

HISTORY

The History of Trephination in Africa with a Discussion of Its Current Status and Continuing Practice

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Trephination of the skull is one of the most fascinating and, certainly, one of the oldest therapeutic procedures known to man. After Prunières' discovery of the trephined skull at Aiguières in 1868, a plethora of information has been gathered about the procedure. There, however, exists little documentation of African trephination or its history. Using both primary and secondary sources, we have discovered that African trephination was known in the time of Herodotus, has a rich history, and is currently practiced widely throughout Africa for specific reasons. We discuss these findings as they relate to preconceived notions of trephinations in other countries and to the history of neurosurgery.

KEY WORDS: Africa; Headache; Medical history; Trepanation; Trephination

Trepanation, or trephination, is one of the most fascinating and ancient practices in the history of medicine. The word trepanation is from the Greek *trypanon* meaning "a borer" whereas trephination is a French variant. Trepanation describes scraping, whereas trephination connotes drilling of the skull. For all intents and purposes they are interchangeable and imply a depression or perforation in the calvarium [8].

Since Prunières discovered a trephined Neolithic skull in 1868 at Aiguières and Broca asserted that the patient survived the procedure, a plethora of reports have appeared concerning this practice. Most articles deal with prehistoric trepanations, particularly in Neolithic Europe and pre-Columbian South America, but it has become evident that the procedure has been performed extensively in almost all regions of the world

and in some areas, especially North and East Africa, it continues even today [2,8,10,11,40,41].

African trephinations were performed by sawing, scraping, or cutting using a fairly standard set of instruments in the hands of a specially trained medicine man. Although none of the tribes paid particular attention to cerebral localization, the North African groups assiduously avoided suture lines that were thought to be the "fingerprints of Allah." All groups avoided the dura because they were well aware of the complications associated with its violation. The indications for trephinations were many and varied, but they were performed primarily for headaches following a head injury or, rarely, for the release of evil spirits.

Trephination in Africa has a long tradition originating in prehistory. The procedure, as practiced in North Africa, originated from ancient Arabs and its practitioners included the extinct Guanches of the Canary Islands and the Tuareg Berbers and Chaouias of Morocco, Libya, Chad, and Algeria [1,2,5,8,13,15,21-23,29,30,32,36,37,46,49]. The East African group included the Kisii and Tende in Kenya and Tanzania. Tribes in both these geographical regions continue to perform the procedure today. The practice of trephination on the continent was not confined to these two regions and examples can be found in Uganda, South Africa, Nigeria, and Somalia. Surprisingly, the early Egyptians did not routinely trephine patients [8,14,16,20,25,33,34,41,45].

Many anthropologists consider Africa to be the center of human evolution with Egypt being a most prominent region of early civilization. This is certainly true with regard to early medical practice and knowledge as reflected by the Edwin Smith Surgical Papyrus and early mummification. Treatments for head injuries and brain removal through the transphenoidal route are documented in this publication. It is surprising, therefore, that trephination of the skull was rarely practiced in Egypt as many more varied and complicated procedures were performed. A few examples of trephination in Egypt are available. One is a trepanned skull from the Twelfth Dynasty (2000-1788 B.C.) found in the deep

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pits at Lisht [3,7,35,39,41]. The question arises, therefore, from whence did early trephination originate and where was it found if not in Egypt. Our attention is next drawn to the unlikely region of the Canary Islands.

The Canary Islands

Hans Meyer, in 1896, was one of the first to document trephination in the Guanches, a group of now extinct aboriginal people who were most likely a Berber group closely related to various North African Arab tribes. In Meyer's book, Von Luschan described three examples of trephined skulls found among a series of 52 skulls on the island of Tenerife [8,28]. After these discoveries several other authors including Lambert, Hooton, and Beattie described crania that showed signs of trephination [4,8,24,48]. Most defects had not completely filled in, but new bone formation was clearly evident around the edges with several showing complete healing. Many of the trephinations were similar to the sincipital "T" form found in many Neolithic trephined skulls. This suggests not only a European influence but also the direct importation of this practice into the Islands [4,8,12,17,24,27,28,48].

North Africa

Along with the the Guanches of the Canary Islands, many Arab tribes in North Africa practiced trephination and continue to do so today. As early as Herodotus, it was noted that Libyans practiced trepanation, and pre-historic skulls showing signs of trepanation were found by General Faidherbe in Algeria and subsequently examined by Broca [8,10,18]. Since the late 1800s several expeditions have been mounted to North Africa to document the practice of trephination amongst the Tuareg Berbers, Tibu, Chaouïa, and Kabyle Berbers. It is quite apparent that the practice is based upon a firm historic foundation, is extensively employed, and is currently extant in this part of Africa [1,2,5,13,15,21-23,29,30,32,37,46,49].

The origins of this trephining tradition can be easily understood once it is realized that Arab medicine men were well-versed in this technique and have been practicing this procedure for thousands of years [8,42]. Add to this the fact that the Canary Islands acted as a bridge allowing the Neolithic techniques of trephination to act upon the already competent Arabic traditions in North Africa, and it becomes apparent that the origins of trephination in North Africa were a synthesis of Neolithic and Arabic practices. Although the trephination of skulls has been practiced in North Africa for thousands of years and was noted by Herodotus as early as

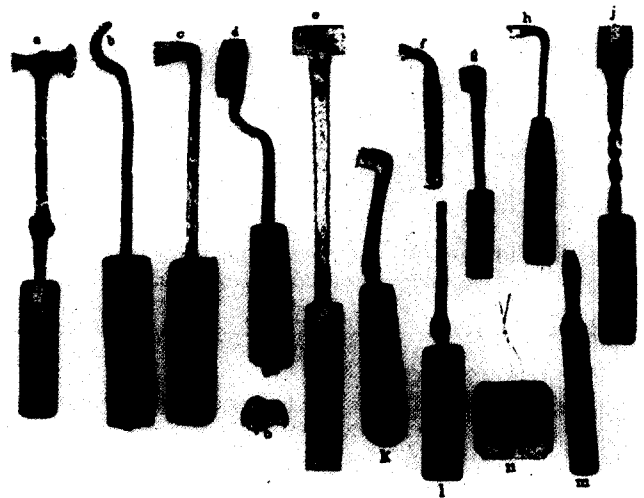


Figure 1. A collection of surgical instruments obtained from Algeria showing various trepanning saws and elevators. Source: Hilton-Simpson MW. *Arab medicine and surgery: a study of the healing art in Algeria*. London: Oxford University Press, 1922:3-38. Used with the permission of Oxford University Press.

the 400s B.C. it has only recently been discovered by "modern medicine" [2,8,11,40-42].

Bertherand, in 1855, indicated that he believed the Kabyle Berbers in Morocco and Algeria practiced trephination [5]. Other French literature later in the century confirmed its existence and summarized its practice [5,8,10,17,18,27,30,32,37]. Hilton-Simpson, in a classical expedition to the mountains of Algeria and Morocco, discovered and observed trephinations amongst the Berbers in the 1920s. A number of skulls, instruments, and bone plugs removed from skulls were collected by their expedition and placed in various museums.

At no time were the dura or sutures (the fingerprints of Allah) violated, and the variety and workmanship of the instruments used were quite excellent (Figure 1). Holes were made in the skull with a hand-twirled drill and connected by means of a serrated saw. However, circular trephines were also used. After the holes were drilled, any blood or pus under the bone was drained and any "bad" bone removed. A dressing was then applied that consisted of sheep's butter, pine, resin, honey, and wheat flour. No sutures were ever used, and the dressing was removed in 14 days. An interesting variant of this procedure was a staged technique wherein all the incisions and bone work were done in one step; the bone was then removed 3 to 15 days after its devitalization. This waiting period allowed the bone to be plucked from the skull. The medicine men in this area were noted to have completed hundreds of these procedures, claimed excellent pain relief, and the restoration of consciousness following injury [8,13,15,18,21-23,27,29,32,40,41].



Figure 2. Trephining in Tibesti. (A,B) Patient who underwent trephination because of headaches. (C) Instruments used by the Tibu witch-doctor. (D) The roundels of bone cut out of the patient's skull, with the epaulette in which they were carried. Source: Oakley K, Brooke W, Akester R, Brothwell DR. *Contributions on trepanning or trephination in ancient and modern times.* Man 1959;59:93-96. Used with the permission of the Royal Anthropological Institute of Great Britain and Ireland. No abridgments made in text.

Another subgroup of primitive Berbers who perform trepanation are the Teda of Chad and Libya. As early as 1935 rumors existed that these tribesmen performed trephinations, but it was not until the Cambridge expedition to Tibesti in 1957 that actual documentation was obtained. The expedition consisted of Cambridge University physicians and an armed escort from the 10th Armored division. The expedition established a clinic in the village of Yibbi Bou in proximity to the peak of Emi Koussi among the Tibu or rock-people. During this sojourn they encountered an example of recent trephination in the form of a man who had been trephined for headache. He carried his bone plugs as good luck amulets in a sardine tin (Figure 2). During this expedition they were able to meet the surgeon involved and observe an actual procedure. They noted that the procedure was done only for headache and had no mystical connotations associated with it [8,15,21-23,36,41].

East Africa

The second major region in which trephination has a long tradition and is currently practiced is East Africa.

The two major countries in which this practice is found are Kenya and Tanzania, and the tribes involved include the Kisii and Tende. Although the practice of trephination was known during the early days of British and German colonization and was documented in early colonial government files, it has only been recently that this practice has been viewed in a modern context. Whereas the amalgamation of Neolithic and Arabic practices produced a clear line of evolution for the history of North African trephination, no such obvious historical basis exists for trephination in East Africa. Coxon believes that the practice can be traced for several thousand years and was inherited from early Persian surgeons—the same source as the Tuareg Berbers and Chaouias. This is not definite, however; the only sure knowledge available is that East African trephination has a long history and is currently practiced as a significant part of the medical tradition [8,14,16,20,25,31,33,34,41,45].

The "head surgeon" or omobari omotwe belong to an elite group in the tribe and usually number no more than 30 in total. Their training is much like that of an apprenticeship or residency where they assist the practicing surgeon in 25 to 30 operations. They take over the practice once he dies or becomes infirm; many times a boy is apprenticed to his father. Women are not allowed to practice this art. In this apprenticeship, both the anatomy and technique involved in this procedure are taught but more importantly, access to the specialized instruments is obtained. These, although crude, are in the forms of the original, ancient instruments and are supposedly highly valued by the tribe. During the teaching process the dura and sutures are taught to be untouchable with disastrous consequences resulting from their violation. The omobari are general healers and are not imbued with any magical powers. They, however, do charge a fee ranging from nominal to quite substantial depending upon the length of a procedure and stature of the patient [8,14,16,20,33,34,41,45].

The operation itself is actually quite simple, but is complicated by primitive instruments and no anesthesia. In essence it is similar to those procedures practiced in North Africa, but it has been better documented. The procedure takes from 1 to as many as 12 hours and involves multiple breaks during this time. Unlike the Berbers, it is almost never a staged procedure but is completed in one sitting. In preparation the omobari may say a chant, and the patient is brought in by a procession of his family and villagers. This is preceded by the blowing of Kudu horns but more importantly, by the washing of the instruments by the surgeons [8,14,16,20,33,34,41,45].

To begin the procedure, the hair may or may not be shaved depending upon the site of the operation. At this



Figure 3. Modern trepanation in Africa. The omabari incises the scalp in a linear fashion and packs the wound with leaves to promote coagulation. Once the bleeding is stopped, he retracts the scalp with his fingers. Source: Meschig R. *Zur Geschichte der Trepanation unter besonderer Berücksichtigung der Schadeloperationen bei den Kisii im Hochland Westkenias*. Dusseldorf: Tritsch Druck und Verlag, 1983:63-161. Used with the permission of Tritsch Druck und Verlag.



Figure 4. Postoperative photograph of the patient seen in Figure 3. Source: Meschig R. *Zur Geschichte der Trepanation unter besonderer Berücksichtigung der Schadeloperationen bei den Kisii im Hochland Westkenias*. Dusseldorf: Tritsch Druck und Verlag, 1983:63-161. Used with the permission of Tritsch Druck und Verlag.

point, the family members, of which there may be a considerable number, are commissioned to restrain the patient in a lying or sitting position. One omabari places his patients on a bed and has the relatives sit on a mattress placed over the patient. The scalp is incised in a linear fashion (rarely cruciate) and the wound is packed with leaves that possibly promote coagulation in the scalp. Once the bleeding is stopped, the scalp is retracted with the fingers and the site of injury or proposed trepanation of the skull i.e., site of headache, is determined (Figure 3). The outer table of the skull is removed by scraping following the removal of any pieces of loose bone. If a fracture line is observed, this is removed in a similar manner. The skull is curretted until the dura is exposed; this scraping is known as ekeore. On rare occasions a saw is used, and this is called enseke. Any blood or pus is evacuated, and the dura is left intact. Several times during this procedure a break will be called for the surgeon to sharpen his instruments. After an arbitrary amount of bone is removed

including all fracture lines, the wound is irrigated with a stream of water and the dressing is applied [8,14,16,20,33,34,41,45].

The dressing is much like that of the North African tribes, and the wound is never sutured closed. Leaves with coagulating properties are placed in the wound as is fat or butter. The edges of the wound are then approximated by plant strips, and a bandage of plaster or local herbs is placed over the wound. The patient is then allowed to retire to his hut. The bandages are changed regularly at several day intervals or any time the wound begins to drain, which is rarely. The wound is totally healed in 14 to 30 days, and the patient, with few exceptions, resumes normal activities after a month [8,14,16,20,33,34,41,45]. Figure 4 shows a postoperative photograph of the patient seen in the previous figure. The postoperative x-ray is also shown (Figure 5).

During the patient's convalescence the omabari takes an active part in his care through visits and wound examinations. The results of these procedures are actu-



Figure 5. *The postoperative x-ray. Source: Meschig R. Zur Geschichte der Trepanation unter besonderer Berücksichtigung der Schadeloperationen bei den Kisii im Hochland Westkenias. Dusseldorf: Tritsch Druck und Verlag.*

ally quite impressive. The infection rate is extremely low due primarily to secondary healing, and the mortality/morbidity rate is also low. This is due to the inviolate nature of the dura as well as the anatomic

sophistication of the surgeon. Deaths are caused primarily by meningitis after a dural perforation or exsanguination after the damaging of a major sinus i.e., the superior sagittal sinus. Interestingly these deaths or any morbidity are usually investigated by the civil authorities but the reality is that the western hospitals in the bush do not attempt any cranial cases—only the omobari do these. Consequently the charges usually do not develop into any type of case. Fees as noted before can be nonexistent or as high as 700 shillings plus livestock. Remarkably it is not uncommon for a patient to have multiple procedures with enlargement of the trephination the rule rather than the production of another skull defect [8,14,16,20,33,34,41,45].

This procedure is quite well documented by investigators such as Margetts, Coxon, Schadewaldt, and Dauer. There have even been videotapes made of this procedure—one of which is in existence today (Figure 6). There are also living examples of African natives who have undergone modern-day trephinations. It is quite apparent that trephination is a flourishing medical practice among these tribes with a very long, although somewhat murky, history [8,14,16,20,33,34,45]. This is not to say that it is limited to Kenya and Tanzania. There exist limited reports that the procedure is attempted in Nigeria, among the Bushmen and the Zulu in South Africa. This procedure among the Zulu is very similar to that practiced by the Kisii and is performed primarily for headache after head injury. Several tribes

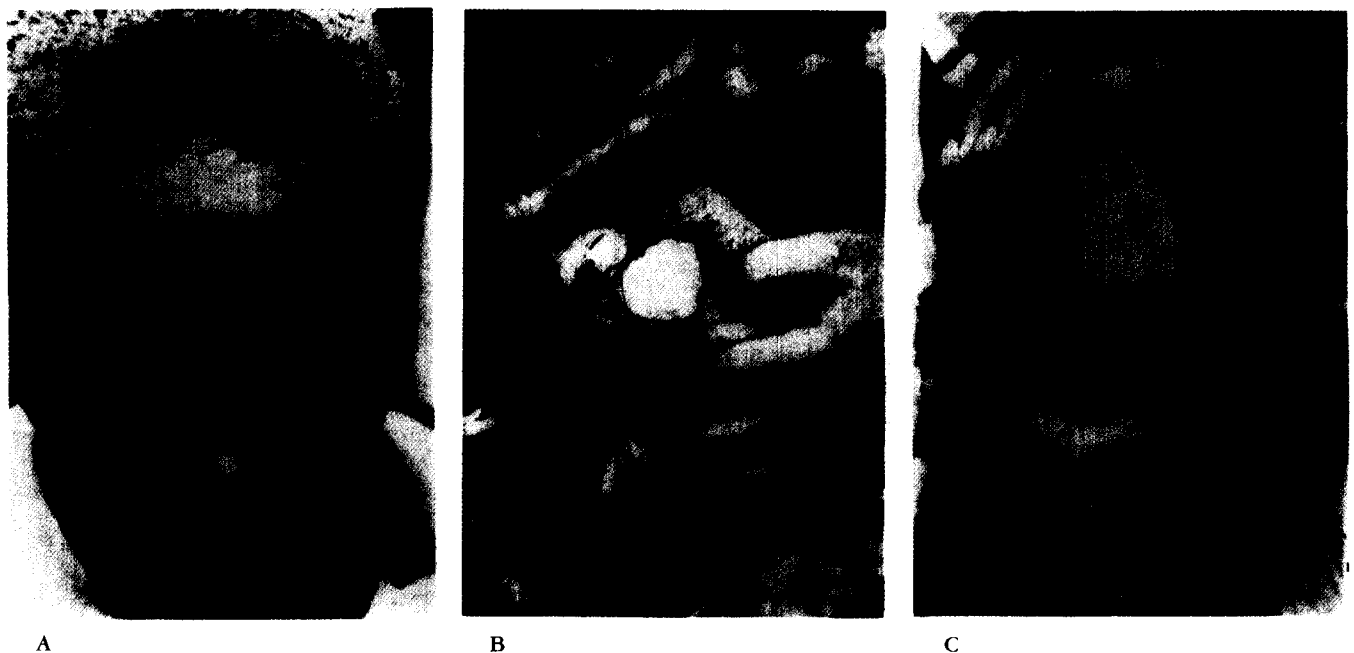


Figure 6. *Still photographs from a video showing an actual trephination of an African youngster after a bead injury to the frontal region. (A) The patient prior to trephination. (B) The patient with skull exposed during trephination. (C) The patient post-trephination with bandages.*



Figure 7. Map of Africa showing locations of tribes that have recently and in some cases, still, practice trephination.

in Uganda including the Ganda, Nkole, and Soga treat both headaches and fractures after head injuries with similar procedures [6,8,9,19,38,43,44,47].

Discussion

African trephination cannot be discussed without commenting upon its indication in the eyes of the surgeon. This is especially pertinent because Africa is one of the few places where trephination is widely practiced today (Figure 7), and thus today's procedure is able to shed considerable light on the myths connected with prehistoric trephination. It is a recurring theme that there exist specific indications for a patient to undergo trephination. Only rarely is it for a magic ceremony or for the release of evil spirits; it is primarily done for the relief of headache and the removal of fracture line after a head injury. Occasionally it may be done in connection with a mystical ceremony, but this is done more for the patient's benefit than any medical purpose. It is clear that except for the bony sutures, the surgeons, although schooled in a long tradition, have no concept of cerebral localization, nor do they even attempt to open the dura. On the contrary, this is anathema to their practice. They do recognize the sutures as places to avoid but do not, otherwise, attach any other anatomic significance to them. The procedure is done for very practical reasons, i.e., headache after head injury and is otherwise not

imbued with any other significance. It is highly doubtful that any of the Neolithic tribes or ancient Peruvians would differ in practice from these procedures done today. Thus, any belief that they had knowledge or cerebral localization or other more sophisticated ideas is erroneous in the face of present-day trephinations [8,14,20-25,28-30,32-34].

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