Massive Penetrating Craniofacial Trauma due to Polyvinyl Chloride Pipe

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Abstract
Penetrating craniofacial trauma can lead to massive injury to the facial tissue and craniofacial skeleton with retained bone as well as foreign body. We present a case of 45-year-old man who sustained massive penetrating craniofacial injuries due to polyvinyl chloride (PVC) pipe. CT scan with bone window of the brain and craniofacial region showed driven fragment of PVC pipe into the nasal cavity with multiple fractures and soft tissue swelling. CT brain showed compound and comminuted depressed fracture of the right frontal bone with underlying contusion of the brain and specks of pneumocephalus. However, detailed examination of the CT scan showed that there was no breach in the anterior cranial fossa and that both the injuries were caused by separate pipe fragments. The wound was debrided; all loose bone fragments, necrotic brain matter, and broken pipe fragments were removed. The patient recovered well after surgical procedure. The approach is aimed to protect the airway, maintain vital parameters followed by remove all the foreign body and necrotic tissue, and restore the functioning and aesthetics. A careful evaluation of the CT scan is mandatory to rule out breach in the skull base, and if the skull base is intact, a limited craniotomy will save the time and associated morbidity.

Keywords ► craniofacial injury ► penetrating injury ► foreign body ► hollow pipe ► skull fracture

Introduction
Penetrating craniofacial trauma can lead to a wide spectrum of injuries and can be challenging to manage.1-9 In addition to massive injury to the facial tissue and craniofacial skeleton, there may be retained foreign-body fragments that will add to the difficulty in the management of these patients.1-12 We present a case of man who sustained massive penetrating craniofacial injuries due to polyvinyl chloride (PCV) pipe and discuss the management.

Case Report
A 45-year-old man presented with the history of road traffic accident while he was going on motorbike and colluded with a rear end of lorry that was carrying PVC pipes. The patient sustained multiple injuries to the face and head regions. He was in altered sensorium since the time of injury. He had multiple episodes of vomiting and profuse bleeding from the laceration in the craniofacial region. There was no history of seizures. At the time of examination in the emergency room, he was drowsy and irritable. He had bilateral peri orbital swelling and subconjunctival ecchymosis. Local examination revealed a circle-shaped large lacerated impression of the pipe entry wound extending over right frontal and right facial (leading to deep laceration over the nose, cheek, and oral cavity region) region through which the broken PVC pipe could be seen and felt. He was moving all four limbs equally. His pulse rate was 73 beats/min, blood pressure was 130/80 mm Hg, and temperature was normal.
His cardiovascular and per abdominal examination was normal. Chest examination revealed bilateral crepitation with equal air entry. He had deformity and swelling of the right thigh and right leg. In view of massive craniofacial, the patient was immediately intubated to secure the airway and mechanically ventilated. After stabilizing the vital parameters, the patient was shifted for a computed tomographic (CT) scan of the brain. CT scan with bone window of the brain and craniofacial region showed in driven fragment of PVC pipe into the nasal cavity with multiple fractures and soft tissue swelling (►Figs. 1, 2). There was compound and comminuted depressed fracture of the right frontal bone with underlying contusion of the brain and specks of pneumocephalus (►Fig. 3). However, detailed examination of the CT scan showed that there was no breach in the anterior cranial fossa and that both the injuries were caused by separate pipe fragments (►Fig. 4). Radiographs of the right lower limbs showed fracture of the shaft of right femur and fracture of the both bones of the right leg. Blood investigations were within normal limits. The patient was taken for emergency surgery. The forehead laceration was extended to expose the frontal bone fracture fragments. The wound was debrided; all loose bone fragments, necrotic brain matter and broken pipe fragments were removed (►Fig. 5). Wound was thoroughly irrigated with normal saline to clear all debris. Following this, the facial wound was explored, the pipe entry wound margin was defined, and broken in-driven pipe fragments was carefully removed (►Fig. 5). Following removal of the pipe piece, the wound was irrigated to clear the debris and all the lacerated margins were defined to understand the distorted normal anatomy. Facial bone fractures were fixed with titanium mini plates and screws. Nasal packs were placed in both nostrils; wound margins were approximated and cleanly sutured to achieve the good aesthetics and function. The patient was
kept on elective ventilation, and on next day tracheostomy was performed. He was started on broad-spectrum antibiotic and antiepileptic. The patient could be weaned off from the ventilator on postsurgery day 3.

Discussion

Numerous intentional or unintentional events (missile injuries, stab injuries, and road traffic or occupational accidents) have been reported to cause wide spectrum of penetrating craniofacial injuries with or without retained penetrating objects.1–18 These injuries can lead to minor penetrating entry wounds to massive external wounds associated with extensive tissue damage.1–12 The extent of injuries depends on the size, shape, velocity (low vs. high) of penetrating object, site, and area of contact at the time of impact.19,20 As we observed in the presented case, if a person is involved in motor vehicle accident, the associated fall can add to the extent and severity of injuries.21

The mainstay of treatment of a patient with craniofacial trauma includes stabilizing the vital parameters, safeguarding the airway against aspiration, detailing clinical history, and examining to rule out other associated life-threatening injury (including injuries to the airway and craniofacial region).2,17,21–23 After that a detail evaluation of the wounds is mandatory to assess the extent of tissue damage and plan the surgical management in order to avoid delayed complications. Thin slice CT scan of the brain and face will help estimate the extent of soft tissue, any skull fracture, presence of intracranial hematomas, and bony injuries.2,17,20,21,24–31 It will also show (if the material is radiopaque) the size, number, and trajectory of the penetrating material.30–32,34 In presence of metallic foreign bodies, the CT scan shows metal artifacts and can be difficult to interpret.14,35

The surgical management of these patients is challenging as it will require removal of the foreign material, debridement of necrotic tissue, evacuation of any intracranial hematomas, removal of depressed bone fragment, dural repair, restoration of craniofacial anatomy, and facial aesthetics.17,20,23,36–44 Wide exposure can be achieved by extending the entry wound and making a craniotomy around the fracture fragments.45 The impacted object needs to be removed gradually in the reverse entry direction (without causing further damage).19,20

The delay in treatment can lead to increased risk of complication (including infection, seizures, risk of cerebrospinal fluid [CSF] fistula), and this risk is greater if it is associated...
The outcome of patients with penetrating craniofacial injuries depends not only on the extent of injuries to the craniofacial skeleton but also on the injuries to the brain parenchyma (skull fracture with underlying contusions/hematoma and any diffuse axonal injury). In absence of major injuries (particularly injury to the vascular and neural structures), the prognosis of penetrating craniofacial injuries is good.\(^{1,2}\)

**Conclusion**

The management of penetrating craniofacial trauma can be challenging and need detail evaluation by a multidisciplinary team so the management and outcome can be optimized. Careful evaluation of the CT scan is mandatory to rule out breach in the skull base. If the skull base is intact, a limited craniotomy in an unstable will save the time and associated morbidity. The approach is aimed to remove all the foreign body and necrotic tissue, and restore the functioning and aesthetics.

**References**

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