

A Case of Vasovagal Syncope Induced by Tooth Extraction

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Abstract

Background: Vasovagal syncope (VVS) is a neurogenic reflex-mediated fainting episode characterized by sudden, transient, and self-limiting symptoms. While VVS accounts for a significant portion (around 60%) of emergent medical events in dental practice, it remains an underrecognized condition among dental professionals, often misdiagnosed as hypoglycemia, conversion disorder, or epilepsy. This case report describes a VVS episode induced by tooth extraction, aiming to improve dental clinicians' awareness and diagnostic approach to VVS. **Case Presentation:** A 35-year-old female visited the dental department in April 2022 with a two-year history of food impaction in the upper right molar. Examination revealed an elongated, discolored, and tender tooth 18, lacking proper occlusion with the opposing tooth. After confirming no contraindications, the tooth was extracted using a minimally invasive technique. Following the procedure, the patient experienced dizziness upon standing; her blood pressure was 69/47 mmHg, and her heart rate was 65 bpm. The nursing staff assisted her to sit as she showed limb weakness, closed eyes, and briefly lost consciousness. Oxygen was administered, and her blood glucose was 6.5. Blood pressure later improved to 124/78 mmHg, with a pulse of 62 bpm. Oral glucose was given, which she vomited, and emergency services were called. Upon arrival, the patient was alert and cooperative. Neurology consultation and imaging (MRI, MRA, and DWI) ruled out cerebral infarction, initially diagnosing a conversion disorder. A subsequent tilt-table test, including sublingual nitroglycerin, induced a marked blood pressure drop and symptoms confirming a diagnosis of vasovagal syncope (VVS). **Conclusions:** This case shows that preoperative anxiety, fear, and prolonged waiting can trigger vasovagal reflex during tooth extraction, especially in patients with anxiety or cardiac arrhythmias. For such patients, preoperative precautions and intraoperative cardiac monitoring are advised. In cases of VVS, quick actions like monitoring blood pressure, placing the patient in a supine position, providing oxygen, and administering IV fluids or medications like atropine, if necessary, can help stabilize the patient.

Keywords

Tooth Extraction, Vasovagal Syncope, Diagnosis

1. Background

Vasovagal syncope (VVS) has the highest occurrence rate among emergent medical events related to dental diagnosis and treatment, accounting for approximately 60% of the overall events. However, the overall incidence of VVS is extremely low. According to a recent retrospective study conducted at a single center in Japan, out of 1,146,929 patients, only 42 patients (0.0037%) experienced emergent medical events related to dental procedures, with over 60% of these events being vasovagal syncope [1]. The low incidence and sudden nature of vasovagal syncope often lead to improper management by most dental practitioners when encountering this condition for the first time [2]. This article combines case analysis with literature review to explore the clinical features and diagnostic and treatment measures of VVS, aiming to enhance the understanding and diagnosis of vasovagal syncope among oral healthcare providers.

2. Case Presentation

The patient, a 35-year-old female, presented to the dental department in April 2022 with a complaint of food impaction in the upper right molar over the past two years. Upon oral examination, tooth 18 was elongated, discolored, and tender, with no proper occlusal relationship with the opposing tooth. After ruling out contraindications for tooth extraction, a minimally invasive dental elevator was used to remove the affected tooth (Figure 1).



Figure 1. Panoramic radiograph of tooth 18, showing elongated and fused roots, with the apex positioned distally from the maxillary sinus. This image helps assess the complexity of the extraction and may contribute to understanding procedural triggers for VVS due to prolonged surgical manipulation and patient anxiety.

3. Diagnosis and Treatment

Before Extraction: Patient reported anxiety and fear regarding the procedure.

Immediately After Extraction: The patient experienced dizziness upon standing, and her blood pressure was measured at 69/47 mmHg with a heart rate of 65 beats per minute. Nursing staff helped her to sit, noticing limb weakness, closed eyes, and brief unconsciousness.

After Oxygen Administration and Glucose Water: Blood pressure improved to 124/78 mmHg; the patient regained alertness but vomited the glucose water.

Emergency Department Arrival: Examination showed normal neurological responses. MRI, MRA, and DWI scans ruled out cerebral infarction (**Figure 2**).

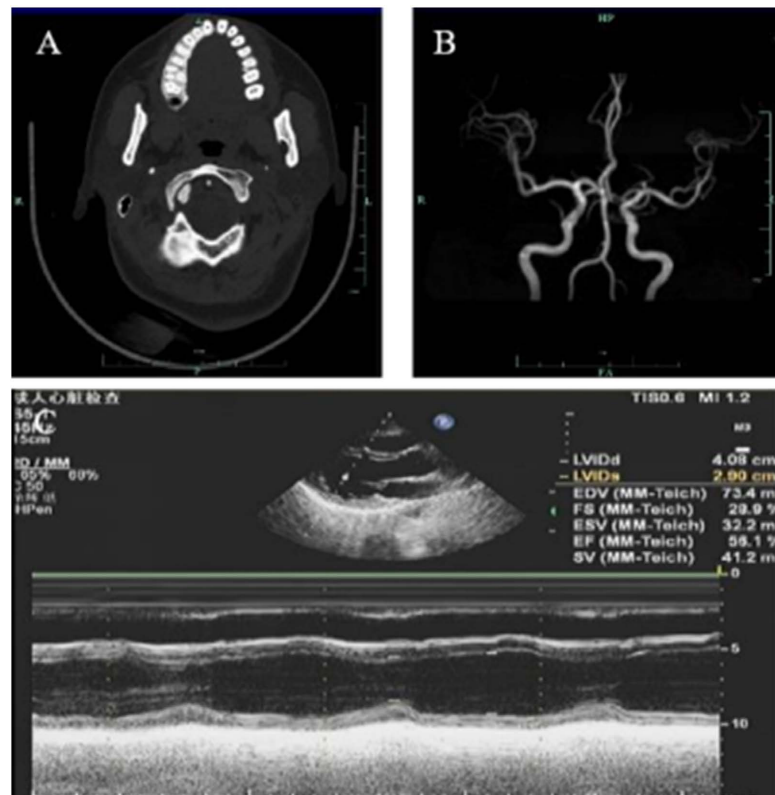


Figure 2. CT, MRI and color Doppler images of the patients. A. CT plain scan of head; B MRA cerebrovascular imaging; C color Doppler echocardiography. No abnormality was found in CT, MRI and color Doppler echocardiography.

Tilt-Table Test: This was conducted later, where sublingual administration of 0.5 mg nitroglycerin led to a significant blood pressure drop, confirming the VVS diagnosis.

4. Discussion

This case involved a patient who had food impaction in the upper right molar for 2 years. The patient sought treatment at our dental department and exhibited nervousness and complained of pain and fear during the waiting and surgical procedures. Upon standing up after the surgery, the patient suddenly felt dizzy, had weakness in the limbs, closed their eyes, became unresponsive, and experienced a brief loss of consciousness. The blood pressure was measured at 69/47 mmHg with

a heart rate of 65 beats per minute. The patient was transferred to the emergency department and consulted with the neurology department. After undergoing brain CT, MRI + MRA + DWI examinations, and laboratory tests, cerebral infarction was ruled out, and a preliminary diagnosis of conversion disorder was made. Subsequently, a tilt table test confirmed vasovagal syncope (VVS). The incidence of VVS caused by tooth extraction is low. Due to its sudden, transient, and atypical symptoms, as well as insufficient awareness among dental professionals, it is prone to misdiagnosis and delayed treatment. Therefore, the clinical diagnosis, treatment, and prognosis of VVS as an emergency medical event in dental surgery should attract the attention of oral clinicians.

5. Etiology and Pathogenesis

Most vasovagal reflexes can be directly activated by the hypothalamus cardiovascular center in the medulla, leading to peripheral vasodilation, reduced cerebral blood flow, decreased venous return, cardiac arrest, bradycardia, hypotension, and syncope [3]. Broadben *et al.* [4] found that VVS can be triggered by patient anxiety during routine dental treatments (35.7%), pain and fear related to local anesthesia (31.4%), anxiety regarding tooth extraction and other oral surgeries (18.6%), and direct observation of blood (5.7%). In this case, the patient continuously expressed fear of tooth extraction to the triage nurse and attending physician during the waiting and treatment processes, exhibiting high levels of anxiety. Prolonged waiting in the queue exacerbated this uneasiness. Furthermore, after anesthesia injection, the patient complained of significant pain. Considering these factors, the patient experienced VVS.

The patient was hospitalized in our hospital for 4 days. During this period, there were slight fluctuations in the condition. On the third day of hospitalization, the patient suddenly felt weak. After resting in a supine position for 2 hours, the condition improved. Unlike most VVS patients who recover and are discharged within a day, this patient did not exhibit spontaneous recovery and discharge. Studies have shown that patients with vasovagal syncope experience a sharp decrease in venous blood return, leading to excessive ventricular contraction due to sympathetic nervous system overactivity and compensatory activation of the parasympathetic nervous system, resulting in bradycardia. Therefore, in patients with underlying arrhythmias, there is an increased risk of exacerbation of symptoms during vasovagal reflex. Additionally, in cases of reduced circulating blood volume, symptoms may worsen and persist due to a temporary decrease in cardiac output [5] [6]. This patient had a history of arrhythmia, which may be the main factor contributing to the aggravation and prolonged course of the symptoms in this case.

6. Clinical Presentation

The clinical manifestations of VVS mainly include the following three aspects: first, transient blood pressure drop, pale complexion, cold sweats, and occasional symptoms of urinary or fecal incontinence. Second, due to the vasovagal reflex in the gastrointestinal tract, visceral symptoms may occur, such as nausea and

vomiting. Third, cardiac symptoms may manifest as bradycardia, cardiac arrest, chest pain, myocardial ischemia, or even severe symptoms of myocardial infarction, as the ischemia and blockage of the heart lead to myocardial infarction [7].

7. Diagnosis and Differential Diagnosis

Research has shown that VVS is often misdiagnosed as hypoglycemia (31.4%), epilepsy (20%), and conversion disorder (14.7%). The reasons for misdiagnosis can be divided into two aspects: 1) insufficient awareness of VVS among attending physicians, leading to biased thinking. When certain system symptoms are prominent before syncope occurs, only diseases related to that system are considered. For example, if a patient experiences headaches and dizziness, only systemic diseases are considered without comprehensive analysis, resulting in misdiagnosis. 2) Insufficiently detailed medical history and physical examination, failing to recognize the importance of the tilt table test in diagnosing VVS [8] [9].

Preliminary examinations for VVS include comprehensive medical history, physical examination, electrocardiogram (ECG), and orthostatic blood pressure measurement. Measurements of blood pressure in the supine and standing positions or during active standing may reveal the potential risk of orthostatic intolerance in patients [10] [11]. In the absence of structural heart disease, a detailed medical history, including a family history, can contribute to the diagnosis in most cases. Based on the medical history and preliminary examinations, a tilt table test is required for confirmation [11]. The tilt table test is the most commonly used method for diagnosing VVS in clinical practice. The Chinese Journal of Cardiovascular Diseases Tilt Test Task Force proposed the “Recommendations for Tilt Testing in the Diagnosis of Vasovagal Syncope in China” in 1998. According to these recommendations, if either of the following criteria “1)” or “2)” is met during the tilt table test, along with the occurrence of near syncope or syncope in the patient, it can be considered a positive diagnosis:

1) Blood pressure drop: Systolic blood pressure ≤ 80 mmHg and/or diastolic blood pressure ≤ 50 mmHg, or a decrease in mean arterial pressure $\geq 25\%$.

2) Bradycardia: Sinus bradycardia (<50 beats/min), sinus pause replaced by junctional escape rhythm, or a transient second-degree or higher atrioventricular block, or a cardiac pause lasting more than 3 seconds.

In this case, after the tooth extraction procedure, the patient complained of dizziness and had a blood pressure measurement of 69/47 mmHg, along with a brief loss of consciousness, which is consistent with the above diagnostic criteria.

8. Treatment and Prognosis

Currently, there is no unified standard for the treatment of patients who experience vasovagal syncope. Most cases of vasovagal syncope do not require any medication, but if necessary, drugs such as ephedrine, intravenous fluids, and atropine can be administered. The Trendelenburg position is not recommended for the treatment of vasovagal neurogenic syncope because it can increase regurgitation

and airway issues, leading to cerebral swelling, increased respiratory difficulties, and the risk of falling off the dental chair [12] [13]. Some patients with hyperventilation syndrome may experience respiratory pauses or hypoxia after hyperventilation, accompanied by loss of consciousness and cyanosis, leading to serious complications. According to literature reports, the following steps can be taken for the diagnosis and treatment of patients who experience vasovagal syncope after tooth extraction: 1) Have the patient lie flat and elevate their legs, which can lead to rapid recovery; 2) Ensure airway patency; 3) If the patient recovers slowly, administer oxygen therapy at a rate of 15 L/min [10] [14]. Due to transient loss of consciousness and decreased muscle tone, vasovagal syncope patients are susceptible to vomiting and choking incidents when consuming liquids orally, so oral fluid intake for volume replacement is not recommended. Research reports show that approximately 90.5% of dental treatment-related emergency medical events patients can recover and be discharged on the same day, while 10% of patients may require hospitalization [1]. The prognosis for vasovagal syncope patients is generally good, but the recurrence rate is high. Studies have shown that by evaluating the number of syncope cases in the previous year, the overall 1-year recurrence rate for vasovagal syncope is estimated to be around 25% - 35% [15]. Most vasovagal syncope patients will spontaneously recover within a short period without specific treatment, although the exact reasons for the recovery are still unclear [16] [17].

9. Conclusion

The VVS in patients undergoing tooth extraction is relatively rare in clinical practice, but it significantly impacts their quality of life. Particularly in severe cases, VVS can even trigger cardiovascular events such as myocardial infarction and heart failure, highlighting the importance of dentists' attention to this condition. This case demonstrates that preoperative emotional anxiety, fear, and prolonged waiting time may trigger the patient's vasovagal reflex, with a concomitant risk of exacerbating VVS through cardiac arrhythmias. For patients with a history of anxiety, fear, and cardiac arrhythmias, necessary measures should be taken prior to surgery to mitigate these risks and intraoperative monitoring of the patient's cardiac rhythm changes should be conducted. In the event of VVS, prompt monitoring of blood pressure fluctuations, placing the patient in a supine position, providing oxygen supplementation, and, if necessary, administering intravenous infusion of glucose or saline to restore blood volume and blood pressure, or administering medications such as atropine, should be considered.

Author Contributions

Liu Boli was responsible for the tooth extraction surgery, patient follow-up, and manuscript writing. Dai Qingyun was responsible for literature review and analysis. Zhang Yong was responsible for manuscript review and revision. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the fundamental principles of the Declaration of Helsinki.

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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