The vicious cycle of BRASH syndrome: A case report and a brief review of literature

ABSTRACT

BRASH syndrome is a constellation of bradycardia and shock in patients with renal failure, atrioventricular (AV) nodal blocking agents, and hyperkalemia. This syndrome commonly occurs in the elderly population with compromised renal function and a history of taking AV nodal blocking agents on a regular basis (1).Hypovolemia and worsening of renal function are considered to be the major risk factors. It is clinically essential to take these manifestations as a syndrome rather than isolated findings because they are interrelated and have synergistic effects. These pathophysiologic processes contribute to a vicious cycle of bradycardia and decreased cardiac output leading to organ dysfunction including renal failure with hyperkalemia, further augmenting bradycardia. It is usually associated with high morbidity and mortality (2). Typically, the treatment involves increasing renal blood flow by augmenting cardiac output using catecholamine infusion. Very rarely, interventions such as intralipid emulsion and continuous renal replacement therapy (CRRT) may be required on a case-to-case basis. Promptly recognizing the symptoms of BRASH syndrome can help to avoid diagnostic delays and reduce mortality rates. Here we present a patient in whom clues in history led to early recognition and aggressive treatment of BRASH. Thus, preventing shock and reducing morbidity, mortality.

Keywords: atrioventricular node blocker; bradycardia; BRASH; hyperkalemia; renal failure; shock

INTRODUCTION

The term BRASH syndrome (Bradycardia, Renal failure, Atrioventricular (AV) nodal blocking agent, Shock, and Hyperkalemia) was first coined in 2016 by Dr Josh Farkas. He proposed a pathophysiologic cycle of events leading to a vicious cycle precipitated by renal failure, leading to hyperkalemia and accumulation of AV nodal blockers like beta-blockers (BB) or calcium channel blockers (CCB) (3). Both hyperkalemia and AV nodal blockers cause bradycardia and hypoperfusion, which make renal failure worse. Many cases are often misdiagnosed and managed as isolated electrolyte abnormalities such as hyperkalemia that can lead to catastrophic events if left untreated.

CASE PRESENTATION

In this report, we present a 66-years-old male, who presented with generalized fatigue, vomiting and many episodes of syncope. The patient was a known case of coronary artery disease, heart failure with low ejection fraction (25%), stage 3 chronic kidney disease, type-2 diabetes mellitus, and hypertension. He was compliant with his medications, including bisoprolol 2.5 mg once daily (OD), sacubitril/valsartan 25 mg twice daily, Furosemide 40 mg OD, and spironolactone

12.5 mg OD. On first medical contact, the patient was mildly drowsy but oriented to time, place, and person. His Glasgow Coma Scale upon presentation was 15/15. He was dehydrated. His blood pressure was 76/55 and his heart rate was 25 beats per minute. The rest of his physical examination was unremarkable. He had an electrocardiogram (ECG) which was remarkable for bradycardia with a junctional rhythm The results of his routine biochemistry blood tests revealed severe hyperkaliemia 6 mEq/L, Metabolic acidosis, acute on chronic kidney failure (creatinine at 35 g/L , GFR of 17mls/min which had deteriorated from a baseline of 40 mls/min) .The rest of his biochemistry blood tests were within the normal range.

Fluid resuscitation was initiated with vasopressor agents. Urgent treatment of his hyperkaliemia with calcium gluconate, regular insulin with dextrose, salbutamol inhalation was undertaken. In evolution, his heart rate, and blood pressure improved, urgent dialysis was arranged due to his refractory hyperkalemia (5.4 mmol/L), and a temporary transvenous pacemaker was inserted for ~~his~~ initial stabilization due to the persistence of bradycardia.

Discussion

Hyperkalemia and AV-nodal blocking agents can cause bradycardia. However, in cases of underlying renal dysfunction, bradycardia itself can exacerbate hyperkalemia, triggering a vicious cycle of multiorgan dysfunction called BRASH syndrome (Bradycardia, Renal Failure, AV-nodal blockers, Shock, Hyperkalemia) (4).

The critical pathophysiologic characteristic of this syndrome involves a synergistic effect of hyperkalemia and AV nodal blockers resulting in bradycardia. Causative agents are typically BB or CCB, as in the present cases (5). Although these classes of medications are generally well-tolerated and benign, they may cause significant AV nodal blockade when patients have precipitating events, such as systemic infection, leading to acute kidney injury, reduced clearance of drugs, and further declining renal function. Clinicians should be careful when starting patients on AV nodal blocking agents with a prior history of chronic kidney disease or with any concerns for acute kidney injury, as it could increase the risk of developing this syndrome(6).

Diagnosis of BRASH syndrome is mainly based on the clinical manifestations, ECG findings, and complete metabolic panel, once other possibilities are ruled out. The index of suspicion should be high while encountering patients with refractory bradycardia, elevated serum potassium, renal failure, and history of AV nodal blocking drugs (7).

Prompt identification of the syndrome can play a crucial role in mortality reduction. Initial management should be directed at membrane stabilization with calcium gluconate, correction of hyperkalemia with dextrose in insulin infusion, and salbutamol nebulization. Electrolyte correction and fluid replacement are some of the critical factors in the management of BRASH, even if classic ECG findings of hyperkalemia are absent (8). Additionally, early hemodialysis should be considered to remove excess potassium from the body. Furthermore, timely transvenous pacing and judicious use of inotropes can be lifesaving in cases of refractory hemodynamic instability.[9] As BRASH syndrome is a diagnostic and therapeutic challenge, understanding the pathophysiology and timely diagnosis of this recently recognized entity is of tremendous importance for prompt management and better patient outcomes(9).

Conclusions

BRASH is a life-threatening yet largely underdiagnosed condition. Patients with BRASH syndrome may present with nonspecific complaints, posing both diagnostic and therapeutic challenges. BRASH warrants increased awareness among clinicians, as it may be treatable by early diagnosis and eliminating precipitating factors. The cornerstone management of BRASH remains to treat hyperkalemia, improve renal function by addressing underlying causes, and, most importantly, eliminate AV nodal blocking agents to stop the vicious cycle.

Conflict of interest declaration on behalf of all co-authors.

Role played by each author to be declared.

Consent declaration – Did the authors obtain permission to write the article to narrate the patient's history?

The References should be written to a publishable-standards because the references were not good for publication and I have made changes to the referencing so the authors to reflect upon and incorporate.

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