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The Difference between the Complications of Early Vs. Late Reconstruction in Patients with Traumatic Orbital Fractures

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Traumatic orbital fractures, resulting from facial trauma, can lead to significant aesthetic and functional issues if not managed appropriately. These fractures typically result from blunt force trauma to the face, such as in car accidents, sports injuries, or physical altercations. The orbit is a complex structure formed by several bones, including the frontal, zygomatic, maxilla, and ethmoid bones, which protect and support the eyeball and surrounding structures. When a traumatic orbital fracture occurs, it can cause a range of symptoms and potential complications. Common signs include periorbital swelling, bruising, double vision, and restricted eye movement. In severe cases, the injury can damage the optic nerve, leading to vision impairment. This literature review investigates into the ongoing debate concerning the optimal timing for surgical intervention in these cases, comparing early and late reconstruction. Studies indicate that early reconstruction tends to yield more favorable outcomes. For instance, one study demonstrated that early correction of enophthalmos within one month of injury led to significantly better outcomes, whereas delayed surgery was associated with more severe complications, including tissue fibrosis and atrophy.

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Factors such as diplopia and enophthalmos were evaluated in patients undergoing surgical treatment for orbital blowout fractures at different time intervals post-injury. The findings revealed that early intervention reduced postoperative diplopia, especially when performed within two weeks of the injury. Similarly, another study focusing on orbital-floor trap-door fractures emphasized the importance of early surgery within eight days of injury, showcasing superior outcomes compared to delayed surgery. A retrospective analysis further suggested that successful fracture repair can be achieved within 29 days following trauma, challenging the notion of a strict 14-day timeframe. In the context of pediatric patients, early intervention was recommended within two weeks for most cases, except for those showing minimal symptoms, where observation and monitoring were deemed appropriate. Overall, the existing literature emphasizes the benefits of early surgical intervention in managing orbital fractures. Timely care within the first two weeks is associated with a higher likelihood of complete recovery of symptoms, lower rates of postoperative diplopia and enophthalmos, and the resolution of motility restriction.

Keywords: Traumatic orbital fractures; early reconstruction; late reconstruction.

1. INTRODUCTION

Fractures involving the orbital rim and/or walls are frequently encountered in cases of “traumatic craniofacial injuries” [1]. While a substantial amount of force is necessary to fracture the lateral orbital walls or thick superior, the comparatively thinner bones of the orbital floor and medial wall can sustain damage from even minor to moderate trauma [2]. The orbital floor is comprised of the palatine bones, zygomatic, and maxillary bones [3]. The orbital floor is the shortest among the four walls, and it terminates at the posterior edge of the maxillary sinus [4]. Floor fractures commonly propagate in the infraorbital groove canal while remaining intact in the posterior region due to the strength of the palatine bone [5]. The close proximity of floor fractures to the “inferior oblique muscles” and “inferior rectus” can potentially lead to entrapment of the extraocular muscles [6]. However, the primary consequence of floor fractures is typically the long-term enlargement of the orbit, exceeding its normal volume of roughly 30 mL [7]. These injuries can cause significant functional and aesthetic impairments due to the orbit's prominent location within the craniofacial bone and its role in protecting the ocular contents [8]. Enophthalmos, as well as other manifestations of globe malposition, might become apparent on clinical and/or radiographic evaluation within a few weeks following the initial damage [9]. Despite the fact that fixing the wounded orbital floor can typically address these sequelae, there is no consensus on the ideal time of repair to effectively heal enophthalmos and other post-traumatic sequelae [10]. Throughout history, there has been much dispute about the optimal technique and time of managing orbital fractures. Some authors have advocated for a conservative approach, arguing that it may yield greater benefits compared to early surgical intervention [11]. Unless there is evidence of risk to visual acuity or muscle entrapment, isolated fractures of the orbital floor do not necessitate immediate surgical intervention. The symptoms generally exhibit improvement when the ocular edema and or hematoma resolve gradually over a period of several weeks. In addition, it is worth noting that consequences associated with fracture repair frequently encompass the very issues that surgical intervention aimed to prevent, such as visual impairment, double vision, or misalignment of the eyeball [12]. However, in cases where symptoms continue to persist, surgical intervention may be necessary [13]. The aim of this review is to compare the differences between early vs. late reconstruction in patients with traumatic orbital fractures.

2. THE COMPLICATIONS OF EARLY VS. LATE RECONSTRUCTION IN PATIENTS WITH TRAUMATIC ORBITAL FRACTURES

Traumatic orbital fractures, a common consequence of facial trauma, can lead to severe aesthetic and functional impairments if not managed appropriately(14). The timing of surgical intervention in these cases, whether early or late reconstruction, has been a topic of ongoing debate within the medical community [14]. Studies indicate that early reconstruction leads to favorable outcomes compared to the interventions that are performed later. One study demonstrated that promptly addressing enophthalmos within a month following an injury was linked to a notably improved outcome. Conversely, a postponement in surgical

intervention resulted in more severe sequelae, including tissue fibrosis and atrophy [15]. The sample for this study consisted of 22 individuals who presented with blowout fractures, categorized as either pure or impure, and subsequently experienced enophthalmos more than 2 mm, as quantified using an exophthalmometer. Measurements were taken at three time points following the surgical procedure: 10 days, 1 month, and 3 to 6 months after the operation.

A study aimed to examine the prevalence of residual diplopia and enophthalmos, as well as identify potential risk factors associated with their development, in patients who underwent surgical treatment for orbital blowout fractures less than 2 weeks or greater than 2 weeks to 6 months [16]. Prior to surgery, diplopia was observed in 35 patients, accounting for 83% of the sample. Additionally, enophthalmos higher than 2 mm was present in 13 patients, representing 30.9% of the participants. Out of a cohort of 35 patients who presented with preoperative diplopia, it was shown that only 7 individuals (constituting 17% of the total sample) continued to exhibit diplopia following the surgical procedure. The condition of diplopia showed a notable improvement during a timeframe of 1 to 4 weeks, with a mean duration of 3 weeks, subsequent to surgical intervention in a cohort of 28 patients. The occurrence of postoperative diplopia was found to be significantly influenced by both the timing of surgery and the age of the patient ($p < 0.05$). The variables of sex, location of the blowout fracture, and the alloplastic material did not demonstrate statistical significance in relation to the occurrence of postoperative diplopia ($p > 0.05$). Enophthalmos was observed to persist in three patients (7%) following the surgical procedure. This research concluded that elderly patients exhibited a higher propensity for experiencing persistent surgical diplopia. The frequency of residual diplopia can be reduced by performing surgical repair of blowout fractures within a two-week timeframe following the trauma.

A research study was conducted to examine the optimal timing for surgery after injury in relation to ocular mobility in individuals diagnosed with orbital-floor blowout fractures [17]. The average duration between damage and surgical intervention was found to be 10.7±7.8 days, with a range of 0 to 30 days. The average "postoperative HAR% (92.9%±10.5%)" showed a substantial improvement when compared to the preoperative "HAR% (73.5%±21.7%) ($p<0.01$)". The average postoperative Horizontal Adduction Range (HAR%) of patients with orbital-floor trap-door fractures and imprisoned tissue who received surgical repair within 8 days after the injury was considerably higher (98.3%±4.4%) compared to those who underwent surgical repair after 8 days "(94.2%±5.8%) ($p<0.01$)". This research concluded that the outcomes of patients who underwent surgical repair for orbital-floor trap-door blowout fractures with imprisoned tissue within 8 days of the injury were found to be superior compared to those who received surgery after 8 days. Additionally, the use of the HAR% approach was found to be valuable in documenting the surgical outcomes of orbital fractures.

Research evaluated the efficacy of delayed surgical intervention, specifically medial wall fracture or orbital wall fracture repair, within a time frame of 15 to 29 days, in comparison to early surgical intervention [18]. This study presented a retrospective analysis that compared the outcomes of fracture repairs conducted within 1-14 days after trauma (referred to as early repairs) with those conducted during 15-29 days after trauma (referred to as delayed repairs). The primary outcomes of interest included ocular mobility, diplopia, and the duration required for diplopia to resolve following the surgical procedure. According to this research, the ocular motility of both groups was found to be comparable, both prior to and during the surgical procedure. The incidence of diplopia and the frequency of strabismus surgery were found to be comparable in both cohorts, as reported by the patients. The duration required for diplopia to resolve or stabilize after surgery is not influenced by the timing of the surgical intervention during the initial 29-day period following the occurrence of trauma. While it is usually stated that orbital blowout repair should be performed within 14 days following trauma, the findings of this study demonstrate that successful fracture repair can still be achieved up to 29 days after the initial injury. Patients who exhibited a gradual improvement in diplopia and had a low likelihood of developing enophthalmos may be suitable candidates for a period of observation lasting 3 to 4 weeks before proceeding with surgical intervention. This research concluded that surgical intervention has the potential to minimize the occurrence of unwarranted surgical procedures in some instances. The time frame of fourteen days should not be regarded as a strict

deadline for the surgical repair of orbital floor and/or medial wall fractures.

A retrospective analysis was conducted to examine 19 papers in order to ascertain whether early treatment of pediatric orbital fracture provides any advantages in terms of postoperative clinical outcomes [19]. The temporal span of treatments varied from 24 hours to almost one month. The majority of researchers concurred that early intervention, ideally within a two-week timeframe, is recommended for the management of orbital fractures in pediatric patients. Surgical intervention should be promptly conducted within a timeframe of 24-48 hours in cases of white-eyed blowout fractures, oculocardiac reflex, and trapdoor fractures with muscle entrapment. It is imperative to do a comprehensive examination of children who exhibit facial injuries in order to identify potential indications of muscle entrapment, diplopia, nausea, vomiting, and bradycardia. If these conditions are present, early intervention should be provided. It is recommended to administer treatment within a two-week timeframe in cases when there are no indications of oculocardiac reflex and muscular entrapment. In cases when diplopia is of a minor nature or showing signs of improvement, accompanied by minimal hypogeous and enophthalmos, it is recommended to adopt a conservative approach of observation and monitoring.

Currently, there is a lack of evidence-based guidance about the optimal timing for surgical intervention in cases of orbital fractures. A study was conducted to investigate the impact of timely care on patient outcomes in cases of ocular fractures [20]. Out of the 1,160 publications that were examined, a total of 20 articles satisfied the established criteria for inclusion. The findings of this study indicate a significant association between undergoing surgery within 2 weeks of sustaining an injury and a higher likelihood of complete recovery of symptoms (odds ratio [OR], 6.9 [95% confidence interval (CI), 1.35-35.06]). Additionally, there was a lower incidence of postoperative diplopia (OR, 0.3 [95% CI, 0.1-0.9]) and enophthalmos (OR, 0.2 [95% CI, 0.1-0.9]) observed in patients who underwent surgery within this timeframe. The repair conducted within a period of fewer than 30 days following the injury was found to be linked with the entire resolution of the preoperative motility restriction (odds ratio [OR], 24.6; 95% confidence interval [CI], 1.30-462.34), along with the alleviation of diplopia.

3. CONCLUSION

Discrepancies in the scheduling of surgical procedures and the criteria used to assess patient outcomes, along with variances in the methodologies employed to evaluate postoperative outcomes, increase the potential for bias and justify a reduction in the quality of evidence presented in a study. The timing of the repair process exhibited variation, with intervals of 2, 4, and 8 weeks observed following the occurrence of the injury. However, there was a notable correlation between a brief duration of surgical intervention and the successful treatment of vertical dystopia, postoperative enophthalmos, and mobility restriction.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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