Cranioplasty with inner table of bone flap

Technical note

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A new method of cranioplasty is described in which the inner table of the bone flap obtained during craniotomy is used for grafting. The method was used in 10 cases to repair bone defects caused by a growing skull fracture in two, created during removal of an invasive skull tumor in two, during the approach to intraorbital tumors in two, and secondary to craniectomy for additional exposure in four. The method has the advantage that a piece of the inner table for grafting can be obtained from the craniotomy bone flap, without the need for an additional skin incision or taking a graft from another part of the body, and foreign-body reaction is minimal.

KEY WORDS • cranioplasty • autogenous bone graft • skull defect

Cranioplasty is usually performed with autogenous bone, metals, acrylic resin, or ceramics.1-3 Although each material has its own advantages, autogenous bone is the best medium from the standpoint of physiological similarity. In order to overcome some of the disadvantages of grafts taken from other parts of the body, Psillakis, et al.,4 and Santoni-Rugiu5 have used the outer table of the skull bone for repair of skull defects. We present a new method of cranioplasty using the inner table of the skull obtained from the bone flap removed during craniotomy.

Summary of Cases

Cranioplasty using the inner table of the skull obtained from the craniotomy bone flap was performed in 10 cases. Two patients had bone defects due to growing fractures, two had bone defects created during removal of a tumor invading the skull, two had orbital roof defects secondary to the approach for excision of intraorbital tumors, and four had bone defects created by additional craniectomy during a craniotomy. The patients were followed with roentgenograms for 1 to 6 years. The postoperative course has been satisfactory in all patients except one, who required another cranioplasty with a titanium plate because of bone absorption.

Illustrative Cases

Case 1

This 61-year-old man was operated on for an olfactory groove meningioma (Fig. 1). The lateral skull tomogram showed hyperostosis of the planum sphenoidale. A bifrontal craniotomy was performed and the tumor was removed together with the involved bone.
A 2 × 2.5-cm bone defect was created in the region of the planum sphenoidale. A piece of the inner table was taken from the craniotomy bone flap by means of an air drill and chisel (Fig. 2). The bone thus obtained was fixed in the defect with cyanoacrylate and duraplasty was performed with lyophilized dura. Postoperatively, cerebrospinal fluid rhinorrhea was noted, but it ceased spontaneously in a few days. A skull tomogram taken 3 months after surgery showed the grafted bone in place without any evidence of absorption (Fig. 3).

**Case 2**

This 59-year-old woman underwent surgery for a left intraorbital meningioma. At surgery, a left frontotemporal craniotomy was made, and the left orbital roof was resected widely to facilitate the approach to the tumor. After the tumor had been removed, the orbital roof was reconstructed using a piece of inner table obtained from the craniotomy bone flap. The postoperative course has been satisfactory.

**Case 3**

This 7-year-old boy had been involved in a car accident at the age of 7 months. A linear skull fracture was found on the x-ray film. Six years later, he again sustained a minor head injury. The roentgenogram showed a growing fracture over the right occipital region. A right parieto-occipital craniotomy was performed and a generous bone flap that included the bone defect was removed. This was divided into two pieces along the longest axis of the bone defect. One of the pieces was then split into outer and inner tables with a chisel, and the inner table was used to fill the bone defect. The three pieces of bone were joined to each other and fixed in place with wires after duraplasty with a piece of fascia. Four years later the patient needed another cranioplasty with a titanium plate because the grafted bone had been partially absorbed.

**Discussion**

Autogenous bone is the most suitable material for cranioplasty because of its physiological similarity to the skull. Autogenous bone grafts for cranioplasty have been performed with tibia, rib, sternum, scapula, and iliac bone. Use of the outer table taken from another part of the skull has been reported by Psillakis, et al., and Santoni-Rugiu. One of the advantages of using the outer table is that it is grafted together with the periosteum. We have been using the inner table because in many cases the size of the bone defect to be grafted is smaller than the craniotomy and therefore, instead of making another skin incision to obtain the outer table from elsewhere, we can use the inner table from the original craniotomy bone flap.
Bone flap cranioplasty

Use of the inner table has the following advantages: 1) no additional skin incision is necessary, nor is there need for bone to be taken from other parts of the body; 2) physiological fusion can be expected; and 3) foreign-body reaction will be minimal. This technique does suffer from some disadvantages, however. It is difficult to replace a large-sized bone defect with an inner table graft. In elderly patients, splitting the two tables of the skull is sometimes difficult because of sclerotic changes of the skull.

There were no cases of infection of the grafted bone in our series. Absorption of the grafted bone occurred in one case of growing fracture (Case 3). We believe that in that case the bone was absorbed by the same mechanism as in growing fractures, where the bone is eroded by pressure of the brain. The computerized tomography scan in that case showed marked bulging of the brain at the defect site. Bone absorption is usually not likely to occur.

In summary, this method provides an intraoperative one-stage cranioplasty using autogenous bone taken from the same operative field. This method of grafting is applicable for various situations, and is especially useful for younger patients.

References

Manuscript received July 26, 1984.
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