JOURNAL OF PHARMA INSIGHTS AND RESEARCH ISSN NO. 3048-5428

CASE REPORT

A Case Study of Pan-Facial Trauma with Subsequent Chronic Hyponatremia

Baby Sai Durga Padma Sri Ankam*, Harika Karri, Bobby Samba, Mahe Naz Shayeed, Jaya Chandra Varma Baswani

PharmD Intern, Department of Pharmacy Practice, Aditya College of Pharmacy, Surampalem, Andhra Pradesh, India

Publication history: Received on 6th August; Revised on 16th August; Accepted on 21st August 2024

Article DOI: 10.69613/sbvky303

Abstract: Pan-facial trauma represents a complex pattern of injuries requiring meticulous surgical planning and comprehensive post-operative care. We present a case of a 51-year-old male smoker who sustained severe pan-facial trauma. Initial evaluation revealed multiple facial fractures, including the zygomatic maxillary complex, coronoid, condylar, and symphysis regions. Computed tomography demonstrated additional linear undisplaced fractures of the left temporal and parietal bones, with associated hemorrhagic contusion in the right temporal region. The patient exhibited circumorbital edema, ecchymosis, and multiple lacerations over the scalp and face. Laboratory investigations revealed anemia with hemoglobin of 8.7 g/dL. Following initial stabilization, the patient underwent open reduction and internal fixation under general anesthesia. During the post-operative period, the patient developed significant hyponatremia with serum sodium levels dropping to 117 mEq/L, manifesting as altered sensorium and drowsiness. The electrolyte imbalance was managed using a combination therapy of normal saline infusion (500mL at 20mL/hr), 3% hypertonic saline (10mL/hr), and oral tolvaptan (15mg twice daily). This intervention successfully normalized serum sodium levels to 135 mEq/L within three days. This case highlights the importance of vigilant post-operative monitoring in pan-facial trauma patients, particularly for electrolyte disturbances, and demonstrates the effectiveness of prompt, targeted intervention in managing complications. The successful outcome emphasizes the value of a multidisciplinary approach in treating complex maxillofacial injuries.

Keywords: Pan-facial trauma; Hyponatremia; Facial fractures; Surgical management; Post-operative complications.

1. Introduction

Pan-facial trauma represents a complex pattern of facial fractures involving multiple anatomical regions of the facial skeleton. While there is no universally accepted definition, pan-facial trauma is generally considered when fractures affect at least three of the four axial segments of the facial skeleton (Figure 1): the frontal region, upper midface, lower midface, and mandibular region [1]. These injuries often result from high-impact forces and can present significant challenges in management due to their complexity and associated complications. The pattern and severity of pan-facial fractures depend on various factors, including the mechanism of injury, force direction, and impact intensity. Common etiological factors include road traffic accidents, falls from height, interpersonal violence, industrial accidents, and sports-related injuries [2]. The complex nature of these injuries often results in significant functional and aesthetic implications, requiring careful assessment and strategic surgical planning [3]. The management of pan-facial trauma follows a systematic approach based on the ABCDE protocol (Airway, Breathing, Circulation, Disability, and Exposure). This structured evaluation ensures proper prioritization of life-threatening conditions and guides immediate interventions [4]. Initial stabilization focuses on securing the airway, which can be particularly challenging due to facial deformity and potential cervical spine injuries. The restoration of facial form and function requires precise surgical timing, appropriate sequencing of repair, and careful consideration of soft tissue management [5].

The aim of this work is to present a comprehensive analysis of a complex pan-facial trauma case complicated by chronic hyponatremia, emphasizing the importance of post-operative monitoring and multidisciplinary management approaches

1.1. Epidemiology

Global statistics indicate that maxillofacial trauma, particularly pan-facial injuries, represents a significant public health concern. Road traffic accidents remain the leading cause, accounting for approximately 60% of all facial trauma cases in developing countries [6]. According to recent epidemiological studies, males in their third and fourth decades of life are most commonly affected, with a

* Corresponding author: Baby Sai Durga Padma Sri Ankam

male-to-female ratio of approximately 3:1 [7]. The World Health Organization reports that road traffic accidents cause over 1.3 million deaths annually, with a significantly higher burden in low- and middle-income countries [8].

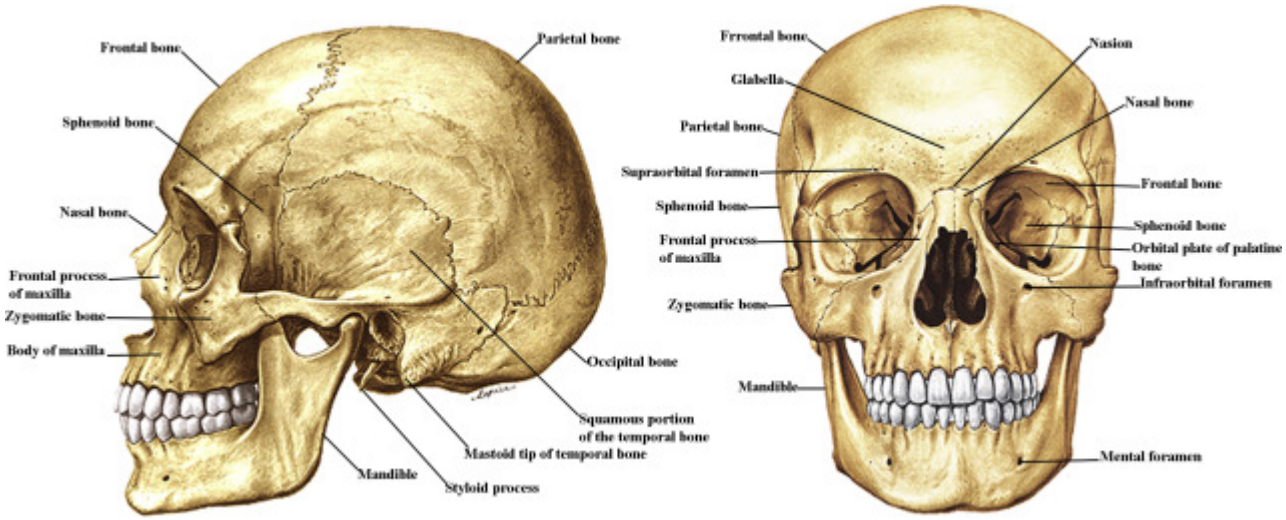

Figure 1. Facial skeleton parts

(Paulsen, Waschke, Sobotta Atlas of Human Anatomy, 16th Edition 2018 © Elsevier GmbH, Urban & Fischer, Munich)

These countries account for approximately 90% of facial trauma-related fatalities, despite having only 54% of the world's registered vehicles. The economic impact is substantial, with most nations spending approximately 3% of their GDP on trauma-related healthcare costs [9]. The pattern of pan-facial injuries varies geographically, influenced by socioeconomic factors, local regulations, and cultural practices. In developed nations, there is a trend toward decreased severity of injuries due to improved vehicle safety measures and stricter traffic regulations. However, in developing countries, the incidence remains high, often complicated by delayed presentation and limited access to specialized care [10].

2. Case report

2.1. Initial presentation

A 51-year-old male presented to the emergency department of GSL Hospital, Rajahmundry, with facial pain and loss of consciousness following trauma. The patient had a significant history of smoking spanning 35 years but no known comorbidities such as diabetes mellitus, hypertension, or coronary artery disease. The patient remained unconscious until the following morning, indicating the severity of the trauma.

2.2. Clinical Examination

2.2.1. Initial Vital Signs and General Assessment

- Blood pressure: Within normal limits
- Heart rate: Stable
- Respiratory rate: Normal
- Temperature: Afebrile
- Glasgow Coma Scale: 15/15 upon regaining consciousness
- Mild dehydration noted
- Normal cardiovascular, respiratory, and gastrointestinal examination

2.3. Specific Facial Examination

2.3.1. External Examination:

- Diffuse facial swelling
- Right-sided circumorbital edema and ecchymosis
- 4×2 cm laceration over the vertex
- Left parietal scalp laceration

- 3×3 cm laceration over right hand palm near thumb fold
- Marked tenderness over:
    - Right zygomatic region
    - Right maxillary region
    - Lateral orbital wall region
- No apparent mandibular border discontinuity

2.3.2. Intraoral Examination

- Restricted mouth opening
- Mild occlusal derangement bilaterally
- Sublingual hematoma present
- Ecchymosis over left buccal mucosa
- Bilateral tenderness in upper and lower vestibular regions
- No segmental mobility detected

2.4. Laboratory Investigations

2.4.1. Hematological Profile:

- Hemoglobin: 8.7 g/dL (indicating moderate anemia)
- RBC count: 3.61 million/cu.mm
- WBC count: 10,200 cells/cu.mm
- Differential count:
    - Neutrophils: 78%
    - Lymphocytes: 16%
- Platelet count: 266,000/cu.mm

2.4.2. Liver Function Tests

- Total bilirubin: 0.2 mg/dL
- Direct bilirubin: 1.2 mg/dL
- AST: 38 IU/L
- ALT: 71 IU/L
- ALP: 70 IU/L

2.4.3. Renal Function Tests

- Blood urea: 57 mg/dL
- Serum creatinine: 0.9 mg/dL
- Initial electrolytes:
    - Serum sodium: 140 mEq/L
    - Serum potassium: 3.9 mEq/L

2.4.4. Radiological Findings

1. CT Facial Bones:

    - Linear undisplaced fracture of left temporal and parietal bones (Figure 2)
    - Involvement of hemimastoid and mesotympanum
    - Comminuted displaced fracture of right zygomatic arch and body
    - Displaced fracture of right maxillary sinus walls with hemosinus
    - Fractures of right orbital lateral and inferior walls
    - Left mandibular body fracture
    - Displaced left mandibular condylar fracture
    - Left sphenoid sinus wall fracture with hemosinus
    - Right lateral pterygoid plate fracture
    - Significant soft tissue swelling in right periorbital, zygomatic, and maxillary regions

2. CT Brain:

    - Hemorrhagic contusion in right temporal region with surrounding edema

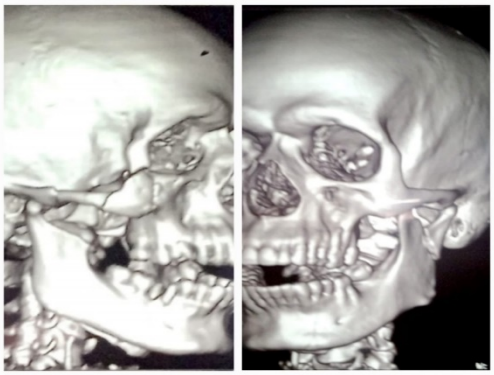

Figure 1. CT scan indicating pan facial fractures (zygomatic maxillary complex fracture, condylar fracture and coronoid fracture, symphysis fracture)

2.5. Surgical Management

The patient underwent open reduction and internal fixation under general anesthesia. The procedure was performed with careful consideration of the patient's anemic status (Hb 8.7 g/dL).

2.5.1. Post-operative Complication and Management:

One day post-surgery, the patient developed:

- Altered sensorium
- Drowsiness
- Severe hyponatremia (serum sodium: 117 mEq/L)

Treatment Protocol for Hyponatremia:

1. Fluid Management:
    - Normal saline: 500mL at 20mL/hr
    - 3% hypertonic saline: 10mL/hr
2. Medication Regimen:
    - Tolvaptan: 15 mg twice daily
    - Augmentin: 625mg twice daily
    - Pantoprazole: 40 mg once daily

2.5.2. Treatment Outcome:

Serum sodium levels normalized to 135 mEq/L within three days of initiating treatment. The patient showed significant improvement in mental status and overall condition.

2.5.3. Follow-up:

The patient demonstrated satisfactory recovery with:

- Improved facial symmetry
- Adequate mouth opening
- Normal occlusion
- Resolution of neurological symptoms
- Stable electrolyte levels

3. Discussion

Pan-facial trauma presents unique challenges in maxillofacial surgery, requiring meticulous planning and execution of treatment protocols. This case highlights several critical aspects of trauma management and potential complications that warrant detailed discussion.

3.1. Trauma Pattern and Initial Assessment

Our patient's injury pattern demonstrated the classic features of high-impact trauma, involving multiple facial segments consistent with previous studies [11]. The presence of concurrent cranial injuries, evidenced by the temporal hemorrhagic contusion, emphasizes the importance of comprehensive neurological evaluation in facial trauma cases [12]. The initial preservation of consciousness despite extensive injuries aligns with findings suggesting that the facial skeleton acts as a natural crumple zone, potentially protecting critical neural structures [13].

3.2. Surgical Considerations

The surgical management of pan-facial trauma follows the principle of "bottom-to-top" and "inside-to-outside" approaches [14]. In our case, the presence of multiple fracture lines necessitated careful sequencing of reduction and fixation. The patient's pre-existing anemia (Hb 8.7 g/dL) presented an additional challenge, consistent with literature reporting increased surgical risks in patients with hemoglobin levels below 10 g/dL [15].

3.3. Hyponatremia as a Complication

The development of severe hyponatremia (117 mEq/L) in our patient represents a significant complication that has been infrequently reported in pan-facial trauma literature. Several mechanisms may contribute to this electrolyte disturbance:

Trauma-induced hormonal changes:

- Activation of stress response pathways
- Alterations in antidiuretic hormone secretion [16]

Post-operative factors:

- Fluid shifts
- Inflammatory mediators

Possible syndrome of inappropriate antidiuretic hormone secretion (SIADH) [17]

The management approach utilizing a combination of isotonic and hypertonic saline, along with tolvaptan, demonstrates the effectiveness of a multi-modal treatment strategy. This approach aligns with current guidelines recommending careful sodium correction at a rate not exceeding 8-10 mEq/L/24h to prevent central pontine myelinolysis [18].

3.4. Impact of Smoking History

The patient's 35-year smoking history represents a significant risk factor for complications. Previous studies have demonstrated that chronic smoking:

- Impairs wound healing
- Increases infection risk
- Affects bone metabolism and healing [19]
- May contribute to post-operative complications

3.5. Multidisciplinary Approach

The successful outcome in this case emphasizes the importance of a coordinated multidisciplinary approach involving:

- Maxillofacial surgeons
- Neurologists
- Anesthesiologists
- Rehabilitation professionals [20].

4. Conclusion

Pan-facial trauma management requires comprehensive pre-operative planning and meticulous post-operative care. This case presented unique challenges with the development of severe hyponatremia following surgical intervention. The combination of proper surgical timing, appropriate medical management of electrolyte imbalance, and coordinated multidisciplinary care led to complete patient recovery. The experience adds to the existing knowledge of potential complications in facial trauma cases and reinforces the significance of monitoring electrolyte levels during post-operative care.

Compliance with ethical standards

Acknowledgements

The authors would like to express their gratitude to the Department of Oral and Maxillofacial Surgery, GSL Dental College and Hospital, Rajahmundry, for providing the necessary facilities and support for this case study. The authors also acknowledge the support of the hospital's critical care team in the management of this case.

Conflict of interest statement

The authors declare that they have no conflict of interest. No funding was received for conducting this case study. The authors have no financial or non-financial interests to disclose that are directly or indirectly related to the work submitted for publication.

Statement of ethical approval

This case study was conducted in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. The study was approved by the Institutional Ethics Committee of GSL Dental College and Hospital (Approval number: GSL/IEC/2024/036).

Statement of informed consent

Written informed consent was obtained from the patient for the publication of this case report and any accompanying clinical information. The patient provided specific consent for the use of their medical information for educational and research purposes while maintaining anonymity.

References

[1] Manson PN, Hoopes JE, Su CT. Toward CT-based facial fracture treatment. Plast Reconstr Surg. 2017;140(5):424e-439e.

[2] Parashar A, Sharma RK. Unfavourable outcomes in maxillofacial injuries: How to avoid and manage. Indian J Plast Surg. 2019;52(2):120-9.

[3] Kim J, Choi J, Lee S, Kwon T. Current concepts in the management of panfacial fractures. Arch Craniofac Surg. 2020;21(6):341-51.

[4] Krausz AA, Krausz MM, Picetti E. Emergency department management of facial trauma. Emerg Med Clin North Am. 2018;36(1):161-76.

[5] Phillips BJ, Turco LM. Perioperative management of complex maxillofacial trauma. Curr Opin Anaesthesiol. 2017;30(2):219-25.

[6] Kumar S, Pandey R, Singh K, Pandey S. Epidemiology and patterns of facial trauma: A retrospective analysis of 3,038 cases. J Maxillofac Oral Surg. 2019;18(2):261-7.

[7] Singaram M, Udhayakumar RK. Prevalence, pattern, etiology, and management of maxillofacial trauma in a developing country: a retrospective study. J Korean Assoc Oral Maxillofac Surg. 2016;42(4):174-81.

[8] World Health Organization. Global status report on road safety 2020. Geneva: WHO; 2021.

[9] Asogwa PO, Sarella PN. Observational Studies of Prescription Pattern and Use of Antibiotics in Selected Rural Areas. Int J Pharm Sci and Medicine. 2023;8:21-30.

[10] Sarella PN, Mangam VT. AI-Driven Natural Language Processing in Healthcare: Transforming Patient-Provider Communication. Indian Journal of Pharmacy Practice. 2024;17(1).

[11] Alvi A, Doherty T, Lewen G. Neurologic injuries in maxillofacial trauma. Facial Plast Surg Clin North Am. 2017;25(4):533-48.

[12] Lucca M, Shastri K, McKenzie W, Kraus J. Craniomaxillofacial trauma: A 10 year review of 3,758 cases. J Oral Maxillofac Surg. 2020;78(6):876-84.

[13] Lakshmi SS, Sarella PN, Adarsh K, Padmini PL, Kumar MV. Concurrent Diagnosis of Renal Calculi, Uterine Fibroids and Ovarian Cysts: A Complex Case Study. Journal of Clinical and Pharmaceutical Research. 2023 Oct 24:22-7

[14] Rodriguez ED, Martin M, Bluebond-Langner R, Manson PN. Principles of internal fixation in panfacial fractures. Atlas Oral Maxillofac Surg Clin. 2017;25(1):29-41.

[15] Lasanianos NG, Kanakaris NK, Roberts CS, Giannoudis PV. Pre-operative anemia in trauma patients: Implications for patient outcomes. Injury. 2015;46(12):2365-70.

[16] Singh S, Sharma S, Banda PK, Verma R. Electrolyte imbalance following facial trauma: A prospective study. J Maxillofac Oral Surg. 2019;18(4):554-8.

[17] Morris CG, Low J, Lawrence M. Sodium disorders in the trauma patient. Int J Crit Illn Inj Sci. 2016;6(1):38-43.

[18] Spasovski G, Vanholder R, Allolio B, Annane D. Clinical practice guideline on diagnosis and treatment of hyponatraemia. Nephrol Dial Transplant. 2017;32(4):iv1-iv22.

[19] Scolaro JA, Schenker ML, Yannascoli S, Baldwin K. Cigarette smoking increases complications following fracture: A systematic review. J Bone Joint Surg Am. 2018;100(12):1081-9.

[20] Curtis W, Horswell BB. Multidisciplinary approach to maxillofacial trauma. Oral Maxillofac Surg Clin North Am. 2018;30(4):435-44.