

Case Report

Third-degree atrioventricular block followed by syncope, labile hypertension, and orthostatic hypotension in a patient with nasopharyngeal cancer: baroreflex failure

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Abstract: Baroreflex failure is a rare cause of syncope and labile blood pressures. Here, we present a case of baroreflex failure in a patient with history of nasopharyngeal cancer, status-post neck radiation. A 76-year-old male presented from an outside facility for possible pacemaker placement as he was found to have symptomatic third-degree atrioventricular (AV) block. The AV block resolved following discontinuation of the patient's his verapamil. The patient then developed labile blood pressures. A work-up for secondary causes of hypertension was negative, but due to the patient's neck radiation history, it was suggested that the labile blood pressures were due to baroreflex failure. We then started the patient on clonidine and other nonpharmacological interventions. The blood pressure was maintained after these treatments and on follow-up, the labile blood pressures had resolved. Our case demonstrates that baroreflex failure can be managed without any invasive intervention by performing frequent blood pressure measurements along with medication management.

Keywords: Baroreflex failure, liable blood pressure, liable hypertension, third-degree atrioventricular (AV) block, syncope, electrophysiologist, electrophysiology

Introduction

Baroreceptors are mechanoreceptor sensory neurons that are excited by stretching of the corresponding blood vessel. They act through an instantaneous negative feedback response system called baroreflex to buffer large changes in blood pressure [1, 2]. The carotid baroreceptors are in the carotid sinuses which are close to the bifurcation of the internal carotid artery from the common carotid artery. They are innervated via a branch of the glossopharyngeal nerve (CN IX). Aortic arch baroreceptors are innervated by the vagus nerve (CN X) [1]. Baroreflex failure is mainly characterized by volatile blood pressures and heart rates due to the loss of buffering mechanism provided by the baroreceptor reflex. Baroreflex failure can occur after neck radiation, surgery, and cerebrovascular accidents involving the damage to brainstem nuclei, resulting in impaired blood pressure regulation [3, 4]. Neck radiation can be complicated with a late-onset of baroreflex failure [1]. Despite being well-documented in the medical literature, baroreflex failure

remains an under-diagnosed cause of labile hypertension with orthostatic changes [2]. While damage of the carotid sinus is an established cause of baroreflex failure, radiation-related damage of the baroreceptors in the aortic arch may have similar consequences [1]. Patients with baroreflex failure typically present with postural lightheadedness, presyncope, syncope, orthostatic hypotension, and also labile hypertension, which can also be found in autonomic nervous system failure. In fact, baroreflex failure is included in the spectrum of autonomic nervous system failure and typically presents with systolic and diastolic hypertensive episodes, tachycardia, and hypotension alternating with relative bradycardia at rest [2]. Here, we present a case of baroreflex failure in a patient with a history of nasopharyngeal cancer status-post neck radiation.

Case presentation

A 76-year-old male with a past medical history of hypertension, hypothyroidism, diabetes mellitus, and nasopharyngeal cancer status post

Case of labile blood pressures secondary to baroreflex failure

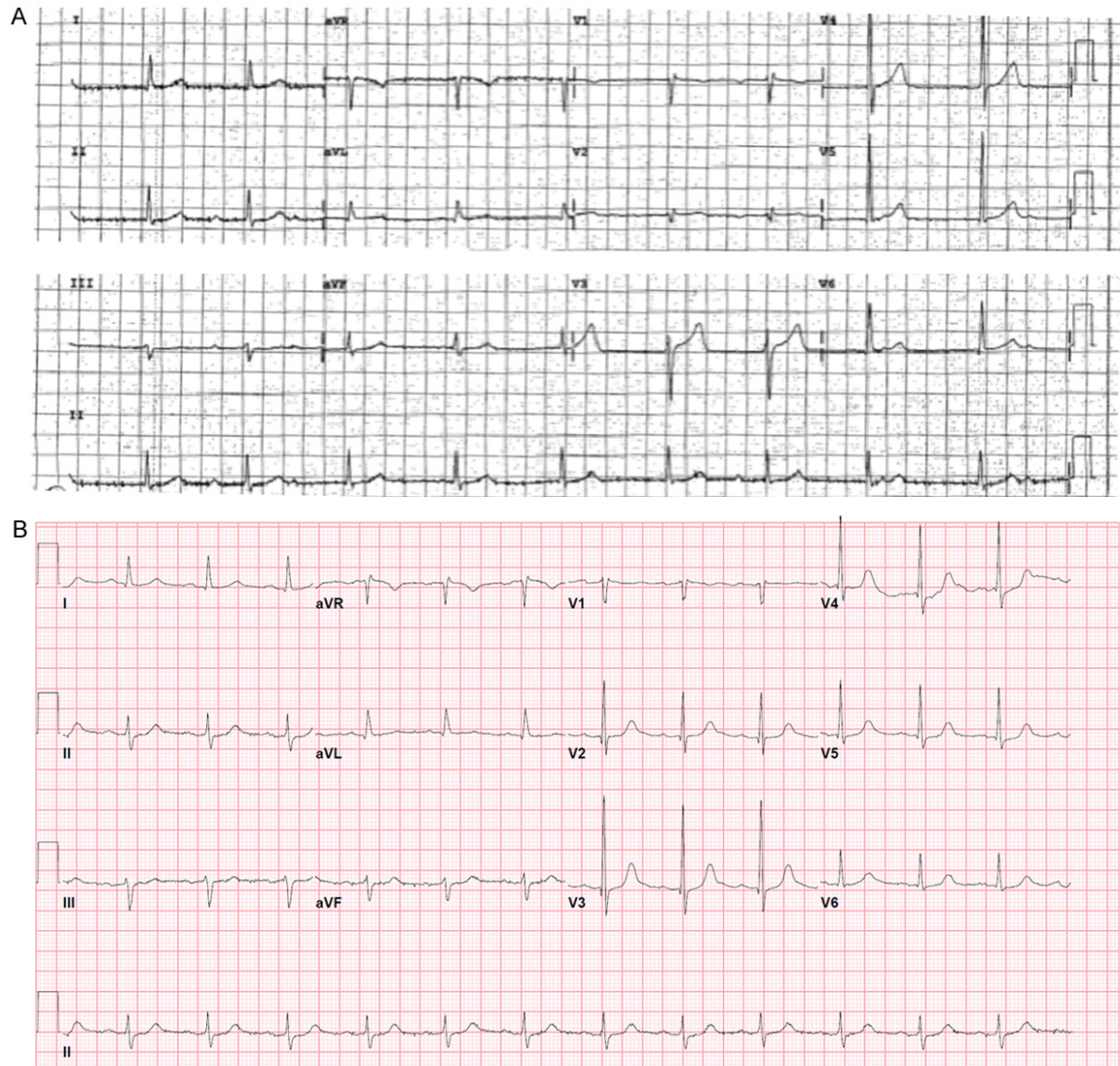


Figure 1. A: The patient's 12-lead ECG with third-degree atrioventricular (AV) heart block on presentation with nausea, vomiting, and a syncopal episode at the outside facility. B: The patient's 12-lead ECG with normal sinus rhythm after discontinuation of verapamil.

radiation treatment presented from an outside facility with nausea, vomiting, syncope, and subsequent finding of severe bradycardia with a third-degree atrioventricular (AV) block (**Figure 1A**). He was given atropine and followed by a dopamine infusion. The patient was then transferred to our facility for possible pacemaker placement. Note that he was taking verapamil at home for blood pressure management. Upon transfer to our facility, the electrophysiology team was consulted for possible pacemaker placement. As per their suggestion, verapamil was discontinued due to the AV block. Upon discontinuing verapamil, his AV block

resolved and he returned to normal sinus rhythm (**Figure 1B**). The electrophysiology team also suggested a 30-day event monitor upon discharge, with possible pacemaker placement in the future if the AV block returned. Prior to discharge, on hospital day 3, the patient was noted to have labile blood pressures with systolic blood pressures ranging from 70 to 220 mmHg. He was also found to have orthostatic hypotension. Due to these labile blood pressures, and associated symptoms of dizziness and headache, all of his antihypertensive medications were discontinued. Even with this intervention, the patient continued to have epi-

Case of labile blood pressures secondary to baroreflex failure

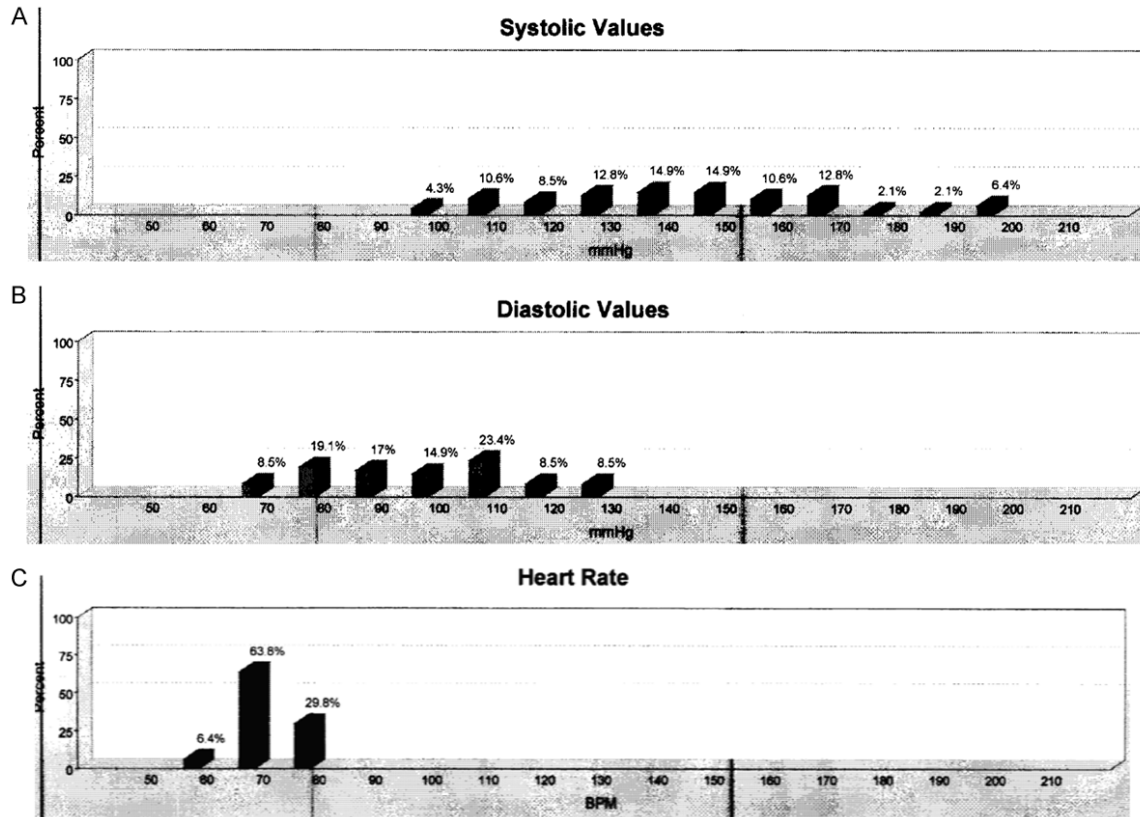


Figure 2. The patient's 48-hour ambulatory blood pressure monitoring after discharged with clonidine and other nonpharmacological interventions for baroreflex failure. A: 48-hour systolic blood pressure measurements. B: 48-hour diastolic blood pressure measurements. C: 48-hour heart rate monitoring.

Table 1. 48-hour blood pressure measurements including maximum, minimum, and average measurements, day and night

| | ALL BP data | | | Day | | | Night | | |
|-----|-------------|-----|-----|-----|-----|-----|-------|-----|-----|
| | Avg | Min | Max | Avg | Min | Max | Avg | Min | Max |
| SBP | 139 | 94 | 195 | 139 | 94 | 195 | 138 | 94 | 192 |
| DBP | 93 | 61 | 127 | 94 | 61 | 127 | 90 | 63 | 123 |
| HR | 66 | 58 | 73 | 68 | 63 | 73 | 63 | 58 | 73 |
| MAP | 114 | 78 | 155 | 115 | 80 | 155 | 112 | 78 | 154 |

sodes of labile blood pressures. All of his laboratory and imaging studies to work-up the labile blood pressures and secondary hypertension were negative. With his heart rate and rhythm stable with the removal of verapamil, his labile blood pressures indicated that the patient was likely exhibiting autonomic dysfunction. In a patient with these symptoms and a history of nasopharyngeal cancer and radiation therapy, baroreflex failure was the most appropriate diagnosis. The history of radiation treatment was discussed with the electrophysiology

team who agreed with the diagnosis. The patient was then started on clonidine for pharmacological management, along with other nonpharmacological intervention for blood pressure management. He was discharged with a 30-day event monitor (**Figure 2**) and 48-hour ambulatory blood pressure monitoring (**Table 1**). His monitoring devices demonstrated no episodes of bradycardia or AV block, and his

systolic and diastolic blood pressures were well-controlled.

Discussion

Baroreflex failure is a diagnosis of exclusion and based on clinical presentation, past medical history, and diagnostic studies that fail to identify an alternative diagnosis. There are many experimental methods which include vasoactive drugs, neck chamber techniques, and Valsalva maneuvers which can be helpful

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to measure the baroreflex [5]. Most of these are experimental techniques only. The patient with baroreflex failure can be managed conservatively with frequent blood pressure measurements that allow for non-pharmacological therapeutic interventions to be performed by the patient, such as timed carbohydrate ingestion, measuring oral fluid intake, caffeine ingestion, and physical exercises. Pharmacological treatment such as clonidine, a centrally acting alpha-2 agonist, has been shown to decrease the onset of hypertensive crisis and tachycardia by 81%. (1) Fludrocortisone and midodrine can help with orthostatic hypotension. (1) Low-dose benzodiazepines can also help by suppressing sympathetic input. (1) In our case, the patient responded to clonidine and nonpharmacological interventions such as frequent blood pressure monitoring at home. He did not require any invasive intervention. After starting the clonidine for baroreflex failure, the patient's monitoring devices demonstrated an improvement in labile blood pressures with average systolic and diastolic blood pressures of \approx 135/90 mmHg. The patient is now asymptomatic, adherent to pharmacological and nonpharmacological interventions. This case demonstrates the importance of keeping baroreceptors baroreflex failure on the differential diagnosis for labile blood pressures, especially in a patient with a history of head or neck radiation as it can lead to potential damage to the baroreflex mechanism. This includes direct radiation damage as well as paraneoplastic autonomic neuropathy [6]. This case also demonstrates that simple nonpharmacological interventions or only one antihypertensive medication is may be enough to treat complex labile blood pressures if the etiology is understood.

Conclusion

The patient with new episodes of labile hypertension, presyncope, syncope, and orthostatic hypotension with normal laboratory and imaging findings may have baroreflex failure, especially in the setting of previous carotid sinus injury or neck radiation. The patient with baroreflex failure may benefit from centrally acting alpha-2 agonists, such as clonidine, in addition to frequent monitoring of blood pressure.

Baroreflex failure often does not require any invasive intervention to achieve symptom control. Potential research avenues include further validation of the existing experimental techniques to assess a patient's baroreflex mechanism, especially in patients with extensive head or neck radiation, thus allowing this source of autonomic dysfunction to be caught earlier in the natural history of the disease, avoiding deadly arrhythmias in high-risk patients.

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Disclosure of conflict of interest

None.

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