

Original Article

Retrospective Review and Analysis on Outcome of Cranioplasty: A Series of 38 Cases

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Abstract

Background: Cranioplasty is a straightforward procedure; it may result in a significant number of complications. These include infections, seizures, intracranial hematomas, and others.

Objective: To evaluate the outcome following cranioplasty with titanium mesh-plate and screw.

Materials and Methods: This retrospective study included patients who underwent decompressive craniectomy due to traumatic brain injury with raised intracranial pressure, acute subdural hematoma, compound comminuted skull fracture and intracranial hemorrhage between January 2019 to December 2020 at Enam Medical College Hospital, Savar, Dhaka. Data were collected in pre-designed data collection sheet and were analyzed using computer-based programme statistical package for social science (SPSS) windows version 25.0. **Results:** This study showed maximum patients (34.2%) were between 21-30 years age. Majority (89.5%) were male and only 5.9% were female. Overall rate of complications was 10.5%. Among them new onset seizure was four, indrawing of skin through bone gap was four, hemorrhage was two, infection was one, hydrocephalus was one, and exposed implant also one. **Conclusion:** We have found the outcome of cranioplasty was better with titanium mesh plate and screw than conventional fixation of bone with polyglactin, polypropylene suture and titanium miniplate and screw. With polypropylene and polyglactin there is more chance of inward displacement of bone fragment and with miniplate and screw there is still chance of indrawing of bone fragment through the bone gap.

Key words: Cranioplasty; Intracranial hematomas; Decompressive craniectomy

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Introduction

Cranioplasty is a common neurosurgical procedure to reconstruct a skull defect. It is commonly performed following a decompressive craniectomy (DC).¹ Other indications for cranioplasty include following the removal of bone-invading tumors or an infected bone flap.² Although cranioplasty (CP) is a straightforward procedure, a significant number of complications may occur, ranging from 10.5% to 50%. These include infections, seizures, intracranial hematomas, and rarely mortality.³⁻⁵ Many reports have stated that early CP is associated with higher complications.⁶⁻¹⁰ Studies examining the complications associated with cranioplasties mostly concentrate on the rate of infection.¹¹⁻¹⁶ Very few studies discuss the various complications that may be encountered when performing cranioplasties.¹⁷ This study evaluated the outcome following cranioplasty with titanium mesh-plate and screw.

Materials and Methods

This was a retrospective study after taking permission from hospital authority to collect data. Patients who underwent cranioplasty between January 2019-December 2020 at Enam Medical College Hospital, Savar, Dhaka were identified from medical record files. Patients who were lost in follow-up were excluded from the study. Duration of cranioplasty after decompressive craniectomy was about three months. Some patients were hospital bed-ridden for long time,

but we always sent them home at least for 2 weeks for development of normal flora and limit the possibilities of hospital-acquired infection. During home stay patients were without any antibiotic to facilitate the growth of normal flora. All the surgeries were done with maximum aseptic precautions. We always prefer autogenous bone graft instead of hydroxyapatite or polymethyl methacrylate (PMMA) bone cement due to higher infection rate.¹⁸ Patients' autologous bone was collected from bone bank from our own institute and processed for sterilization. Further the graft was autoclaved two times. Previously we used mini plate and screw, but now we use titanium mesh plate 2×4 inches and divide it into 4-6 small pieces as required. Number of screws for bilateral cranioplasty were about 50, for unilateral cranioplasty about 30 and for mini-cranioplasty 10-12. We placed one suction drain in unilateral cranioplasty and two in bilateral cranioplasty. Drain was placed in the most inferior cleft between temporalis muscle and the bone. In some cases, allogenic bone graft was used as autologous bone was discarded due to compound comminuted fracture with contamination. Allogenic bone graft was collected from Institute of Tissue Banking and Biomaterial Research of Atomic Energy Research Establishment, Savar. In some cases, small bone gap was filled with allogenic bone dust which was also collected from the same institute. We found that fixation of bones with titanium mesh plate and screw is superior to miniplate and screw.



Fig 1. Pre-operative CT scan showing bone gap of bilateral craniectomy (left), post-operative x-ray skull showing accurate placement of bone graft (middle) and per-operative image of cranioplasty of a different patient showing bone gap and burr hole gap covered sufficiently with titanium mesh plate

Data were collected in pre-designed data collection sheet and analyzed using computer-based programme statistical package for social science (SPSS) for windows version 25.0.

Results

This study shows maximum patients (34.2%) were between 21-30 years. The average age was 28.44±12.96 years. We found majority (89.5%) were males and only 5.9% were females.

Table I shows the mode of injuries of study subjects, Table II shows the types of cranioplasties, Table III shows the implants which were used in our cases. Table IV shows the complications in study subjects. Overall rate of complications was 10.5%. Among them new onset seizure was in four cases, indrawing of skin through bone gap was in four, hemorrhage in two, infection in one, HCP in one, and exposed implant was in one cases.

Table I: Mode of injury of study subjects

Mode of injuries	Frequency	Percentage
RTA (mostly motor cycle accidents)	26	68.4
Alleged physical assault	4	10.5
Fall from height	4	10.5
Drop of heavy object on head	1	2.6

Table II: Types of cranioplasties

Previous management	Frequency	Percentage
Unilateral cranioplasty	17	44.7
Bilateral cranioplasty	21	55.2

Table III: Implants used

Operation name	Frequency	Percentage
Mini Plate and Screw	4	10.5
Mesh Plate and Screw	34	89.5

Table IV: Complications in study subjects (n=38)

Complications	Frequency	Percentage
Nil	34	89.5
Infection	1	2.6
HCP	1	2.6
New onset seizure	4	10.5
Exposed implant	1	2.6
Indrawing of skin through bone gap	4	10.5
Hemorrhage	2	5.3

Discussion

This study shows maximum patients (34.2%) were between 21-30 years. The average age was 28.44±12.96 years. In similar study Prasad et al⁶ reported the mean and median ages were 38.3 years (range 1–68 years) and 38 years, respectively. We

found majority (89.5%) were male and only 5.9% were female. These findings are in well agreement with two other studies.^{2,6}

This study shows road traffic accidents (RTA) were the most frequent causative event of traumatic brain injury. Since road traffic accidents involved mainly

motorcycles (n=18) compared to other types of vehicles, motorcycle accidents should be analyzed separately from other traffic accidents. Similar findings also were found in some other studies.³⁻⁵

In this study overall rate of complications was 10.5%. There were 14 complications: new onset seizure - 4, indrawing of skin through bone gap - 4, haemorrhage - 2, infection - 1, HCP - 1, and exposed implant - 1. These findings are similar to the findings in Prasad et al⁶ and Klinger et al¹⁹ who analyzed 258 cranioplasties over a 10-year period and noted 10.8% complication rate in their series. Some other large studies have shown the rate of complications in cranioplasties as high as 19.7–32%.²⁰⁻²² Most of these studies focused on the rate of infection and factors which contribute to it. It is however also important to understand and treat all other different complications that might arise as cranioplasty has such a higher rate of complications.

We have found one exposed implant with infection. After surgery the patient did not come for follow-up. Possible factors of this complication include poor personal hygiene, inadequate nutrition, dressing and medication. This patient underwent re-exploration surgery.

Four patients suffered from indrawing of skin through the bone gap. The graft bones were fixed with titanium mini plates and screws. Although the bone gap was minimum but due to skin indrawing we subsequently fixed all the graft with titanium mesh plate and screw and did not find any complication. And also, we have found fixation of the graft is better than miniplate and screw and the bone gap was completely covered with the mesh plate.

This study shows overall complications were 10.5% but infection rate was 2.6% and skin indrawing was 10.5%. The bone graft of all the patients with skin indrawing were fixed with miniplates and screws. To avoid these complications our recommendation is to use autologous bone graft as it has less chance of infection, and no implant related complication. We suggest to use mesh plate and screw instead of miniplate and screw as it obsoletes the possibilities of skin indrawing and provides better bone fixation. But we did not find such kind of complication in our series

with mesh plate and screws.

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