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Trigemino Cardiac Reflex: An Anesthetic Challenge In Oral And Maxillofacial Surgery

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ABSTRACT

The Trigeminocardiac Reflex (TCR) is characterized by sudden hypotension and dysrhythmia triggered by manipulation of the trigeminal nerve's branches, often starting as

bradyarrhythmias and potentially leading to asystole. This reflex, particularly noted during maxillofacial surgeries, raises significant concern among surgical and anesthetic teams. The

response involves vagal nerve activation caused by pressure on the trigeminal nerve, resulting in bradycardia, bradypnea, and altered gastrointestinal motility. TCR affects the entire

trigeminal nerve and was previously referred to as the oculocardiac reflex. Various surgical procedures, including temporomandibular joint arthroscopy and midface disimpaction, can induce TCR. This paper aims to explore TCR's pathophysiology, risk factors, treatment,

prevention, and management strategies, emphasizing the important roles of anesthetists and maxillofacial surgeons in its management. Awareness and understanding of TCR's

presentations and preventative measures are crucial for maxillofacial surgeons to mitigate its impacts

Keywords: *Aschener's Phenomenon, Bradycardia, Bradypnea, Oculocardiac reflex, Trigeminocardiac reflex, Trigemino vagal reflex*

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1. INTRODUCTION

The largest cranial nerve, the trigeminal nerve, is subject to pressure effects that cause a

series of physiological reactions known as the Trigeminocardiac Reflex, formerly known as the Aschener – Dagnini reflex (Aschener's Phenomenon) or oculo cardiac reflex. This

surprising occurrence typically occurs with surgical manipulation of craniofacial tissues in the trigeminal nerve distribution and orbital injuries. Though uncommon in daily practice

maxillofacial surgeons should be aware of this phenomenon of TCR [1].

It is a neurological response that is triggered by the vagus nerve and results in cardiac

depression. Positive TCR was defined as a change in heart rate or dysrhythmia of 10% or more from the control [2]. It results in abrupt drop-in pulse rate, with or without mean arterial blood pressure (MABP). This can lead to asystole or even cardiac collapse. Acute changes in

MABP, cardiac arrhythmia, bradycardia (more than 20% of baseline), ectopic beats, syncope, vomiting, asystole, a decrease in oxygen saturation (SPO2), and alterations in the stomach

(gastric hypermotility) are all signs of TCR [3].

2. BACKGROUND

In 1868, Joseph Breuer explained how the vagus nerves regulate breathing, and in 1870,

Florian Kratschmer explained how the nasal mucosa's reflexes affect respiration and

circulation. In 1870, Florian Kratschmer wrote on how the nasal mucosa's reflexes affected breathing and circulation. Kratschmer reported that, based on research on cats and rabbits, manipulation of the nasal mucosa resulted in the abrupt onset of cardiac dysrhythmia up toasystole, arterial hypotension, apnea, and gastric hypermotility. BERNARD ASCHER AND GUISEPPE originally defined the TCR as the OCULOCARDIAC reflex in 1908. In 1988, two anaesthetists, Shelly and Church, coined the phrase "trigeminocardiac reflex." Shelly and Church proposed renaming the reflex Trigemino cardiac (TCR) or Trigemino vagal reflex

(TVR) to be more inclusive and physically descriptive of the reaction, as it does not seem to be restricted to the ophthalmic branch [4].

3. MECHANISM

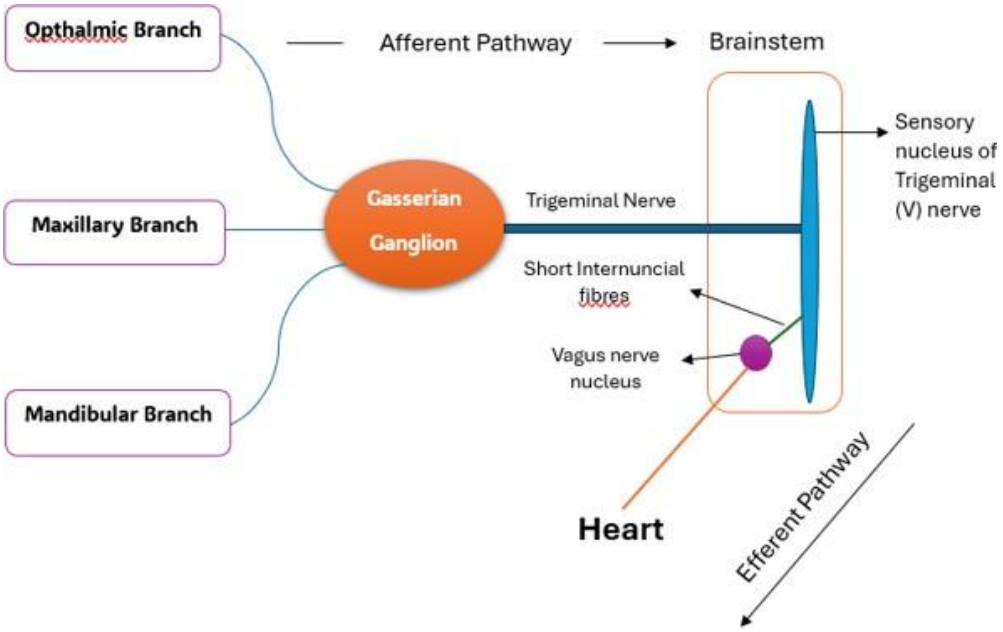
The trigeminal nerve's sensory fibers, or afferent limb, use the Gasserian ganglion to transmit messages to the trigeminal sensory nucleus. Short internuncial fibers in the reticular

formation connect the motor nucleus of the vagus nerve to the afferent arm, which in turn connects to the efferent pathway. Vagus mediates negative chronotropic and ionotropic

responses in the heart when the efferent travels and ends up in the heart's muscarinic receptors. Additionally, the efferents reach the stomach, increasing the motility of the stomach.

One apparent illustration of these physiological defenses against ischemia found in the brain is the TCR. It might belong to a class of related reactions known as "oxygen-conserving

reflexes." A strong and distinct sympathetic nerve activity occurs seconds after the start of such a response, leading to a main cerebrovascular vasodilation [4].



Classification of Trigeminocardiac Reflex

Peripheral

Gasserian ganglion

Central

The location of the trigger point determines how the trigeminocardiac reflex is traditionally classified. Stimulating the intracranial portion of the trigeminal nerve, as in neurosurgery procedures, activates a central TCR. Thus, the extracranial course of the nerve activates the peripheral TCR. A reaction to direct stimulation around the ganglion is known as a Gasserian

ganglion subtype, and it manifests clinically as a shift in heart rate or MABP or a decline in both measures. The maxilla-mandibular reflexes, and the oculocardiac reflex are further subdivided into peripheral TCR based on a branch of the afflicted trigeminal nerve.

Bradycardia, or a slowing in heart rate, is found in all subtypes. While it is not required for peripheral type, a drop in MABP is always observed in the central TCR. The occurrence of this response during intraoperative mouth opening in patients with TMJ ankylosis is still debatable, however it can be triggered by a variety of oral and maxillofacial surgical procedures, resulting in a severe or moderate reduction in heart rate and sinus rhythms. The TCR reflex is typically observed during general anaesthesia, when stimulation of the trigeminal nerve branches blunts all sympathetic responses and increases vagal activity [3].

4. PREDISPOSING FACTORS

Predisposing conditions for TCR include hypoxemia, hypercarbia, and inadequate anesthetic. The power and duration of the inciting stimuli also play a role in the significance of the drop in blood pressure and heart rate. Children experience it more acutely because their resting vagal tone is higher. TCR may be predisposed by pharmacological drugs like as beta-blockers, calcium channel blockers, and strong opioids like alfentanil and sufentanil. It has been asserted that repetitive stimuli typically cause OCR to become fatigued [4].

Table 1: Predisposing and Risk Factors for Trigeminocardiac Reflex

PREDISPOSING AND RISK FACTORS	
1	Children

2	Males
3	High sympathetic activity
4	Hypoxemia
5	Hypercarbia
6	Light anaesthesia
7	Neuromuscular blockers
8	Opiods
9	β Adrenergic blockers
10	Strength and duration of stimulus

5. CASE REPORT

A 29-year-old male patient reported to the Department of Oral and Maxillofacial Surgery with a complain of restricted mouth opening since 7 years. The patient had a history of a frontoparietal growth which was operated previously. On intraoral examination mouth

opening was 8 mm due to which the Modified Mallampati grade could not be assessed. 3D CT revealed elongation of the coronoid process posteriorly which accounted for the

restriction in mouth opening. Patient was advised for Coronoidectomy under GA.

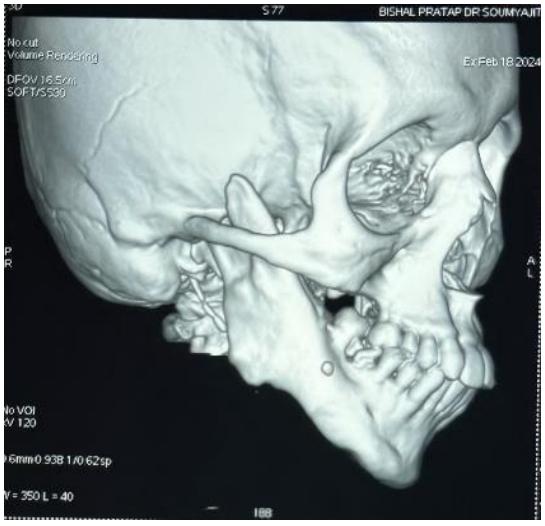


Fig. 1 3D CT showing elongation of the coronoid process

In order to intubate the patient, a tracheostomy was performed. The coronal flap was reflected after a hemicoronal incision was made. The elongated component was removed during a

coronoidectomy. After that, Heister's mouth gag was put in and the mouth was opened, which caused Bradycardia (HR from 70 to 38). This returned to 70 when the mouth was reopened and the gag was taken out. Patient was extubated and recovery was uneventful. Post

operatively patient did not complain of any complications and 25mm of mouth opening was achieved.

Fig. 2 Patient's photograph during mouth opening

6. PREVENTION AND MANAGEMENT

Incidence of TCR is bound to occur with any type of oral surgical procedures and hence its importance should not be under estimated [1]. Recognition of bradycardia is the first step in treatment. Most importantly, preoperative infiltration of the possible afferent pathway to achieve local anesthesia should block the response and is highly recommended in

Craniomaxillofacial surgeries involving manipulation of the trigeminal nerve branches [4].

Interaction between the anaesthetist and surgeon before the surgery and during the surgical procedure especially when a traction or elevation is done in craniofacial region is important

Pharmacological agents such as potent narcotics like sufentanil and alfentanil, beta-blockers, and calcium channel blockers may predispose to OCR. 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 hypermobility [1].

7. CONCLUSION

Trigeminocardiac reflex caused bradycardia after intraoperative forceful jaw opening in patients with TMJ ankylosis. Maxillofacial surgeons should understand the risk factors, prevention, and management strategies for this abrupt physiological reaction, which can occasionally be lethal, as well as how it might arise during surgical procedures

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