Massive Penetrating Craniofacial Trauma due to Polyvinyl Chloride Pipe

Somashekhar Srinivas[1] Amit Agrawal[2] Yashawant Sandeep[2] Ninad Nareschandra Shrikhande[2]

[1]Department of Burns and Plastic Surgery, Narayana Medical College Hospital, Chintharedypalem, Nellore, Andhra Pradesh, India
[2]Department of Neurosurgery, Narayana Medical College Hospital, Chintharedypalem, Nellore, Andhra Pradesh, India

Address for correspondence Amit Agrawal, MCh, Department of Neurosurgery, Narayana Medical College Hospital, Chintharedypalem, Nellore, Andhra Pradesh 524003, India (e-mail: dramitagrawal@gmail.com).

Indian J Neurosurg 2018;7:142–146

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 in 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 periorbital 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.

received
August 27, 2016
accepted after revision
January 23, 2017
published online
April 18, 2017

DOI http://dx.doi.org/10.1055/s-0037-1599790.
ISSN 2277-954X.

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

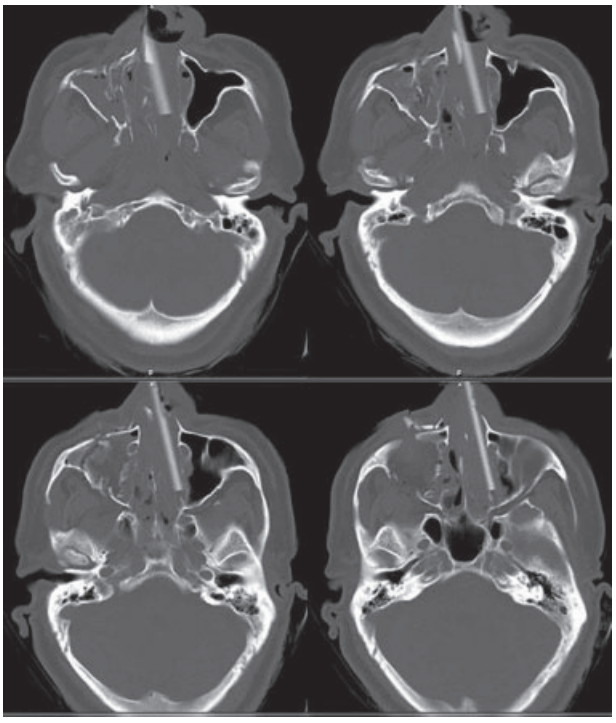

Fig. 2 CT scan of the face region (bone window) showing the broken pipe and associated facial bone fractures.

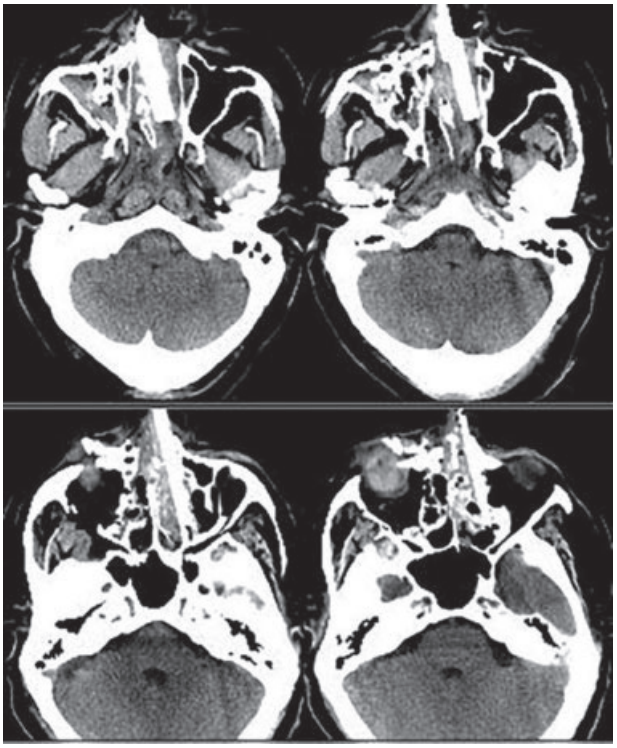

Fig. 1 CT scan of the face region showing trajectory of the broken pipe that has entered into the right nostril and penetrated toward the left side.

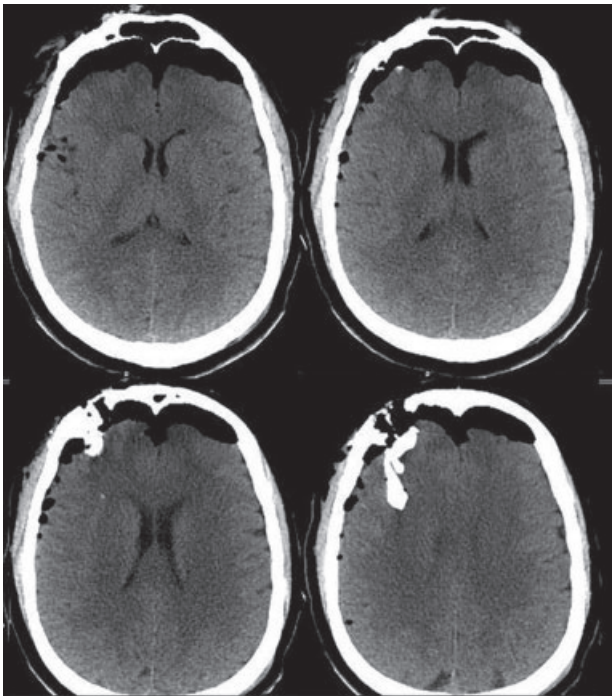

Fig. 3 CT scan of the brain showing compound depressed fracture of the right frontal bone, in driven bone fragments and pneumocephalus.

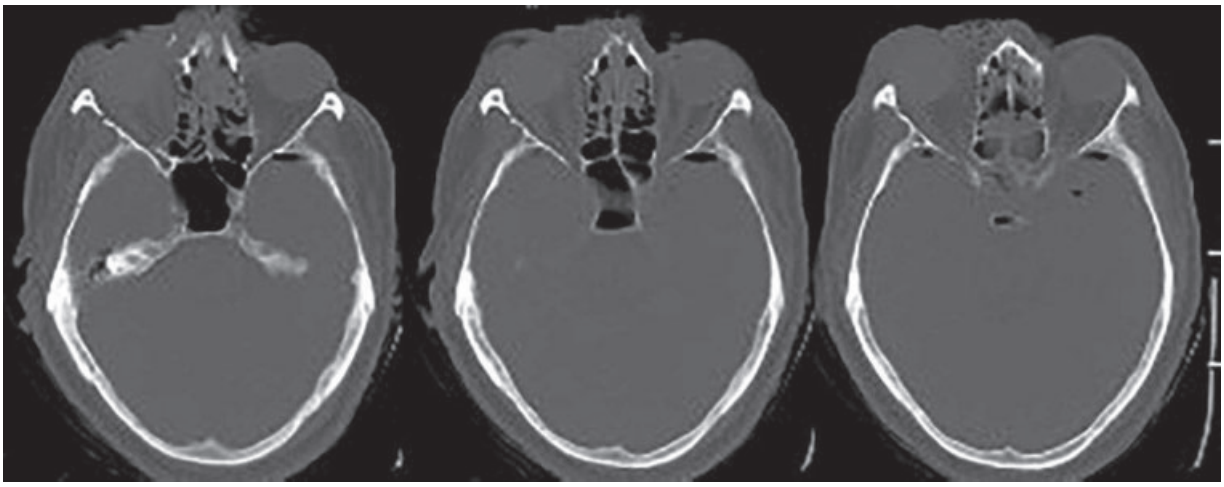

Fig. 4 CT scan revealing an intact anterior skull base (suggested two separate injuries, facial versus cranial), thus preventing the need for skull base exploration.

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.[2,17,20,21,24–33] 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

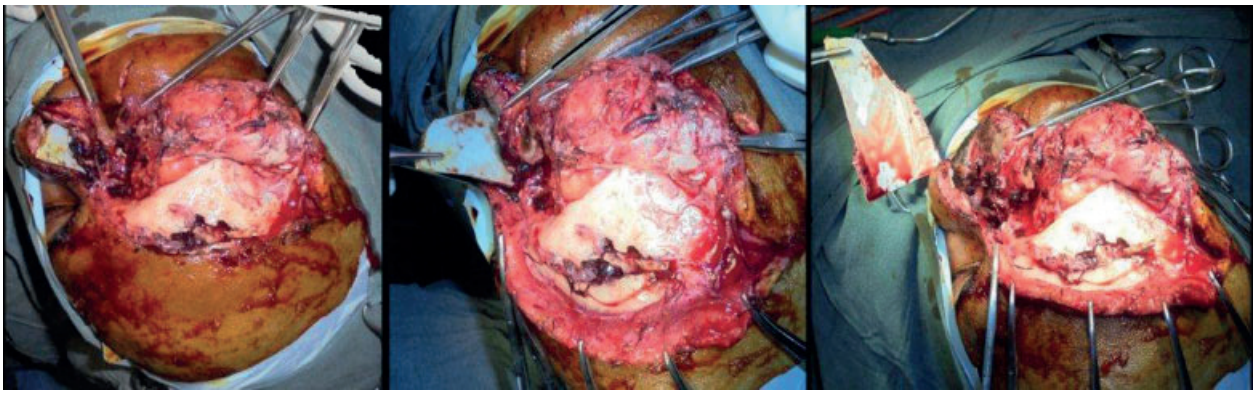

Fig. 5 Intraoperative photograph showing wide exposure of all the wound and retrieved broken pipe fragments.

with retained bone fragments and foreign-body material in the brain parenchyma.[17,46] 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).[2,17] In absence of major injuries (particularly injury to the vascular and neural structures), the prognosis of penetrating craniofacial injuries is good.[17,47]

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

1 Dubhashi SP, Choudhary K. Penetrating facial injury. Indian J Surg 2014;76(03):237–238
2 Agrawal A, Mishra V, Jain H, Reddy VU. Management of craniofacial injuries: a primer for residents. Romanian Neurosurgery 2014;21:341–347
3 Erisen L, Basut O, Coskun H, Hizalan I. An unusual penetrating facial injury due to a fishing-line sinker. J Oral Maxillofac Surg 2001;59(08):945–947
4 Al Hashmi A, Cheng A, Nikolarakos D, Goss A. Penetrating injuries to the orbit despite safety equipment. Br J Oral Maxillofac Surg 2009;47(01):71–72
5 Kwon B, Chang HW, Kim SJ, Sohn I, Choi TH. Penetrating facial injury. Emerg Med J 2014;31(09):774
6 Patel NN, Wang SC, Marentette L. Penetrating injury of the cheek requiring skull base exploration. J Laryngol Otol 2002;116(07):548–550
7 Polini F, Robiony M, Toro C, Costa F, Sembronio S, Politi M. Penetrating injury of the facial skeleton through the orbit, by a massive metallic shotgun block: a case report. Br J Oral Maxillofac Surg 2007;45(07):586–587
8 Shadid O, Simpson M, Sizer J. Penetrating injury of the maxillofacial region with an arrow: an unsuccessful attempt of suicide. Br J Oral Maxillofac Surg 2008;46(03):244–246
9 Strong B, Coady M. Penetrating facial injury with an “Airsoft” pellet: a case report. Br J Oral Maxillofac Surg 2014;52(9):e129–e131
10 Agrawal ATrans-orbital penetrating head injury, Indian J Neurotrauma 2014
11 Agrawal A, Pratap A, Agrawal CS, Kumar A, Rupakheti S. Transorbital orbitocranial penetrating injury due to bicycle brake handle in a child. Pediatr Neurosurg 2007;43(06):498–500
12 Agrawal A, Reddy VU, Kumar SS, Hegde KV, Rao GM. Transorbital orbitocranial penetrating injury with an iron rod. Craniomaxillofac Trauma Reconstr 2016;9(02):145–148
13 Bakay L, Glasauer FE, Grand W. Unusual intracranial foreign bodies. Report of five cases. Acta Neurochir (Wien) 1977;39 (3–4):219–231
14 Herring CJ, Lumsden AB, Tindall SC. Transcranial stab wounds: a report of three cases and suggestions for management. Neurosurgery 1988;23(05):658–662
15 Pascual JM, Navas M, Carrasco R. Penetrating ballistic-like frontal brain injury caused by a metallic rod. Acta Neurochir (Wien) 2009;151(06):689–691
16 Salar G, Costella GB, Mottaran R, Mattana M, Gazzola L, Munari M. Multiple craniocerebral injuries from penetrating nails. Case illustration. J Neurosurg 2004;100(05):963
17 Karim T, Topno M. An unusual case of penetrating head injury in a child. J Emerg Trauma Shock 2010;3(02):197–198
18 Atabaki SM. Pediatric head injury. Pediatrics in Review. Am Acad Pediatr 2007;28:215–224
19 Domingo Z, Peter JC, de Villiers JC. Low-velocity penetrating craniocerebral injury in childhood. Pediatr Neurosurg 1994;21(01):45–49
20 Kataria R, Singh D, Chopra S, Sinha VD. Low velocity penetrating head injury with impacted foreign bodies in situ. Asian J Neurosurg 2011;6(01):39–44
21 Carr MM, Freiberg A, Martin RD. Facial fractures. Can Fam Physician 1994;40:519–524, 527–528
22 Blissitt PA. Care of the critically ill patient with penetrating head injury. Crit Care Nurs Clin North Am 2006;18(03):321–332
23 Shah MU, Sridhara SK, Wolf JS, Ambro BT. Retained crossbow bolt after penetrating facial trauma. Ear Nose Throat J 2016;95(01):E1–E4
24 Bacelar MT, Rao VM. Facial and other head and neck trauma: imaging patterns and their significance. Appl Radiol 2002;31:20–27
25 Hollier LH Jr, Sharabi SE, Koshy JC, Stal S. Facial trauma: general principles of management. J Craniofac Surg 2010;21(04):1051–1053
26 Reuben AD, Watt-Smith SR, Dobson D, Golding SJ. A comparative study of evaluation of radiographs, CT and 3D reformatted CT in facial trauma: what is the role of 3D? Br J Radiol 2005;78(927):198–201
27 Sidebottom AJ, Sissons G. Radiographic screening for midfacial fracture in A&E. Br J Radiol 1999;72(858):523–524
28 Kanagarajan A, Sgouros S. Unusual penetrating cranio-cerebral injuries in children from mains plugs. Childs Nerv Syst 2007;23(10):1181–1183
29 Pereira KD, Wang BS, Webb BD. Impalement injuries of the pediatric craniofacial skeleton with retained foreign bodies. Arch Otolaryngol Head Neck Surg 2005;131(02):158–162
30 Neuroimaging in the management of penetrating brain injury. J Trauma 2001;51(2, Suppl):S7–S11
31 Aarabi B. Comparative study of bacteriological contamination between primary and secondary exploration of missile head wounds. Neurosurgery 1987;20(04):610–616
32 Nagib MG, Rockswold GL, Sherman RS, Lagaard MW. Civilian gunshot wounds to the brain: prognosis and management. Neurosurgery 1986;18(05):533–537
33 Chen AY, Stewart MG, Raup G. Penetrating injuries of the face. Otolaryngol Head Neck Surg 1996;115(05):464–470
34 Kazim SF, Shamim MS, Tahir MZ, Enam SA, Waheed S. Management of penetrating brain injury. J Emerg Trauma Shock 2011;4(03):395–402
35 Taylor AG, Peter JC. Patients with retained transcranial knife blades: a high-risk group. J Neurosurg 1997;87(04):512–515
36 Iordache A, Kaya J, Alliez J, Alliez B. A rare case of severe craniocerebral trauma with penetrating head injury. Romanian Neurosurg 2011;18:77–81
37 Nason RW, Assuras GN, Gray PR, Lipschitz J, Burns CM. Penetrating neck injuries: analysis of experience from a Canadian trauma centre. Can J Surg 2001;44(02):122–126

38 Agrawal R, Timilsina DS, Reddy NS, Ganguly SN, Tayal A. Penetrating foreign body neck: a case report. Kathmandu Univ Med J (KUMJ) 2007;5(03):414–416
39 Mohan S, Varghese G, Kumar S, Subramanian DP. Penetrating facial injury by a wooden log. Natl J Maxillofac Surg 2014;5(02):228–231
40 Surgical management of penetrating brain injury. J Trauma 2001;51(2, Suppl):S16–S25
41 Hubschmann O, Shapiro K, Baden M, Shulman K. Craniocerebral gunshot injuries in civilian practice—prognostic criteria and surgical management: experience with 82 cases. J Trauma 1979;19(01):6–12
42 Gönül E, Baysefer A, Kahraman S, et al. Causes of infections and management results in penetrating craniocerebral injuries. Neurosurg Rev 1997;20(03):177–181
43 Aarabi B, Taghipour M, Alibaii E, Kamgarpour A. Central nervous system infections after military missile head wounds. Neurosurgery 1998;42(03):500–507, discussion 507–509
44 Esposito DP, Walker JB. Contemporary management of penetrating brain injury. Neurosurg Q 2009;19:249–254
45 Haworth CS, de Villiers JC. Stab wounds to the temporal fossa. Neurosurgery 1988;23(04):431–435
46 Hagan RE. Early complications following penetrating wounds of the brain. J Neurosurg 1971;34(2 Pt 1):132–141
47 Kothari K, Singh AK, Das S. Penetrating skull injury with six inch fence rod. Natl J Maxillofac Surg 2012;3(02):207–210