

## A COMPOUND ELEVATED DEPRESSED FRACTURE OF SKULL- UNFOLDING THE HYPOTHESES!!!

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Dear Sir

Skull fractures with age old classification are categorised into linear, comminuted, depressed fractures. Depressed fractures have fracture fragments driven into the cranial cavity. There is a theoretical possibility of the fracture fragment to be elevated from the level of intact skull bone, but has sparingly been reported in the literature, with few hypothesis regarding the mechanism and transfer of force. Here we present a case with compound depressed fracture with elevated fracture fragments in a 24 yr old male sustaining head injury following RTA and try to dig deep into the various hypotheses mentioned in the literature. A pattern of antiquity with unicity, these depressed fractures once become elevated may open a pandora's box.

A 24 year old male presented to our emergency department with alleged history of sustaining head injury following a Motor Vehicular

Accident (MVA) where he was thrown off, hitting his head onto the pavement, and being dragged alongwith his vehicle for some distance (however, there was no evidence of dragging on the exposed or unexposed surfaces like- torn clothes, abrasions etc). The scalp wound was sutured at local hospital and measured 4 cms in length. There was no history of loss of consciousness or vomiting or seizure following the trauma. He presented to our casualty after 8 hours of sustaining injury. At the time of presentation, he was hemodynamically stable with Glasgow Coma Scale (GCS) of 15/15 without any focal neurological deficits.

Computed tomogram (CT) of the head showed right frontal depressed fracture with elevation of bony fragments around its margins, soft tissue edema, frontal contusion, parenchymal edema with frontal pneumocephalus (Figure 1). Though the wound was repaired, with the presence of pneumocephalus and a vertical bone fragment, we had serious doubts regarding the dural integrity and hence the wound was re-explored with an idea to debride and repair the dura. The wound was opened, debrided and loose bone fragments were removed to notice a dural tear which was sutured to prevent CSF leak. The wound healed well without any complications.

Calvarial fractures are usually a result of high energy impacts with depressed fractures or compound fractures being common due the inwardly directed force of impact. The search into the literature led us to various hypothesis viz-

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elevation while retrieving an object driven in, tangential forces, massive externally directed forces like in bear mauling, explosive forces of gun shots

etc<sup>1-12</sup> (Table 1) but, on a closer few cases have a mechanism of injury unexplained.

Author, year	No. Of cases	Patient details	Mode of injury	Hypothesis
Ralston <sup>1</sup> , 1976	2	1. 16 F 2. 17 M	1. Machete cut of propeller 2. Deceleration of vehicle	1. Tangential force 2. Unexplained
Verdura & White <sup>2</sup> , 1976	1	Not described	Blunt, penetrating injury	1. Unexplained
Adeolu et al <sup>3</sup> , 2006	3	1. 30 M 2. 34 F 3. 8 F 4. 35 M	1, 4. Machetecut 2. Deceleration 3. Penetrating	1, 4. Tangential force 2. Unexplained 3. Penetrating force
Garg et al <sup>4</sup> , 2007	1	30 M	Assault with sword	Tangential, penetrating force
Talha et al <sup>5</sup> , 2008	1	40 M	Assault by sharp object	Tangential, penetrating injury
Borker et al <sup>6</sup> , 2009	1	20 M	Railboard injury due to hit by electric pole	1. Tangential force
Singh <sup>7</sup> , 2009	1	55 M	Hit by bull	Penetrating injury, tangential force
Bhaskar <sup>8</sup> , 2010	1	19 M	RTA, fall from 2 wheeler	Extradural hematoma lifting the bone flap
Chibber et al <sup>9</sup> , 2011	2	1. 3M 2. 8 F	1. Fall from height with head hitting an elevated surface 2. Attacked by bear	1. Tangential force 2. Tangential force/ outwardly directed forces
Balasubramaniam et al <sup>10</sup> , 2011	1	21 F	Railway accident	Tangential force
Sharma et al <sup>11</sup> , 2012	1	25 M	RTA, hitting an electrical	Tangential force
Sharma et al <sup>12</sup> , 2012	5	1. 24 M 2. 32 M 3. 25 M 4. 30 M 5. 24 M	1, 3, 5. RTA 2, 4. Assault sharp weapon	1, 3, 5. Tangential force 2, 4. Lateral pull of the weapon.

**Table 1- Summary of elevated fractures present in literature.**

According to us, traumatic conditions usually have numerous dynamic phenomenons occurring simultaneously leading to injuries and all these hypotheses are speculative and not evidence based. Our case was not supposedly having any of the

mechanisms mentioned, but still had elevated fracture segment at the periphery. A) direct inward force with no tangential component of sufficient energy to crack a bone, lacerate a skin and injure the dura might have had sharp, loose, fracture fragments gaining energy

and piercing the skin while their journey towards the dura was blocked by other fragments or B) massive force in the centre caused the fragment to go in whereas the periphery of the fragment pierced out or C) a rebound energy diversion within the skull may impart centrifugal force to the elevated fragment. But, essentially we opine that, in this evidence based medicine era, all these hypotheses still remain an author's imagination and as these types of traumatic situations cannot be simulated on humans, they will remain speculative. Like, in our case, the patient had sustained head injury following collision of the bike with a car and the patient was dragged (along with the bike) for a distance after hitting a stone. Hence a tangential force along with rotation of the head can be a probable mechanism. But, aren't we imagining too much when it is almost impossible to underline the true mechanisms at the time of the event? Load bearing models simulating skull and studies regarding their pattern of impact on them may be one possible way of implementing objectivity as are the objective evidence provided by the recordings at the site of occurrence. Otherwise, these hypotheses will remain as it is for some time to come.



**Figure 1:** CT scan brain showing the comminuted fracture of right frontal bone with a fracture fragment elevated from the surrounding bone, with contusion of the brain.

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