

Oculocardiac reflex during zygomatico maxillary complex fracture management - a retrospective study

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Abstract

The aim of the study was to evaluate the incidence and factors associated with Oculocardiac reflex (OCR) in subjects operated for zygomatico maxillary complex (ZMC) fractures.

A retrospective analysis of subjects operated for ZMC fractures was carried out in our institution. Data related to gender, age, comorbidities, and associated medications, the presence of OCR and the need for intraoperative anticholinergic drugs were recorded. Only subjects with complete data were included in the study.

A total of 209 subjects had complete records out of which 73.2% were males with an OCR incidence of 10.05%. No significant difference was seen in the distribution of OCR when compared to age and gender ($P=0.394$ and 0.398) respectively. Significantly higher number of individuals with OCR had hypertension (57.1%), hyperlipidemia (52.4%) and medication of β -blockers (42.9%) than those who did not develop OCR ($P<0.001$, 0.002 and <0.001) respectively. No significant difference was seen between the presence of diabetes, use of calcium channel blockers and distribution of OCR. Only three subjects needed intra-operative anticholinergic drugs.

The incidence of OCR in subjects undergoing reduction of ZMC fractures was 10.05%. Subjects with comorbidities like hypertension, hyperlipidemia, and use of β -blockers may be more susceptible for OCR.

Clinical article (J Int Dent Med Res 2018; 11(1): pp. 243-247)

Keywords: Cardiac, bradycardia, fractures, reflex, zygomatico maxillary complex. development and to improve the function of the stomatognathic system.

Received date: 28 September 2017

Accept date: 27 October 2017

Introduction

Trigemino-cardiac reflex previously known as an oculocardiac reflex (OCR) /Aschner-Dagnini reflex/ Achener-phenomenon/ Trigemino-vagal reflex, is a cardiac reflex that is a physiological response to the physical stimulation of the eye or the adnexa¹. OCR has afferent and efferent pathways with the former mediated by the peripheral nerve innervations from the

extraocular muscle that pass through the ophthalmic branch to Gasserian ganglion and reaches the main sensory nucleus of the trigeminal nerve. This afferent pathway synapses with the vagus nerve of the parasympathetic system forming the efferent pathway which reaches the heart causing parasympathetic effect¹⁻³.

The clinical implications of OCR range from the sudden onset of sinus bradycardia (heart rate less than 60 beats /minute), bradycardia terminating asystole, asystole with no preceding bradycardia, arterial hypotension, apnea and gastric hypermobility⁴⁻¹⁰. Bradycardia caused by this reflex was reported previously during the treatment of zygomatic, orbital blowout and maxillary fractures¹⁰⁻¹³. OCR is documented in the ophthalmology and neurosurgery literature,

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but there is a relative paucity of literature about facial trauma.

A recent review by Lubbers HT et al¹⁴ reported OCR incidence (bradycardia/asystole) in wide variety of surgical manipulations which involved elevation of zygomatic arch fractures, insufflation of temporomandibular joint during arthroscopy, orthognathic procedure of the mandible, endoscopic transsphenoidal surgery, reposition of nasoethmoidal fractures, Blepharoplasty, intraorbital foreign body, periorbital laceration manipulation, mesiodens removal, mid-face disimpaction and use of mouth prop. The incidence from the existing literature ranged from 1-2% in craniofacial surgery to 32-90% in strabismus surgery. However, Lubbers et al., 2010 classified craniofacial surgeries like insufflation of Temporo- mandibular joint, Le Fort 1 Osteotomy, and elevation of zygomatic fractures as low-risk surgical risk factors¹⁴. There are reports in the recent literature about the occurrence of Trigemino-cardiac reflex during excision of a large osteoma in zygomatic arch,¹⁵ Le Fort I osteotomy,¹⁶ and in isolated pediatric orbital floor fracture¹⁷. Moreover, Huang et al. recently reported a significant blood pressure drop during vital pulp extirpation under local anesthesia possibly related to oculocardiac reflex¹⁸. Considering the alarming rates of OCR incidence, the surgeon must be aware that the OCR can happen quite frequently during the manipulations in head and neck surgeries and should well prepare in the management of the same.

Tripod fractures is a misnomer which constitutes fracture of 4 bones that includes maxillary sinus including the anterior and postero-lateral walls and the orbital floor, the zygomatic arch, lateral orbital rim including the lateral orbital wall, or the zygomaticofrontal suture and sphenozygomatic suture¹⁹. Hence any manipulation around these structures can lead to the initiation of OCR.

The treatment of these fractures depends on the extent of displacement resulting in cosmetic and functional deformity. The isolated zygomatic arch fractures are well reported in the literature which usually results in restriction of the mouth opening due to impingement of fractured arcus zygomaticus on coronoid process of the mandible²⁰. Cardiac asystole during the treatment of isolated zygomatic arch fracture was reported in the literature¹². The management of

the displaced zygomatico maxillary complex (ZMC) fractures can be done by closed reduction with skeletal traction as reported in the literature especially in monobloc zygomatic tetrapod fractures²¹. Severely displaced unstable fractures are treated by open reduction and internal fixation.

The primary purpose of our study was to determine the incidence of OCR in subjects operated for Tripod fractures or zygomatico maxillary complex (ZMC) fractures and its association with demographic characteristics, medical comorbidities, and pharmacological agents.

Materials and methods

A retrospective study was conducted from May 2010 to September 2015 among subjects who were treated for ZMC fractures in the department of Oral and maxillofacial surgery, Manipal. All patients undergo computed tomography scan to evaluate the extent of the fracture and its precise pattern as per our protocol. A total of 219 subjects were treated for ZMC fractures during the study period out of which complete records were available for 209 subjects.

Subject's data was obtained from Medical Record Department by two examiners. Initially, the list of all the individuals who had oro-facial trauma during the study period was obtained from the trauma registry. They were then screened for the ZMC fractures. Then subject's records were checked for completeness of the data related to gender, age, comorbidities, medications in view of associated comorbidities, the presence of OCR and the need for intraoperative anticholinergic drugs. The working definition for OCR event is defined as newly emergent bradycardia with heart rate less than 60 beats per minute lasting for a period of 15 seconds or a >10 beat per minute drop in heart rate²². Only patients with full information concerning the above parameters were considered for the study. Exclusion criteria were patients with incomplete data. All the parameters were immediately entered into the proforma developed for the study. Informed consent was routinely obtained from all the subjects.

All the subjects had undergone general anesthesia which was administered using a single protocol based on weight. Atropine was

not used for medications and premedication. Vecuronium was used as a muscle relaxant. Prior permission to carry out the study was obtained from the institutional ethics committee, Kasturba hospital, Manipal (IEC 67/2015).

Statistical analysis:

All the analysis was done using SPSS version 18 (SPSS Inc, Ill, USA). A P-value of <0.05 was considered statistically significant. Chi-Square test was done to evaluate the significant differences in the distribution of OCR concerning demographics, comorbidities, medications in view of associated comorbidities, thyroid disorders, tobacco use and the need for intra-operative anticholinergic drugs.

Results

		OCR		P-value
		Absent N (%)	Present N (%)	
Age in years	≤30	99(52.7)	9(42.9)	0.394
	>30	89(47.3)	12(57.1)	
Gender	Male	136(72.3)	17(81.0)	0.398
	Female	52(27.7)	4(19.0)	
Hypertension	Absent	158(84.0)	9(42.9)	<0.001
	Present	30(16.0)	12(57.1)	
Hyperlipidemia	Absent	151(80.3)	10(47.6)	0.002
	Present	37(19.7)	11(52.4)	
Diabetes	Absent	164(87.2)	16(76.2)	0.146
	Present	24(12.8)	5(23.8)	
β-blockers	No	169(89.9)	12(57.1)	<0.001
	Yes	19(10.1)	9(42.9)	
Calcium channel blockers	No	180(95.7)	18(85.7)	0.085
	Yes	8(4.3)	3(14.3)	

Table 1. Comparison of distribution of OCR with demographic, comorbidities and drug usage.

A total of 209 subjects had complete records out of which 73.2% were males. The incidence of OCR in our study was 10.05% (n=21). No significant difference was seen in the distribution of OCR when compared to age and gender (P=0.394 and 0.398) respectively. Significantly higher number of individuals with OCR had hypertension (57.1%), hyperlipidemia (52.4%) and medication of β-blockers (42.9%) than those who did not develop OCR (P<0.001, 0.002 and <0.001) respectively. No significant difference was seen between the presence of diabetes, use of calcium channel blockers and distribution of OCR.

Significantly higher number of subjects with OCR was under β-blockers (42.9%) (P<0.001) than those who did not develop OCR (Table 1). None of the subjects had thyroid disorders, history of tobacco. Only three subjects needed intra-operative anticholinergic drugs for the management of OCR.

Discussion

Our study assessed the incidence of OCR during ZMC fractures and its relationship with demographic, comorbidities and medications in a tertiary care hospital. We report a 10% incidence in OCR in our subjects which was slightly higher than that reported by Precious and Skulsky,¹⁰ and Schaller et al²³. Lubbers et al¹⁴ stated that bradycardia during maxillofacial surgical procedures might happen much more frequently than what is reported in the literature. Joshi UM et al. reported OCR in the management of facial fractures especially in mid face fractures and emphasized the meticulous monitoring of the electrocardiogram during the surgery²⁴. On the other hand, clinical features like nausea, vomiting, or bradycardia, particularly in children, can also be interpreted as commotio cerebri rather than being attributable to OCR alone. Hence, authors concluded that specific numbers concerning the true incidence might not be available for reporting the OCR¹⁴.

Blanc et al²⁵ reported significantly higher incidence in children but also reported that OCR could be provoked in any patient even without the pre-existing cardiac disease. Burnstine²⁶, Gerbino et al²⁷ have reported of OCR being more common in pediatric patients. This could be due to their higher resting vagal tone and their elastic nature of the bony orbital rim and floor. However, there were no significant differences concerning age and gender with OCR in our study. Kayikcioglu et al. reported that a minimum period of 15 to 20 seconds of stimulation is required to elicit the reflex that can lead to at least 20% or more reduction in heart rate, or presence of arrhythmias.²⁸

Lubbers HT et al¹⁴, Schaller et al,²³ Min et al²⁹ and Khurana et al³⁰ have shown medical co-morbidities in the form of hypertension, hyperlipidemia, and history of diabetes mellitus and medications like the use of β blockers, calcium channel blockers to be significant covariates with OCR. Our study reported that

hypertension, hyperlipidemia, use of β -blockers could have a predisposing role for OCR, whereas no incidence was reported in case of diabetes mellitus and calcium channel blockers.

A total of 21 subjects had OCR out of which, 18 subjects had bradycardia, two subjects had refractory bradycardia, and one subject had bradycardia with hypotension. No subjects reported with asystole. The episode of OCR was transient and had minimal complications except for three subjects. Intraoperative anticholinergic drug (atropine) was administered due to refractory bradycardia in 2 subjects (0.02 mg/kg) and bradycardia with hypotension in one subject (0.5 mg). Out of these three subjects who needed the intraoperative anticholinergic drug, only one subject had medical comorbidity (hypertension) with medications (β -blockers and Calcium channel blockers) while other two subjects were children without any comorbidities. Cessation of surgical procedure was sufficient to normalize heart rate in most of the subjects (n=18).

Considering the above facts and within limits of this study, we can conclude that OCR represents a significant event during oral and maxillofacial surgeries. The surgeon and anesthesiology team should be well aware of the events and be prepared for mobilization in case of adverse events. It is also recommended that information to the patient regarding the degree of risk should be provided before the procedure. Based on the risk classification proposed by Lubbers et al¹⁴ high-risk patients can be prophylactically administered atropine 0.5 mg IV before any surgical manipulation in oral and maxillofacial surgeries.

Conclusions

The incidence of oculocardiac reflex was 10.05%. Patients associated with hypertension, hyperlipidemia, and use of β -blockers may be more susceptible and have minimal complications as long as the surgeon temporarily ceases surgical manipulation.

Acknowledgements

We thank all the non-teaching staff of department of oral and maxillofacial surgery and medical record department for their co-operation and support.

Declaration of Interest

The authors report no conflict of interest.

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