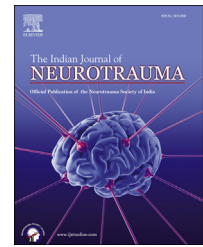


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## Case Report

# Use of autologous comminuted calvarial fragments and pedicled pericranial graft for single stage repair of frontal and cranial base injury

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## ABSTRACT

Frontal sinus fractures are usually caused motor vehicular accidents. Because of the anatomic position of the frontal sinus and the enormous amount of force; these injuries are often associated with injuries to skull base, intracranial, ocular, and maxillofacial structures and thus has a large potential of complications. In present case we describe the use of autologous comminuted calvarial fragments and pedicled pericranial graft for single stage repair of frontal and cranial base injury.

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## 1. Introduction

Frontal sinus fractures are usually caused motor vehicular accidents and account for 5–12% of all maxillofacial fractures.<sup>1–6</sup> Because of the anatomic position of the frontal sinus and the enormous amount of force; these injuries are often associated with injuries to skull base, intracranial, ocular and maxillofacial structures<sup>1</sup> and thus has a large potential of complications.<sup>2</sup> In present case we describe the use of autologous comminuted calvarial fragments and pedicled pericranial graft for single stage repair of frontal and cranial base injury.

## 2. Case report

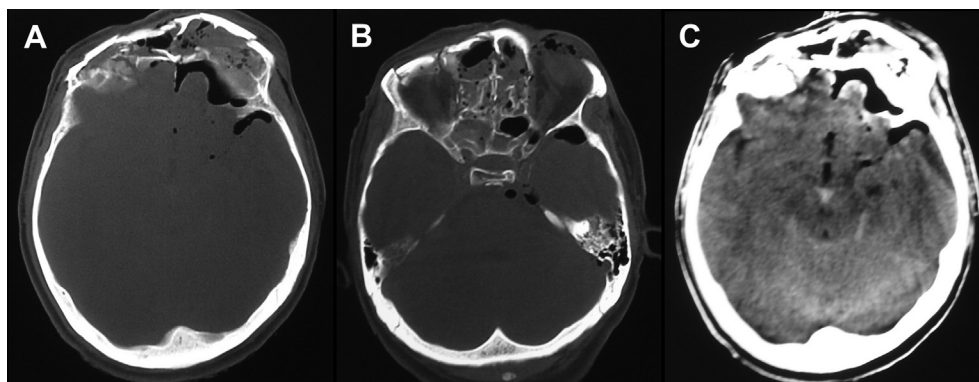
A 55-year-old male presented 6 h after road traffic accident. The vehicle in which he was traveling had head on collision with another vehicle. He sustained multiple facial injuries. There was history of loss of consciousness for 30 min, vomiting 3–4 episodes, nasal bleeding and left ear. On examination in emergency room his vital were stable, general and systemic examination was unremarkable except bilateral crepitations on chest auscultation. Neurologically he was in altered sensorium (GCS-E2, V3, M5), moving all four limbs equally and

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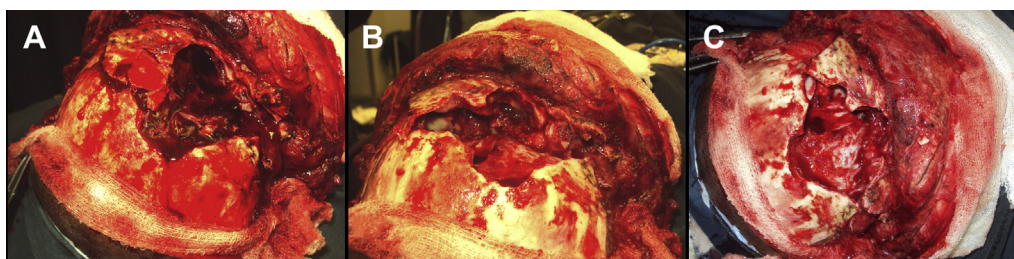
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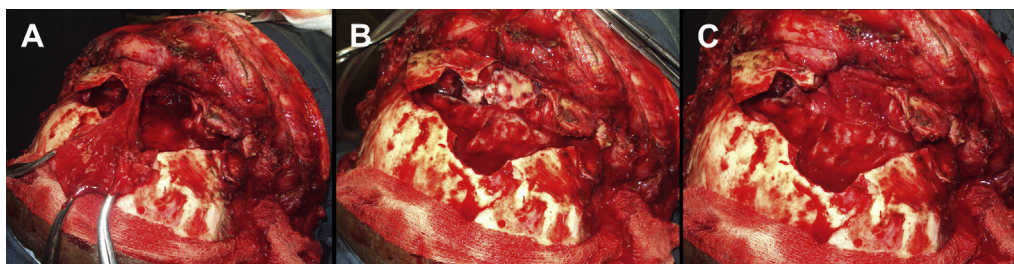
**Fig. 1** – Pre-operative CT images showing extensive comminuted fractures involving frontal bone, anterior and posterior table of frontal sinus and anterior cranial base with patchy frontal contusions and pneumocephalus.



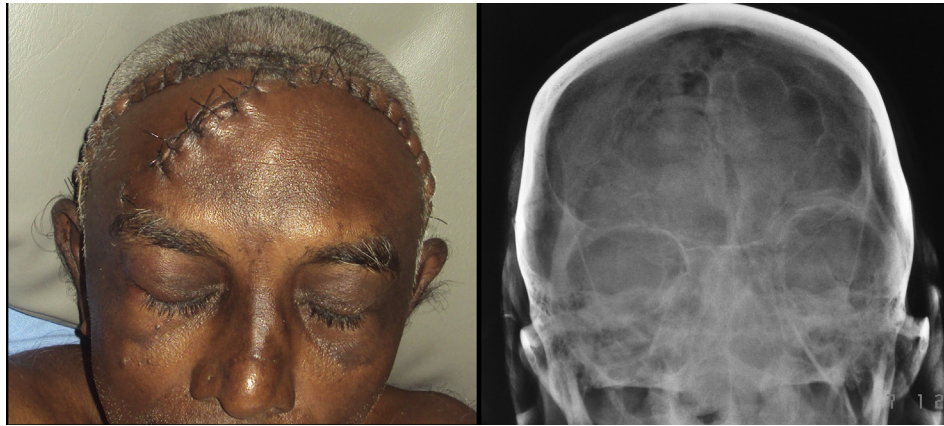
**Fig. 2** – Intra-operative photograph showing (A) extensive comminuted and depressed frontal bone fragments, (B) grossly comminuted anterior, posterior tables of frontal sinus and cribriform plate and (C) grossly intact dura after removal of all loose bone fragments and sinus mucosa.

pupils were equal and reacting to light. Local examination revealed a large laceration on right side of forehead and depressed fragment on frontal bone. Pre-operative CT images showing extensive comminuted fractures involving frontal bone, anterior and posterior table of frontal sinus and anterior cranial base with patchy frontal contusions and pneumocephalus (Fig. 1). The patient was taken for emergency surgery. Bicoronal scalp flap was raised. Frontal bone and fracture were exposed (Fig. 2A). There was a depressed comminuted fracture of frontal bone with multiple loose fragments. All loose fragments and necrotic, unhealthy tissue including shattered cribriform plate was removed (Fig. 2B

and C). Almost all the posterior wall of the frontal sinus involved in comminuted fracture and it needed to be removed (Fig. 2C). The defect was thoroughly irrigated with diluted povidone-iodine and plenty of normal saline. All loose bone fragments were cleaned and washed with povidone-iodine and normal saline. Pedicled pericranial graft was harvested (Fig. 3A). Inner calvarial table fragment retrieved from fractured frontal was used to reconstruct cribriform plate (Fig. 3B). Pedicled pericranial graft was carpeted and secured over the bone graft to isolate the nasal cavity and redundant frontal sinuses from intracranial cavity (Fig. 3C). Utmost care was taken to avoid kinking and tenting of the pedicle of the graft.



**Fig. 3** – (A) Harvested well-vascularized pedicled pericranial flap, (B) placement of bone fragment harvested from shattered posterior table of frontal sinus to reconstruct cribriform plate and for separation of the anterior skull base from the nasal cavity and (C) placement of pedicled pericranial graft over the bone fragment and raw surfaces.

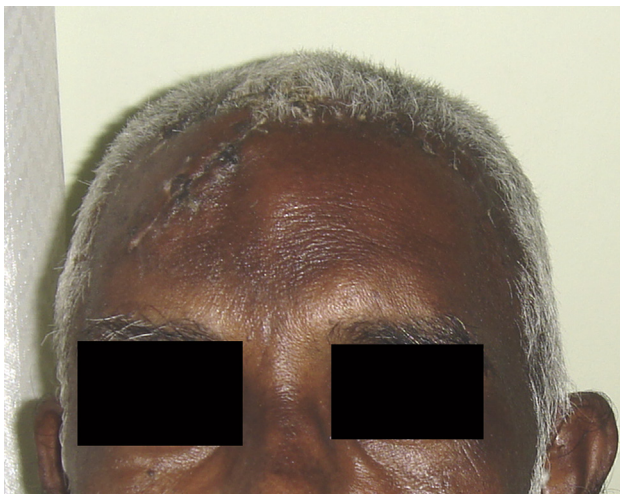


**Fig. 4 – Follow up photograph (left) showing acceptable cosmetic result and (right) X ray showing well aligned bone fragments and construction of the nasal roof.**

Gel foam was placed over the graft. Artificial dural graft was placed over the intact dural to hold the bone fragments and the graft was secured to the intact frontal bone margins. Relatively larger loose fractured frontal bone fragments were placed over the graft. The scalp flap was closed over these fragments. Incision was closed in layers. A dressing with mild pressure was placed to avoid unnecessary movements of the bone fragments. Patient was electively ventilated and could be weaned off over next 48 h. He received intravenous broad spectrum antibiotics for five days and anti-epileptics were continued. The wound healed well with acceptable cosmetic results and no other complication (Figs. 4 and 5).

### 3. Discussion

Involvement of both outer and inner tables of frontal sinus represent greater severity of impact thus resulting in fractures of both plates, floor with bone fragmentation and derangement.<sup>7–13</sup> If left untreated there can be infectious and



**Fig. 5 – Six months follow up photograph showing well healed wound.**

other life threatening complications more frequently after multiple fractures.<sup>1,14,15</sup> To avoid these complications, early intervention not only makes anatomical reconstruction possible<sup>16</sup> but also helps to prevent secondary operations and reduce the risk of infection.<sup>17</sup> Management of these fractures require detailed clinical and radiographic evaluation, prompt surgical intervention (to excise any necrotic tissues inside or outside the cranial cavity), brain isolation by meticulous dural closure, ablation of the frontal air sinuses and repair of the bony defect.<sup>1,18</sup> Reconstruction and recontouring of these frontal and anterior skull base defects can be technically challenging<sup>19–21</sup> and the choice of surgical management is usually decided by the site and extent of the damage.<sup>12</sup> The basics of surgical management to repair these defects include (1) Separation of the anterior cranial base from the nasal cavity (preferably with vascularized tissue), (2) Thorough and complete mucosal removal, (3) Use of autologous material preferably cancellous bone) to repair the bony defect and (4) Also to restore the esthetics.<sup>1,4,19,22–27</sup> Various factors favor the use of autologous bone for reconstruction including a lower incidence of graft loss, the mechanical, immunological, and technical-grafting properties of autologous bone.<sup>19–21,28–33</sup> Apart from this autogenous local bone obviates second surgical intervention, donor site morbidity<sup>10,28–30,34</sup> and ideal particularly in our circumstances where the finances may be a limiting factor.<sup>28–30,34</sup> In summary, the use of autologous comminuted calvarial fragments and pedicled pericranial graft for single stage repair of frontal and cranial base injury in present case resulted in good functional and esthetic outcome.

### Conflicts of interest

All authors have none to declare.

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