Craniofacial Surgery for Mental Disorders: Trepanation, Stone of Madness, and Third Eye

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The inner table only now protected his soft brain, One final scrape and he did make That hole a windowpane.

The devil stirred within his skull And, with a fearfull yell, Escaped from out its prison-house. To seek its own in hell. Surgery of the Stone Age: A Ballad of Neolithic Times/ Thomas Wilson Parry, 1918

P sychosurgery, which is attempting to cure a mental disorder by surgery, is rarely practiced today and is limited to a few cerebral ablative procedures, like cingulotomy, anterior capsulotomy, subcaudate tractotomy, and limbic leucotomy. The frontal lobotomies, which crippled thousands of patients during the 20th century, have been completely abandoned since the 1970s. Retrospectively, it is interesting to remember that these procedures were introduced following the work of Portuguese neurologist Antonio Egas Moniz, who shared the Nobel Prize in Physiology or Medicine in 1949 for the "discovery of the therapeutic value of leucotomy in certain psychoses."

Skulls dating back thousands of years, with traces of trepanning, have been found in many archeological sites. Examination of these skulls reveals that many show signs of healing on the border of the bony holes, meaning that the procedures were carried out while the patients were still alive and that they survived. Without a doubt, these trephined skulls represent the oldest tangible evidence of human surgical intervention, whatever the reason for the operation. These trephined skulls have been found in every region of the globe, particularly among the Inca and pre-Inca inhabitants of ancient Peru and Bolivia, but also in Europe and Africa, New Zealand, Australia, China, Japan, and India, and have been the object of numerous publications.^{1,2} We can find the first mentions of these operations in Ancient Egypt papyri, but mainly in one of the Hippocratic treatises (5th century BC) named On Injuries of the Head, where extensive details concerning the handling of skull wounds are given, advising the surgeon to take particular care not to injure or overheat the dura. In case of trauma, the procedure was probably performed to check the extent of the wound or with the intention of relieving the patient from headaches. But when there was no sign of trauma, the reasons

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for such surgery in Antiquity were probably the same as those supposed by palaeologists or described by anthropologists who observed this practice still used in a few African tribes: headaches, epileptic seizures, mental illness, vertigo, deafness, and other mental disorders.

CRANIOTRYPESIS, HOW TO BURR A HOLE IN THE SKULL?

Concerning trepanation during the prehistory and the present African tribes who practice this operation, we are indebted to 2 renowned surgeons who have spent a fair amount of time observing and experimenting with the various ways used by our ancestors and medicine-men to burr a hole in the skull.

British surgeon Thomas Wilson Parry (1866-1945) was fascinated with these operated prehistoric skulls and studied the methods and tools used by ancient societies to perform what he called a "craniotrypesis" (a hole in the skull), as it was rarely made with a trephine. Throughout the early 20th century, he conducted his own experiments into what implements Neolithic tribes would have employed, using whatever skulls he could lay his hands on and making his own equipment out of flint, obsidian, glass, shell, and shark teeth.^{3,4} In 1918, he even published a humorous poem about the prehistoric custom, titled Surgery of the Stone Age: A Ballad of Neolithic Times, describing the trepanation of an epileptic man. Parry identified 4 main methods of ancient craniotrypesis: scraping (Fig. 1), boring or drilling, the "push-plough" method, which involves scraping a circular furrow until you can prise a piece of skull out (Fig. 2); and the fourth and most difficult practice in his opinion, that is sawing in straight lines to lift out a piece of skull, which was common in ancient Peru. The first method, which seems to have been the most common, consisted of scraping a hole in the skull by means of a tool made of a small flake of obsidian, flint, or another material held between the thumb and forefinger. The procedure started with the making of a V-shaped or Y-shaped incision, which was then made into a groove by repeating the action. Next, the edges of the groove were worked on with a curved movement of the scraper, which eventually produced an elliptical-shaped depression. This depression was scraped until it was circular in shape, and when the inner table was reached, the roundel of bone could then be removed from the skull. Another method of trepanation involved a mixture of boring and sawing. Several closely knit holes were bored with a trepan in the form of a circle, and then the ridges of bone between the holes were cut or sawed to complete the circle, thus facilitating the removal of the roundel. The trepans were made from a bow of springy wood and had a leather thong wound around the drill several times (Fig. 3). The sawing out of a rectangular piece of the skull by 4 straight cuts was particularly difficult and, therefore, dangerous since the slightest error could injure the dura. In both pre-Inca and Inca cultures, trepanation was performed using a ceremonial knife called a tumi.

David Furnas (1931–2022) has been a pillar of plastic and craniofacial surgery, founder and director of the Division of

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FIGURE 1. Human skull illustrating the scraping method for craniotrypesis according to Wilson Parry.

Plastic Surgery at the University of California, Irvine. He had learned that ritual trepanning was still practiced by certain people in East Africa. While on a mission with the Flying Doctors in East Africa, he visited a Kisii Tribe in Kenya, an agricultural/pastoral tribe in the highlands east of Lake Victoria, where medicine-men practiced this operation, probably in the same way it was done thousands of years ago. David carefully observed the method used by the surgeon and recorded it in a fascinating movie. He also returned 1 year later to assure himself that the patient was still alive and relieved of her symptoms. In comparison to ethnologists, as a craniofacial surgeon, he was able to fully appreciate the skill of the ababari emetwe (craniotomists). With his research team, they also interviewed several of the local surgeons and their patients. Cultural background, rationale and indications, techniques and instrumentations, complications, and medical implications of these practices were examined.⁵ The Kisii craniotomists adopted the scraping method described by Parry, using a Swiss army knife to cut the skin, then retractors and metallic picks and scrapers to burr the bone hole, always trying to expose the pulsating dura over a few square centimeters. The dressing was made with leaves without any attempt to close the scalp. There were relatively few complications. Several patients had had more than 1 trepanation over the years. Posttraumatic headache, giddiness, drowsiness, epilepsy, and deafness were the main indications for these procedures.



FIGURE 3. Three types of ancient Greek bone drills.

MADNESS STONES

The idea of removing a bad humor or an evil spirit from the head of an individual in case of mental disorders has been mentioned in several ancient texts, as in the Gospels of Luke or Mark, where there is an account of Jesus healing an epileptic boy by rebuking an unclean spirit. The example given by Jesus and other saints led to the exorcisms still practiced by a few priests today. Greek papyri found in Egypt, dating from the 2nd century AC, describe different types of operations to be performed on the cranium and face of the patients suffering from mental diseases. According to the *humoral* theory of Hippocrates and Galen, when the phlegm, which originates from the head, is excessive, it can affect the eyes and produce a condition called the *fluxion of the eyes*. To stop this malefic flux, interventional methods are proposed and developed in detail.⁶

During the Middle Ages and Renaissance, trephining to treat mental diseases was mentioned by Roger of Parma (ca. 1170) in *Practica Chirurgiae*: "An incision is made in the top of the head, and the cranium is penetrated to permit the noxious material to exhale to the outside." Robert Burton, in *Anatomy of Melancholy* (1652), recommended boring a hole in the skull for madness, a view which was also shared by neuroanatomist Thomas Willis (1621–1675). In the same period, from the 15th to the mid-17th centuries, particularly in the Flemish and Dutch



FIGURE 2. Human skull illustrating the "push-plough" method according to Wilson Parry.



FIGURE 4. Extraction of the stone of madness by Pieter Huys (1560).

schools [Pieter Bruegel, Nicolas Weydmans, and Pieter Huys (Fig. 4)] but also in Spain, without any mention of medical or esoteric explanation, a series of paintings and engravings flourished, showing the removal of a stone from the cranium of individuals with obvious signs of madness or debility. One of the first and most famous depictions of trephining for mental disease is seen in the Dutch painting of Hieronymus Bosch (1450–1516), *The Cure for Madness (or Folly)* (Fig. 5).

Most of these paintings are stereotyped: a patient is usually seated in a sturdy armchair, chest and arms restrained by a belt, and an operator uses a long lancet to make a vertical incision in the middle of the forehead, or if the operation is more advanced, he extracts a spherical mass from the same area using a bulky pair of forceps. Various instruments are at hand: tweezers, scissors, curettes, but there are no instruments evoking cranial bone surgery, though commonly practiced at the time: no drill bits, crowns, or augers. On a table, an assortment of stones of various sizes, no doubt attesting to the skill and renown of the operator. Surrounding the main actors, a variable number of assistants: patients in a variety of postures and grins awaiting their turn, and above all, recent surgeries with foreheads girded in a crude bandage, whose serene smiles and faces attest to their recovery. Is this pure artistic fiction? An allegory, along the lines of the lithotripsy of the bladder, charlatanism, or the beginnings of a therapeutic gesture? The fact remains that, for 200 years, the idea held sway that madness could be cured by extracting a foreign body and that it was necessary to literally extract the madness from the skull. Up until the mid-18th century, numerous texts allude to the "expulsion by demonic madmen" of things foreign to the body: vomit, nails, and other "satanic materials."

THE THIRD EYE

In Hinduism, Buddhism, and Taoism, the third eye (also called the mind's eye or inner eye) is an invisible eye, which provides perception beyond ordinary sight and symbolizes the power of



FIGURE 5. Extraction of the stone of madness by Hieronymus Bosch (1494), Museo del Prado, Madrid.

knowledge, enlightenment, and the detection of evil. It refers to the gate that leads to the inner realms and spaces of higher consciousness. The third eye is usually located in the middle of the forehead, slightly above the junction of the eyebrows (Fig. 6).

In 1956, a book entitled *The Third Eye*, published in the United Kingdom, became a bestseller. It was originally claimed that this autobiography was written by a Tibetan Lama named Lobsang Rampa. The book describes the initiation of a young Lama and the piercing of a hole in the location of the Buddhist *third eye* to improve his aura and the state of his consciousness and "see people as they are and not as they pretend to be." On investigation, the author was found to be the son of a British plumber, who claimed that his body was occupied by the spirit of a Tibetan monk named Tuesday Lobsang Rampa, although he had never traveled to Tibet. The book is now considered a hoax, but the minute descriptions of the piercing of a hole in the frontal bone of a child by 2 monks seem very realistic, and most readers still believe that this custom is anchored in the tradition of Tibetan monks.

AUTOTREPANATION

On April 16, 1943, while studying ergot alkaloids at the Sandoz pharmaceutical laboratories in Basel, chemist Albert Hofmann discovered by inadvertence, the effects of lysergic acid dieth-



FIGURE 6. The third eye on the Buddha from Hadda (Victoria and Albert Museum, London).

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ylamide (LSD): anxiety, dizziness, supernatural visions, happiness, and gratitude. The discovery of the hallucinogenic effects of this substance became inseparable from the psychedelic movement of the 1960s and became the number one drug, especially in the United States, and was glorified in certain circles, notably artistic ones. The Dutch Hugo Bart Huges (1934-2004), who attended medical school at the University of Amsterdam, was experimenting with LSD and other drugs and observed that remaining upside down on his head for 15 minutes got him high and gave him sensations like absorbing LSD. He developed a theory that it was the increase in the volume of brain blood that may produce this expanded consciousness. In 1964, he published a paper, The Mechanism of Brainbloodvolume, in which he proposed that trepanation could be used to enhance brain functionality by balancing the proportion of blood and cerebral spinal fluid. In 1965, not finding any surgeon willing to open his skull, he did it himself, using an electric drill. He also published later 2 monographs: Trepanation: A Cure for Psychosis, in which he expanded upon his theory, and an autobiography, The Book with the Hole. Experiencing immediate beneficial effects from this operation, he began preaching to anyone who would listen to the doctrine of trepanation. By liberating his brain from its total imprisonment in his skull, he claimed to have restored its pulsations, increased the volume of blood in it, and acquired a more complete consciousness, like the effects of LSD (Fig. 7).

At that time, 2 British individuals who were experimenting on themselves with the power of drugs like mescaline, psilocybin, and LSD were deeply influenced by Bart Huges and followed his advice. Joey Mellen and his partner Amanda Feilding both succeeded with difficulty to bore a hole in their frontal bone, realizing physically the *third eye* of the Eastern religions. Mellen described the operation in his book *Bore Hole* and his experience as "a lightness, like a weight had been lifted off him." Amanda Feilding promoted the operation in the United Kingdom, describing her own post-trepanation experience as "a feeling of rising, slowly and gently, to levels that felt good." In



FIGURE 7. Frontal trepanning by Hector de la Vallée.

1604

1996, the same Amanda Feilding, also known as Countess of Wemyss and March, set up *The Foundation to Further Consciousness*, changing its name to the *Beckley Foundation* in 1998. Through the Foundation, she set about using cutting-edge brain imaging technologies to examine the neurophysiological changes underlying altered states of consciousness.

TREPANATION TO PREVENT ALZHEIMER DISEASE?

Making a hole in the forehead or anywhere in the skull to cure madness or improve intelligence seems nowadays unspeakably futile or linked to religious or magical thinking. However, surprisingly several questionably scientific theories have tried to confirm the pertinence of these operations. An article entitled Variation in Blood Volume and Oxygen Availability in the Human Brain, published in 1964 in the journal Nature,⁷ was probably the start of a renewed concept of the effects of making a hole in the skull to improve mental performance. Its author was a young Soviet neurophysiologist, Yuri Moskalenko, who was visiting the United Kingdom on an exchange program with the Royal Society of Science. Decades later, having worked and published several articles in Russian, Moskalenko returned to the United Kingdom, now collaborating with researchers at the Beckley Foundation in Oxford. His main research interests are still the physiological mechanisms of cerebral circulation, studying both cerebrospinal fluid (CSF) dynamics and blood supply. Independently, recent investigations on physiology and pathophysiology have shown that CSF integrates several functions not very well known before. From fetal life through adulthood and extending into terminal stages, it actively engages in building, maintaining, and repairing the cerebral cells. Efficient CSF homeostatic mechanisms are vital to neuronal networks.8 CSF dys-homeostasis in aging and illness, however, can compromise motor functions and cognition. Cerebral blood flow (CBF) delivers the blood to the brain and has another vital role: the circulation and production of CSF, carrying the nutrients that feed it and remove the waste it produces, including the tau and beta-amyloid proteins that have been implicated in the formation of plaques found in the brains of people with Alzheimer's disease. Moskalenko's investigations on Slow-Wave Oscillations in the craniosacral space led him to the conclusion that as we age, cerebral blood flow decreases, and the earlier this happens, the more likely someone is to develop early onset of dementia. Studying elderly people with dementia, Moskalenko found that the severity of their cognitive disorder was strongly correlated with alteration of the cranial compliance, as defined as a volume pressure relationship responsible for the brain homeostasis.9 Among other investigations, Yuri Moskalenko studied 15 people who had undergone a trepanation following head injuries. He found that their cranial compliance was around 20% higher than the average for their age. On this basis, he suggested that trepanation could be an effective prevention for Alzheimer's and improve the mental functions of anyone in their mid-40s when cranial compliance starts to decline. According to the Russian neurophysiologist, a permanent hole might increase blood flow in the cranium and allow more room for the brain to swell and subside with the heartbeat, the way it does in infants before their skull bones knit together.^{10,11}

NEUROSURGEONS AND CRANIECTOMIES

During the 1960s and up to the 1980s, prominent neurosurgeons in the southeast of the United States used to remove part of the occipital bone of a few patients in an attempt to relieve them from headaches or epilepsy and even improve their intelligence.

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This practice was probably linked to the suspicion or the discovery of a Chiari malformation, where the brain expends into the upper spinal canal and might cause symptoms of mental disorders. A suboccipital craniectomy is sometimes an effective procedure that can make more room for the cerebellum and relieve pressure on the spinal cord. Several of these skull holes had to be repaired later by bone grafts and others by methyl methacrylate (M.B. Habal, written communication, 2024).

The treatment of premature craniosynostosis is another subject of debate among neurosurgeons and plastic surgeons. Premature cranial sutures' fusion may affect not only the development of the skull shape but also be a factor of increased intracranial pressure due to disproportion between the growing brain and constricted skull. Multiple and syndromic synostosis are much more prone to affect cortical complexity development than a single suture synostosis.¹² Already in 1890, French surgeon Odilon Lannelongue introduced the correction of sagittal synostosis by strip craniectomy. This method is still in use by some neurosurgeons for sagittal or metopic synostosis (by open or endoscopically aided approach), with or without postoperative orthotic helmet therapy. Badiee et al claim that, for metopic craniosynostosis, this method gives an equivalent or even superior esthetic appearance compared to more major skull remodeling, as initiated in the 1980s by Marchac and Renier.¹³ However, these strip craniectomies are limited to cases where only 1 suture is involved and who rarely present a risk of developing a raised intracranial pressure. Long-term studies have yet to be performed to assess the beneficial potential effect of a strip craniectomy on the skull and brain development.

CONCLUSIONS

Today, the term "mental disorders" covers multiple conditions arising from very different causes. Some have a clear anatomic or physiological substrate that may be recognizable or quantified, like a tumor, a raised intracranial pressure, or the deposit of amyloid plaques in the brain. Others refer to our mind, our psyche, our spirit, something immaterial that took generations of physicians and philosophers to be conceptualized, as recalled by George Makari in his book on the invention of the modern mind.¹⁴ Our ancestors could only make a direct link between head trauma and subsequent mental disorders, hence their attempt to explore the site of the trauma. However, for many, they also assumed that headaches, epilepsy, abnormal behaviors, and folly were also linked to something inside the cranium, something that can be expelled or improved by making a hole in the cranial bone. The controversial scientific theories to justify similar operations are not very convincing, but it may be that in the future, new discoveries in neurosciences might change our understanding of the relationship between our "exocranium" and what happens inside and possibly improve the alterations of these immaterial entities with a surgical intervention. The recent observation that skull cortical thickness may be different in patients suffering from schizophrenia is an example of this possible link,¹⁵ although nobody has yet suggested curing schizophrenia with an operation.

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REFERENCES

- Gross CG. A Hole in the Head: More Tales in the History of Neuroscience. MIT Press; 2009
- Iorio S, Licata M, Ciliberti R, et al. Cranial trepanation: an ancient neurosurgical therapy? Thoughts of a follower of positivist medicine and anthropology. J Craniofac Surg 2019;20:e570–e573
- Wilson Parry T, Cantab FSA. Diagnosis of holes in prehistoric skulls: a differential diagnosis of the various kinds of holes discovered in the skulls of prehistoric man. *Postgrad Med J* 1927;2: 122–125
- Wilson Parry T. An address on trephination of the living human skull in prehistoric times. Br Med J 1923;1:457–456.2
- Furnas D, Sheikh M, Hombergh P, et al. Traditional craniotomies of the Kisii tribe of Kenya. Ann Plast Surg 1985;15:538–556
- Montandon D. Facial surgery in antiquity. J Craniofac Surg 2018; 29:1110–1113
- Moskalenko YE, Cooper R, Crow H, et al. Variations in blood volume and oxygen availability in the human brain. *Nature* 1964; 202:159–161
- Johanson CE, Duncan JA III, Klinge PM, et al. Multiplicity of cerebrospinal fluid functions: new challenges in health and disease. *Cerebrospinal Fluid Res* 2008;14:5–10
- Ocamoto GN, Russo TL, Mendes Zambetta R, et al. Intracranial compliance concepts and assessment: a scoping review. *Front Neurol* 2021:12. https://doi.org/10.3389/fneur.2021.756112
- Moskalenko IE, Vaĭnshteĭn GB, Kravchenko TI, et al. The effect of craniotomy on the intracranial hemodyamics and cerebrospinal fluid dynamics in humans. [in Russian]. *Fiziol Cheloveka* 2008;34: 41–48
- Moskalenko YE, Kravchenko TI, Vainshtein GB, et al. Slow-wave oscillations in the craniosacral space: a hemoliquorodynamic concept of origination. *Neurosci Behav Physiol* 2009;39:377–381
- Kalmar CL, Humphries LS, Mackay D, et al. Changes in intracranial pressure with craniosynostosis based on age at intervention, syndromic status, and multiple suture involvement. *Plast Reconstr Surg Glob Open* 2020;8(suppl 9):24–24
- Badiee RK, Popowitz E, Mark IT, et al. Superior long-term appearance of strip craniectomy compared with cranial vault reconstruction in metopic craniosynostosis. *Plast Reconstr Surg Glob Open* 2022;10:e4097
- 14. Makari G. Soul Machine, the Invention of the Modern Mind. Blackwell; 2015
- Bolat E, Polat S, Tunç M, et al. Investigation of skull cortical thickness changes in healthy population and patients with schizophrenia on computed tomography images. J Craniofac Surg 2024;35:1284–1288

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