A COMPARISON OF POLYETHYLENE AND TANTALUM FOR CRANIOPLASTY
A PRELIMINARY REPORT


Neurosurgical Section, Surgical Service, Valley Forge Army Hospital, Phoenixville, Pennsylvania

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ANIMAL experimentation in 1947 by Ingraham, Alexander and Matson with polyethylene in contact with the brain and its coverings showed the plastic to be innocuous to the tissue studied.

Busch reported in 1949 the successful use of polyethylene plate for cranioplasty in 8 patients.

Alexander and Dillard used polyethylene for cranioplasty and in 1950 described its advantages over other materials, citing experimental and clinical data from their own investigations and reviewing the literature concerning the properties of polyethylene and the tissue-response to this material. Polyethylene cranioplasty was reported in 5 patients. The report emphasized that polyethylene is firm, resilient, radiolucent, easy to fashion at the operating table and innocuous to tissues. Its cost is about 1/50 that of tantalum.

As is widely known, tantalum has been used successfully during recent years in large numbers of cranioplasties.

The present study is of the immediate results of cranioplasty in a group of 24 patients with skull defects following war injuries. Polyethylene was used in 12 patients. Tantalum was used in an equal number of patients. The same operating team performed surgery on both groups.

CLINICAL MATERIAL

All 24 patients were overseas casualties from the Korean Area. Twenty-two had open craniocerebral missile injuries. Two had closed head injuries with depressed skull fractures. All had had craniectomies at overseas hospitals.

Operative notes made at overseas hospitals indicated that in instances in which the dura was not penetrated by the missile, opening of the dura was carried out to determine if subdural hematoma was present.

Removal of reasonably accessible bone fragments and metallic foreign bodies had been accomplished overseas.

As a result of preparation at overseas hospitals, the edges of the skull

* Associate Professor of Neurosurgery, Graduate School of Medicine, University of Pennsylvania, Philadelphia.
defects were universally rather smooth and dural defects, where present, had been covered with galeal, epidermal or fascia lata grafts. The average skull defect was 6 cm. in diameter. This study did not include cranioplasty over a previously injured frontal sinus or repair of any supraorbital skull defects.

Five of the patients had had major infections with cerebral abscess or infection in the scalp flap. None had had osteomyelitis of the skull.

In the cases where cerebral abscess or infection in the scalp flap had been present, the average length of time between injury and cranioplasty was 10 months. In those cases where there had not been infection, the average length of time between injury and cranioplasty was 6 months.

All patients had been ambulatory for at least 4 months and were without exception well-nourished young adults in good general physical condition.

OPERATIVE METHODS

Polyethylene. The polyethylene plate,* 3 mm. in thickness, was sterilized by scrubbing for 10 minutes with soap (Septisol) followed by immersion for 24 hours in 1:1,000 aqueous Zephiran solution.

The cranial defect was exposed and the pericranium incised circumferentially 1 cm. from its margin. The pericranium was then resected centrally together with any excessive scar tissue overlying the dura. A ledge then was formed in the bone edge by using a hammer and gouge, or dental drill with burr, to remove the outer table of the skull to a width of 1 cm. about the entire circumference of the defect (Fig. 1).

A rough pattern of the defect was prepared with cloth, x-ray film or aluminum foil. The polyethylene plate was fashioned roughly from this pattern by using tin shears, or a linoleum-cutting knife, and the desired contour was obtained by manual molding during immersion in hot water.

When the desired contour was obtained, it was set by immersing the plate in cold water for 1 minute. The edges of the plate then were shaved and beveled with a linoleum-cutting knife and scalpel to obtain a smooth, tight fit in the defect with the surface of the plate flush with the outer surface of the skull.

Multiple perforations, approximately 5 mm. in diameter, to permit the escape of any accumulation of fluid or blood under the plate, were drilled in the polyethylene. These perforations also permit granulation tissue to protrude and ultimately be-

* Obtained from Plastics Department, du Pont de Nemours & Co. (Inc.), Arlington, New Jersey.