A REPORT OF THE EARLY RESULTS IN TANTALUM CRANIOPLASTY

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Experience gained in World War II has shown that the use of tantalum for cranioplasty has appeared to be satisfactory. This material, used extensively for the repair of cranial defects, has the advantages of simplicity of insertion and inertness in the tissue.

There have been few reports concerning the fate of the material following insertion. Woodhall and Cramer4 in 1945, reported 2 cases of extradural pneumatocele following tantalum cranioplasty due to a fistula between the frontal sinus and the thin connective tissues enclosing the plate. Repair of the fistula and replacement of the tantalum plate effected a good result. It is the purpose of this report to record the results of a survey of Veterans Administration Hospitals concerning their experience with tantalum cranioplasties; to point out several indications for the removal of tantalum plates; and to present several cases illustrating this necessity.

MATERIAL

Since the majority of tantalum cranioplasties were performed to repair the skull defects resulting from war injuries, it is probable that patients with complications of cranioplasty have and will have eventually gravitated to Veterans Hospitals for treatment. In April, 1947, a survey was made by questionnaire of the Veterans Hospitals in the United States. A total of 115 replies were received. Of this group, 22 reported experiences with complications of tantalum cranioplasties. A summary of the 22 reports indicated that a total of 49 tantalum plates were removed. In an additional 7 cases, associated abscesses or collections of exudate under the scalp were treated conservatively by aspiration or drainage, and removal of the plate was not required. The factor common to practically every case in which the plate was removed was the presence of persistent infection, associated in some cases with a recognizable osteomyelitis involving the bone edge. In 10 of 12 cases where the time interval was reported, the infection was a delayed reaction occurring from 4 to 22 months after the insertion of the plate.

Three additional plates have been removed at the Veterans Hospital at Dearborn, Michigan, and brief reviews of these cases accompany Figs. 1, 2 and 3. Of a total of the 52 plates removed, 26 or 50 per cent, had been in-

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serted in the frontal area of the skull. In 18 of these 26 cases, or 35 per cent of the total, the cranial defect involved the frontal sinuses.

DISCUSSION

The use of tantalum for the repair of cranial defects appears to be a notable advance in the field of neurosurgery. Burke, in 1940, pointed out the desirable properties of tensile strength, malleability and inertness inherent in the element tantalum. The investigative work of Pudenz (1943) verified the minimal reaction of the meninges and brain to this element. Fulcher, in 1943, reported the use of tantalum for the repair of skull defects. Following this report many hundreds of such cranioplasties were performed. Since less than 100 plates have been removed in a total of 115 hospitals, the early success of this material is evident. Approximately one-third of the plates that were removed communicated with the frontal sinus. In 2 of our patients such communication was present. The possibility of infection following the insertion of plates in this region suggests that the use of an osteoperiosteal transplant may be to greater advantage in the repair of a defect in this area.

Failure could also be ascribed to the fact that the blood supply to the scalp overlying a large tantalum plate may be poor since the scalp does not rest upon underlying living tissue. Trauma to the poorly nourished scalp has been noted to favor the development of infection. Occasionally,
impingement of the distal edge of an ill-fitting plate against the upper eyelid has resulted in necrosis and subsequent fistula formation requiring removal of the tantalum. This complication can be obviated by a more accurate pre-form molding of the plate and firm tantalum screw fixation.

**Fig. 2.** E. G., aged 36, sustained a shell fragment wound of the frontal area of the skull involving the frontal sinuses in October, 1944. A tantalum cranioplasty was done in February, 1945. In September, 1946, the skin of the right supraorbital area necrosed and plate became exposed. Conservative measures failed. Plate was removed in February, 1947.

**Fig. 3.** R. M., aged 24, sustained a gunshot wound of the left occipital area in November, 1944. A tantalum cranioplasty was done in July, 1945. Eleven months later (June, 1946) he experienced a blow at the site of the plate followed by abscess beneath scalp several days later. The plate was loose and not perforated. Conservative measures failed. Plate was removed in October, 1946.

In our experience, when infection of the cranioplasty has occurred, conservative measures of aspiration and instillation of penicillin; catheter drainage and instillation of penicillin, have always failed. Success by this method of treatment has been but temporary. This has also been the experience of others. A continuing recurrence of infection has finally required plate removal. Following this the wound healed immediately. It is of interest that bone regeneration was remarkable in 1 instance. In this patient the defect was caused by removal of osteomyelitic bone. The regeneration of bone was so complete that a secondary cranioplasty was not necessary.
SUMMARY

One hundred and fifteen Veterans Hospitals have reported that a total of 49 tantalum plates were removed at these hospitals up until April, 1947. Three more cases have been reported and briefly reviewed with several observations concerning the complications of tantalum cranioplasty. The early results in tantalum cranioplasty are satisfactory.

REFERENCES