



Revista Española de
Cirugía Oral y
Maxilofacial

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Original article

Surgical indications of orbital fractures depending on the size of the fault area determined by computed tomography: A systematic review[☆]



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ARTICLE INFO

Article history:

Received 5 December 2013

Accepted 16 March 2014

Available online xxx

Keywords:

Orbital

Fracture

Volume

Enophthalmos

Computed tomography

ABSTRACT

Introduction: Surgical treatment of the orbital fractures is used in an attempt to prevent or treat complications, such as the enophthalmos, double vision, or limitations in ocular movements. The aim of this study is to carry out a systematic review of the literature in order to quantify the fault area in orbital walls. It also aims to increase the volume of the orbital cavity in the orbital traumatism that determines the appearance of ocular symptomatology and that, in turn, may require surgical reconstruction.

Material and methods: An electronic search was conducted in Medline (Pub-Med) using the terms: "orbital", "volume", "fracture", "enophthalmos" and "computer". Only these studies that relied on CT measurements, only included fractures of floor and medial wall of the orbit, and fulfilled the criteria for high methodological quality, were selected.

Results: Various studies determine that fractures with areas greater than 1.10–2.00 cm², as well as an increase in orbital volume, will lead to the appearance of enophthalmos in 10–15% of the cases. In addition, for every 1 cm³ increase in the volume of the orbital cavity, the enophthalmos increases between 0.47 mm and 0.90 mm.

Conclusions: According to the published results, surgical orbital reconstruction is indicated for faults greater than 2 cm², with a volume greater than 1.62 cm³, an orbital volume greater than 10–15% of the orbital cavity, or when the fracture is located in the innermost region, between the floor and medial wall of the orbit in the so called "key area".

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[☆] Please cite this article as: Garcia BG, Ferrer AD. Indicaciones quirúrgicas de las fracturas orbitarias atendiendo al tamaño del defecto de fractura determinado por tomografía computarizada: Una revisión sistemática. Rev Esp Cir Oral Maxilofac. 2015. <http://dx.doi.org/10.1016/j.maxilo.2014.03.011>

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Indicaciones quirúrgicas de las fracturas orbitarias atendiendo al tamaño del defecto de fractura determinado por tomografía computarizada: Una revisión sistemática

R E S U M E N

Palabras clave:

Órbita
Fractura
Volumen
Enoftalmos
Tomografía computarizada

Introducción: El tratamiento quirúrgico de las fracturas orbitarias pretende prevenir o tratar complicaciones tales como el enoftalmos, la diplopía o la limitación de los movimientos oculares. El objetivo de este estudio es realizar una revisión sistemática de la literatura para cuantificar el área del defecto de paredes orbitarias y el incremento de volumen de la cavidad orbitaria en traumatismos orbitarios que va a determinar la aparición de sintomatología ocular y que, por tanto, indica la reconstrucción quirúrgica.

Material y métodos: Se ha realizado una búsqueda electrónica en Medline (PubMed) utilizando los términos: «orbital», «volume», «fracture», «enophthalmos» y «computer». Se seleccionaron aquellos estudios que realizaban mediciones sobre TC, que incluían exclusivamente fracturas de suelo y pared medial de la órbita y que cumplían los criterios de alta calidad metodológica.

Resultados: Los distintos estudios determinan que fracturas con áreas de defectos superiores a 1,10-2,00 cm² así como incrementos de volumen orbitario superiores al 10-15% conducirán a la aparición de enoftalmos. Además, por cada cm³ de incremento de volumen de la cavidad orbitaria, se produce un aumento del enoftalmos entre 0,47 y 0,90 mm.

Conclusiones: Según los resultados publicados, estaría indicada la reconstrucción quirúrgica orbitaria ante un defecto superior a 2 cm², ante un incremento de volumen superior a 1,62 cm³, ante incrementos de volumen orbitario superiores al 10-15% de la cavidad orbitaria o cuando la fractura se localiza en la región más posterior, entre el suelo y la pared medial de la órbita en la llamada «área clave».

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Introduction

The purpose of the surgical treatment of orbital fractures is to restore the anatomy by reconstructing the orbital walls and reducing herniated soft tissues. Surgical reconstruction is indicated in order to prevent sequelae or to treat the complications derived from fractures of this type, such as such entrapment of the extraocular musculature, diplopia, limited ocular motility or enophthalmos.¹

With respect to enophthalmos, the critical cut-off that classically indicates surgical orbital reconstruction is determined by the very definition of enophthalmos: a difference in the ocular position between the 2 eyes greater than or equal to 2 mm, measured on the anteroposterior axis by Hertel exophthalmometry.^{2,3}

The explanation for why it is necessary to know the size of the orbital fracture defect that indicates surgical reconstruction lies in the fact that early surgical treatment of orbital fractures could reduce the complications outlined above, provided it is performed within the first 2 weeks after the injury.^{4,5} Moreover, the edema and emphysema produced in orbital fractures can mask a latent enophthalmos that can become evident toward the 2nd or 3rd week, when the edema and emphysema disappear.² On the other hand, a number of studies published in recent years have shown that an increase in orbital volume, without taking into account the changes produced in the soft tissues (which are less determinant in the development of enophthalmos), correlates linearly with the development and severity of posttraumatic enophthalmos.⁶⁻¹²

The objective of this study is to carry out a systematic review of the literature to quantify, using measurements obtained from computed tomography (CT) images, the area of the defect in the orbital walls and the increase in volume of the orbital cavity in orbital trauma. As orbital fracture will result in the development of ocular symptoms, it is an indication for surgical reconstruction of the orbital walls. The quantification of these 2 data by CT could serve as a guideline and indication for this reconstruction.

Material and methods

All the searches were performed electronically according to the bases proposed in the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement,¹³ on 10 February 2014, using the Medline (PubMed), Cochrane Plus, Scielo and Education Resources Information Center (ERIC) databases and search engines. The inclusion and exclusion criteria were established a priori. The search involved the use of the medical terms: “orbital”, “volume”, “fracture”, “enophthalmos” and “computer”.

With these key words, we found 27 articles, but selected only those that met the following inclusion criteria: (1) measurements made from CT images; (2) fractures that involved only one orbit; (3) orbital floor or medial wall fractures; (4) the determination of the volume or area; and (5) definition of the degree of enophthalmos according to the orbital defect. We also excluded those studies in which the site of the fracture was not specified and those that included

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