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THE DIAGNOSIS AND MANAGEMENT OF SAGITTAL MAXILLARY FRACTURES

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Abstract

Background: Various approaches for managing sagittal maxillary fractures have been documented, each with its own set of pros and cons. In this report, we share our own experiences and outcomes concerning the utilization of reverse pre-activated maxillary expanders, while also assessing their effectiveness. This study aimed to facilitate effective management, the patients were split into three consecutive groups on the basis of their specific fracture type and presentation.

Methods: This study comprised of 120 patients who were diagnosed with sagittal maxillary fractures. These fractures were further categorized into six distinct subgroups based on the location and severity.

Results: Sagittal maxillary fractures exhibited a higher prevalence among young men. Notably, Le Fort i and ii fractures were observed recurringly either as isolated injuries or in combination with other fracture types. Sagittal and parasagittal fractures represented bulk prevalence in fracture subtypes. The study included the management of 32 patients in group A, 40 patients in group B, and 48 patients in group C. The most common complications encountered were malocclusion (4 cases), plate extrusion (4 cases), and oroantral fistula (4 cases).

Conclusion: The diagnosis of a sagittal maxillary fracture involves clinical and radiological examinations. “Palatal fractures” of type ii and iii displaced necessitate palatal vault plating. The placement of one plate in the post 1/2 of the middle 1/3 of the palate provides adequate stability to the palatal vault.

Keywords: Palatal vault fracture, anterior alveolar plating, palatal vault plating, maxillary buttress stabilization

Introduction

The sagittal split of the palate is a rare event in facial trauma. It can appear as either a segmented fracture of the palatoalveolar region or be observed alongside more complex Le Fort fractures, as noted by Banks and Manson et al. [1, 2]. Generally, this fracture line runs in a nearly central direction through the palate, reaching both sides of the vomer bone. This split in the bone may come with a tear in the mucosal lining or, in certain instances, remain contained within an undamaged palatal mucosa [2].

The majority of facial-mid fractures with "sagittal splitting" of the palate are pulverized, involving substantial displacement and dislocation of bony fragments that have their normal connections astray to adjoining structures, as noted by Manson et al. [1]. These fractures are often the result of automobile accidents, tumble from significant high points, or blunt weapon wounds.

Maxillary fractures are a common clinical condition frequently encountered in trauma center triage. Interestingly, the mandible fractures ratio to maxilla fractures stands at 3.9: 1.01. Le Fort originally categorized "maxillary fractures" into 3 distinct classes [3]. Meanwhile, in practice most of the fractures present were of various amalgamations in Le Fort and may exhibit variations in presentation on either side [4]. Occurrence of maxillary fractures in the plane sagittal, resulting in a longitudinal split at the intersection of the maxilla with the vomer of the palate [5]. Consequently, diagnosing, allocation, and devising a definitive treatment plan for Le Fort fractures involvement of palate pose formidable challenges for plastic surgeons.

For patients with palatal fractures, the predominant objective of management is to restore transverse breadth, maintain vertical height, and achieve normal anterior prediction of the midface, all while ensuring proper occlusion [6]. This study aimed to identify palatal fractures in cases presenting maxillary fractures, categorized in three groups, further tailored our management strategies accordingly.

Material and Methodology

The study took place within a tertiary care centre from February 2023 to August 2023 and involved 120 patients who were presented with sagittal maxillary fractures. Initially, each patient underwent an evaluation in the area triage to exclude airway, surgical, neurosurgical, and orthopedic crisis. Those with fractures in face were assessed for clinical symptoms and symptoms such as malocclusion, midface widening, anterior upper alveolar fractures, open bite, facial lacerations, any indications of mucosal palate involvement or ecchymosis in cases of fractures that have been recovered.

For all subjects, a comprehensive evaluation included computed tomography (CT) scans with both axial and coronal sections, with a specific focus on 3-D reorganization and conception of the palatal bones. Maxillary fracture were classified following the classification by Le Fort, while "palate fractures" were further categorized according to Hendrickson et al.'s extensive CT-based classification that delineates palate fractures into six distinct subheadings.

The management of palate fractures was carried out following a comprehensive investigation, with the use of nasal or sub-mental intubation as necessary. Patients were categorized into three subgroups based on their specific conditions.

In subgroup A of group A, patients exhibited evidence of fracture assessed in radiology unaccompanied by displacement, with the fracture falling into type (i), type (iv), type (v), or type (vi) categories. The management approach involved open depletion and internal treatment with minute screws and plates, along with application of interdental wiring and Erich arch bars. If there was any requirement of additional splinting, they were consulted to a outpatient department (dental).

The subgroup B of patients, which included those with type (i), type (ii), type (iii), and type (iv) palate fractures, the management approach consisted of several steps. This involved the application of erich-arch bars, penetration of the palatal mucosa with 1.0 % lidocaine along with adrenaline, anterior alveolar plating followed by the dissection of flaps of mucoperiosteal and suturing when deemed necessary. Subsequently, anterior maxillary buttress stabilization was performed. The duration of maxillomandibular fixation was determined by the achieved stability, typically ranging from 4 to 6 weeks.

Results

Out of a total of 436 maxillary fractures, we identified 120 cases with sagittal maxillary fractures, specifically palatal fractures. The age range among our patients spanned from 7 to 61 years. In terms of gender distribution, there were 79 males and 41 females.

Regarding the cause of injury, 76 patients sustained fractures due to road traffic accidents, 22 due to assault, 14 from falls from heights, 6 from sports-related incidents, and 2 patients experienced a fracture caused by mobile battery blast.

We classified the "palatal fractures" in accordance with the study conducted by Hendrickson in his classification: 32 patients had sagittal fractures, 40 had parasagittal fractures, 14 had alveolar fractures (4 anterior and 10 posterolateral), 26 had paraalveolar fractures, 2 had a complex fracture, and 6 had transverse fractures (with respective changes required).

These palatal fractures were often associated with other types of facial fractures, including Le Fort i fractures in 30 instances (17 uni-lateral and 13 bi-lateral), Le Fort ii fractures withing 30 cases (16 uni-lateral and 14 bi-lateral), integrated Le Fort I and II fractures in 46 cases (26 uni-lateral and 20 bi-lateral), combined Le Fort i, ii, and iii fractures in 4 cases, Le Fort ii and iii fractures within 2 case, naso-ethmoid fractures among 74 cases, frontal bone fractures within 24 cases, zygoma fractures in 58 cases, and mandible fractures in 74 cases.

The cases were categorized in three categories based on the class of palate fracture, the cause of injury, the therapeutic approach, and any resulting complications.

Table 1: Assessment of treatment approach and adverse effects

Parameters	Group A (32 patients)	Group B (40 patients)	Group C (48 patients)
Type of palatal fracture	-Alveolar -Para alveolar - Complex - Transverse	-Sagittal (Type II) -Para-sagittal (Type III)	- Sagittal (Type II) - Paraalveolar (Type IV)
Mode of injury	-Assault -RTA -Fall from height	-RTA -Fall from height -Assault	-RTA -Fall from height -Sports injury
Management of the symptoms	-Mycophenolate mofetil with ant- maxillary buttress stabilization	Mycophenolate mofetil with ant. alveolar plating and ant. maxillary buttress stabilization	Mycophenolate mofetil with palatal vault plating and anterior maxillary buttress stabilization
Complications	-Malocclusion	- Fistula -Malocclusion	- Palate exposure - Fistula

In our study, we allocated patients into three groups for management:

1. **Group A (32 patients):** These patients were treated with fixation of maxillomandibula and the stabilization of the ant-maxillary buttress.
2. **Group B (40 patients):** Patients in this group underwent fixation of maxillomandibula, palate suture incase necessary, "ant. alveola or pyriform plating", and anterior maxillary buttress stabilization.
3. **Group C (48 patients):** The management for this group included erich-arch bar application, palate vault plating, and ant. maxilla buttress counteraction.

During the period of assessment, we encountered several complications:

- Four patients experienced extrusion of plate, which was accompanied by un-tightening of screws. Both cases were treated via removal of disc.
- Four cases developed palatal fistulas during the assessment period of (four to six weeks). Within single patient, there was concurrent loss of bone near the posterior nasal spine along with soft tissue. The fistula eventually cured after undergoing fistula closure surgery.
- Four patients reported malocclusion issues, which were addressed through prolonged maxillomandibular fixation and consultation with a dental specialist.

- Two cases evolved ectropion of the lower eyelid, which was managed with full-thickness skin grafting after a 6-month period.

These findings highlight the various challenges and complications that can arise in the treatment of "sagittal maxillary fractures" and the diverse approaches required for their resolution.

Discussion

Sagittal maxillary fractures represent relatively tiny proportion concerning "Le Fort fractures". Coexistence of "palatal fractures" with Le Fort fractures as described in the range of 8 to 13.20 percentages. Chen et al. found that 46.40% cases were of maxilla fractures that too palate fractures, also these rarely arise in isolation [7].

Another study conducted had a system developed of allocation for palate fracture on the basis of their point of action and characteristics of anatomy. This classification includes six types: (a) alveolar fractures (i), further divided into ant. and posterolateral subtypes; (b) sagittal fractures (ii); (c) para-sagittal fractures (iii); (d) paraalveolar fractures (iv); (e) complex fractures (v); and (f) transverse fractures (vi) [8].

On the other hand, Park and Ock devised a classification system for palatal fractures based on criteria such as closed depletion, site of treatment, stability of the fractured segment after rigid fixation. They categorized patients into four subgroups: (a) Closed reduction; (b) rigid fixation of the maxillary buttress and alveolar ridge; (c) rigid fixation of the palatal vault and anterior structures; and (d) rigid fixation with extended immobilization [9].

Although, it has been previously established by authors that a rationalized allocation system that combines optimal treatment and anatomical characteristics. This classification includes three categories: (a) sagittal fractures (i); (b) transverse fractures (ii); and (c) comminuted fractures (iii) [7]. In this course of study, which included 120 patients, parasagittal fractures (40 cases) and sagittal fractures (32 cases) were the most prevalent class of palatal fractures. It's worth noting that sagittal fractures tend to be more frequent in patients of young age [10]. However, they can also appear in older patients depending on the severity of the trauma. In Melsen's study it has been indicated that "palatal sutures" typically solidified at the junction of the 2nd and 3rd decades of life [11].

The young male population, known for their activity and susceptibility to road traffic accidents, may be at higher risk. Additionally, the severity of influence endure in traffic road incidents, along with deficient or absent solidification, can be contributing factors in the occurrence of "sagittal and parasagittal fractures" [12]. Authors in 2017 established similar conclusions to the course of ours, highlighting an alveolar and para-sagittal fractures were the most common types of palatal fractures. They also identified assault as the primary cause of fractures, accompanied by automobile accidents [13].

When detailing "parasagittal and paraalveolar fractures", categorization can be challenging for fractures that follow an oblique or lazy S-shaped pattern [5]. Such fractures may exhibit a parasagittal trajectory in the ant. Portion a a paraalveolar pattern in the posterior part of the hard palate. These fracture patterns of fracture may never neatly fit into any of the categories detailed. In our study, we encountered such fracture lines in eight out of 120 patients.

To address this issue, Park and Ock suggested using "median" & "paramedian" terminology, the terms "sagittal" & "parasagittal" primarily indicate supervision alternatively providing a particular location for the fracture [10].

Conclusion

Managing sagittal split maxillary fractures may involve the use of palatal vault plating, depending on the specific case. Palatal vault plating is recommended when fractures show displacement in the post. section of the stiff palate. When combining an anterior alveolar plate with a single plate, it is usually adequate to achieve stability.

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