Reconstruction of the Craniotomy Flap in Patients with Brain Swelling: A Technical Note

Beyin Ödeminde Kraniyotomi Flebinin Rekonstrüksiyonu: Teknik Not

BAŞAR ATALAY, HAKAN CANER, NUR ALTINÖRS

Başkent University Faculty of Medicine, Department of Neurosurgery, Ankara, Turkey

Received: 01.10.2002 ⇨ Accepted: 10.12.2002

Abstract: This technical note describes a surgical technique than can be used to reconstruct the craniotomy flap in cases of severe brain swelling. Extensive craniotomy with duraplasty and drilling of the inner table of the craniotomy bone flap are the main features of the method. In appropriate cases, this technique is a good, cost-effective physiologic alternative to synthetic cranioplasty materials.

Key Words: Brain edema, cranioplasty, surgical treatment

Özet: Bu teknik not ile ileri derecede beyin ödemi olan hastalarda uygulanabilecek cerrahi bir teknik tarif edildi. Bu tekniğin prensipleri; geniş kraniotomi ve duraplasti ile birlikte internal tabulanın drillenerek kemik flebinin inceltilmesidir. Bu teknik, masrafsız olmasının yanında fizyolojik olmasıyla da uygun vakalarda sentetik kranioplastinin alternatifidir.

Anahtar Kelimeler: Beyin ödemi, cerrahi tedavi, kranioplasti

INTRODUCTION

Reconstruction of the craniotomy flap is very important in neurosurgery for both cosmetic and safety reasons. However, in some cases, brain edema makes it impossible to replace the unaltered bone flap. Numerous surgical techniques have been developed for reconstruction and preservation of the free bone flap in cases where the bone piece cannot be replaced in its original form (1,4). This technical note describes a case of glioblastoma multiforme in which the craniotomy flap was modified by drilling to the level of the outer table of the cranium.

CASE REPORT

A 31-year-old female patient presented with severe headache of 1 month's duration. The only abnormality on neurological examination was grade IV papilledema. Cranial magnetic resonance imaging revealed multiple mass lesions with associated brain edema.

Surgical Technique:

The patient was operated in supine position and the neoplasms were subtotally removed. The degree of brain tissue herniation through dural opening decreased after tumor resection; however, the patient still exhibited brain swelling to the level of the outer table of the cranium. The dura was closed by duraplasty, and the bone flap was modified by drilling out the inner table of the bone such that 2-3 mm of outer table remained after drilling (Figure 1). Silk bone sutures were used to fix the bone piece in position. The patient's neurological status improved in the first postoperative day, and she was mobilized after 2 days. She started radiotherapy at 1 month post-surgery.

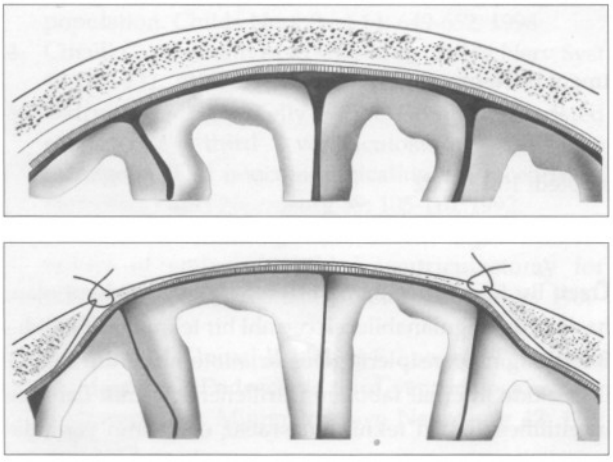

Figure 1: A drawing of the cross-sectional view of a head with normal bone and brain tissue (top). A drawing of the cross-sectional view of the patient's head (bottom) shows swollen brain tissue, narrowed cisterns, and brain herniation through the craniectomy site. The bone flap was modified by drilling to the level of the outer table, and was then fixed in place over the defect.

DISCUSSION

Malignant brain edema is often fatal, regardless of whether conservative treatment (sedation, blood pressure management, mannitol therapy, hyperventilation and hypothermia) or non-conservative treatment with routine trephination is used (5). In patients with traumatic brain swelling, extensive trephination yields favorable results (2,3). In most cases of severe brain swelling, duraplasty is performed using galeal graft material and the craniotomy flap is removed. In long-term follow up, these patients tend to complain of severe headaches associated with changes in atmospheric pressure. In addition, psychosocial problems due to cranial defects are significant issues in the long term. Cranioplastic reconstruction procedures are important, both for cosmetic reasons and because of potential risks from mechanical insults.

Patients who undergo decompressive craniectomy for intracranial hypertension often require interval cranioplasty. In many cases, it is not possible to preserve the free craniotomy bone long enough for use in later surgeries; however, some authors have reported success with storing bone flaps in the abdominal wall (1) and even the scalp (4). Acrylic cranioplasty is the preferred technique for most cases in which the craniotomy flap cannot be preserved. Foreign-body reactions, infection and economic cost (hospital stay, radiological investigations, etc.) are the main problems associated with this form of treatment.

Modifying the craniotomy flap by thinning the bone provides extra space for brain swelling after the flap is replaced. When the entire inner table of the cranium is removed, the total space available between the dura and the outer table is approximately 1.5-2 cm.

This technique must be used in combination with duraplasty. In addition to creating free space for expansion of the swollen brain, the above-mentioned cosmetic and mechanical aspects are other important benefits of this method. However, we do not recommend use of this technique where the cranium is thin, such as in the temporal bone. The most suitable sites for this type of flap modification are the frontal, parietal and occipital bones, where cranium thickness exceeds 1.5 cm.

Correspondence: Başar Atalay
16. Sokak No: 24/4
Bahcelievler 06500 Ankara/Turkey
Phone: 0090 312 212 68 68/1366-1368
Fax: 0090 312 223 73 33
e-mail: basara@baskent-ank.edu.tr

REFERENCES

1. Flannery T, McConnel RS: Cranioplasty: Why throw the bone flap out? Br J Neurosurg 15(6): 518-20, 2001
2. Guerra WK, Gaab MR, Dietz H, Mueller JU, Piek J, Fritsch MJ: Surgical decompression for traumatic brain swelling: indications and results. J Neurosurg 90(2): 187-96, 1999
3. Kunze E, Meixensberger J, Janka M, Sorensen N, Roosen K: Decompressive craniectomy in patients with uncontrollable intracranial hypertension. Acta Neurochir Suppl 71: 16-8, 1998
4. Paşaoğlu A, Kurtsoy A, Koç RK, Kontas O, Akdemir H, Oktem IS, Selçuklu A, Kavuncu IA: Cranioplasty with bone flaps preserved under the scalp. Neurosurg Rev 19(3): 153-6, 1996
5. Traxler H, Ender HG, Weber G, Surd R, Redl H, Firbas W: Applying circular posterior-hinged craniotomy to malignant cerebral edemas. Clin Anat 15(3): 173-81, 2002