Original Research Article

Open skull fractures with brain fungation: Simple principles for good outcome – Our experience

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Abstract

The incidence of head injuries is increasing worldwide. The associated skull fractures are also increasing with rise in vehicular traffic. In the present study, a total of 214 cases of head injuries which were admitted into a Rangaraya Medical College Hospital from the time period of 2 years, were taken for the study. Out of them 124 cases presented with skull fractures ranging from simple linear to stellate, depressed, comminuted, compound and compound comminuted depressed fractures. Some fractures were extending to the base of skull and some to the vault and some were associated with facio-maxillary injuries. 17 cases out of the 124 open skull fractures, presented with cerebro-spinal fluid leak and brain matter seen directly herniating through the wound. The wounds in all the cases were contaminated, with many cases harboring hair, sand particles etc. Majority of them were secondary to road traffic accidents, but assaults and some directly hitting injuries under the influence of alcohol were also included. As there was an evident CSF leak and brain matter already present in the wounds, all the cases were taken up for emergency surgery. In spite of the grossly contaminated wounds, thorough wound debridement and closure of defects and duraplasty wherever feasible, resulted in very good improvement in all the cases. No mortality or procedure related morbidity was observed in any of these cases.

Key words

Brain matter, Compound comminuted depressed fractures, CSF leak, Debridement, Duraplasty, Open skull fractures, Repair of ACF base.

Introduction

Head injuries and skull fractures are on a steep rise worldwide. Road traffic accidents are the major cause of skull fractures secondary to the rise in vehicular traffic [1, 2], the high speeding vehicles, drunken driving etc. Out of these, a number of skull fractures presented as open skull fractures with brain matter being exposed into wound. These cases were considered in the present study. Surgical intervention was done in all the cases, with thorough wound debridement with minimal tissue handling, following simple but meticulous surgical principles. All the cases had good outcome, in spite of grossly contaminated wounds, cerebrospinal fluid leaks, exposed brain parenchyma and ghostly injuries. The various etiological factors, principles of management and the results were analyzed.

Material and methods

The period which extended for a period of 2 years, from January 2013 to December 2014, enabled the study of a total number of 214 Head injuries, which were admitted, of which 124 (57.9%) were skull fractures. 17 (13.7%) cases out of these 124 skull fractures presented with open fractures along with CSF leak/ herniation of brain matter constituted the study group. Pure CSF rhinorhoea/ otorhoea without brain matter in the wounds not taken in the study.

Results and Discussion

The present study included 17 cases out of which 10 cases were due to road traffic accidents, 4 cases due to assaults and 3 cases due to self falls (mostly under influence of alcohol). Totally, 11 cases were having alcohol as a contributory factor and none of the patients with RTA were wearing helmets.

13 cases had open fractures involving the fronto-parietal region, 3 cases had fractures of mastoid with CSF leak along with brain matter herniation and 1 case had an injury in the parieto-occipital region. Frontal fractures extending to the nasal bones and anterior cranial fossa base presented at 47.05% followed by fronto-parietal fractures at a rate of 29.5% and Temporal fractures at 17.65%. Only 5.9% of cases presented with parieto-occipital fractures. (**Table – 1**)

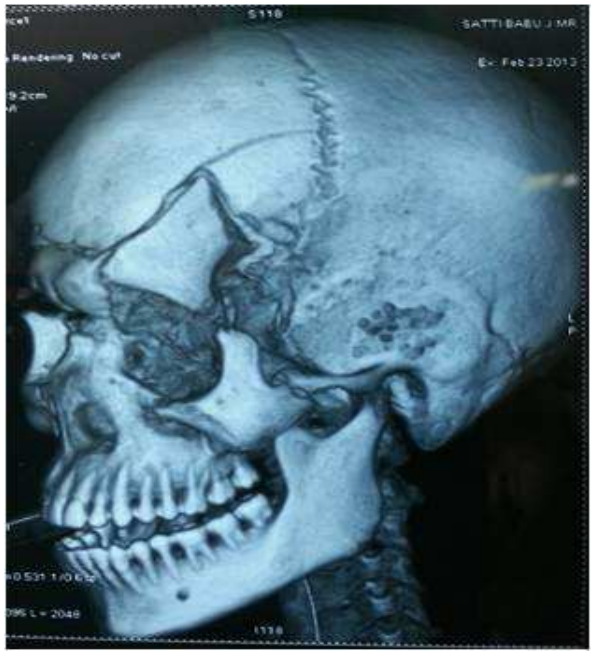
Table – 1: Site of open fracture.

Location of open fracture	No. of cases out of 17cases	%
Fronto-parietal	5	29.5
Frontal extending to nasal bones/ ACF base	8	47.05
Temporal	3	17.65
Parieto-occipital	1	5.9

Case - 1

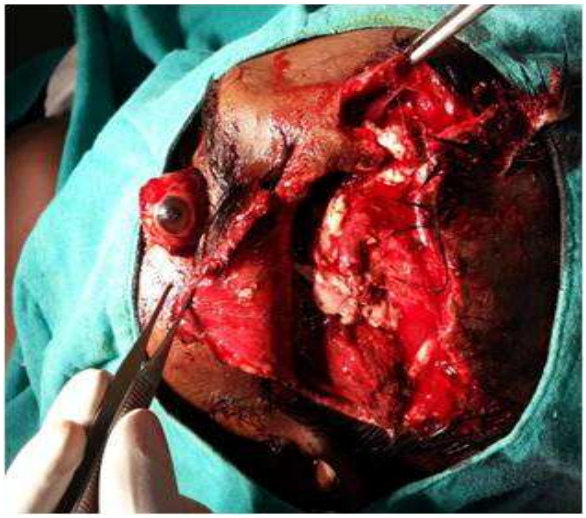
A 23 years old male, a cleaner of a lorry, took over the driving when the regular driver was sleeping. Suddenly, the lorry collided into another truck carrying steel rods, one of which penetrated the skull, fractured it and driven the entire eye ball out of orbit. The boy was brought to casualty with the globe hanging out, with open skull bones, brain matter, hair etc seen through the wound. His GCS was 12/15, evaluated by CT brain which showed compound comminuted depressed fracture with displaced bone fragments. (**Photo – 1**)

Photo – 1: Depressed comminuted fracture.



Emergency surgery was undertaken, thorough wound debridement, excision of small, loose bone fragments done. The hanging brain matter was irrigated and gently sucked. (**Photo – 2**)

Photo – 2: Open brain injury.



The eye ball, which was hanging out, with a small connection of optic nerve, could not be saved and excised. (**Photo – 3**) Wound irrigated with topical Gentamicin solution, and dura repaired, wound closed with monofilament non absorbable suture to minimize infection. Patient has an uneventful postoperative period. Recovered well and discharged in good condition, except for unilateral loss of vision. (**Photo – 4**)

Photo – 3: Excised eye ball.

Case - 2

Following an assault with an axe, a 50 years old male was brought to the Emergency with brain matter herniating out. His GCS was 15/15, CT brain showed a compound depressed fracture with in driven bone fragment. (**Photo – 5A, 5B**)

Under GA, wound was explored, bone fragment removed and the dura repaired with G patch. The patient recovered well without post operative infection or sequelae. (**Photo – 6A, 6B, 6C**)

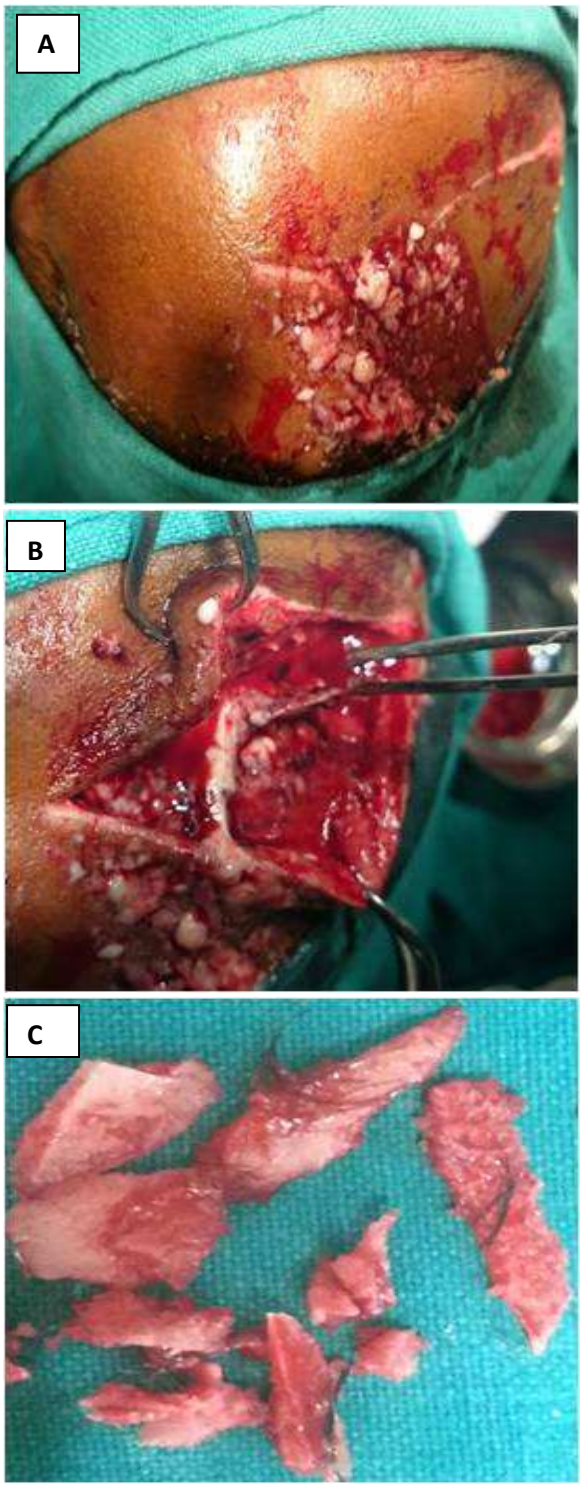
Photo – 4: Post-operative outcome.

Photo – 5A, 5B: Compound depressed fracture.

Clinical presentation

All the patients were brought with open skull fractures with brain matter coming out of wound within 6-8 hours of injury. 3 of them gave a history of seizures before reaching hospital.

Photo – 6A, 6B, 6C: Operative outcome.



Management

Immediately on admission, all the cases were administered anticonvulsants (Phosphenytoin), 20% mannitol to counter cerebral edema and parenteral antibiotics along with other supportive treatment. All the patients were evaluated by emergency CT scan with bone windows, which gave the details of bone fragments, their comminuted or depressed nature. 3D reconstruction of the skull and facial bones done in some cases, helped in a better understanding of the anatomy and thereby a better planning for surgery pre-operatively. After acquiring thorough understanding of the fracture fragments and brain parenchyma status along with associated pathology with CT scans, patients were undertaken for surgery [3-5].

Under general anesthesia, head end was elevated to 15-20 degrees and the head was turned to opposite side and supported on a ring with open wound facing upwards. The incision was extended along the lacerated/ torn skin edges, as per the maximum exposure and convenience of the operating field. The skin flaps were raised with self-retaining retractors or stay sutures. Few cases, where skin was closed at a first aid center were also opened and exposed. Small, free bone fragments of comminuted fractures were removed. Tufts of hair, dirt and sand particles were also removed. A thorough debridement was done with normal saline irrigation in all the cases, for a sufficient time. Under CT guidance, in-driven and buried fragments of bone in the brain parenchyma (of some cases) were removed with a blunt probe. In depressed, comminuted fractures with no gap for an instrument to be inserted in between the fractured bones, a burr hole was made in the normal bone close to the fracture line and an elevator/ dissector introduced through it, lifting the in driven bone fragments. Once the depressed fragments were removed, small, comminuted bone was also removed. Large fragments of bone were washed and replaced to minimize the bony defects. For fractures extending into the paranasal sinuses or into the nose, in addition to debridement and irrigation with normal saline, the exposed sinuses

were filled with Gentamicin soaked gelfoam and bone wax. The pericranium or G patch were kept covering the paranasal sinuses and excluding the brain parenchyma from contact. In 5 cases with dural tears on the convexity, primary closure of dura could be done. In others, duraplasty with G patch was done. In 4 cases with basal fractures, no repair was done. The wound packed with gel foam over the bony defects resulting from excision of the bone. (**Table – 2**)

Table – 2: Frequency of Procedure done.

Procedure done	**No. of cases out of 17 cases**	**%**
Primary closure of Dura	5	29.14
Duroplasty with synthetic patch	8	47.05
Not repaired	4	23.52
Cranioplasty	---	---

As all the cases were primarily compound fractures, no cranioplasty was considered. Direct closure of skin with monofilament, non-absorbable suture was done. Duraplasty was done in 47.05% cases followed by simple closure of dura in 29.14% of cases and no repair was done in 23.52% of cased. Postoperatively, the AED and anti edema treatment continued along with head end elevation.

All the 17 cases recovered uneventfully. There were no post-operative seizures, meningitis or CSF leaks and no procedure related morbidity. One teenager, who presented with associated eye ball injury and avulsion of the globe, lost his vision, but was preserved intact. In a few cases, deficits related to the primary site of involvement like motor weakness, aphasia, irritability etc. subsided gradually over 1-2 weeks. All the patients accepted cosmetic and minimal bony defects but none required a cranioplasty. For complex cases with associated fracture nasal bones and petrous temporal fractures with CSF leak, acetazolamide 500 mg 6 hourly has significantly reduced the leaks.

Conclusion

Surgical treatment is a good option for skull fractures even with herniation of the brain tissue. Prophylactic antibiotic use reduces the risk postoperative/ posttraumatic infection with effective outcomes.

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