Asystole during Temporomandibular Joint Arthroscopy

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MOST anesthesiologists are aware that compression of the eye or traction on the extracocular muscles can cause oculocardiac reflex. Perhaps less well known is that noxious stimulation of trigeminal divisions other than the ophthalmic division (V₁) can also trigger life-threatening dysrhythmias and asystole. We present a case of asystole after stimulation of the mandibular division of the trigeminal nerve (V₃).

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5. Grant RT, Bland EF: Observations on arteriovenous anastomoses in human skin and in the bird’s foot with special reference to the reaction to cold. Heart 1931; 15:385 - 407
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Fig. 1. Asystole followed irrigation of a temporomandibular joint and lasted 20 s before ventricular escape beats appeared. The nonisoelectric segment at the end of the traces is artifactual.

analysis. After preoxygenation and a 3 mg of tubocurarine intravenously, anesthesia was induced intravenously with 550 mg sodium thiopental; 180 mg succinylcholine also was administered. A 7-mm-diameter, cuffed endotracheal tube was placed nasotracheally during direct vision. Anesthesia was maintained with isoflurane at an end-tidal concentration of 0.30-0.91% nitrous oxide at 70%, and oxygen at 50% An additional 50 µg fentanyl was administered after skin incision. The lungs were ventilated to maintain an end-tidal carbon dioxide of 29-38 mmHg. Temperature was maintained at 36.0-36.4°C. Hemoglobin oxygen saturation was 99-100%. Blood pressure ranged from 65-80 beats·min⁻¹, and blood pressure from 115/60-140/90 mmHg. No dysrhythmias were noted during induction. We administered 500 mg clindamycin and 10 mg dexamethasone intravenously.

At surgical exposure of the TMJ, the surgeons lysed fibrous adhesions posteriorly and medially after application of 1 ml of 0.5% lidocaine, with 1:100,000 epinephrine. The joint disc cartilage was partially plicated and repositioned over the condylar head to obtain good motion without slippage. Near the end of the procedure and 140 min after anesthetic induction, the joint was irrigated with water at room temperature (approximately 20°C). Concurrently, the patient experienced a complete sinus arrest (fig. 1). No pulse could be detected by detection of radial artery palpation or by pulse oximetry. The surgeon were alert, and the water was suctioned from the joint. Ventricular escape rhythm at approximately 20 beats·min⁻¹ appeared 20 s later. 800 µg atropine was administered intravenously. Heart rate promptly increased to 90-100 beats·min⁻¹ with a sinus rhythm. Blood pressure was 140/70 mmHg, and hemoglobin oxygen saturation was 99%. Irrigation of the joint was completed with water at room temperature and continuous joint suction. The procedure was completed without further incident. The patient did well postoperatively and was discharged without apparent sequelae.

Discussion

Anesthesiologists and ophthalmologists have long recognized that traction or pressure on the eye and orbital contents can precipitate an oculocardiac reflex. This reflex is polymodal and mediated afferently via V₃, and efferently by the vagus nerve. We propose that the asystole described in the current case was caused by a trigeminal-vagal reflex similar to the oculocardiac reflex, but with afferent innervation from V₃. Several facts support this hypothesis. The asystole was temporally related to TMJ irrigation. The surgeons were neither compressing the eye nor manipulating retractor during the asystole. Rather, it developed during TMJ irrigation. The patient had no known intrinsic heart disease and had not experienced any hemodynamic instability during the case. The medial, lateral, and posterior parts of the TMJ are innervated by the auriculotemporal nerve, which is derived from the posterior branch of V₃, and supplies sympathetic fibers along with the plexus of the superficial temporal artery. Small contributions from the masseter and deep temporal nerves from the anterior branch of V₃ also innervates the TMJ anteriorly, medially, and laterally. Afferent input is carried via these nerves to the trigeminal ganglion, which contains the cell bodies, and then to the trigeminal main sensory nucleus and trigeminal spinal nucleus. Short internuncial fibers exit the main sensory nucleus of the trigeminal nerve and supply the motor nuclei of the vagus nerve. The concept of reflex vagal dysrhythmia dependency on trigeminal divisions besides V₃ is not new but is not well known. Many vagal reflex events afferently mediated from the maxillary division (V₃) have been reported. Observations of bradycardia, sinus asystole, and other dysrhythmias have been noted during dissection and mobilization of bony tissues for Le Fort I and II osteotomies, facial disimpaction, zygomatic fracture fixation, and other facial surgeries (V₃). In the only study of this phenomena, 501 medical records of patients who underwent orthognathic surgery were reviewed for cardiac bradycardia and asystole. When the maxillary segment was mobilized during Le Fort I osteotomy, six patients experienced bradycardia (heart rate 20-40 beats·min⁻¹). Based on these and other cases, to distinguish bradycardia and asystole after trigeminal stimulation from the nerve-specific oculocardiac reflex, the term trigeminocardiac reflex has been advocated.
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The paucity of previous reports that stimulation to V₃ triggers cardiac events may indicate that this happens only rarely. In one study, two healthy patients undergoing TMJ arthroscopy suffered dysrhythmia during stretching of the temporalis coronoid muscle complex or detachment of muscular and tendinous fibers from the coronoid process. In one patient, bradycardia (20–30 beats/min) developed several times, and asystole developed twice, but responded favorably to glycopyrrolate and chest compression. In the other patient, bradycardia developed but resolved before treatment could be administered. In a separate report, in a young woman with coexisting disease, asystole developed during placement of a subperiosteal retractor along the medial aspect of the ascending mandibular ramus. This dysrhythmia terminated when the retractor was withdrawn and recurred when the retractor was replaced. After 0.6 mg atropine intravenously and an inferior alveolar nerve block, the reflex was ablated.

These cases of cardiac dysrhythmia after V₃ stimulation, along with the current report, are interesting for several reasons. First, the reflex developed enough intensity to cause asystole in three of the four cases. Second, bradycardia did not precede asystole in two patients. Third, the reflex recurred when the retractors were repositioned. We treated our patient immediately with atropine and did not allow an opportunity for recurrence. Such recurrences may imply that, unlike the oculocardiac reflex, the trigeminocardiac reflex mediated via V₃ may fatigue more slowly than the oculocardiac reflex. Fourth, all these patients probably received succinylcholine, whereas only two patients likely received fentanyl. Fentanyl, succinylcholine, and succinylmonocholine can induce enough vagal activity to elicit bradycardia. The quantity of either drug 145 min after administration in the current case, however, was very small, and probably contributed negligibly to vagal output or sensitization. We speculate that these considerations may indicate that V₃-mediated cardiac events, unlike the oculocardiac reflex, are more likely to present with asystole and less likely to fatigue with time.

Several maneuvers are available to treat the trigeminovagal reflex. In the current case, cessation of irrigation probably disrupted the reflex. Eliminating the stimulus was previously noted to be the best first step. Muscarinic antagonism with atropine or glycopyrrolate is controversial during the acute event, because some think that this therapy may convert a sinus bradycardia into ventricular premature contraction and bigeminy. Administration of atropine, however, is deemed safe after heart rate has recovered due to stimulus removal. To our knowledge, no investigators have explored treatment of V₃-mediated dysrhythmia with external transcutaneous or transesophageal pacing. Like the oculocardiac reflex, avoidance of hypercapnia may help prevent V₃-mediated dysrhythmia. Once asystole has occurred, treatment with stimulus elimination may be all that is necessary, as occurred in the current case. Some anesthesiologists, however, may prefer to follow the algorithm recommended for asystole by the American Heart Association, which includes cardiopulmonary resuscitation, endotracheal intubation, transcutaneous pacing, epinephrine, and atropine.

This disparity between the incidence of cardiac events and the trigeminal divisions may be related to different underlying physiologic mechanisms or neural pathways, different intensities of stimuli during surgery, different frequencies of surgery in tissues innervated by the three trigeminal divisions, or a combination of these reasons.

In summary, we reported a case of cardiac dysrhythmia after stimulation of the mandibular or V₃ division of the trigeminal nerve. Based on the paucity of previous reports, V₃ apparently mediates trigeminovagal reflexes infrequently compared with the other trigeminal branches but may be associated with more serious dysrythmias. Clinically, this report emphasizes that vagal reflexes can be caused not only by afferent stimulation from V₃ (oculocardiac reflex), but also by stimulation of the other divisions of the trigeminal nerve. Anesthesiologists should be wary of cardiac dysrythmias during mandibular or TMJ surgery.

References


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