



Outcome analysis of preformed titanium versus free-hand polymethylmethacrylate cranioplasty

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Introduction

Cranioplasty restores cranial function and reshapes the neurocranium and viscerocranium after craniectomy. Various materials have been used for cranioplasty, and virtually designed computerized implants have found increasingly wider use. However, no consistent data are yet available that compare the different materials regarding indications, complications, and outcome (1,2). We report our experiences with preformed titanium and free-hand polymethylmethacrylate cranioplasty in a large study population.

Methods

In this retrospective mono-centric analysis, we included 122 consecutive patients who had been operated on in our neurosurgical department between 2006 and 2013. 61 patients (28 women, 33 men; mean age 54 years) had received a preformed titanium implant and 61 patients (21 women, 40 men; mean age 46 years) free-hand PMMA cranioplasty. We evaluated all demographic and procedure-related data, indications, and outcome parameters and screened the postoperative images for any relevant hemorrhage, accurate fitting, and artifacts. The mean follow-up was 2 months.

Results

The most frequent indications were infarction (N=31, titanium n=12, PMMA n=19), acute subdural hematoma (N=24, titanium n=14, PMMA n=10), and skull-base meningioma (N=16, titanium n=8, PMMA n=8). Patients in the PMMA group required significantly longer operating times ($p=0.02$), and had more cerebral fluid leaks ($p=0.003$), and a significantly higher revision rate ($p=0.04$) than patients in the titanium group. Postoperative imaging confirmed accurate fitting for all patients in the titanium group but only for 69% of patients in the PMMA group ($p<0.001$). Postoperative magnetic resonance imaging (MRI) of patients with titanium implants (n=5) did not show any relevant artifacts.

Conclusions

Titanium is a nonferrous metal of low atomic number that does not generate any relevant artifacts, neither in computed tomography (CT, Fig.3) nor in magnetic resonance imaging (MRI, Fig.2) (3). Titanium for cranioplasty has been evaluated in previous studies, and some authors have recommended this material as the method of choice for secondary cranioplasty (4,5,6). For cranioplasty, preformed titanium seems to be superior to PMMA with regard to surgical morbidity, revision rates, and esthetic results. Because titanium does not cause artifacts in MRI, correct postoperative evaluation is warranted that may justify the significantly higher costs of this type of cranioplasty.

References

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Learning Objectives

Cranioplasty and cosmetic restoration of the skull in the context of modern materials and techniques

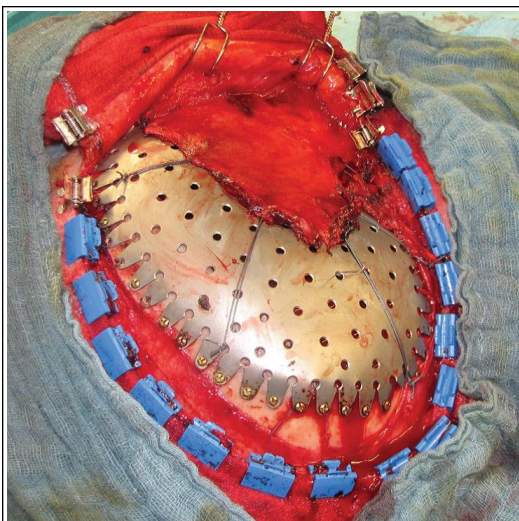


Fig.1 Titanium cranioplasty

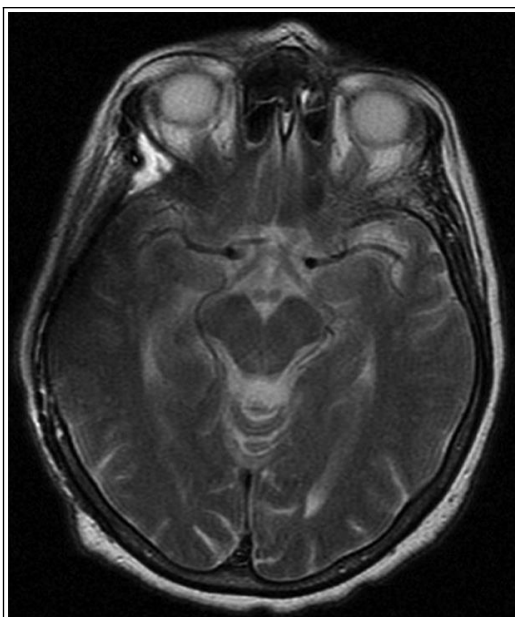


Fig.2 Postoperative MRI scan

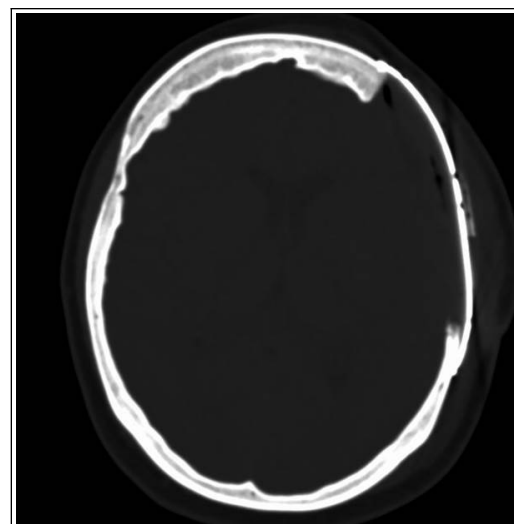


Fig.3 Postoperative CT scan