overlain the cauda equina, have had a better prognosis, and have presumably caused their neurological signs by compression.

In the former group, no differential point is found that might distinguish a subdural from an epidural abscess; its presence can only be suspected preoperatively. In the latter, it appears that the diagnosis can be made by careful lumbar puncture.

In both instances treatment should be an emergency laminectomy and drainage of the purulent subdural contents.

REFERENCES
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TANTALUM CRANIOPLASTY AND REPEATED TRAUMA

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There is uniform agreement that protection from trauma constitutes one of the major indications for cranioplasty. The necessity for such protection is greatest in the younger age group and increases with the size of the cranial defect.

Tantalum is probably the most commonly employed alloplastic material used for this purpose and while generally the thickness of plate employed has been sufficient to withstand considerable direct trauma, there has been some recent tendency to

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use thinner sheets because of the facility with which the prosthesis may be formed to correspond to the contour of the skull. Weiford and Gardner, in a recent review of 106 cases of tantalum cranioplasty, indicated that the thickness of the sheets employed had been reduced in successive stages from 0.020 to 0.007 inch and felt that the latter was of sufficient strength, was more easily and more accurately fashioned, and was less expensive. Gardner noted that with tantalum sheet of 0.007 inch thickness, pneumoencephalography and arteriography could be done with adequate visualization of the air-filled ventricles or of diodrast-filled vessels.

Deformity of a tantalum implant due to trauma probably occurs more often than one would suspect from the infrequency with which it is mentioned in the literature. Lane and Webster in 1947 mentioned the necessity for removal of a tantalum implant because of an abscess of the scalp after a blow at the site of a cranioplasty 11 months after the procedure had been done for a gunshot wound. In a recent review by Reeves, no mention is made of this complication.

The following instance of gross deformity of a tantalum implant due to repeated trauma served to stimulate observations relative to the ability of various sizes and various thicknesses of tantalum plate to withstand direct trauma.

CASE REPORT

The patient was an 8-year-old boy, first seen on April 11, 1950, because of a compounded and comminuted fracture of the frontal region sustained when he was struck by an iron pipe. The fracture overlay the anterior portion of the superior longitudinal sinus and indriven bone fragments could be visualized radiologically at a depth of 2 cm. The comminuted area measured about 5.5 cm. in width with the central portion of the depression at the midline. The patient was in mild shock but there was no evidence of extensive intracranial damage.

Operative debridement was carried out and a 6 to 7 cm. tantalum plate of 0.007 inch thickness was used to cover the defect in the bone. No attempt was made to inlay the plate, which was fixed in position with several tantalum wedges driven through the outer table of the skull into the diploic space. The wound healed well and the patient was discharged from the hospital with no evidence of residual neurologic defect.

The patient was seen on July 15, 1950, because of a deformity of the scalp at the site of the tantalum implant. On July 4, 1950, almost 3 months after discharge from the hospital, he had been struck in the frontal region by a steel helmet of the type worn by steel workers. The patient had not been unconscious from the blow and had no complaint other than some tenderness at the site of the injury. Examination revealed a 3½ cm. long depression of 6 to 7 mm. depth at the site of the cranioplasty. There were no neurologic abnormalities. Because the depression was not marked and in the absence of any apparent neurologic disturbance, replacement of the implant was deferred.

He was not seen again until June 1951, about 1 year after the first injury that had resulted in deformity of the tantalum plate. At this time there was a more marked deformity at the site of the implant and he gave a history that about 3 to 4 weeks previously he had been struck in the frontal region with a baseball. The distortion was more marked and the entire implant appeared to have been badly depressed. On June 16, 1951, the implant was removed (Fig. 1) and replaced with another of 0.015 inch thickness. At operation there was no evidence of damage to the local tissue as a result of the repeated trauma.

Observations were made on the ability of formed tantalum plates to withstand direct impact, using implants of approximately 2, 3, and 4 inch diameter and 0.005, 0.007, 0.010 and 0.015 inch thickness. All plates had the same relative contour and had been hand-formed on the anvil described in a previous communication. Figures were obtained by allowing a quarter-pound weight to drop from a specified height onto the plate, which was fixed in a manner similar to that used in a tantalum cranio-
plasty. The striking surface was a 1 inch square of aluminum bar and figures were obtained for the minimum impact, measured in inch-pounds, that would cause a definite indentation or distortion of the surface of the plate.

Table 1 gives a summary of the results obtained and it is of interest that the diameter of the implant made relatively little difference in the ability of the metal to withstand the impact. From the figures obtained, it became apparent that tantalum, even of 0.015 inch thickness, falls far short of the ability of the skull to withstand direct trauma. However, the fact that the implant does deform under direct impact may be a factor of safety in allowing dissipation of energy which might otherwise produce serious intracranial damage. The figures obtained suggest that tantalum of 0.010 inch thickness or less is not sufficient to withstand even very slight trauma without marked deformity and should probably be considered as unsuitable for cranioplasty except in very small defects or where considerable molding or contouring is necessary, as in the repair of defects involving the supraorbital ridge or orbital roof.

**TABLE 1**

*Maximum energy requirements in inch-pounds necessary to deform tantalum plates*

<table>
<thead>
<tr>
<th>Thickness of Plate (inches)</th>
<th>Size of Plate (Diameter)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2 inch</td>
</tr>
<tr>
<td>0.005</td>
<td>0.75</td>
</tr>
<tr>
<td>0.007</td>
<td>2.0</td>
</tr>
<tr>
<td>0.010</td>
<td>2.5</td>
</tr>
<tr>
<td>0.015</td>
<td>5.0</td>
</tr>
</tbody>
</table>

**ADDENDUM**

Since the above was submitted for publication an additional instance of traumatic deformity of a tantalum implant has been observed. This was in a 14-year-old girl who struck her head against the corner of a sofa denting a 0.007 inch thick, 3½ inch implant which had been used to cover a defect, after removal of an area of fibrous dysplasia of bone in the parietal area.

**REFERENCES**

THE LUCITE CALVARIUM

A CASE REPORT

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(Received for publication September 5, 1951)

The purpose of this report is to describe a situation which was benefited by the use of a lucite calvarium. This is probably the first use of the acrylic cap in a human where there was avulsion of the scalp, skull, dura and brain; it was applied in an effort to get the patient into such condition that he could be evacuated to a "rear" area from the "forward" area at Wonsan, Korea.

The original work with the lucite calvarium, in a manner similar to that to be described, was done on monkeys by Shelden, Pudenz, Restarski and Craig at the Naval Medical Research Institute at Bethesda, Maryland in 1943 and 1944. Acrylic substitutions for ordinary skull defects have been in use since 1940, and have recently been appraised in Reeves' monograph on cranioplasty.

CASE REPORT

On Oct. 31, 1950 a right-handed hospital corpsman was involved in an accident when he was helping at the loading of a stretcher-patient onto a helicopter. He had evidently backed up toward the rear of the plane and was struck in the head by the whirling propeller, which rotates vertically. Three of the four blades of this propeller were broken off as they cut into his head.

The patient was rendered unconscious immediately and a battle dressing was applied to the macerated right side of his head. He was given last rites by the Catholic Chaplain and was transported to the hospital ship U.S.S. Consolation (AH-15) where he was admitted to the neurosurgical service in critical condition. He arrived aboard 60 minutes after the accident. Therapy for shock was instituted and plasma, blood, and intravenous fluids were given; his B.P. rose from 76/50 to 100/70.

Operation. Preparations were then made for craniotomy; however, because he was rapidly losing considerable amounts of blood and going into shock again, it was necessary to remove the head dressing and put hemostats on the bleeding pulsating arteries. Thus the exposed right middle meningeal and ascending parietal and parietotemporal branches of the middle cerebral artery were clamped (Fig. 1). Then the wound was packed with gauze; his head was shaved; and surgical "prep" was accomplished.

A large amount of foreign material including sand, flecks of paint from the plane's propeller, free chunks of scalp, pieces of skull bone, and blood-matted hair were removed from the cranial vault. Debridement was continued, using a sucker, and necrotic and macerated brain tissue was removed from the whole area of the parietal lobe, the posterior aspect of the frontal lobe, the superior half of the temporal lobe and the anterior part of the occipital lobe on the right. The white matter was involved to a depth of 5–6 cm. in certain areas and the temporal horn of the right lateral ventricle communicated with the wound. Hemostasis was

* The opinions or conclusions in this report are those of the author. They are not to be construed as necessarily reflecting the views or the endorsement of the Navy Department.

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