

The Vicious Cycle of BRASH Syndrome: A Case Report on Diagnosis and Management in a Complex Patient

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Introduction:

BRASH syndrome, an acronym for bradycardia, renal failure, AV nodal block, shock, and hyperkalemia, is a rare but serious clinical syndrome. It is underdiagnosed due to overlapping symptoms with more common conditions such as isolated hyperkalemia or AV nodal blocker toxicity. It is typically seen in patients on AV nodal blocking agents, in the context of underlying renal impairment, leading to a vicious cycle of bradycardia, worsening renal function, and escalating hyperkalemia. If not promptly recognized and treated, BRASH syndrome can rapidly progress to hypotension and end-organ failure, known as shock.

Figure 1

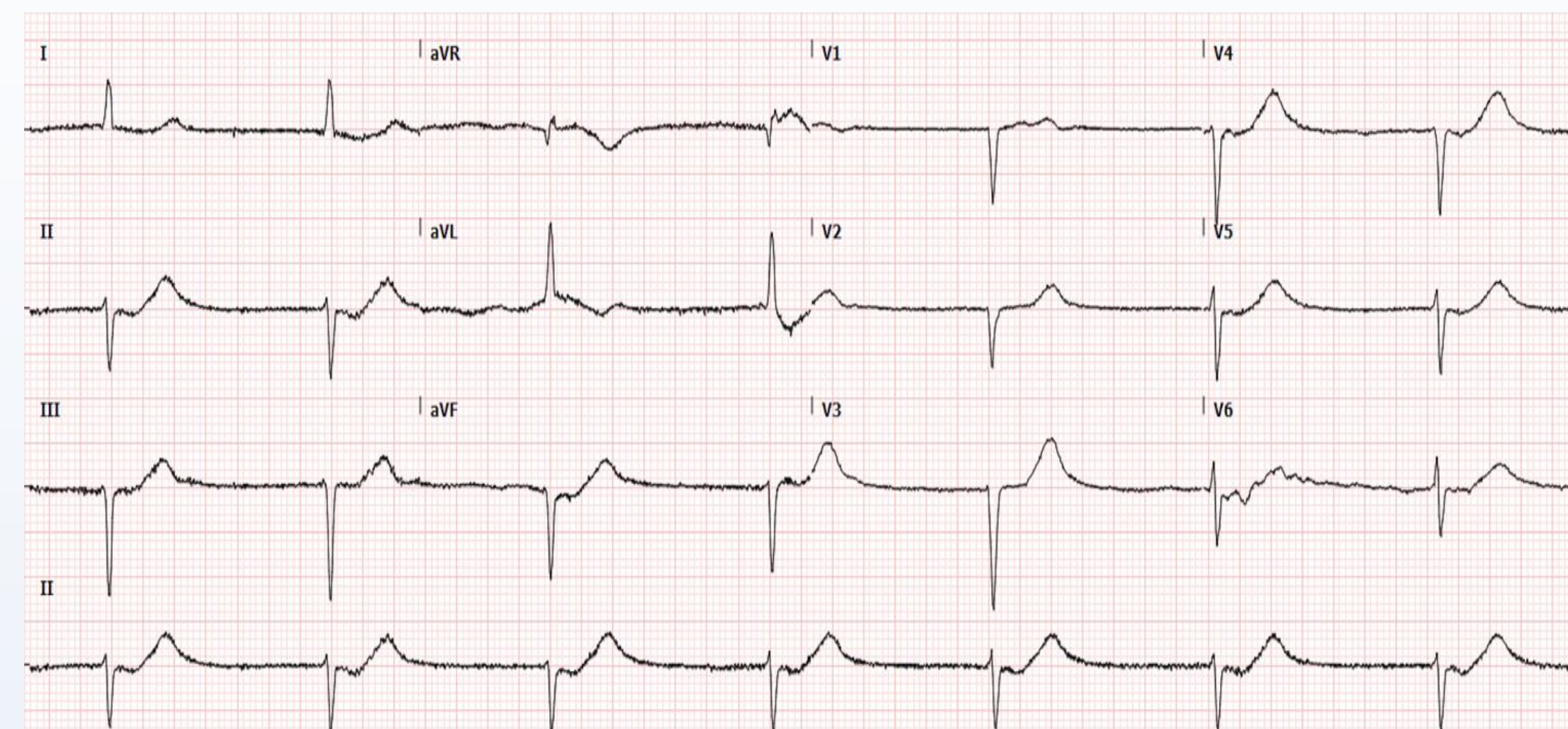


Figure 2

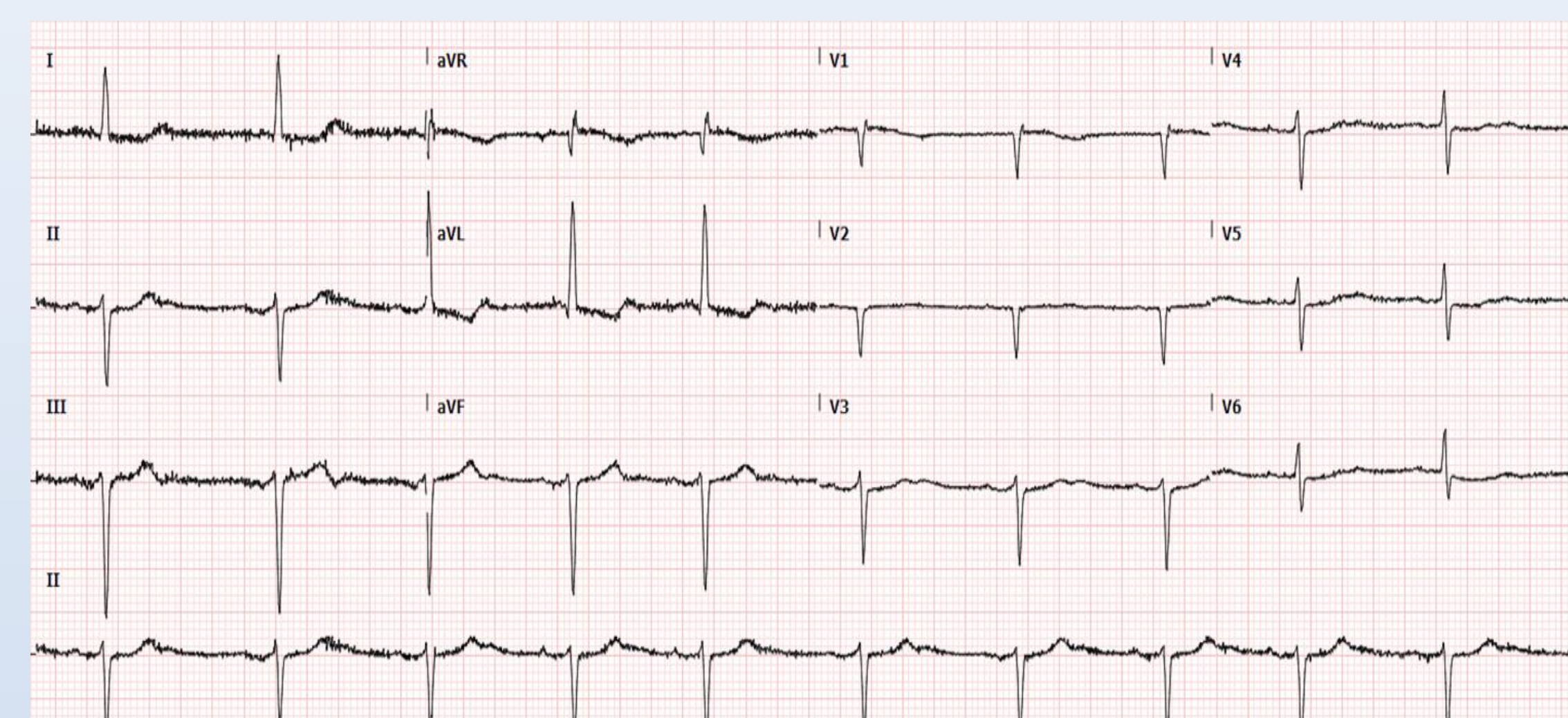


Figure 1. ECG with bradycardia and junctional escape rhythm with left anterior fascicular block upon presenting to ED.

Figure 2. Sinus rhythm with sinus arrhythmia with left anterior fascicular block after resolution of BRASH

Case Presentation:

An 88-year-old female with a history of heart failure with preserved ejection fraction (HFpEF), paroxysmal atrial fibrillation, and insulin-dependent diabetes presented to the emergency department with lightheadedness and dizziness. She had previously been hospitalized multiple times for pulmonary edema and volume overload. Her medication regimen included amiodarone, spironolactone, and carvedilol recently switched from metoprolol succinate. On presentation she was found to have bradycardia to the 30s, hypotension with MAPs in the 50s, oliguria, hyperkalemia, and elevated creatinine levels. Her initial assessment had a high suspicion for BRASH syndrome in the setting of bradycardia with recent changes to her beta blocker regimen as well as hyperkalemia and renal dysfunction. Treatment involved withholding AV nodal blockers, administering IV fluids and IV calcium gluconate, and managing hyperkalemia with diuretics. Despite initial fluid resuscitation the patient developed acute hypoxic respiratory failure requiring careful monitoring and adjustment of her fluid status. She eventually stabilized with diuresis, and her creatinine levels returned to baseline.

Discussion:

BRASH syndrome is a clinical constellation of symptoms resulting from the synergistic effects of hyperkalemia and AV nodal blockers leading to a dangerous cycle of bradycardia and renal dysfunction. Differentiating BRASH syndrome from pure hyperkalemia or AV nodal blocker toxicity can be challenging, as symptoms and objective data often overlap. This case highlights the importance of considering BRASH syndrome in patients with bradycardia, renal dysfunction, and hyperkalemia, particularly in the context of recent medication changes or dose up-titration. Treatment should focus on managing each component of the syndrome, with careful attention to the patient's overall fluid status and medical history.

Conclusion:

BRASH syndrome is a complex condition that requires early recognition and comprehensive management to prevent progression to shock and multi-organ failure. Clinicians should maintain a high index of suspicion for BRASH syndrome in patients with coexisting hyperkalemia, bradycardia, and renal dysfunction, particularly those on AV nodal blocking agents. Proper identification and treatment of the underlying cause are crucial in breaking the vicious cycle of BRASH syndrome and improving patient outcomes. Further research is needed to better understand the pathophysiology and optimal management strategies for this underrecognized syndrome.

Reference:

- Saini T, Reny J, Hennawi HA, Cox A, Janga C, DeLiana D, McCaffrey J. The vicious cycle of BRASH syndrome: A case report. *Glob Cardiol Sci Pract.* 2023 Jan 30;2023(1):e202302. doi: 10.21542/gcsp.2023.2. PMID: 36890842; PMCID: PMC9988297.
- Wong CK, Jaafar MJ. Bradycardia, renal failure, atrioventricular nodal blockade, shock, and hyperkalemia: An important syndrome to recognize. *Turk J Emerg Med.* 2021 Feb 12;21(2):86-89. doi: 10.4103/2452-2473.309138. PMID: 33969246; PMCID: PMC8091996.
- Hegazi MO, Aldabie G, Al-Mutairi S, El Sayed A. Junctional bradycardia with verapamil in renal failure--care required even with mild hyperkalaemia. *J Clin Pharm Ther.* 2012 Dec;37(6):726-8. doi: 10.1111/j.1365-2710.2012.01352.x. Epub 2012 May 9. PMID: 22568727.
- Farkas JD, Long B, Koyfman A, Menson K. BRASH Syndrome: Bradycardia, Renal Failure, AV Blockade, Shock, and Hyperkalemia. *J Emerg Med.* 2020 Aug;59(2):216-223. doi: 10.1016/j.jemermed.2020.05.001. Epub 2020 Jun 18. PMID: 32565167.