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Spontaneous fracture of cranioplastic titanium implants without head trauma in an adult: A case report



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ABSTRACT

INTRODUCTION: The cranioplasty is a classical surgical procedure to repair large skull defects. The prosthesis fracture was one rare complication following cranioplasty, which was only known to happen in traumatic head injury or child growing skull.

PRESENTATION OF CASE: In the current report, we documented the first reported case of cranioplasty prosthesis fracture in an adult neurological trauma patient at the proximal pterion point region without head trauma. During the first cranioplasty, due to the cerebromalacia at temporal lobe, patient's temporalis muscle was not stripped from the dura mater and the prosthesis was anchored outside the temporalis muscle. Thus, no screw was used for anchoring the prosthesis at the basitemporal skull. The prosthesis fracture was observed on 12th-month post-surgically at the proximal pterion point region. During the second cranioplasty, the temporalis muscle was semi-partitioned from the back due to cerebromalacia recovery and five screws were used to anchor the prosthesis onto the basitemporal skull. The follow-up result was unremarkable on 21st-month post-second-cranioplasty.

DISCUSSION: A dynamic load was generated on the prosthesis due to head-pillow contact during sleeping. Via the parietal tuber-temporopzygomatic suture line, this inward load generates an outward force at the proximal pterion point region, where became a shearing force locating just right below the lowest screw anchoring in this region. This shearing force eventually led to prosthesis fracture at the proximal pterion point due to the fatigue effect.

CONCLUSION: This case presented the importance of prosthesis anchoring location on the skull, especially when temporalis muscle was required to be preserved due to clinical necessity.

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1. Introduction

To meet both cosmetic and functional requirement after large skull defects, cranioplasty is carried out to alleviate the “syndrome of the trephined” due to direct pressure from the atmosphere onto the scalp and dura. Although the surgical procedure is quite straightforward in most cases, various complications following cranioplasty have been reported [1]. Among all complications, prosthesis fracture was extremely rare, which was only subject to traumatic head injury [2–4] or child growing skull [5]. In the current study, we documented the very first case of cranioplasty titanium mesh prosthesis fracture in an adult, which occurred 13 months post-surgically without any trauma on the head. We used this case to propose the importance of cranioplasty prosthesis anchoring at the basitemporal skull, as otherwise non-traumatic dynamic load from head-pillow contact during sleeping will cause fatigue failure of the prosthesis.

2. Presentation of case

A 50-year-old previously healthy man fell from 6 meter high and hit his head on the ground. He was emergently transferred to a local hospital and diagnosed with a right parietal-temporal skull fracture and right frontal-parietal-temporal epidural hematoma with severe cerebral contusion and laceration. An emergent craniotomy was conducted to clear the epidural hematoma, following the large decompressive craniectomy of the frontal-parietal-temporal skull flap. The patient got apparent clinical improvement 13 months post-surgically and was admitted to our hospital. His neurological examinations were unremarkable. Head CT scans confirmed a 6 × 8 cm bone defect at the right frontal-parietal-temporal skull (Fig. 1). Additionally, multiple loci of decreased density at right posterior temporal lobe were found, which was diagnosed as cerebromalacia.

4 days after admission, the patient underwent the parietal-temporal cranioplasty under general anesthesia. Skin incision following the original craniotomy was made and the pericranial tissue corresponding to the area of the estimated edge of the skull was stripped. A computer-based patient-matched titanium mesh

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Fig. 1. The 3-D reconstruction CT imaging revealing a 6 × 8 cm skull defect at the right frontal-parietal-temporal skull prior to the cranioplasty.

implant was anchored by the matched titanium screws directly onto the skull and confirmed by surgeons that the implant completely covered the skull defect area. Anatomically speaking, the temporal branches of middle meningeal artery anastomoses with the temporal arteries in the temporalis muscle [6]. Thus, partition

the temporalis muscle could break blood flow between these two arteries and therefore decrease brain blood supply, which is a negative factor for brain trauma patient to recover (cerebromalacia after trauma in our case). In order to maintain proper temporal lobe blood flow, the integrity of the temporalis muscle was kept and not stripped from the dura mater during the surgery. The temporalis muscle was simply covered by the titanium mesh and thus no titanium screw could be used for anchoring prosthesis at the basitemporal skull. The patient recovered to a great degree post-surgically without negative complaints. Physical and laboratory examination were unremarkable and 3-D reconstruction CT imaging was performed right before discharge, showing the implant was intact and in an ideal position.

Thirteen months later, the patient re-visited our outpatient clinic and complained a prominence at the right upper orbital region appeared approximately 12 months post the first cranioplasty (Fig. 2A). No trauma or intensive force on the head could be recalled by the patient. However, the patient did mention that he started to use the right lateral position during sleep since the 6th-month post the first cranioplasty, which allowed extra load on the titanium mesh implants. Neurological examinations were unremarkable while the physical examinations identified a linear deformity, facing back and up at 45° and starting from proximal pterion point to an unclear ending point. 3-D reconstruction CT imaging revealed the clear edge of titanium mesh implant fracture,

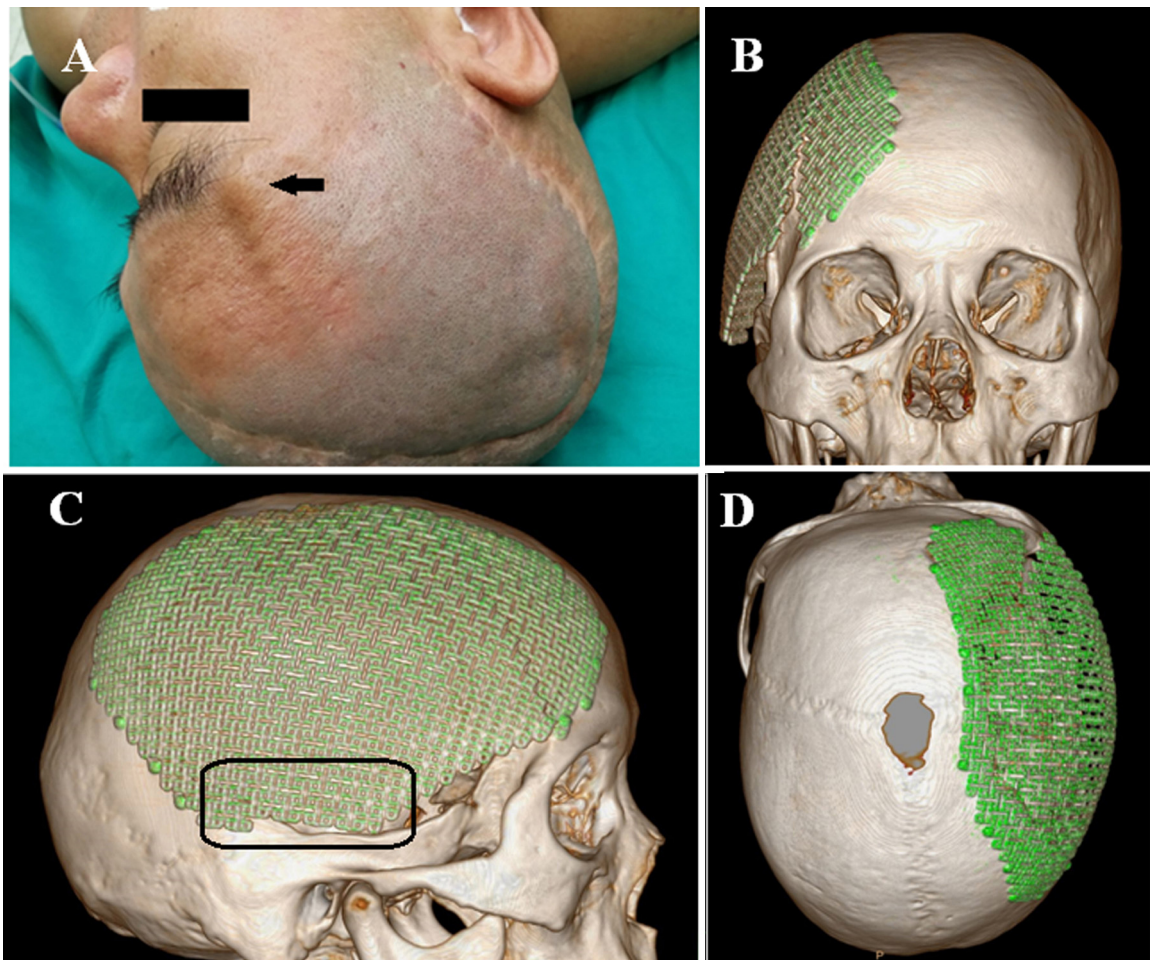


Fig. 2. (A) There existed a prominence at the right upper orbital region of the patient during the second visit (as indicated by the black arrow). (B–D) 3-D reconstruction CT imaging at sagittal, coronal and axial plane revealed titanium mesh prosthesis fracture, which was a 6 cm linear crack and extended from the proximal pterion point to the parietal bone. Clearly, the area in the black rectangular area in C was the skull basitemporal locus, which was absent of titanium screw in order to keep the integrity of the temporalis muscle during the first surgery.

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