HEAD INJURY MANAGEMENT ALGORITHM AS DESCRIBED IN HIPPOCRATES' "PERI TON EN CEPHALI TRAUMATON"

Vassilios G. Dimopoulos, M.D.
Department of Neurosurgery,
The Medical Center
of Central Georgia,
Mercer University
School of Medicine
Macon, Georgia

Theofilos G. Machinis, M.D.
Department of Neurosurgery,
The Medical Center
of Central Georgia,
Mercer University
School of Medicine
Macon, Georgia

Kostas N. Fountas, M.D., Ph.D.
Department of Neurosurgery,
The Medical Center
of Central Georgia,
Mercer University
School of Medicine
Macon, Georgia

Joe S. Robinson, M.D., F.A.C.S.
Department of Neurosurgery,
The Medical Center
of Central Georgia,
Mercer University
School of Medicine
Macon, Georgia

Reprint requests:
Kostas N. Fountas, M.D., Ph.D.,
840 Pine St., Ste. 880,
Macon, GA 31204.
Email: knfountasmd@excite.com

Received, December 29, 2004.
Accepted, April 28, 2004.

HIPPOCRATIC WORKS LEND themselves still today to the modern physician for further analysis of his approach to the diagnosis and treatment of various pathological conditions. We present an attempt to systematize his methodology regarding the management of head trauma and present it in the format of a modern-era algorithm.

KEY WORDS: Head Injury, Hippocrates, History

Neurosurgery 57:1303-1305, 2005 DOI: 10.1227/01.NEU.0000187321.13149.B9 www.neurosurgery-online.com

Hippocrates is considered to be the father of modern medicine. Although as with most paternal figures of history, it has often been difficult to separate myth from reality, it is well recognized that Hippocrates, son of a physician himself, was the first to release the healing art from demons, superstition and magic (5). Hippocrates was born on the Greek island of Kos and was considered to be the eighteenth descendant of the Greek God of health, Asclepias (*Fig. 1*). Celsus wrote about him: "Hippocrates first gave the physician an independent standing, separating him from the cosmological speculator or nature philosopher" (2). Indeed, Hippocrates separated the medical practice from the rhetoric of philosophy as well as the dogmatism of religion.

Hippocrates recognized disease as an entity governed by natural rules. His works are characterized by a detailed and accurate description of the diseases' course and treatment. He noted that there were differences in the presentation, severity and outcome of a disease among different individuals. In many cases, it becomes apparent that Hippocrates consistently adjusted his treatment regimen according to the precise nature and severity of the patients' symptoms, in the same way that a physician of the modern era would carefully follow the guidelines for the management of a disease. In our current communication, we attempted to extract the Hippocratic suggestions for the treatment of head trauma, depending on the nature and the extent of the injury, and present them in a modern-format of a therapeutic algorithm. This would allow for a better understanding of the Hippocratic approach to head injuries and the similarities and differences with the modern neurosurgical practice.

MATERIALS AND METHODS

We examined one of Hippocrates surgical books, named "Περι των εν κεφαλη τρωματων"; "Peri Ton En Cephali Traumaton," which can be translated in English as: "About the head trauma." This is considered to be a genuine book of Hippocrates. The ancient Greek text was studied, along with two Modern Greek translations (4) and one English translation (1). We tried to summarize the Hippocratic "guidelines" for the treatment of head injuries in a modern-format algorithm (*Fig. 2*).

RESULTS

In the introduction of his book, Hippocrates referred to the correlation between the configuration of the sutures ('ραφαβ' "raphe" in Greek) and the shape of the skull. He also defined bregma to be the most vulnerable site of the skull, followed by the temporal and occipital regions.

Hippocrates suggested that the physician should start with an accurate history and a detailed physical examination. While taking the patient's history, the physician was required to assess the risk of injury from the patient's symptoms, such as lost of consciousness, dizziness, amaurosis or from the severity of impact as described by the weapon type, the intention, the direction of the impact or the details of a possible fall. The physician should

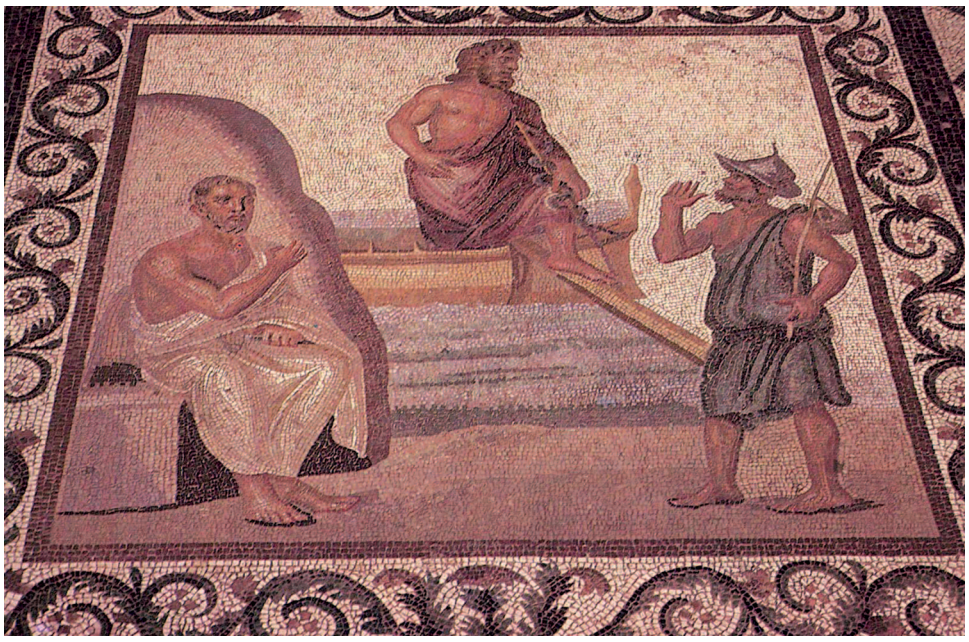

FIGURE 1. *3rd century AD mosaic exhibited in Museum of Kos depicting the arrival of Asclepios, the god of health, to the Island of Kos. Asclepios is welcomed by Hippocrates on the left and a local citizen of Kos on the right.*

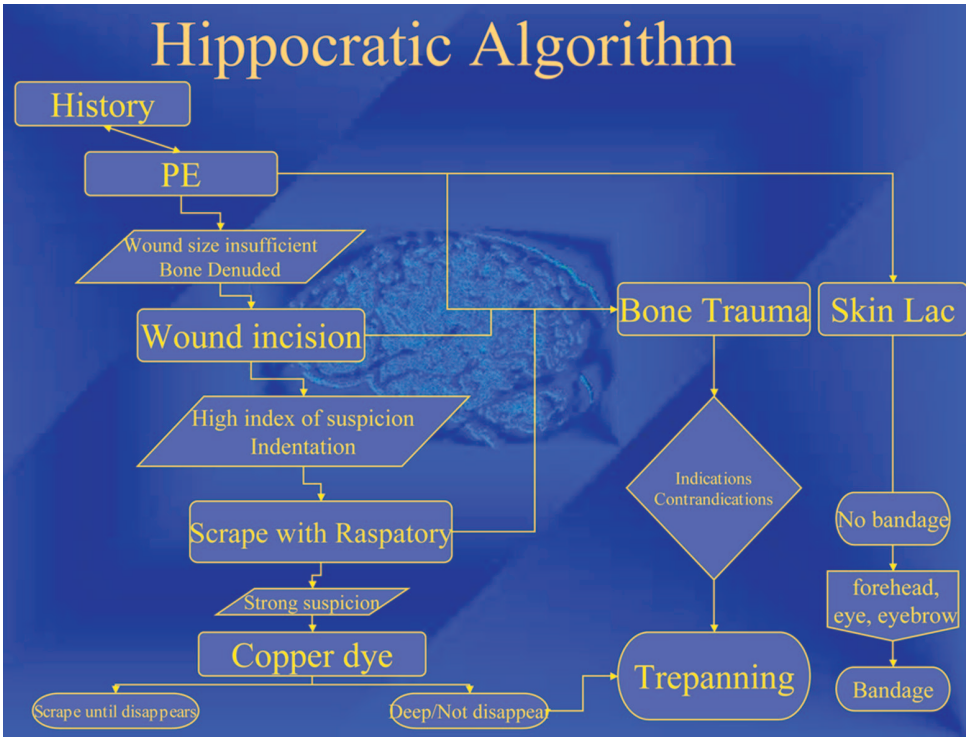

FIGURE 2. *Hippocratic suggestions formatted in a modern algorithm.*

also perform a detailed examination including inspection and palpation of the wound. If these revealed a simple skin laceration, he advocated that no bandage was necessary, unless the wound involved the forehead, eye or eyebrow. This may reflect either some understanding of the importance of this anatomic region and the frequently observed extension of the wound infection through collateral blood circulation or some cosmetic concern, although it is not clear if cosmetic results were taken into consideration in the Hippocratic era. He further suggested that the use of bandage in the area of the forehead and around the eyes should be discontinued as soon as inflammation subsided.

If significant bone trauma, or head injury were diagnosed, then taking into consideration the indications and contraindications, the physician should perform trephination of the skull within the first three days. If the wound size was insufficient for an accurate diagnosis, extension of the wound incision should be performed. Hippocrates clearly warned against performing an incision over the temporal area since that could lead to the development of contralateral seizures/spasms. If significant injury was diagnosed, then trephination should be considered. If no significant injury was appreciated, but there was a high index of suspicion, scraping of the bone with a raspatory should be performed.

If trauma was evident, then the mentioned algorithm should be followed. If the suspicion was strong, but no apparent trauma was present, Hippocrates advocated the use of a copper based dye in order to identify fine small fracture lines that were not visible to the naked eye. If such a fracture line was present, the physician should scrape the bone until the fracture line disappears, otherwise trephination should be considered.

Furthermore, Hippocrates provided specific indications for the trephination of the skull. Specifically, he advocated trephination when the following diagnoses were made: bone contusion (obvious or not), bone fracture (obvious or not), hedra (indentation in bone) when combined with contusion alone or frac-

ture and contusion. In case of depressed skull fracture, trephination was rarely indicated with the most depressed and comminuted fractures requiring trepanning the least. Regarding the timing of trephination, Hippocrates suggested early intervention and especially within the first three days. Trephination should be avoided on skull sutures. Additionally, trepanning should not expose the dura (meninges), but instead a thin, mobile layer of bone should be left in place. The physician should avoid dura necrosis and penetration. Caution should be exercised during trepanning and the trepan should be frequently withdrawn and plunged in cold water as heated trepan dries the bone and causes larger pieces of bone to drop off. In cases of delayed treatment, trepanning should be performed at once; and the track of the trepan should be frequently examined in these cases by removing the trepan and using percussion with a dull instrument in order to avoid injury to the underlying meninges and the brain. It is mentioned that suppurated bone was drilled faster and that attention should be paid to the fact that bone may be thinner in certain anatomic areas.

Particularly in the pediatric population, trephination should be performed with great precautions using a small-sized specially designed trepan, as it was known, based on careful observation and not through anatomic knowledge, that children's skull bones were thinner and softer than adults'. Hippocrates advocated that the physician should perform trephination in order to provide exit of the blood (hematoma).

CONCLUSION

Hippocrates' contribution to medicine is indisputable; medical practice was, for the first time, based on observation and logic, and the symptoms of many diseases were classified (3). Many of the principles of modern medicine, and in particular modern neurosurgery, can be identified in his texts, such as the attention to history and physical examination, as well as, the importance of accurate diagnosis and early intervention in the case of head trauma. Depending on the extent of the head injury as well as the presence or not of fracture, Hippocrates advocated early and prompt diagnostic and therapeutic intervention. Even today, the same principles such as development of specific methodology and classification, establishment of indications/contraindications, detailed technique instructions, meticulous attention to wound care and prevention of complications, are considered of paramount importance for a good outcome of the head-injured patient.

REFERENCES

1. Adams F: *The Genuine Works of Hippocrates*, London, The Sydenham Society, 1886.
2. Celsus: *De Medicina*. London, Loeb Classical Library, 1935–1938.
3. Fabre JW: *The Hippocratic Doctor: Ancient Lessons for the Modern World*, London: RSM, 1997.
4. Mandilaras VA (ed): *Hippocrates: Complete Works: About the head trauma* [in Greek], Athens, Kaktos Editions, 1992, vol 11, pp 28–69.
5. Marketos SG, Skiadas P: Hippocrates. The father of spine surgery. **Spine** 24:1381–1387.

COMMENTS

This article presents a part of the Hippocratic literary corpus that helps to substantiate the lofty position Hippocrates has enjoyed over the past two millennia. The authors' algorithm is an interesting way of emphasizing the objectivity and accuracy of information that formed the basis of his treatments that, more than the treatment itself, represents the modernity of his prescriptions.

Lycurgus M. Davey
New Haven, Connecticut

It is informative, and a bit humbling, to reflect on what was recommended for the treatment of head injuries more than 2000 years ago and note that many of the same principles still apply. Hippocrates is often thought of as advocating a conservative approach to medicine and treatment of diseases with diet and hygienic measures. So, it is particularly interesting that he had such specific recommendations for the surgical treatment of traumatic brain injury.

Donald W. Marion
Boston, Massachusetts

When reviewing this paper on Hippocrates and the management of head trauma, one is reminded again why Hippocrates is referred to as the father of modern medicine. It is clear that Hippocrates and his school had a remarkably clear understanding of medical and surgical management for the time. Many of the concepts introduced by this great school remain the same today. As the authors nicely point out in the algorithm, there was a very systematized approach to dealing with head injury. Certain cases were done while others were considered too risky to undertake. In an era with minimal antisepsis, minimal anesthesia, and rather primitive instrumentation, their results appear to have been quite good. One must also not forget that a pre-surgical history and physical examination were absolutely essential in the work-up and eventual surgical planning, which is being forgotten more and more in this modern day of imaging where the MR is often ordered first with only the most rudimentary physical examination being done before hand.

James Tait Goodrich
Bronx, New York

This paper is fascinating. It reminds us of the paradox of how far we've come in some areas and how little things have changed in others. The authors deserve our thanks for bringing this bit of history to our attention.

Alex B. Valadka
Houston, Texas