

Bradyarrhythmia and hypotension during anesthetic induction—reconsideration of nifedipine: a case report

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Abstract

Cardiac events sometimes occur during anesthesia and surgery and may be severe or even life-threatening. This report describes a case of severe bradyarrhythmia during anesthetic induction with propofol, midazolam, sufentanil, and vecuronium. The patient took nifedipine sustained-release tablets on the morning of surgery as routine treatment for hypertension, and this medication may have contributed to the bradyarrhythmia. Nifedipine is a calcium channel blocker that can dilate blood vessels, depress the activity of the sinoatrial node, and delay the conduction of the atrioventricular node. Although these effects are not usually significant, they may be enhanced by anesthetics or other concomitant drugs. For patients of advanced age, especially those with autonomic disturbance or cardiac abnormalities, these effects can be remarkable, and discontinuation of nifedipine should be considered.

Keywords

Bradyarrhythmia, hypotension, nifedipine, anesthesia, advanced age, case report

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Introduction

Induction of anesthesia can greatly affect the activity of the heart. Cardiac arrhythmia sometimes occurs, and some cases are life-threatening. For patients who already have cardiac abnormalities or are taking cardiac medications, the arrhythmogenic effects of anesthetic induction are more

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remarkable. The present report describes a case of severe bradyarrhythmia during anesthetic induction with propofol, midazolam, sufentanil, and vecuronium. The patient took nifedipine sustained-release tablets on the morning of surgery as routine treatment for hypertension, which may have contributed to the bradyarrhythmia.

Case presentation

The patient was a 67-year-old man (175 cm, 77.5 kg) with a 6-year history of hypertension treated by nifedipine sustained-release tablets at 30 mg daily and losartan hydrochlorothiazide at 62.5 mg/daily. He also had a 20-year history of diabetes treated by acarbose at 50 mg three times daily and subcutaneous injection of insulin daily. His blood pressure and glucose concentration were well regulated. His prostate-specific antigen concentration was 11 ng/mL 14 days before admission, which was much higher than that 2 years previously (6 ng/mL). A tubercle was found in the left peripheral zone of the prostate by magnetic resonance imaging. Prostatic cancer was finally diagnosed through biopsy. The patient was scheduled to undergo laparoscopic radical prostatectomy. His electrocardiogram (ECG) on admission revealed a wandering pacemaker within the sinoatrial node, but the patient denied any cardiac symptoms.

Upon arrival in the operating room, the patient had a blood pressure of 175/80 mmHg, sinus rhythm, heart rate of 55 beats/minute (ECG), and oxygen saturation of 98% on room air (fraction of inspired oxygen, 21%). Air with a fraction of inspired oxygen of 100% was then supplied through a facemask, and the patient's oxygen saturation reached 100% within 5 minutes. A catheter was inserted into the right radial artery, through which continuous invasive blood pressure monitoring was performed, beginning at 170/88 mmHg.

Anesthesia was induced by sequential infusion of midazolam (1 mg), sufentanil (15 µg), propofol (150 mg, two infusions), and vecuronium (50 mg).

Immediately after the second infusion of propofol, the patient's heart rate suddenly increased to >105 beats/minute and maintained this rate for several seconds. His heart rate then sharply dropped to <30 beats/minute, with a simultaneous decrease in his blood pressure from >130/80 mmHg to 80/35 mmHg. His ECG showed premature ventricular contractions. Ephedrine (15 mg) was immediately given in two infusions. His heart rate increased to >60 beats/minute and his blood pressure returned to >125/80 mmHg. The results of a blood gas analysis were within normal limits. Tracheal intubation was then smoothly performed. The ECG revealed occasional supraventricular premature beats until 10 minutes after administration of the ephedrine. Propofol (4–6 mg/kg/hour), remifentanil (8–15 µg/kg/hour), and vecuronium (1 µg/kg/minute) were intravenously administered for maintenance of anesthesia.

Laparoscopic radical prostatectomy was completed within 2 hours. During the whole surgical procedure, the patient's blood pressure and heart rate remained stable at around 130/80 mmHg and 60 beats/minute, respectively. The ECG showed sinus rhythm. After surgery, the patient was smoothly extubated in the operating room and sent to the post-anesthesia care unit for further recovery. He was then sent back to the urology ward, and his postoperative course was uneventful until discharge from the hospital.

The reporting of this study conforms to the CARE guidelines.¹ All protocols in this study were general and conventional without inducing additional risks or outcomes. Therefore, the requirement for ethics approval was waived. All patient details have been de-identified in this manuscript,

and both verbal and written consent to treatment was obtained from the patient.

Discussion

Bradycardia sometimes occurs perioperatively, and some cases are induced by the administration of anesthetics. Propofol reduces the heart rate; this is mediated through direct depression of sinoatrial pacemaker activity and by a reduction in cardiac sympathetic tone.² Sufentanil enhances vagal tone and diminishes sympathetic outflow, which can attenuate cardiovascular responses during tracheal intubation.³ Midazolam and most non-depolarizing neuromuscular blockers show minor effects on autonomic functions, and they are therefore not associated with significant cardiac responses. For patients without severe heart disease, all of these anesthetics are usually safe. This leads to the question: What happened in the present case?

First, the patient's preoperative condition was analyzed with particular focus on his treatment with nifedipine. This drug is a calcium channel blocker that is commonly used as primary treatment for hypertension. Through dilation of blood vessels, nifedipine reduces the blood pressure rather rapidly, making it appropriate for perioperative management of hypertension. However, the frequent occurrence of reflex tachycardia is one of its disadvantages and is often a concern of anesthesiologists.⁴ In the present case, tachycardia did not occur until the second infusion of propofol. This transient tachycardia was likely still a reflexive reaction to the drop in blood pressure, which was induced by a combination of the effects of both nifedipine and the anesthetics (especially propofol and sufentanil).

The most concerning events in this case were the subsequent severe bradycardia and hypotension, which may have become life-threatening if not treated

properly in a timely manner. The autonomic effects of propofol and sufentanil probably at least partly contributed to these phenomena. However, this raises the question of why these events do not occur in many other patients during anesthetic induction? Three possible reasons are as follows. First, nifedipine is a calcium channel blocker and is thus able to depress the activity of the sinoatrial node and delay the conduction of the atrioventricular node.⁵ Although these effects are not usually significant, they were enhanced by the anesthetics in this case. As a result, bradycardia and consequent hypotension occurred. Second, the carotid sinus baroreflex may be disturbed by propofol,⁶ which would inhibit the development of reflexive tachycardia and result in the development of a repeating hypotension-bradycardia pattern.

Third, losartan may also have contributed to the patient's severe bradycardia and hypotension. Losartan is an angiotensin II receptor antagonist with antihypertensive activity. Severe hypotension after induction of general anesthesia was observed in a patient receiving an angiotensin II receptor antagonist and an alpha-blocker.⁷ Moreover, losartan has been found to have important anesthetic implications, among which intraoperative hypotension is the most widely recognized.⁸ Therefore, losartan was also likely responsible for the hypotension in the present case. Notably, however, one study showed that short-term use of losartan did not alter the sympathetically mediated responses during anesthesia.⁹ This may explain two aspects of the present case: that the reflexive tachycardia induced by nifedipine was preserved and that the ephedrine treatment was effective.

Other factors may also contribute to the development of bradycardia and hypotension in cases such as this. First, the autonomic function of the cardiovascular system in patients with diabetes mellitus

can be disturbed, and more arrhythmias can occur in these patients.¹⁰ Second, the number of sinus node pacemaker cells and their activity decrease with age, whereas vagal tone simultaneously increases; this makes the hearts of older patients susceptible to the effects of anesthetics and the development of bradyarrhythmia.¹¹ Finally, the patient in the present case was diagnosed with a wandering pacemaker within the sinus node. This is considered to be a normal variant and can occur in the absence of heart disease; it appears to result from excess vagal tone.¹² Could this situation differ during anesthetic induction? Further considerations are required.

Sublingual nifedipine for treatment of hypertension has been forbidden by the United States Food and Drug Administration. Among the adverse effects of nifedipine, hypotension and tachyarrhythmia are the most concerning among anesthetists. This case provides additional evidence for more cautious use of this calcium channel blocker preoperatively, especially when used concomitantly with other drugs such as losartan.

For patients who already have autonomic disturbance caused by diseases such as diabetes mellitus, stopping nifedipine prior to surgery should be considered. Otherwise, administration of anticholinergic agents may be helpful based on our experience with several other similar cases. Further investigations might provide fresh evidence for preoperative treatment.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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