surgeons, particularly neurosurgeons are capable of performing feats deemed incredible and/or impossible only half a century ago. When a surgical intervention is called for in the treatment of any indisposition affecting the brain, cranial trephination is necessary so as to provide access to the brain.

Of all types of injury, injuries to the brain are among the most likely to result in death or permanent disability⁽¹⁾. An estimated 1.7 million head/brain injuries occur every year in the U.S.⁽²⁾. Every year in the U.S., approximately 50,000 deaths occur subsequent to a traumatic brain injury⁽³⁾. An estimated 5.3 million Americans, or 2% of our population currently live with disabilities resulting from brain injury⁽⁴⁾. 230,000 are hospitalized annually following a TBI and survive⁽⁵⁾.

The leading cause of traumatic brain injury in the general population of the U.S. are: falls, 40.5%; motor vehicle accidents, 14.3%; struck by/against events, 15.5%; unknown or other, 19%; and assaults, 10.7%⁽⁶⁾. Brain trauma from blast force is the signature injury of the Iraq and Afghanistan campaigns, afflicting hundreds of thousands of U.S. combat personnel⁽⁷⁾. Veteran advocates believe

that between 10 and 20 % of Iraq veterans, or between 150,000 and 300,000 service members have some level of TBI⁽⁸⁾. Traumatic brain injury resulting from blast force trauma can happen when one is in close proximity to an improvised explosive device (IED) or an exploding military shell. The surgical management of head trauma is the only surgery known to be of great antiquity and traumatic head/brain injury is as old as man.

The Edwin Smith Papyrus from Egypt represents the earliest written record of medical treatment. Among the forty-eight cases described, are a number of references to head and brain injury. These descriptions were written around 3000 to 2500 BC. Hippocrates (460 -377 BC), our 'Father of Medicine' was born on the Greek Island of Cos. Hippocrates left many texts on the surgical management of head trauma. He systematically described head injuries and categorized them as fractures, contusions of bone, compressed fractures, depressions or indentations with or without fracture. Aulus Cornelius Celsus, born in 25 BC, a renowned advanced surgeon of ancient Rome, described his treatment of head trauma in great detail. Claudius Galen, born in 139 AD in Pergamus, Asia Minor was summoned to Rome at age 28 to serve as a physician to their gladiators and to Rome's then emperor Marcus Aurelius. His experience dealing with head trauma led to the recognition of a correlation between side of injury and side of motor loss. Thus, the early Greeks and Romans developed their art of trephining to a certain level of competence.

In the Medieval period, 500 to 1500 AD, Roger of Salerno (1070 – 1119) recommended trephining for skull fractures and the draining of exudates. An exudate is a fluid that has discharged out of a tissue or its capillaries due to injury or inflammation. In the 14th century, Guid Sholiac was the first to remove successfully a part of the brain damaged by injury. Much later in 1660 AD, Richard Wiseman (1621 – 1675) removed an epidural hematoma and advised incising the dura to evacuate a subdural hematoma. In the last hundred years, thousands of trephined skulls that date to the Mesolithic period have been recovered from Western Europe, Africa, the Middle East, India, China, southern Siberia and Melanesia, as well as Central and South America. The Mesolithic period is the historic time between XII and VIII BC. The earliest known trephined skulls were found in North Africa and are dated from 10,000 BC⁽⁹⁾.

Today, the neurosurgical management of head/brain trauma demands an extensive education along with an exceptional aptitude, manual grace and a capable endurance. I came to develop a great appreciation and respect for the tireless effort of man in his lionhearted pursuit of an effective management of head/brain trauma. As I was driven to understand the story behind this remarkable surgery, I came to develop a great respect for Peru. In turn, I simply felt a need to share with the world her outstanding contribution to the early evolution of the neurosurgical arts.

Trephination and its justification varied widely within the many differing cultures during ancient time, reaching its highest number as well as its most skilled level in the Moche, Chimu and Inca civilizations of what in present time is Peru. That the practice of trephination during the pre-Inca and Inca period was widespread is without doubt, since two thousand five hundred and thirty nine trephined skulls had been reported by the year 1988. Dr. John Verano, Professor of Anthropology at Tulane University at one time shared with me that he and his students are still discovering trephined skulls to this day. Dr. Verano has been excavating and analyzing skeletal remains from Pre-Columbian sites in South America since 1983, and for the last 33 years, has spent his summers in Peru.

Dr. Paul Broca (1824-1880) was born in Sainte-Foy-la-Grande, Bordeaux, France. At the age of seventeen he entered medical school in Paris. He went on to become a Physician, Anatomist and

Anthropologist. In 1867, Dr. Paul Broca made it known to the world that a skull he had received from the U.S. diplomat to Peru, Ephraim George Squire, evidenced a man-made opening. Though, it was not the earliest reported instance of a man made opening of a human skull, it was the first case of trephination to be correctly identified. A trephined skull had earlier been discovered in 1839; however the significance of the opening had not been recognized. Dr. Broca was not only considered the leading anthropologist of the day, he was also a dominant figure in the world of medicine. Dr. Broca also determined the individual to have survived the operation a few weeks following the surgery.

What you see in the photos below are of the skull identified by Dr. Broca in 1867. No specimen has proven to be of more value in the history of trephination than this Inca skull shown below. It is considered, not only a marvelous example of human ingenuity, it is also considered a wonderful compliment to the human intellect during ancient time. The rectangular opening measures 15 x 17mm.

This skull was discovered in an Inca cemetery in the valley of Yucay, in the Cuzco region of Peru. It has been dated between 1400 and 1530 AD. The posterior and interior portions are missing, and only the frontal and facial portions remain. This rather extraordinary skull is now held at the American Museum of Natural History in New York, NY. Photo courtesy of the American Museum of Natural History.



Ephraim George Squier, born in Bethlehem, New York on June 17, 1821 had become a respected diplomat and traveled to Peru in 1863, as part of special negotiating commission. In 1863, Squier had been appointed as U.S. Commissioner to Peru by then President Abraham Lincoln. It occurred during a visit to the home of a Senora Zantino, a well-known collector of a number of Peru's finest and most valuable artifacts, that Squier happened upon this remarkable human skull. During his visit and following a time of sharing their mutual fascination and interest, Senora Zantino allowed Mr. Squier to take the skull for the purpose of an investigative research towards determining the significance, if any, of this rectangular opening of the skull.

Mr. Squier first presented the skull before the New York Academy of Medicine, who critically scrutinize this unprecedented relic of early history. There was no quarrel the incisions were made by man, however, the Academy could not agree as to when the incisions were made. Were these incisions made before or after death? Following the Academy's inability to reach a decisive ruling, Squier then presented the skull to Dr. Paul Broca in Paris, France. Following the completion of his official work in Peru, Squier remained active in Peru exploring the Andes and studying the Inca culture from 1864 to 1865. It was in 1866, that Squier returned to Boston, MA, where he presented a series of lectures on the Inca Empire at Lowell Institute located in Boston, MA.

Ultimately, this Peruvian specimen had spawned a great deal of attention and fascination in the United States and Europe. Previously, trephined skulls had been found in France as well as Peru, but they had been either dismissed or misunderstood. This skull clearly evidenced an opening that could not have been made by a weapon of war, or by any force of nature. More important than that, the opening evidenced the individual to have survived the surgery a few weeks. This trephined skull was not only considered important because the individual survived. This trephined skull, furthermore suggested that a possible diagnosis may have preceded the surgery. There isn't any evidence of fracture or wound to the skull.

Josiah Clark Nott (1804 - 1873) was born in the state of South Carolina and received his medical degree from the University of Pennsylvania, becoming a Physician and a Surgeon. Dr. Nott at that time was recognized as a leading authority on skulls. Dr. Nott explained the wound, though not evidenced, as having likely been made by a bayonet or possibly a dagger. During Nott's time, an injury such as this would have clearly called out for a trephination to be performed on the victim's skull. This surgery would also call for the removal of the injured bone, leaving no trace of fracture or other bone injury.

Nomadic tribes along with established centers of civilization are known to have existed in South America as early as 2500 BC. The Incas' 'Tahuantinsuyo Empire' was in place when the Spanish arrived in 1532 AD. Prior to this, the land of what is now Peru was overrun by primitive peoples who were constantly at war with each other and were among a succession of civilizations dating back to 2500 BC. The Moche-Chimu 500 BC to 1470 AD, an accomplished tribe of that era demonstrated an abundant practice of trephination. Their survival-rate in the early coastal regions of Peru was approximately forty percent. In 1470 AD, the Chimu, descendants of the Moche culture were conquered by the Inca.

The Inca tribal surgeons, were adept at opening the skull to relieve pressures from cranial fractures. The Inca arrived late on the historical scene of Peru, and even their legends do not predate 1200 AD. Be that as it may, by AD 1350-1400, the skill and success rate of the highland Inca had climbed to approximately eighty percent. The Inca tribal surgeons of pre-Columbian Peru remain man's finest example in the early surgical management of head trauma. Prior to Spain's penetration in 1532 AD, these surgeons of the pre-Inca and Inca period had a notable success rate in their surgical management of head trauma; while the surgical management of head trauma during eighteenth century Europe was nearly 100% fatal and was for a while discontinued. As a testament to the unequalled efforts of the pre-Inca and Inca, nearly all the trephined skulls recovered in Peru demonstrate a healing with infrequent evidence of infection. The specimens utilized in my tribute to Peru reveal a success rate of 75.7 %

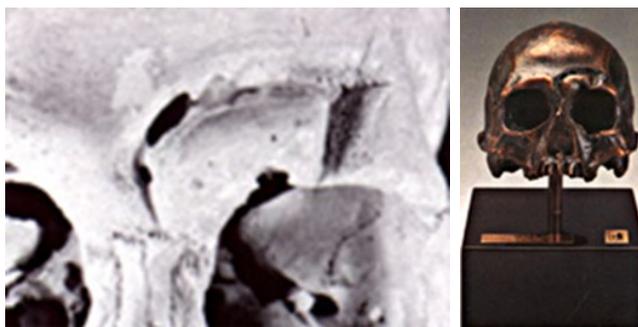
Pictured here is an example of a gold cranioplasty with perfect healing around the bone. I believe this example validates the superlative capabilities of Peru's ancient surgeons. This skull is currently held at the Museo del Oro, Lima Peru



Despite their rudimentary knowledge of disease and pathology, a considerable knowledge of anatomy and natural medicine provided the pre-Inca and Inca with hemostatic agents, antiseptics and other medicinal drugs such as quinine for fever and malaria. Their knowledge of gold and silver allowed their use of these metals for cranioplasties. The surgeons of pre-Columbian Peru were also known to have opened inflamed sinuses, excised tumors, amputated limbs and replaced them with prosthetics. But, it was in the area of skull intervention that the surgeons of ancient Peru demonstrated a singular level of skill and propensity. Between five and six percent of the skulls exhumed from ancient burial grounds in Peru, provide evidence of skull intervention.

Trephination of old, most often always involved a removal of a part or parts of the skull. I am pleased to say here, there is evidence in one of the skulls I've reproduced in bronze that suggests the section of skull removed was utilized as the cranioplasty. Dr. Blanca Alva-Guerrero, Director, Preservation of Historical Heritage, National Institute of Culture, Lima, Peru, (2006 to present) having reviewed my web site, shared with me in a letter that up until visiting my web site, it was understood by her, that there was only one example which demonstrated the section of bone removed by trephination was utilized as the cranioplasty. Dr. Alva-Guerrero spoke of this skull as being held within the collections of Peru's National Museum of Archaeology, Anthropology and History of Peru. Dr. Alva-Guerrero describes this skull as being an Inca skull, discovered at the Inca site of Kanamarca, Cuzco, Peru, and further indicated this skull to have achieved a successful healing. Dr. Alva-Guerrero went on to say that the technique observed in my bronze reproduction of the San Diego Museum of Man's specimen # 1915-2-288 appears to match the technique as seen in this Inca skull of Kanamarca, Cuzco, Peru.

Skull #1915-2-288 pictured to the right, was discovered in Cinco-Cerros, Peru. The trephination of cutting involved an area 4.9 x 2.3 cm. at left brow area. The cutting procedure is noted as having penetrated the frontal sinus. This skull was determined be that of an adult male and is dated as being of prehistoric time. Dr. Ales Hrdlicka, who discovered this skull in 1915, determined skull #1915-288 to be exhibiting only a slight evidence of healing.



There are a number of skulls within the collections of Peru's Museo del Oro and National Museum of Archeology, Anthropology and History of Peru that exhibit multiple trephinations; indicating the individual survived to fight another day. However, the majority of trephined skulls all over the world evidence single openings. The skull with the highest number of openings comes from Cuzco in Peru. This skull has seven openings and speaks of the remarkable fortitude of the Peruvian people as well as the remarkable proficiency of their early surgeons. Skull is currently held in the British Museum

The majority of tribes during the pre-Inca and Inca period were a warring people who frequently engaged in unsparing, hand to hand battles utilizing weapons of a fierce design. Stellate war club heads crafted from stone or hardened copper were attached to the ends of poles five feet or more in length were called *porra*. The *porra* is considered most responsible for the injuries of trauma to the head. But, there was also the *clava*, *maza* or *huactana* - a heavy 90 cm long club of hard wood with splints of copper or stone inserted into the sides. There were also weapons such as the Inca copper axe and star mace along with lance and arrow heads that produced a multitude of head wounds.



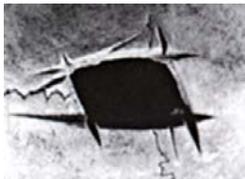
What you see in the photo to the left is a skull exhibiting 2 circular cutting craniotomies. It is believed that the injury was caused by the stone porra weapon, which is pictured inset into the skull. The photo next to it shows an assortment of war club heads that would be attached to the ends of poles five feet or more in length.

A *casco* or helmet is said to have been worn to protect the head. These helmets were crafted of wood or thin metal. Some were of interwoven cane and very light. Most were decorated with ribbons, feathers, emblems, and other ornaments. These helmets were very fragile, which may help explain the exceptional development in their management of head trauma.

In 1938, Dr. Spencer Rogers of then San Diego State College, conducted a scholarly study on the skulls of the "Hrdlicka Paleopathology Collection". This collection was then as is now held at the San Diego Museum of Man. Dr. Rogers determined there to be four methods of trephination. The four methods of trephination utilized by the Peruvian surgeon were: 1) Cutting, 2) Abrasion, 3) the combination of Cutting & Abrasion, and 4) Drilling.

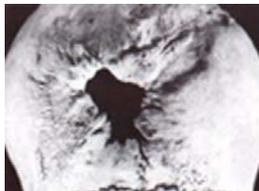
Trephination by Cutting is evidenced by clean margins. Dr. Rogers makes mention of the Museum of Man's #1915-2-308 from the "Hrdlicka Paleopathology Collection."

1) Dr. Rogers notes that specimen #1915-2-308 presents a wonderful example of this Cutting technique utilized by the ancient Peruvian surgeon. Pictured here is a photograph of my bronze reproduction of specimen #1915-2-308, accompanied with a photograph of the actual skull detailing the site of trephination. This skull demonstrates the same method of trephination as was seen in the Inca skull identified by Dr. Broca in 1867.



Specimen #1915-2-308 was discovered in San Damian, Peru and was determined to be an adult female. It is dated as prehistoric. The trephined opening measures 3.0 x 1.7 cm. The trephined opening does not exhibit any sign of bone regeneration, indicating the individual did not survive.

2) In trephination by Abrasion or Scraping as it is sometime referred to, the bone thickness is reduced until the vault is perforated. Dr. Rogers indicates in his study that the Museum of Man's specimen #1915-2-286 is a good example of this method that also exhibits a wonderful example of advanced bone growth/healing.



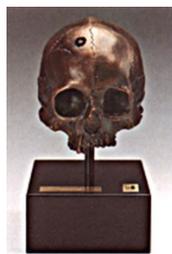
Specimen #1915-2-286 was discovered in Cinco Cerros, Peru and was determined to be an adult male. It is dated as prehistoric. The total area of trephination measures 10.5 x 14.5 cm.

3) In trephination by Abrasion and Cutting, the thickness of bone is reduced until the vault is perforated. A brief cutting procedure would then release the bone fragment. Abrasion was rarely carried through the inner table because of the difficulty in opening a large area by this means alone, together with the likelihood of hemorrhage through irritating the meninges: three membranous envelopes — pia mater, arachnoid and dura mater that surround the brain. Dr. Rogers identified specimen #1915-2-284 as the most instructive example of Abrasion and Cutting. Shown below is a photograph of my bronze reproduction of specimen #1915-2-284 accompanied with a photo of the actual skull detailing the site of trephination.



Specimen #1915-2-284 was discovered in Lupo, Peru and determined to be that of an adult male. The skull is dated as prehistoric or early historic. The total area of trephination measures out to be 4.7 x 6.0 cm.

4) The performance of a trephining through rotating an implement was rare among the pre-Inca and Inca. Specimen #1915-2-283 as understood by Dr. Rogers is an excellent example of the drilling method. Though not completed and indicating death, it demonstrates well this method of drilling a series of holes which were then merged into a circular opening by breaking down the walls separating the drilled holes. It has been speculated that the drilling was accomplished using a sharp edged flint scraper or knife. It also has been considered that the drilling was performed using sharpened obsidian, a hard glassy, volcanic rock. There are no written accounts nor drawings that illustrate/describe their technique of drilling, or for that matter any one of their techniques in the surgical management of head trauma. Shown below is my bronze reproduction of specimen #1915-2-283, accompanied with a photo of the actual skull detailing the actual site of trephination.



Specimen #1915-2-283 was discovered in Matucana, Peru. Gender was not effectively determined, but the skull is dated as prehistoric. Area of trephination is estimated at 1.6 cm in diameter. The patient's death is indicated at some point during the operation. The trephining procedure is seen as not having been completed. In addition, there is no evidence of bone regeneration/healing, indicating the patient did not survive.

The tumi is the crescent-bladed, long handled knife which was part of the surgeon's inventory of instruments. The earliest known examples are from the Moche culture. Sharp knives crafted from obsidian, were also known to have been used in their surgical intervention. Bone elevators, dura protectors, suturing needles, cotton bandages, and hemostatic wool tourniquets for the head have also been found.

The tumi was also used by the Chimú, the descendants of the Moche culture. They, like the Moche, made the tumi of copper, and additionally in bronze. Upon conquering the Chimú, the highland Inca co-opted many of their traditions including the manufacture of the crescent-bladed knife. It is from

the Inca language Quechua, that the word tumi is derived. In Quechua, tumi means knife. Incidentally, the tumi is also known to have been used as a weapon during their many hand to hand conflicts.

When this tumi was discovered, which is 5.125 inches high, it had a considerable part of its blade missing. It is believed that its blade, which is now 1.75 inches wide was similar to the blade of the tumi with two human effigies. Perched on the crown of this tumi is a penguin finial which has a small bell hanging from around its neck. During the pre-Inca and Inca period, penguins were indigenous to the area of South America that is now Peru.



It is thought that this small tumi, 2.75 inches high, was made with a very sharp blade 1.375 inches wide, and was used to intersect the scalp so the trephination could be performed.

President Alejandro Toledo was Peru’s first-ever President of native Indian descent. President Toledo was also fluent in Quechua, the ancient language of the Inca. The dedication inscription on the accompanying plaque is written in Quechua. It reads: “In recognition of the magnificent accomplishments born of ancient Peru, which have contributed so significantly to the development of the surgical arts.” The tumi is also a recognized symbol of Peru. Then Peruvian Ambassador to the United States, Roberto Danino personally delivered this work to President Toledo.

This tumi, 5.375 inches high is shaped like the letter T and its blade, 4 inches wide, is in a crescent shape. On the upper end of the shaft are two seated human effigies. Behind the effigies are positioned two rings. The function of these two rings is speculative; possibly to pass a handle or thong through.



A work commissioned in 2002 for Peru’s President Alejandro Toledo

Along with a good knowledge of anatomy, it is believed the surgeons of pre-Columbian Peru had a considerable knowledge of natural medicine, which provided them with hemostatic agents and antiseptics. A significant contribution of Peru at that time, was its outstanding collection of medicinal plants. The better known were coca leaves, source of cocaine and cinchona bark, source of quinine. Evidence indicates these drugs were in use for quite some time prior to the Spanish arriving at the borders of the Inca Empire in 1532 AD.

These early surgeons of pre-Columbian Peru were also known to have used remedies derived from animal and mineral sources. Perhaps the most startling thing about the many head injuries treated by trephining is the infrequent evidence of infection. This rarity of infection speaks very clearly, either for their extraordinary native resistance to infection or for the gifted disposition of these daring surgeons of the pre-Inca and Inca period.

Dr. Spencer Rogers, who I had mentioned earlier as having conducted a study of the Peruvian trephined skulls at the Museum of Man, titled his study: "The Healing of Trephined Wounds in Skulls from Pre-Columbian Peru". It was his study of the collection of pre-Columbian Peruvian trephined crania collected in 1913 by Dr. Ales Hrdlicka, who was then with the Department of Physical Anthropology at the United States National Museum. This United States National Museum was established within the Smithsonian Institute.

This collection contains sixty skulls and is known as the "Hrdlicka Paleopathology Collection". This collection was part of Hrdlicka's 1915 Panama California Exposition held in San Diego. Hrdlicka's Exposition was the biggest exhibition ever held up to that time, and the material from this exhibition became the core collection for San Diego's Museum of Man.

The operation of trephining a skull, which was widely and successfully performed by primitive peoples in nearly all parts of the world, may be considered the most impressive feat of prehistoric surgery. This operation requires such a high degree of technical skill and a steadfast control that it is of substantial interest to those who study primitive psychology, primitive anthropology as well as those who study ancient medicine.

Of the fifty-nine skulls within the "Hrdlicka Paleopathology Collection" studied by Dr. Rogers; thirteen or 22% show no evidence of healing. Nine or 13% show a slight evidence of healing. Thirty-seven or 62.7% show evidence of an advanced bone growth, indicating a substantial healing. One of the sixty skulls in the "Hrdlicka Paleopathology Collection" is a trephined skullcap from Lovosice, Czechoslovakia. Though not discovered by Dr. Hrdlicka, it had been brought to his attention for identification, description and exhibit for his 1915 Panama-California Exposition and subsequently is part of Dr. Hrdlicka's Paleopathology Collection. The origin of this skull, not being of pre-Columbian Peru was not included in Dr. Rodgers Study.

In 1962, the Peruvian neurosurgeon, Dr. Francisco Grana, who had been a life long student of the surgical practices of the ancient Peruvians, undertook an unusual and sensational operation. He performed a trephining operation using the same instruments employed by the ancient tribal surgeons of Pre-Columbian Peru. His patient, a thirty-one year old Peruvian, had become paralyzed on his right side after an accident. A blood clot had formed under the cranium, exerting pressure upon several of the motion-centers of the brain. Only removing the clot could eliminate the paralysis.

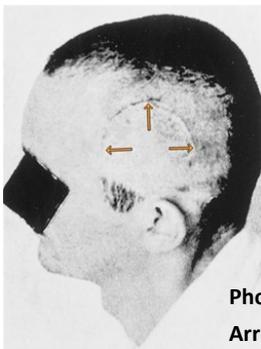


Photo of patient post operation.

Arrows indicating path of trephination.

In opening the skull, Dr. Grana observed all the rules of asepsis and utilized modern anesthesia, but otherwise made use of only those instruments utilized by the tribal surgeons of Pre-Columbian Peru. The patient survived the operation and recovered; just as the sick and wounded, who in a primitive and harsher world had endured and survived the same operation.

Though at times, these early efforts of the pre-Inca and Inca are referred to as brain surgery. Their surgeries were performed only to relieve pressure from cranial fractures suffered in any one of their frequent hostile skirmishes. Dr. Verano, who was earlier mentioned writes: "The objective of trephination following head injury presumably was to elevate depressed fractures, remove bone fragments and smooth broken edges, and possibility to drain epidural hematomas. Although there is no soft tissue to confirm this, practitioners probably learned through experience to avoid penetration of the dura mater, due to high risk of infection and physical damage to the brain."

These surgeons in fact lacked the necessary skills, surgical implements and knowledge to effectively deal with any amount of injury to the brain. Albeit, they did not operate on the brain; nevertheless, their outstanding record in the surgical management of head trauma did provide a resulting means leading to the eventual neurosurgical management of brain trauma.

No primitive or ancient race of people anywhere in the world had developed such an extraordinary insight and understanding in the surgical management of head trauma as the dauntless surgeons of the pre-Inca and Inca period. My work with the Museum of Man is my passion and remains for now, my heartfelt tribute to the bold and daring surgeons of ancient Peru and their incomparable gift to the early beginnings of the neurosurgical arts.

Today's neurosurgical science, which is responsible for saving the lives of so many people all across the globe, particularly those engaged in the warfare of today, has its origin rooted in man's effort seeking a successful management of head trauma suffered in the warfare of ancient time. Such as it was in ancient time, war is continuously providing a theater where the advancements that need be made are being made in the surgical management of today's head/brain trauma. I would like to direct your attention to the February, 2015 edition of the National Geographic, whose lead story is titled: "Healing Our Soldiers, Unlocking the Secrets of Traumatic Brain Injury". It tells of the blast-force brain injuries that affect untold thousands of our U.S. combat personnel. It also speaks of the heroic efforts of our combat medical personnel in their seeking an effective management of this ghastly; and at times, particularly for the victims, such an unsettling, terrifying, insufferable injury.

I remain equally passionate towards my work with the INNOVA HOUSE and my effort towards providing a personal and virtual community where TBI survivors, their families, friends and caregivers can find a ready access to much needed resources, inspiration and support. I choose to be personally and respectfully engaged in a survivor's quest towards achieving an able, rewarding recovery.

My heartfelt best wishes to all TBI survivors, who presently contend with the severely demanding and grim circumstance that follows a traumatic brain injury. Without question, a TBI presents a condition in life that is all too **real** and so undisputedly overwhelming and so, so terribly challenging. My e-mail address is (blaiseevers@gmail.com). I welcome any/all comments, inquiries and/or questions, and I will remain happy to readily respond to all. Thank you.

Notes:

All reproductions were reproduced in bronze utilizing the actual skulls and surgical implements from the San Diego Museum of Man's outstanding collection of pre-Columbian Peruvian trephination artifacts.

The world's oldest known surgery, trephination or the surgical management of head trauma is dated from 10,000 BC. For a thorough accounting of man's efforts towards an effective surgical management of head trauma, I recommend: "**TREPANATION, History - Discovery - Theory**", Editors: Robert Arnott, Stanley Finger and C.U.M Smith. Swets & Zeitlinger Publishers, 2003.

Blaise remains very thankful to Magister Arqueloga, Patricia Maita Arguto, Curator, Physical Anthropology Collection, National Museum of Archeology and History of Peru and Dr. Blanca Alva-Guerrero, Director, Preservation of Historical Heritage, National Institute of Culture, Lima, Peru for their spirited appreciation and wonderful assistance, which included a fine provision of information towards his effectively capturing Ancient Peru's singular contribution to the early evolution of the neurosurgical arts.

References:

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- 3) Data from the National Hospital Discharge Survey, 1996 of the Center for Health Statistics
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- 5) Brain Trauma Foundation
- 6) Centers for Disease Control and Prevention
- 7) National Geographic, February, 2015, "Healing Our Soldiers"
- 8) Brain Trauma Foundation
- 9) 'Neurology and Trauma', 2nd Edition, Oxford University Press, Edited, Randolph W. Evans, Chapter 2, History of Cerebral Trauma', pg. 19, F. Clifford Rose