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REVIEW ARTICLE

NASO-ORBITO-ETHMOID FRACTURES: AN OVERVIEW

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ABSTRACT:

NOE injuries have been the most complex and difficult facial fractures to treat. These types of fractures are routinely encountered by practicing oral and maxillofacial surgeons. For optimal results, an accurate assessment of the injury and a comprehensive treatment plan is to be formulated as early as possible, as management of facial fractures and injuries remains a mainstay of the specialty. The intricate anatomy and difficulty in fracture fixation makes Naso-orbital-ethmoidal fractures the most complex of all facial fractures to diagnose and treat, so a thorough knowledge of facial norms, surgical anatomy, and reconstruction techniques is mandatory for successful treatment. The purpose of this article is to give a general overview NOE fractureswith diagnosis, classification, and management with review of literature.

Key Words: Naso-orbital-ethmoidal, Fractures, Diagnosis, Management

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INTRODUCTION:

The complex anatomy of the region and difficulty with access makes the repair of NOE fracture a challenging task for the surgeon's. Secondary deformities if any add on to its existing complexity .Over the decades various authors have described it in many ways:-as fracture of ethmoid by Dawson and Fordyce in 1953, Naso-orbital fractures by Converse and Smith in 1963.Naso-Ethmoid injuries by Stranc in 1970.Naso-Ethmoido Maxillo-Fronto-orbitaire complex by Vaillant and Peri in 1971. Epker coined the term "naso-orbito-ethmoid," (NOE) in 1973. Manson et al have used two terms for these injuries; "naso-orbital-ethmoid" and "nasoethmoid orbital". "Orbito-Ethmoid" by Jackson in 1989. Most commonly the term Naso-Ethmoid injury is preferred as it emphasised concisely the principal parts involved.[1]The causes of fracture of the nasoethmoidal fractures are chiefly road traffic accidents, interpersonal violence, sporting injuries and industrial trauma. Road traffic accidents were found to be the major cause of nasoethmoidal complex fractures accounting for 35 and 60 % of fractures of the facial bones, In 1988 Perkins and Layton have reviewed the etiology of maxillofacial injuries in general and have drawn attention to global changes.[2]

CLASSIFICATION:

Gruss in 1985 [3] in his classification provided a broader view of the injuries and associated management issues by proposing a classification which included NOE fractures as either isolated or in conjunction with other adjacent facial fractures

Markowitz etal[4] in 1991, introduced the system to standardize the various fracture patterns of the NOE complex and facilitate surgical treatment planning

_ Type I: single-segment central segment

_ Type II: single-segment or comminuted central fragment fracture external to the MCT insertion

_ Type III: comminution within the central fragment with extension beneath the MCT insertion

In 2007 in a review article, Sargent[5]proposed asimplified classification:

_ Unilateral or bilateral fractures and

_ Simple or complex (comminuted) fracture Segments

DIAGNOSIS :

Trauma in association with clinical features characterised by a short and retruded nasal bridge, telecanthus, enophthalmos, and a shortened palpebral fissure clinician: should always suspect a potential NOE fracture[1,6,7.]A systematic and proper clinical examination and imaging delineates and confirms the extent of injury. Clinical evaluation included facial edema when NOE fractures are associated with panfacial injuries, or in other cases it may be localised edema and ecchymosis in nasal and periorbital regions. Physical examination include evaluation of intercanthal distance, medial canthalrounding and ligament laxity, condition of the nasofrontal junction and nasal dorsum, and assessment of the globe and its position[8] ,eyelid structures and lacrimal apparatus and should also be evaluated.

The stability of the central fragment at the medial canthus is assessed using specific examination techniques. The bowstring or traction test is a bimanual palpation, with placement of the index finger and thumb of 1 hand at the medial canthal region; with the index finger of the opposite hand applying lateral traction at the lateral canthal region.[8]The bimanual examination not only confirms the diagnosis of a questionable fracture but also determines the need for surgical repair.[9, 10]Furness test Another clinical examination technique is done by placing a Kelly clamp intranasally, in an anesthetized patient, against the medial orbital rim and the opposite index finger is placed in the medial canthal area and any mobility palpated with movement of the Kelly clamp suggests instability. [11.] Assessment of nasal dorsum is evaluated by applying digital pressure as posttraumatic edema may camouflage the extent of the deformity.Extranasal and intranasal physical examination findings as summarised by Vora etal[8] include Lacerations, edema, and ecchymosis of the periorbital and nasal regions ,Loss of nasal projection and height, flattening of the nasal dorsum,Telecanthus,Rounding of the medial canthus,Mobility of the central fragment, Lacerations of the septal mucosa, Dislocation of the septum,Fractures and comminution of the bony portion of the septum, Septal hematoma .Above clinical findings may

also be associated with Cerebrospinal fluid leak,Pneumocephalus,Anosmia,Verticaldystopia,Enophthalmos,Diplopia,Epiphora.

DISCUSSION:

Understanding of the mechanism of injury as well as any associated injuries is crucial to the comprehensive care of the patient and often has surgical treatment implications, especially if associated with intracranial haemorrhage or cerebrospinal fluid leakage. No other facial fracture is more challenging to repair than an NOE fracture.Computed tomography (CT) is considered the gold standard for diagnosing fractures of the nasofrontal region, especially for evaluating the fracture pattern, displacement, extent of comminution, nasoseptal status, and any other associated facial fractures. More global assessment of the injuries can be done by Volume reconstruction three-dimensional images which can be particularly useful in the surgical planning and sequencing of repair, especially in panfacial fracture surgery. Remmler etal[12] proposed that combination of three-dimensional and two-dimensional CT images has a higher diagnostic value in the evaluation of NOE fractures than using either modality alone.

SURGICAL APPROACH :

In the past this has been achieved in many ways. During the last decades the coronal method of exposure of the fronto-nasoethmoidal area has virtually superseded all methods; on occasions modifying existing lacerations is done inorder to access the site has been done. Outlining of other approaches gives an insight into the advances in the treatment of this type of injury[5, 13, 14]. In 1962 Converse and smith[15] described an H- shaped approachwhich was later incorporated in the 'open sky' approach for naso - orbital fractures by Converse and Hogan[15] in 1970. Bilateral Z-approach was brought out by Dingmanet al[14] in 1969 which was subsequently followed by Midline vertical approach a 2-3 cm where a vertical incision is made from forehead down to the base of nose. A W-shaped approach is also described in literature where in a curved transverse incision is made across base of nose within a skin crease and extended on both sides upwards and laterally just below eyebrows. Facial degloving was also done to expose the maxilla, nasal

complex, and NOE regions without any significant cutaneous incisions. Lower eyelid, including subciliary, transconjunctival, and transcaruncular are placed depending on surgeon preference and experience, the infraorbital rim and internal orbit can be accessed, and when these approaches are combined with the transcaruncular incision; the medial orbit can be accessed. Maxillary vestibular approach exposes the nasomaxillary buttress region at the piriform region.

MANAGEMENT:

Until in around 1960,whenMustarde and Dingman[14,18]demonstratedopen reduction and internal fixation using interfragmental wiring, the treatment of NOE fractures mostly confined to closed reduction with external plates and splint fixation techniques[1, 15, 16] In 1970, Stranc[18] advocated exploration through existing lacerations or local incisions and treatment of avulsion of medial canthal tendon with anterior transnasal wires. Current treatment modalities combine most of the ideologies that has been put forth in literature, but till date no absolute consensus has been arrived at as to how long one should wait before treating these fractures. Some investigators have suggested waiting no more than 2 weeks[1, 19] .As long as the patient is stable enough to undergo the procedure·treatment should be initiated as an when the edema has subsided, not waiting than 10 to 14 days[19]. The Hallmark of obtaining optimal results with NOE fractures is the proper management of the medial canthal tendon and the adjacent bones [19]. The extent of injury plays a crucial role in the management its management, and this is best summarized by the Markowitz etal[4 ·]

Type I injuries are the easiest to manage with three-point stabilization using rigid fixation at the nasofrontal junction, infraorbital rim, and piriform rim. Treatment is almost similar for Type II and type III injuries, as both require fixation of the bony fragments which is accomplished with a combination of microplates for larger bony segments and wires for smaller bony segments. Identification of the medial canthal tendon in cases where it is attached to a small bony fragment or avulsed, either from the traumatic injury or inadvertent detachment by the surgeon and trans nasal canthopexy is done to prevent subsequent telecanthus.Adacryocystorhinostomy should not be performed prophylactically as the incidence of nasolacrimal dysfunction after NOE injury is only 5% to17.4%[20·]It is done at the time of Fracture treatment only when s an obvious injury is

noted, such as a laceration in the region of the nasolacrimal apparatus. Grafting the Nasal Dorsum is done in cases of Type II and III injuries as these cases mostly require a reconstruction of the nasal dorsum with a bone graft inorder to reestablish nasal projection. Calvarium is the graft of choice; other autogenous sites include the rib, ilium, and mandible[19].

CONCLUSION:

The complete knowledge including etiology, surgical anatomy, and classification with proper examination of patient and treatment planning will lead to better management of patients with NOE fractures or any fracture of the facial skeleton. Although managing these fractures can be extremely challenging, but good results can be achieved by an early intervention, wide exposure through aesthetic incisions, and reconstruction using rigid fixation and bone grafting where needed.

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