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Research Article

TRIGEMINOCARDIAC REFLEX DURING ZYGOMATIC-COMPLEX SURGERY, A RARE PHENOMENON

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ABSTRACT

Trigeminocardiac reflex (TCR) is a shocking event in the course of operation involving the maxillofacial area.Trigeminocardiac reflex is a sudden physiologic response due to mechanical manipulation of any of the branches of trigeminal nerve. Trigeminocardiac reflex occurs due to pressure effect or stretching of trigeminal nerve which causes fall in blood pressure and decrease in heart rate. In this reflex arc, the trigeminal nerve serves as afferent pathway and vagus nerve, which is cardio inhibitory in nature, serves as efferent pathway. The present report describes a case of displaced zygomaticomaxillary complex (ZMC) fracture eliciting TCR during reduction.

INTRODUCTION

Trigeminocardiac reflex (TCR), also known as Aschner phenomenon, is a well-known phenomenon seen during ocular surgeries, seen as a decrease in pulse rate associated with traction applied to extraocular muscles and/or compression of the eyeball.[1] It was first described as Oculocardiac Reflex (OCR) in 1908.[2],[3].They attributed this response to a pressure-induced neural reflex that causes cardiac depression through the stimulation of the vagal nerve.[3] Today oculocardiac response is defined as a sudden decrease in heart rate (HR) of more than 20% of the baseline value, dysrhythmias, or sinoatrial arrest.In 1988, the term "trigeminocardiac reflex" was described by 2 anesthetists, Shelly and Church.[4] Since the development of modern reconstructive plastic surgery techniques in 1967, new intraoperative anesthetic complications have been described in this field.[5] This phenomenon may be generated as a result of procedures or conditions that increase intraocular pressure,[3], nasal packing after rhinoplasty,[6] the reduction of zygoma and zygomatic arch fractures,[3] elevation of bone flap or osteotomies, reflection of a palatal flap for removal of a mesiodens,[7]during Le Fort I downfractures, sagittal split ramus retraction,[3] midface disimpaction,[8]cutting maxillary tuberosity,[7] and temporomandibular joint (TMJ) arthroscopy.[5] Because the reflex does not appear to be limited to the ophthalmic branch and in order to be more inclusive and anatomically descriptive of the response, Shelly and Church[4]suggested changing the name to trigeminocardiac (TCR) or trigeminovagal reflex (TVR).The reflex is mediated by nerve connections between the ophthalmic branch of the trigeminal nerve via the ciliary ganglion, and the vagus nerve. Nerve fibres from the maxillary and mandibular divisions of the trigeminal nerve have also been documented to cause this reflex.[2]

Case Report

A 30 year-old-male with a history of road traffic accident 6 days back was admitted in T.S.Misra Medical College & Hospital, Lucknow,India, with a chief complaint of pain all over his face following trauma. There was no history of loss of consciousness, vomiting and seizures. Patient was conscious, cooperative and well oriented; with a Glasgow coma scale score of 15. Patient was referred to the Department of Dentistry, T.S. Misra Medical College &Hospital,Lucknow India, for further evaluation. On clinical examination, the

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patient had gross facial edema, bilateral subconjunctival ecchymosis.[Fig-1] Both pupils were equally reactive to light, and extraocular movements were normal with no sign of diplopia. Intraoral examination revealed mouth opening to be 20mm, occlusion was intact and tenderness on palpation was found at right maxilla. A non-contrast CT scan of face was done for better evaluation of the facial fracture.The Patient was diagnosed with Right Zygomatico maxillary complex(ZMC) fracture involving right zygomaticomaxillary, right frontozygomatic and right zygomaticotemporal sutures with lateral wall of right orbit.[Fig-2,3] The treatment plan was open reduction and internal fixation with Titaniumminiplates of 1.5mm plating system under general anaesthesia. Written informed consent was taken from the patient. Preoperative routine blood investigations were within normal limits and physician, neurosurgeons and ophthalmologist clearance was also taken before surgery. General anesthesia was induced via IV route.

The rightzygomaticomaxillary buttress were approached through intraoral Keen's incision while frontozygomatic fracture approached through lateral eyebrow extraoral incision
The blood pressure and pulse rate of the patient was constantly being monitored throughout the surgery. It was noted that the blood pressure and pulse of the patient remained fairly constant before and after the induction of general anesthesia. However, as soon as the zygomatic arch was reduced a sharp fall in both the blood pressure and the pulse rate was observed, which could be attributed to TCR. The surgery was discontinued and the anesthetist informed who gave 0.5 mg intravenous atropine to restore the blood pressure and pulse rate. The surgery was continued only once the blood pressure and the pulse ratereturned to normal.The elevation of the zygomatic arch and Two point fixation done with 4 hole with gap titanium miniplate at frontozygomatic fracture and 'Y' shaped titanium miniplte at zygomaticomaxillary fracture segment without any further consequence. [Fig-4,5]. Post operative radiograph was taken after 10 days of follow up. [Fig-6]

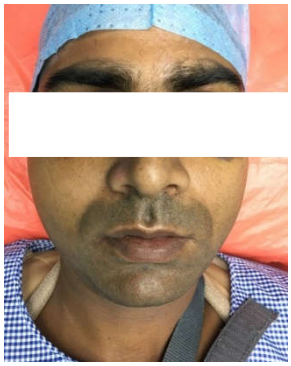

Fig 1 Preoperative Clinical Picture of patient showing bilateral periorbital ecchymosis and gross facial edema

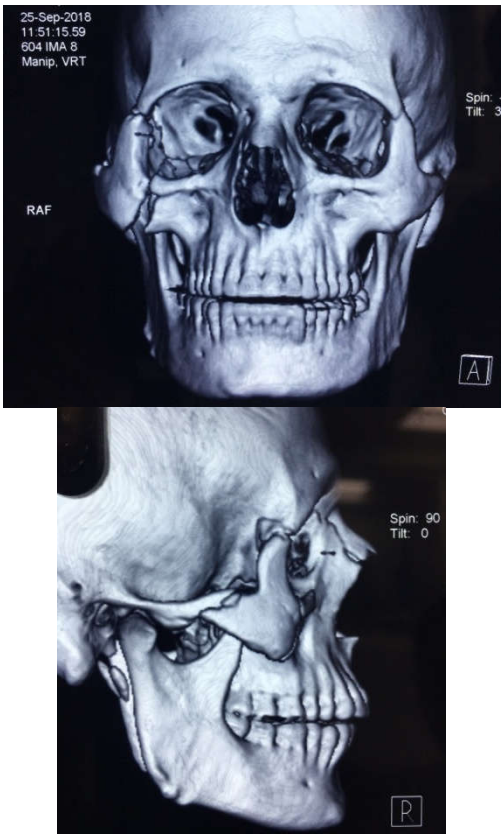

Fig 2&3, 3 D reconstruction CT, showing fracture involving right zygomaticomaxillary, right frontozygomatic and right zygomaticotemporal sutures with lateral wall of right orbit of the face.

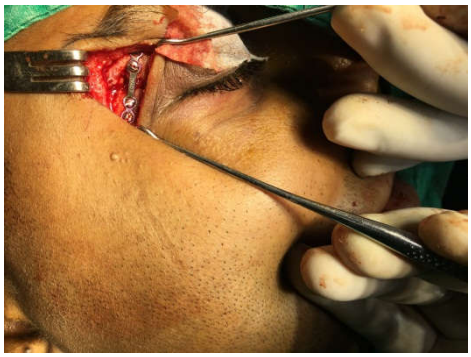

Fig 4 Titanium miniplate at frontozygomatic fracture

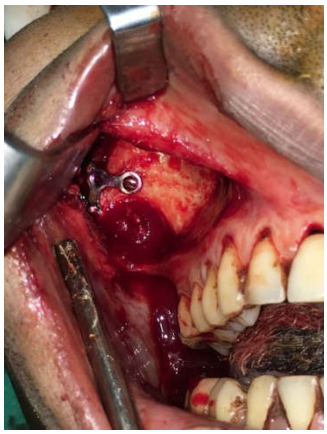

Fig 5 'Y' shaped titanium miniplte at zygomaticomaxillary fracture segment

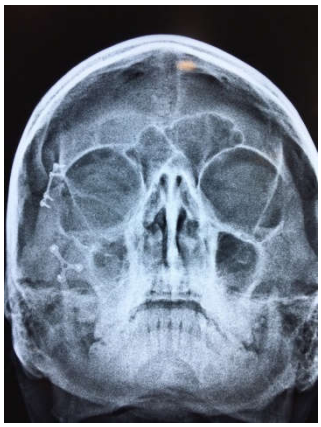

Fig 6 Post operative radiograph

DISCUSSION

TCR is defined as the sudden onset of sinus bradycardia (heart rate [HR] <60 beats/min and mean arterial pressure >20% lower than the baseline).[9] Few authors have also stated that reduction of 10% or more in the heart rate can be considered as positive trigeminocardiac reflex [10]. Because this definition cannot be applicable to all cases including those with a <20% value and to avoid the underestimation caused by this definition, Later on TCR definition came with a more inclusive and simplified version as "any sudden onset of relative bradycardia upon the stimulation of any of the 3 branches of the trigeminal nerve".[11]

The accepted mechanism for occurrence of trigeminocardiac reflex is that when any mechanical manipulation, stretching, pressure effect happens on any of the three branches or peripheral branches, the sensory nerve endings of the trigeminal nerve send impulse via Gasserian ganglion to the sensory nucleus of the trigeminal nerve forming the efferent pathway [12].

There are two types of trigeminocardiac reflex, central and peripheral. The central type is induced by stimulation of the Gasserian ganglion, which causes bradycardia, apnoea and hypotension. The peripheral type has three subtypes, oculocardiacreflex, maxilla-mandibular cardiac reflex (both inducing bradycardia, apnoea and normotension) and the third type is a diving reflex stimulated by the anterior ethmoidal nerve inducing bradycardia, apnea and hypertension [13].

In 1987, Bainton and Lizi[14] reported a case of cardiacasystole complicating the operation of a zygomaticarch fracture. Another case of bradycardia during theelevation of a zygomatic arch fracture was reported inthe same year by Loewinger *et al*.[15]Also Shearer andWensione[16] reported episodes of bradycardia duringelevations of zygomatic fractures in 1987. Robideaux[8]documented a case of a sudden decrease in heart rate(from 90 to 54 beats per minute) consonant with surgicaldisimpaction of a fractured maxilla in a 22-yearoldhealthy male.These case reports aimed to alert oraland maxillofacial surgeons and also anesthesiologists to the possible hazards during surgical elevation of afractured zygomatic arch. They suggested that trigeminocardiac reflexes (TCR) can be elicited by stimulating afferent paths other than the ciliary nerves (branches ofV1of the trigeminal nerve), which are classically associated with OCR.[14],[15]Reaume and MacNicol[17] are among the first who noticed the occurrence of this phenomenon in maxillofacial osteotomies. In 1988 they mentioned this reflex as a complication encountered during Le Fort I osteotomy in a patient with mandibulofacialdysostosis.In 1989, Matarasso,[18] a plastic surgeon, reported a case of oculocardiac reflex in blepharopl astysurgery. He describes this phenomenon as an intraoperative bradycardia exceeding 10% of the preoperative heart rate or any dysrhythmia during ocular manipulation. He introduced this reflex as a trigeminalvagal- mediated reflex arc. Roberts *et al*.[3] in 1999 reported a case of trigeminocardiac reflex during TMJ arthroscopy. Kosaka *et al*.[19] reported a unique case of oculocardiac reflex induced by zygomatic fracture.

As Schaller and Buchfelder [20] have mentioned, "The clinical importance of the TCR lies in the fact that its clinical features range from sudden onset of sinus bradycardia,bradycardia terminating asystole, asystole with no preceding bradycardia, arterial hypotension, apnea, and gastric hyper mobility." Recognition of bradycardiais the first step in treatment. Avoidance of predisposing or triggering factors, halting the surgical stimulus, IV administration of atropine or glycopyrrolate, and complementary anesthesia of the afferent nerves are mentioned as management protocol for thisreflex. Local anesthetic infiltration or afferent nerve blockade applies to the persistent cases that do not respond to primary management.[2],[3],[7]Fortunately, most cases are associated with only a 10% to 50% heart rate reduction and sinus rhythm usually returns to baseline upon stimuli cessation.[3] Most cases of TCR will therefore resolve spontaneously without any other therapeutic measures. If resolution does not happen during a reasonable amount of time after cessation of the evolving surgical maneuver (refractory bradycardia, asystole, or the development of bradycardia with hypotension), atropine or glycopyrrolate should be administered intravenously.[2],[3] Atropine would be given before epinephrine only if bradycardia was thought to be attributable to vagal stimulation and not some other cause such as hypoxia.[7]

CONCLUSION

Every surgeon performing surgery in the maxillofacial region should be aware of the occurrence of the TCR during a surgical procedure. Because the occurrence of TCR may be associated with life-threatening consequences without any significant signs, its prevention and management are crucial to the surgeon and anesthesiologist.It is essential for prudent maxillofacial surgeons to know about this sudden physiologic response, which may occur from a minor or major surgical procedure. A good knowledge about trigeminocardiac reflex is essential for proper management and correct initiatives can prevent untoward complications and morbidities. Whenever trigeminocardiac reflex is anticipated during any maxillofacial surgery a collaborative effort of maxillofacial surgeons and anaesthesiologists is mandatory and life-saving.

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