Historical Vignette

The history of awake craniotomy for brain tumor and its spread into Asia

Julius July, MD, Pirjo Manninen, MD, FRCPC, Jacob Lai, MD, FRCPC, Zhenhai Yao, MD, PhD, FRCPC, Mark Bernstein, MD, MHSc, FRCPC

Reprinted from
SURGICAL NEUROLOGY
Vol. 71 No. 5, 2009
Historical Vignette

The history of awake craniotomy for brain tumor and its spread into Asia

Julius July, MD a,b, Pirjo Manninen, MD, FRCPC c, Jacob Lai, MD, FRCPC c, Zhenhai Yao, MD, PhD, FRCPC c, Mark Bernstein, MD, MHSc, FRCPC a,*

aDivision of Neurosurgery, University Health Network, Toronto Western Hospital, Toronto, Ontario, Canada M5T 2S8
bDepartment of Neurosurgery, Siloam Lippo Karawaci Hospital, Jl. Siloam No. 6 Lippo Karawaci 1900, Tangerang, Indonesia
cDepartment of Anesthesia, University Health Network, Toronto Western Hospital, Toronto, Ontario, Canada

Received 11 May 2007; accepted 17 December 2007

Abstract
In ancient times, awake craniotomy was used for trepanation to treat seizures and remove a variety of morbid conditions or even to permit the escape of evil air. In modern times, this technique was initially used for removal of epileptic focus with simultaneous application of brain mapping with electrical current. Further developments brought this technique into use for resection of tumors involving functional cortex. Recently, awake craniotomy has been described as an approach for removal of supratentorial tumors nonselectively, regardless of the involvement of eloquent cortex. It has been used in North America since the 1980s, then Europe, and recently has spread into Asia. Its spread to Asia could have significant impact based on the large population of patients and the low resource utilization associated with awake craniotomy.

© 2009 Elsevier Inc. All rights reserved.

Keywords: Asia; Awake craniotomy; Brain tumor; History of neurosurgery

1. The evolution of brain mapping

The idea of awake craniotomy for tumor surgery arose from its use for epilepsy surgery. It is known from archeological findings that in ancient times, thousands of years ago, patients were treated for seizures by trepanation of the skull [21,28]. Seizures are a common clinical presentation of brain tumor in adults; and therefore, some of these ancient trepanations must have been done in patients harboring brain tumors. The surgery was also done to correct morbid conditions of the skull like contusion or fracture, or to permit the escape of evil air [14]. The first documentation of awake craniotomy in "modern" times was to treat epilepsy in the early 17th century [28].

The poor results of trepanation drove physicians and scientists to explore the brain and try to define the seizure source. Hughlings Jackson, who did an extensive study of focal epilepsy between 1864 and 1870, predicted that an area existed in the cerebral cortex that governed isolated movements [24]. This was verified by Fritsch and Hitzig in 1870, who for the first time were able to elicit movements of the extremities in animals by means of electrical stimulation on the cerebral cortex [15].

The first concept of brain mapping with electrical stimulation in humans was generated by Bartholow in 1874 [5]. He used an electrode to stimulate the cerebral cortex through a skull defect resulting from the osseous infiltration of an epitheloma. A decade later in 1886, Horsley, whose studies of animals gave him an excellent understanding of the human cortex, and his colleague Jackson applied electrical stimulation to localize the thumb area and decided to excise...