# Autologous bone flap cranioplasty case series

## 2020

Patients who underwent autogenous bone graft for cranial defect coverage from December 2011 to November 2015 at our institution were reviewed. Rib bone graft or latissimus dorsi rib myoosseocutaneous free flaps were done to cover the defect. The patient follow-up period ranged from 3 months to 7 years.

There were 6 patients, with 9 surgeries. Two cases of latissimus dorsi rib myoosseocutaneous free flap procedures were performed in 2 patients and 7 sagittal split rib bone grafts were performed in 6 patients. There were no postoperative infections in any patients, despite 4 patients had previous surgical site infection histories. Two patients with neurologic sequalae showed improvement after the surgeries.

Sagittal split rib bone graft and latissimus dorsi rib myoosseocutaneous free flap procedures could be fine options for calvarial reconstruction of defects under the unfavorable conditions of bilateral cranial defects or previous infection history [1)].

## 2019

Data of children and adults who underwent cranioplasty between July 2010 and March 2018 were analyzed retrospectively. Clinical data, complications, and risk factors regarding aseptic bone resorption (ABR) were evaluated including patient age, occurrence of shunt-dependent hydrocephalus, and number of fragments in autologous bone flaps.

Severe traumatic brain injury (TBI) was the leading cause for DC among children (66.7%), associated with a significantly higher number of fragments ($p = 0.002$). In the adult population, the most common cause was malignant infarction (55.9%) followed by TBI (24.6%). Pediatric patients in our institution received autologous bone flaps less frequently than adult patients (61.1% and 83.1%, respectively). Young age and a higher number of fragments in autologous bone flaps were associated with the occurrence of ABR. Children and adolescents showed significantly higher rates of aseptic bone necrosis ($p = 0.007$) and revision cranioplasty ($p = 0.036$). Kaplan-Meier estimates were used to further analyze bone flap resorption in children and adults, showing that revision surgery due to ABR was performed earlier in children ($p = 0.001$, log-rank test).

Pediatric patients demand specific care when cranioplasty is performed following DC. We identified age as an independent risk factor. The higher number of fragments appears to be a correlation due to the higher number of TBIs in children. Our data indicate that young age is the most important risk factor for the development of ABR as a frequent and early complication with a shorter revision-free time interval in children. Consequently, the uncritical use of cryopreserved autologous bone flaps should be questioned in this population [2)]

**2015**

A total of 187 patients underwent delayed cranioplasty using autologous bone flaps cryopreserved at -30°C following decompressive craniectomy. Indications for craniectomy were trauma (77.0%), stroke (16.0%), subarachnoid hemorrhage (2.67%), tumor (2.14%), and infection (2.14%). There were 64 complications overall (34.2%), the most common being infection (11.2%) and bone resorption (5.35%). After multivariate analysis, intraoperative cerebrospinal fluid leak was significantly associated with infection, whereas longer duration of surgery and unilateral site were associated with resorption. Cranioplasty using frozen autologous bone is associated with a high rate of infective complications. Intraoperative CSF leak is a potentially modifiable risk factor. Meticulous dissection during cranioplasty surgery to minimize the chance of breaching the dural or pseudodural plane may reduce the chance of bone flap [3)]

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149 patients who underwent cranioplasty following decompressive craniectomy during the time period January 1998 to December 2012. Autologous bone flaps were sterilised in an autoclave and stored in a refrigerator at a temperature of 8 degrees above zero until cranioplasty was performed. Complications were registered and patient data were analysed in order to identify risk factors for surgical site infection and bone flap resorption after cranioplasty. Only the patients with a follow-up period of >24 months were included in the analysis of bone flap resorption (110 patients).

Surgical side infection occurred in only five patients (3.3%), whereas bone flap resorption developed in 22 patients (20%). The multivariate analysis of the presented data identified the operating time of >120 min ($p = 0.0277$; OR, 16.877; 95% CI, 1.364-208.906) and the presence of diabetes mellitus ($p = 0.0016$; OR, 54.261; 95% CI, 4.529-650.083) as independent risk factors of development of infection and the presence of ventriculo-peritoneal (VP) shunt ($p < 0.0001$; OR, 35.564; 95% CI, 9.962-126.960) as independent risk factor of development of the bone flap resorption.

Reimplantation of the autoclaved autologous bone flap following decompressive craniectomy is a simple and cheep alternative to other techniques and is available to any institution that provides autoclaving sterilisation services. This method is associated with a low rate of surgical site infection, but with a significant rate of the bone flap resorption [4)].

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In 87 patients. Post-operative complications were recorded in 31 (36 %) patients of whom 22 lost their primary implant. Surgical site infection (SSI) and bone flap resorption (BFR) were the two most common complications, affecting 8 (9.2 %) and 14 (19.7 %) patients, respectively. Only BFR was associated with some of the recorded variables. Using multivariable logistic regression analysis, young age (OR = 0.94, 95 % CI 0.88-1.00, p = 0.04), bone flap fragmentation (OR = 14.3, 95 % CI 2.26-89, p = 0.005), long storage time (OR = 1.03, 95 % CI 1.00-1.04, p = 0.02) and Glasgow Outcome Scale at the time of cranioplasty (OR = 2.55, 95 % CI 1.04-6.23, p = 0.04) were found to be significant risk factors for bone flap resorption.

Cranioplasty after decompressive craniectomy carries a high rate of complications. In this study, SSI and BFR were the two most common complications of which predictive clinical parameters could be identified for BFR only. The results indicate that synthetic implants may be considered in pediatric patients and in cases with fragmented bone flaps or delayed time to cranioplasty. Although the rate of

complications was high, 73 % had a successful reinsertion of the autologous graft at a low cost. We feel this result justifies the continued use of cryopreserved bone flaps [5].

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