Naso-orbito-ethmoid fractures at Viet Duc University Hospital period 2021 – 2022

Vu Trung Truc[1,2], Nguyen Huy Kien[2], Le Van Nam[1]

1. Viet Duc University Hospital, 2. University of Medicine and Pharmacy, Vietnam National University

Corresponding Author:
Vu Trung Truc
Viet Duc University Hospital
40 Trang Thi, Hoan Kiem, Ha Noi
Mobile: +84983383009
Email: drvutrungtruc@gmail.com

Received date: 01/6/2023
Accepted date: 10/8/2023
Published date: 15/9/2023

Abstract

Introduction: Trauma to the nose, ethmoid, and orbit is a common clinical condition that makes challenges in treating. Management of these lesions remains a challenge, and there are few studies on this issue in Vietnam.

Subjects and methods: Retrospective study. The 100 patients with naso-orbito-ethmoid (NOE) fractures were hospitalized and treated at the Department of Maxillofacial - Plastic – Aesthetic Surgery of Viet Duc University Hospital from January 2021 to December 2022.

Results: The male/female ratio was 4/1, the common age group was 20-40 years old (65%); the mean age was 30.1±11.46, the main cause was traffic accident (93%), 15% had blood alcohol concentration exceeding the legal limit. Regarding clinical symptoms: 94% had soft tissue contusion, 74% had skin laceration, 87% had a hematoma in the eye area, 60% had nosebleeds, and 63% had combined traumatic brain injury. First aid: 17% needed endotracheal intubation, 72% had nasal wicks to stop bleeding. Grades based on Markowitz classification: grade 1 (60%), grade 2 (30%), grade 3 (10%). 82% had a fracture of the maxilla. About the treatment: 98% of cases were repaired the nasal bone, 54% of NOE were fixed with plates and screws, 13% needed grafting materials for the orbital cavity and 7% were reconstructed medial orbital ligaments. Follow-up during hospital stay, no complications were noted.

Conclusions: NOE trauma mainly occurred in men of working age and the main cause of injury was traffic accidents. The rate of combined lesions was high, and treatment requires coordination of multi-disciplinary specialties.

Keywords: facial trauma, nasal bone fractures, naso-orbito-ethmoid fractures

Introduction

Maxillofacial trauma is currently paid much attention in the world. Facial trauma costs approximately 1.06 billion dollars annually in the United States, with 93.808 days associated hospitalization [1]. In Viet Nam, Le Thanh Huyen et al. (2011) reported that the percentage of the 19 - 29 age group was 45.1%, male/female ratio was 5/1

[2]. The leading cause of facial trauma was traffic accidents (73.4%), followed by domestic accidents (12.3%), labor accidents, and sports accidents were rare respectively [2]. Maxillofacial trauma has many different types such as mandible injuries, midface fractures, and zygomatic fractures.... Naso-orbito-ethmoid is part of maxillofacial trauma, with a percentage of 5% in adults and pediatric (16%), commonly affected in young males. Naso-orbito-ethmoid happens typically in combination with midface trauma.

Naso–orbito–ethmoid, also called NOE, fracture has more challenges in diagnosis and treatment. Parts of anatomy affected are the orbital floor, inferior orbital rims, nasal bones, ethmoid sinus, and frontal sinus, especially associated with inner medial canthal tendons and lacrimal gland systems. Sometimes associated injuries of the anterior cranial fossa cause the leak cerebrospinal fluid (CSF). Clinical features that appear may be nose bleeding, diplopia, telecanthus, and epiphora...

In Vietnam, so far there are still few researchs on the epidemiology, etiology, and injury mechanism of naso–orbito–ethmoid fracture. In 2021, Phan Van Anh researched characteristics of lesions with naso-orbito-ethmoid on computer tomography in the Department of Maxillofacial–Plastic–Aesthetic at Viet Duc University Hospital. The research aims to report clinical, subclinical, and treatment characteristics with naso–orbito–ethmoid patients treated as inpatients at the Department of Maxillofacial-Plastic-Aesthetic Surgery from January 2021 to December 2022.

Patients and methods

Patients

We analyzed 100 medical records of hospitalized patients with NOE have been treated at the Department of Maxillofacial-Plastic-Aesthetic Surgery from January 2021 to December 2022.

Methods

Retrospective cross-sectional study.

Steps of research

- Make a list of patients with NOE from the management software of the hospital. We collected patients medical records treated as an inpatient at the Department of Maxillofacial-Plastic-Aesthetic Surgery from January 2021 to December 2022. The medical records should to be met with three criteria: (1) completed information from admitting to discharging; (2) a CT scan; (3) a photo of the patient before treatment.

- All the information was collected in the form of medical research.

- The patients put on the Markowitz classification (1991) [5].

Type I: In which the medial canthal tendon is intact and connected to a single large fracture fragment.

Type II: The fracture is comminuted, and the medial canthal tendon is attached to a single bone fragment.

Type III: Comminution extends to the medial canthal tendon insertion site on the anterior medial orbital wall at the lacrimal fossa's level, with resultant tendon avulsion.

The data was input and analyzed with STATA 17 software (Stata Corporation, College Station, TX, USA).

Results

From January 2021 to December 2022, the Department of Maxillofacial–Plastic–Aesthetic Surgery has treated 3828 patients with Maxillofacial trauma, including 118 patients with NOE (3.08%). After processing the data, there were 100 medical records that met the selection criteria.

General characteristics of subjects

Among 100 patients, 80% were males, 20% were females. The most popular age group was 20 – 29 (41%), followed by 30 – 39 (24%). Other age groups including 0-9, 40-49, 50-60, and 60-69 were 1%, 15%, 7%, and 1% respectively. The mean age was 30.1 ± 11.46, the oldest patient is 61, and the youngest was 9. The leading cause of trauma is traffic accidents (93%).

Table 1: Etiology of trauma

Etiology		Frequency (n)	Percentage (%)
Traffic accident	Motorbike vs motorbike	41	41%
	Motorbike self-accident	36	36%
	Motorbike vs car	13	13%
	Car vs car	1	1%
	Motorbike vs bicycle	2	2%
Labor accident		5	5%
Domestic accident		1	1%
Social violence		1	1%
Total		100	100%

The percentage of patients were admitted to the hospital earlier than 72 hours post-traumatic was 89%, pre-hospital first aid was provided for 76% including endotracheal intubation accounted for 17%, and nasal hemostasis in 72% respectively.

Clinical characteristics

Soft tissue trauma with contusion accounted for 94%, and 74% of wounds with different levels. Eye hematoma at 87%, blurred vision, injuries to the globe, oculomotor paralysis, injuries to the lacrimal system, and ptosis, followed by percentages of 19%, 16%, 6%, 5%, and 3% respectively. Patients with nasal bleeding (60%) hemorrhage on Markowitz classification following type I: 63.33%, type II 56.66%, type III 50%. The highest combined injuries were brain 63%, combined maxillofacial fractures (86.3%), limb trauma (20.54%), and trauma of the cervical spine, thorax, and abdomen, followed by 4.1%, 6.8%, and 2.7%, respectively.

Subclinical characteristics

All patients who had computer tomography taken for fractured bones. 100% nasal bone fracture, medial orbital wall fracture, and ethmoid sinuses fracture follow 99% and 98%. Markowitz classification: Type I 60%, type II 30%, type III 10%. Maxillary fracture with Le Fort II is 50%.

Treatment overview

11% of patients needed a blood transfusion during the time of treatment. 19% of patients who underwent emergency surgery due to brain injury were the highest proportion, accounting for 89.5% (17/19). Besides that, there were emergency surgeries for limb and cervical spine trauma. Combined with maxillofacial surgeries 79%, brain surgeries 15%, limb surgeries 8%, and orbital surgeries 6%. Nasal dorsum reductions were 98%, naso-orbital-ethmoid repaired with plates and screws at 54%, and fixation of orbital rims at 58%. Orbital floor reconstruction using grafts 13%. Transnasal canthopexy 7%, corresponding to 70% of Markowitz type III. Hospitalization averaged 8.72 ± 4.62 days. There were no complications during the period of treatment. There were no complications during the period of treatment.

Discussions

Naso-orbito-ethmoid trauma, or NOE fracture, is still challenging for diagnosis and treatment. The trauma of the NOE locations included the orbital floor, inferior orbital rims, nasal bones, ethmoid sinus, and frontal sinus, especially associated with inner medial canthal tendons and lacrimal gland systems. Sometimes, associated injuries can affect the anterior cranial fossa, which can cause the leaking cerebrospinal fluid (CSF). Clinical features may include nasal bleeding, diplopia, telecanthus, or epiphora. Though nasal bone fractures have been recognized for a long time, the fracture of the ethmoids was highlighted by Dawson and Fordyce in 1953. Converse and Smith 1963 identified the involvement of the medial orbital wall and termed it naso-orbital. Stranc was the first in modern English literature to adopt the term naso-ethmoid. Epker recognized the present-day terminology of naso-orbito-ethmoid in 1973, while Gruss 1985 preferred the term naso-ethmoid-orbital [7]. The age characteristics of the subject (male/female = 4/1, age group 20-40 at 65%) are similar to domestic and international research [1],[8]. The leading cause was traffic accidents (93%); the result was also similar to other researchs in Vietnam - one developing country [9], [10]. In contrast, social violence is the leading cause of facial trauma in developed nations.

Soft tissue injuries included contusions (94%), lacerations and abrasions (74%), depressed nasal dorsums (100%), and nasal hemorrhages (60%). The percentage of contusion tissues is similar to Pati's research (86%) [11] and lower than the research of Zeeshan Arif about soft tissue injuries from motorcycle accidents in India. According to Zeeshan Arif's result, patients who did not wear a helmet have soft tissue injuries with abrasion at 100%, laceration at 97.4%, and contusion at 97.4% [14]. This result also suits the mechanical trauma theory with high-energy direct force into a narrow area. Common combined injuries organs: maxillofacial (82%), brain (63%) following limbs, cervical spine, and abdomen trauma. This result is also similar to previous research in Viet Duc University Hospital, one of the biggest surgical centers in northern Vietnam [12].

Although naso-orbital-ethmoid has been classified for a long time, many surgeons prefer Markowitz's classification (1991). Markowitz's classification has three types corresponding to 3 levels of trauma: mild, moderate, and severe. In our research on type I (60%), type II (30%), and type III (10%), this result is similar to Phan Van Anh's research (2021) at Viet Duc University Hospital (type I 65.1%, type II 30.2% and type III 4.7%) [3] (Figure 1). Our results showed no significant difference between first-aid nasal hemostasis blood transfusion with three levels of Markowitz classification. However, multiple organ injuries and levels of brain injuries (among the patients who required blood transfusion, 73.73% had brain injuries) with three levels of Markowitz classification were related. This difference was statistically significant. This analysis showed that Markowitz classification can help surgeons to prognosis the difficulty and result of surgeries. When a patient comes to the hospital with NOE causing the massive bleeding, the patient needs to be evaluated for brain injuries, especially a severe fracture of the front cranial base.

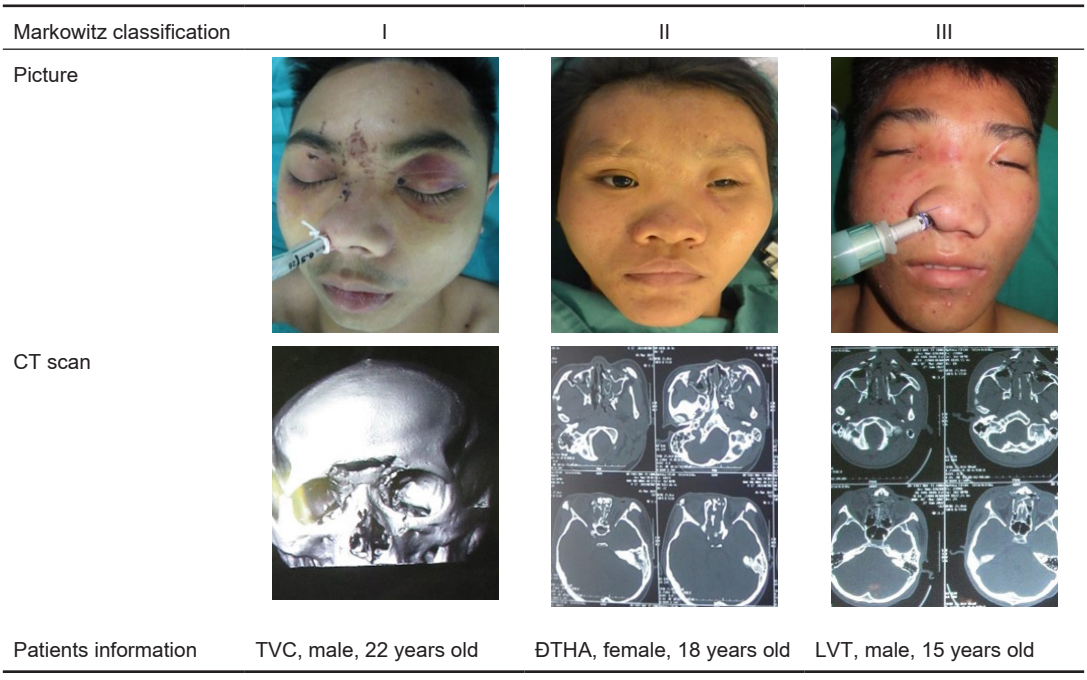

Figure 1. Patients images with Markowwitz classification

The rate of nasal hemostasis with wick was 72%, and most received first aid before being transferred to Viet Duc University Hospital. Nasal injuries usually cause bleeding, making patients go to the nearest medical service (76%). In addition, with the advancement of science, new hemostatic materials,

such as nasal wicks, have been widely found in the market. It is easy to use, so doctors can avoid the classical technique (inserting mechs for hemostasis).

For emergency treatment, the rate of endotracheal intubation was 17%, and emergency surgery was 19% (brain injury was highest at 89.5%). This difference was statistically significant when compared with other combined injuries. Brain injury is mainly caused by traffic accidents, a persistent problem in our country that needs synchronous solutions to control. Nasal fracture reduction (98%), conservative treatment (2%). In our research, the rate of interventional treatment was high because we chose all inpatient patients. Most mild cases that came to the clinic indicated outpatient treatment. Patients were often evaluated, and combined surgeries in a single operation were performed with nasal-ethmoid fixation (54%). Patients received an orbital floor reconstruction with a graft (13%). 7/10 of those cases were on type III and underwent medial canthus repair, reduction, and fixation of the maxillofacial bone (79%) and brain surgery (15%). The advance of anesthesia and multi-specialty coordination in one surgery for multi-trauma patients have created a tendency for quick recovery, which also helps shorten hospitalization and lower costs [13]. The mean hospitalization time was 8.72 ± 4.62 days (range from 3 to 32 days). According to medical records, there were no complications during the period of inpatient treatment.

Conclusion

The retrospective study of NOE for inpatients at Viet Duc University Hospital during the period of 2021-2022 showed that the rate of NOE injuries accounted for 3% of the general maxillofacial trauma. Most injured patients were males of working age with multiple injuries. The main clinical characteristics were signs of direct force into the NOE region; type I Markowitz was the majority. The principle of treatment required evaluation from multiple specialists. No complications during treatment were recorded.

References

1. Goodmaker C, Hohman MH, De Jesus O. Naso-Orbito-Ethmoid Fractures. 2023 Mar 1. In: StatPearls [Internet]. Treasure Island (FL): *StatPearls Publishing*; 2023
2. Le Thanh Huyen, Hoang Tien Cong. Overview of facial trauna treatment at Thai Nguyen General Centre Hospital. *TNU journal of Science and Technology* 2011, 89(01)/1: 270 – 275.
3. Phan Van Anh, Nguyen Hong Ha, Le Van Nam. Characteristics on computed tomography in patients with naso-orbito-ethmoid fractures at Viet Duc University Hospital. *Vietnam Medical Journal*, 2021, 507(1): 145-149.
4. Han PS, Kim Y, Herford AS, Inman JC. Complications and Treatment of Delayed or Inadequately Treated Nasoorbitoethmoid Fractures. *Semin Plast Surg*. 2019 May;33(2):138-142.
5. Markowitz BL, Manson PN. Panfacial fractures: organization of treatment. *Clin Plast Surg* 1989;16:105
6. Fonseca, R. J. *Oral and maxillofacial surgery.* 2018. p. 220-223 vol 2.
7. Bonanthaya K. Oral and Maxillofacial Surgery for the Clinician. *Springer,* Singapore. 2021; p. 1251–1266
8. Septa D, Newaskar VP, Agrawal D, Tibra S. Etiology, incidence and patterns ofmid-face fractures and associated ocular injuries. *J Maxillofac Oral Surg*. 2014 Jun;13(2):115-9.
9. Phan Duy Vinh. Clinical and X-rays features of combined facial fractures. *Journal of 108 – clinical medicine and pharmacy*, 2022, 17(6).
10. Tran Tan Tai, Đang Van Tri, Hoang Le Trong Chau. Clinical, radiographic characteristics and results of surgical treatment of maxillofacial fractures. *Journal of Medicine and Pharmacy - Hue University of Medicine and Pharmacy*, 2021, 11(4): 87-94.
11. Pati D, Mishra N, Kar I, Meher B, Samal D, Rath KC. Nasoorbitoethmoid fractures in a tertiary care hospital of eastern India: A prospective study. *Natl J Maxillofac Surg*. 2021 Jan-Apr;12(1):42-49.
12. Dinh Van Quynh, Nguyen Duc Chinh., Pham Hai Bang. Situation of pre-hospital trauma first-aid through cases of severe brain injuries due to emergency traffic accidents at Viet Duc University Hospital. *Vietnam Medical Journal*, 2021, 509(1): 189-193.
13. Pisano J, Tiwana PS. Management of Panfacial, Naso-Orbital-Ethmoid and Frontal Sinus Fractures. *Atlas Oral Maxillofac Surg Clin North Am*. 2019 Sep;27(2):83-92.