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CASE REPORT

Tachyarrhythmia Ventricular Tachycardia Following Injection Neostigmine: A Rare Case Report

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ABSTRACT

Background: Neostigmine methyl sulfate, a quaternary ammonium compound with anticholinesterase activity, is routinely employed for the reversal of non-depolarising neuromuscular blockade. Despite its favourable safety profile, cardiovascular complications, including bradycardia, atrioventricular block, and, in rare instances, ventricular arrhythmias, have been documented.

Case description: We describe the case of a 58-year-old female with diabetes mellitus, hypertension, bronchial asthma, and post-thyroidectomy status on thyroxine, who underwent Functional Endoscopic Sinus Surgery under general anaesthesia. Neuromuscular blockade with vecuronium was reversed postoperatively using neostigmine and glycopyrrolate; however, the patient subsequently developed stable monomorphic ventricular tachycardia. Pharmacologic intervention with lidocaine and amiodarone restored sinus rhythm.

Literature review: Although neostigmine is more frequently associated with bradyarrhythmias, isolated cases of ventricular tachyarrhythmias have been reported. Beta-agonist and thyroxine use may upregulate myocardial β-receptors, thereby enhancing susceptibility to cholinergic-induced arrhythmogenesis, particularly in the perioperative setting.

Clinical relevance: This case highlights the importance of anticipating arrhythmic complications in patients receiving chronically administered sympathomimetic and thyroid replacement therapies. Perioperative vigilance and readiness to manage such adverse events are essential when reversing neuromuscular blockade with anticholinesterase agents.

KEYWORDS

• Ventricular tachycardia • Neostigmine • Glycopyrrolate

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INTRODUCTION

Neostigmine methylsulfate is a widely used anticholinesterase agent in anaesthetic practice, primarily for reversing neuromuscular blockade induced by non-depolarizing muscle relaxants. By inhibiting acetylcholinesterase, neostigmine increases the concentration of acetylcholine at the neuromuscular junction, facilitating muscle contraction and recovery from paralysis. Despite its therapeutic benefits, neostigmine is associated with various cardiovascular side effects, including bradycardia, atrioventricular (AV) block, and even cardiac arrest in susceptible individuals.[1,2]

The risk of adverse effects may be increased in patients with preexisting conditions or those on multiple medications that influence cardiac function. Chronic use of beta-agonists in patients with bronchial asthma can lead to beta-receptor upregulation, potentially increasing the risk of tachyarrhythmias when exposed to cholinergic agents like neostigmine.[3,4]. Additionally, patients who have undergone thyroidectomy and are on thyroxine may experience altered cardiac responses due to hormonal influences on myocardial receptors.[1]

This case report describes a 58-year-old female patient with a complex medical history who developed stable monomorphic ventricular tachycardia following the administration of neostigmine and glycopyrrolate for reversal of neuromuscular blockade at the end of surgery. The interplay between her chronic medications and the pharmacological effects of neostigmine raises important considerations for anaesthetic management in similar patients.

Case presentation

A 58-year-old female patient (height, 160 cm; weight, 65 kg) with chronic sinusitis was admitted for Functional Endoscopic Sinus Surgery (FESS) under general anaesthesia. She had a history of diabetes mellitus for the past 18 years and is currently receiving oral hypoglycemic agents (metformin 500 mg three times daily). Additionally, she was hypertensive and took ramipril 5 mg once daily. The patient also had bronchial asthma, managed with levosalbutamol and ipratropium inhalers (400 µg, 2 puffs twice daily). Ten years ago, she had undergone thyroidectomy and had been on thyroxine (100 µg once daily) since her previous anaesthetic history was unremarkable.

A preoperative physical examination revealed a heart rate of 88 beats per minute and blood pressure of 130/80 mmHg. The room air saturation level was 98%, and the preoperative laboratory values were unremarkable, with normal electrolyte levels. Thyroid-stimulating hormone (TSH) was measured at 4.4 IU/L, and both electrocardiogram (ECG) and echocardiography (ECHO) were normal, showing an ejection fraction of 62% with no regional wall motion abnormalities.

In the operating room, multiparameter monitors were connected to assess the heart rate, non-invasive blood pressure, oxygen saturation, temperature, and end-tidal carbon dioxide (ETCO2). After premedication with ondansetron (4 mg), pantoprazole (40 mg), and fentanyl (100 µg), the patient was preoxygenated with 100% oxygen for three minutes. Induction was achieved using propofol (120 mg IV), followed by ventilation. Succinylcholine (100 mcg IV) was administered for tracheal intubation using a 7.5 mm orotracheal cuffed endotracheal tube. Anesthesia was maintained with a mixture of oxygen, nitrous oxide, and sevoflurane (0.7 L: 0.8 L: 2%). The patient's condition remained stable throughout the two-hour procedure.

After the surgery, the patient was reversed with neostigmine (2.5 mg) and glycopyrrolate (0.4 mg) once she began to develop spontaneous respiratory efforts. Two minutes after neostigmine administration, the patient experienced stable monomorphic ventricular tachycardia with a heart rate of 130 beats/min. Her pulse volume was good, regular, and rapid, and her blood pressure increased to 170/90 mm Hg. A call for assistance was made and a defibrillator was prepared in the case of rhythm conversion to unstable ventricular tachycardia. Loxicard (60 mg IV) was administered, followed by a waiting period of two minutes. Since the rhythm did not revert to a normal sinus rhythm, amiodarone (150 mg IV) was given over five minutes. The rhythm subsequently reverted to normal sinus rhythm with a heart rate of 65 beats per minute and a blood pressure of 130/80 mmHg.

A bedside echocardiogram confirmed normal left ventricular function, with an ejection fraction of 62% and no regional wall motion abnormalities. Extubation proceeded uneventfully, and the patient remained hemodynamically stable throughout the

postoperative period. There were no signs of electrolyte imbalance postoperatively, nor were there any further episodes of dysrhythmia. Two days later, the patient was discharged without complications.

DISCUSSION

Neostigmine methylsulfate is an anticholinesterase agent that is used to reverse the effects of non-depolarizing skeletal muscle relaxants. Neostigmine is known to cause adverse cardiovascular effects, such as hypotension, syncope, and cardiac arrhythmias, including bradycardia, AV block, and cardiac arrest.[5] In this case, the patient underwent a thorough preoperative evaluation and had an uneventful intraoperative period. The patient developed stable monomorphic ventricular tachycardia following the injection and neostigmine within 2 min of administration.

This patient was on beta-agonist treatment with anticholinergics for a long duration for bronchial asthma, which could have caused upregulation of beta receptors, making the patient prone to tachyarrhythmias following neostigmine treatment. The patient had undergone thyroidectomy under general anaesthesia 10 years previously, which was uneventful. The details of the drug administered are not available to the patient, but presumably, the patient would have received neostigmine even during thyroid surgery for reversal but claims to be uneventful. Therefore, the sensitization of myocardial receptors could be secondary to thyroxine intake or upregulation of beta receptors, which requires further study.

The patient received long-term beta-agonist treatment and anticholinergic medications for bronchial asthma, potentially causing beta-receptor upregulation and increasing susceptibility to tachyarrhythmias after neostigmine administration. She had undergone thyroidectomy under general anaesthesia ten years ago without complications, likely involving neostigmine for neuromuscular blockade reversal. This uneventful experience suggests that myocardial receptor sensitization might be influenced by chronic thyroxine intake or beta-receptor upregulation, warranting further investigation into arrhythmias in patients receiving anaesthesia and neuromuscular blocking agents. Given the cardiovascular risks of neostigmine, including arrhythmias, close monitoring is essential for patients taking multiple cardiac-affecting medications. Chronic beta-agonist and anticholinergic use may create a unique risk profile that requires careful anaesthetic management.

In 1995, Rodriguez *et al*. reported bradycardia and asystole following atropine-neostigmine administration after caesarean section in a parturient receiving methyldopa for pregnancy-induced hypertension.[6] In 2005, Zeidan and Baraka reported a case of ventricular fibrillation following an atropine-neostigmine mixture in a patient with undiagnosed mitral valve prolapse.[7] In 2004, Ali and Akhtar described a case of cardiac arrest following the administration of neostigmine and atropine, which was detected and managed successfully.[8]

Table 1: Comparison of reported cases of severe cardiac arrhythmias following neostigmine administration

Author(s)	Year	Setting	Adverse Event	Outcome	Notes
Rodríguez *et al*.[6]	1995	C-section (Methyldopa)	Bradycardia, Asystole	Resolved	With methyldopa
Zeidan & Baraka[7]	2005	Unknown	Ventricular fibrillation	Resuscitated	MVP undiagnosed
Ali & Akhtar[8]	2004	Reversal	Cardiac arrest	Resuscitated	Atropine-neostigmine
Present Case	2024	FESS surgery	Ventricular tachycardia	Reverted with Amiodarone	Beta-agonist + thyroxine

CONCLUSION

Conduction abnormalities, bradycardia, and asystole are relatively common and are anticipated after neostigmine administration. However, patients who are on multiple drugs, especially beta-agonists and other cardiac stimulants, may have upregulated beta receptors and may develop tachyarrhythmia, as in our case. Therefore, vigilant monitoring and precautions should be taken while administering neostigmine to these patients.

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