Case Report

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Corticosteroid-induced bradycardia following high-dose methylprednisolone administration: a case report

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Introduction: Besides their wide use in the clinical field due to their anti-inflammatory and immune-modulating effect, corticosteroids still have a lot of adverse effects. The most common adverse effects are hyperglycemia, hypertension, osteoporosis, psychosis, immunosuppression, weight gain, and hyperlipidemia. Another important side effect is cardiac arrhythmias.

Case presentation: We report a case of a 43-year-old woman with multiple sclerosis who developed symptomatic bradycardia after 3 days of treatment with a high dose of methylprednisolone. The patient received a dose of atropine and her bradycardia resolved after 36 h of stopping methylprednisolone.

Discussion: While tachyarrhythmias are more common, bradyarrhythmias such as bradycardia and premature atrial or ventricular contraction are rare but crucial to be considered.

Conclusion: Corticosteroid-induced bradycardia is usually in sinus rhythm and has an unknown etiology, possibly occurring at high and low doses. The majority of cases in the literature were asymptomatic and resolved spontaneously.

Keywords: bradycardia, corticosteroid, multiple sclerosis, side effects

Introduction

Acute inflammatory diseases and some autoimmune diseases are treated with corticosteroids.

Physicians should be mindful of the cardiovascular side effects of short-term steroids, even though hyperglycemia, electrolyte abnormalities, hypertension, osteoporosis, and gastritis are the more frequent side effects of steroid therapy. When patients receive short-term intravenous steroids, researchers have reported changes in blood pressure, heart rate, cardiac dysrhythmias, and even fatalities[1]. Individuals receiving high doses of corticosteroids1–82% have been reported to experience cardiac arrhythmias as one of the side effects; bradycardia is an unusual occurrence following corticosteroid therapy and is frequently asymptomatic[2].

HIGHLIGHTS

- Corticosteroid-induced bradycardia is an increasingly reported rare phenomenon.
- Bradycardia is usually asymptomatic and resolves spontaneously upon corticosteroid cessation.
- Symptomatic patients can present with chest pain, dyspnea, lightheadedness, and syncope, requiring close monitoring and management.
- Electrolyte and cardiac monitoring during corticosteroid treatment is essential in patients with predisposing factors.

Case presentation

A 43-year-old Middle Eastern female with a 25-year history of poorly controlled multiple sclerosis (MS) presented to the emergency department complaining of unilateral blurred vision and painful left eye movement that started 3 days before presentation. Apart from the poorly controlled MS with frequent flares, her past medical history, surgical history, and traumatic history were unremarkable. Additionally, she had not taken any medications as she had completely stopped MS treatment 3 months before the presentation. Vital signs were stable (blood pressure of 115/60 mmHg, heart rate of 82 bpm, and body temperature of 37°C), and a full neurological and ophthalmologic examination was compatible with optic neuritis. Therefore, she was admitted to the hospital, and methylprednisolone 1000 mg diluted in 150 ml of 0.9% normal saline was intravenously administered daily over 30–40 min.

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On the third day of treatment, the patient experienced a sudden onset of chest tightness, palpitations, and lightheadedness 2 h after the methylprednisolone infusion. An electrocardiogram documented sinus bradycardia of 41 beats per minute (bpm) (Fig. 1). Blood pressure at that time declined to 100/50 mmHg, while other vital signs, including respiratory rate, body temperature, and oxygen saturation, were within normal limits. Aside from the symptomatic sinus bradycardia, the cardiorespiratory examination was totally normal, and the neurological examination did not reveal any changes or signs of increased intracranial pressure. A full laboratory workup showed no abnormalities suggestive of any underlying causes of bradycardia (Na: 141 mEq/l, Ca: 9.22 mg/dl, P: 3.1 mg/dl, Mg: 1.9 mg/dl, TSH: 1.32 mU/l, WBC $=8.4\times10^{9}$/l, SGPT: 25 mg/dl, total bilirubin: 0.4 mg/dl). Echocardiography revealed no structural cardiac abnormalities as well. After excluding all arrhythmia-provoking factors, the Adverse Drug Reaction Probability (Naranjo) Scale was applied with a score of 7, which indicated a probable causal association[3].

Thus, the diagnosis of corticosteroid-induced bradycardia was highly suggested, and corticosteroid treatment was discontinued.

The patient was transferred to the cardiac care unit, and the symptomatic episode of bradycardia was terminated by 0.5 mg of intravenous (i.v.) atropine, which improved the heart rate to about 83 bpm. The patient experienced a total of three episodes of bradycardia in the following hours, all of which were treated concomitantly with atropine with a good response. A complete resolution of sinus bradycardia was observed 36 h after cessation of methylprednisolone treatment. As our patient was asymptomatic and vitally stable, she was discharged with her own preference to complete her MS treatment and follow-up as an outpatient.

Discussion

Corticosteroids are widely used immunosuppressant medications with anti-inflammatory properties. Long-term usage of corticosteroids can lead to side effects such as hyperglycemia, hypertension, peptic ulcers, muscle weakness, and Cushing syndrome[4]. Cardiological serious side effects, including arrhythmias and sudden death[5]. For instance, high-dose intravenous methylprednisolone has been reported to cause hypotension, myocardial infarction, and asystole[6].

In recent years, corticosteroid-induced arrhythmias have been increasingly reported. These arrhythmias could manifest as tachyarrhythmias (such as sinus tachycardia and atrial fibrillation), bradyarrhythmias (such as sinus bradycardia), or premature atrial or ventricular contractions. While sinus tachycardia is the most common corticosteroid-induced arrhythmia, sinus bradycardia remains the most prevalent corticosteroid-induced bradycardia, which is usually benign, asymptomatic, and well-tolerated in the absence of underlying heart or renal diseases[4,7,8]. Corticosteroid-induced bradycardia is typically reported following high-dose intravenous corticosteroid treatment. However, some cases reported sinus bradycardia associated with low-dose intravenous or oral corticosteroid treatment[9].

While most patients with corticosteroid-induced arrhythmias are asymptomatic, the most common symptoms include chest pain, palpitations, lightheadedness, and syncope[4]. Our patient experienced a sudden onset of chest tightness, palpitation, and

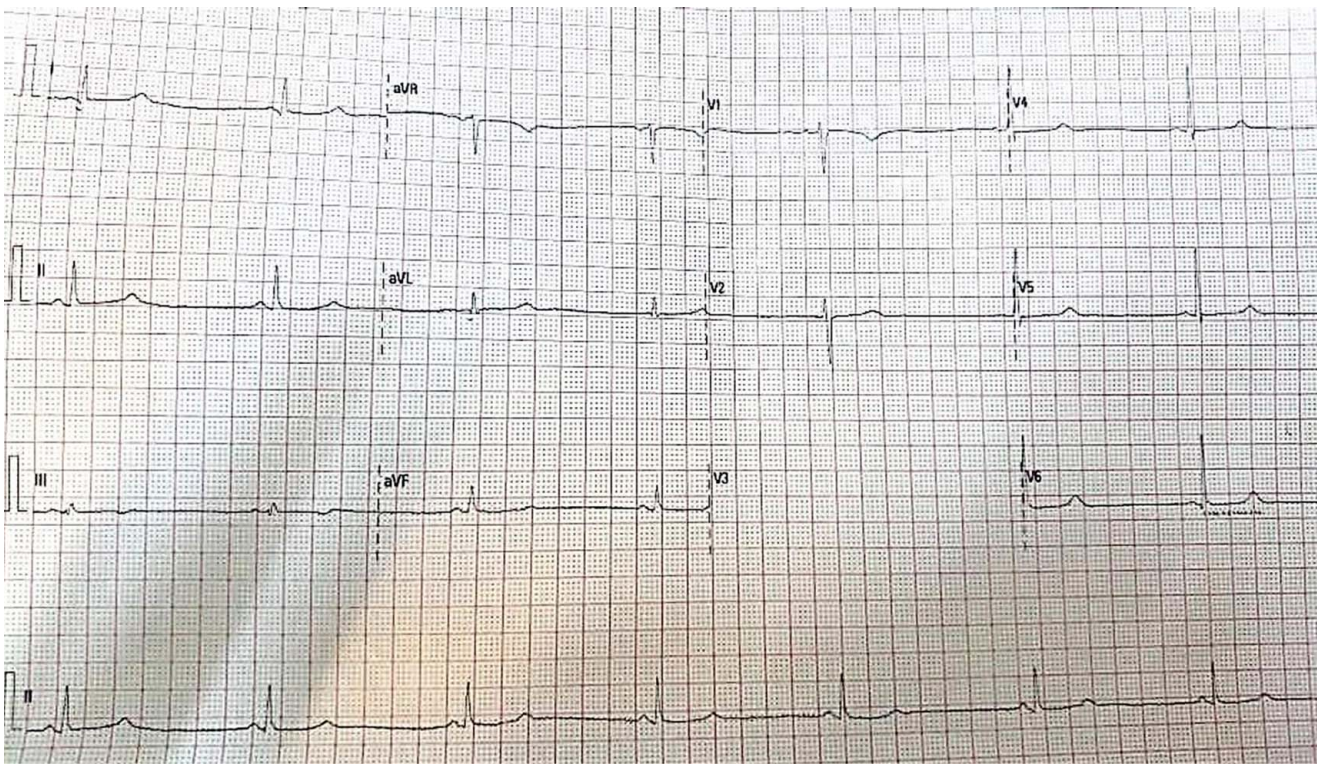

Figure 1. An electrocardiogram documented sinus bradycardia of 41 beats per minute (bpm).

lightheadedness after the administration of high-dose (1000 mg/day) intravenous methylprednisolone as a treatment for a multiple sclerosis flare-up.

A delay in symptoms onset, typically ranging between 1 and 7 days, as in our case, is a common finding. This delayed-onset bradycardia makes it challenging to suspect corticosteroid treatment as the underlying cause. Additionally, this 'silent' bradycardia can lead to sudden death linked to pulse corticosteroid treatment[5].

Many predisposing factors for corticosteroid-induced bradycardia have been suggested, including male gender, smoking, the presence of renal or cardiac comorbidities, autonomic abnormalities such as disruption of the bladder or bowel sphincter, and fast corticosteroid infusion rates (especially less than 30 min)[7,9].

However, none of these factors was present in our patient.

The exact etiology of corticosteroid-induced bradycardia remains unclear despite a number of theories proposed to explain it. One possible explanation is baroreceptor-mediated reflex bradycardia triggered by hypertension. However, this mechanism lacks supportive evidence as many cases in the literature are reported in normotensive patients, including our case[10]. Another hypothesis is that corticosteroids might induce sudden changes in electrolyte levels by acting on the mineralocorticoid receptors in the kidneys, causing renal potassium excretion and, thus, hypokalemia[5]. However, most cases in the literature, including our case, did not have any alterations in their serum electrolyte levels.

The majority of cases with corticosteroid-induced sinus bradycardia reported in the literature demonstrated spontaneous recovery over a varying amount of time following therapy discontinuation or dosage reduction[10]. In our case, in addition to corticosteroid discontinuation, the patient was treated with 0.5 mg i.v. atropine, which terminated the symptomatic episode of sinus bradycardia. Throughout the next few hours, the patient had three bradycardia episodes that were managed accordingly.

In conclusion, corticosteroid-induced bradycardia is an increasingly reported rare phenomenon. Bradycardia is usually asymptomatic and resolves spontaneously upon corticosteroid cessation. However, symptomatic patients can present with chest pain, dyspnea, lightheadedness, and syncope, requiring close monitoring and management. Given its unclear etiology, we believe that electrolyte and cardiac monitoring during corticosteroid treatment is essential in patients with predisposing factors.

Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

Consent

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

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Author contribution

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Conflicts of interest disclosure

The authors declare no conflicts of interest.

Guarantor

All authors have read and approved the manuscript. On behalf of all the contributors, I, Sultaneh Haddad, will act as guarantor and will correspond with the journal from this point onward.

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Data sharing is not applicable to this article.

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