



## Case Report

## Atrioventricular nodal reentrant tachycardia and cannon A waves

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## ABSTRACT

Regular, narrow complex tachycardia with a ventricular rate around 150 can be challenging. The differential includes sinus tachycardia, atrioventricular nodal reentrant tachycardia (AVNRT), atrioventricular reentrant tachycardia (AVRT), and atrial tachycardia (focal or macro re-entrant - i.e. flutter). We present a case of a 90-year-old woman presenting with shortness of breath in which the ECG was not diagnostic, but the presence of regular neck pulsations helped secure the diagnosis of AVNRT. In AVNRT, atria and ventricular contractions occur nearly simultaneously. When the right atrium attempts to contract against a closed tricuspid valve, an abrupt increase in venous pressure is encountered. This increase in venous pressure manifests as prominent neck pulsations termed “cannon A waves.” The patient was ultimately successfully electrically cardioverted resulting in resolution of her presenting symptoms, neck pulsations, and tachycardia. While irregular “cannon A waves” can be seen in conditions of AV dissociation, regular “cannon A waves” strongly favor the diagnosis of AVNRT.

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## 1. Introduction

Adult tachycardia with a ventricular rate around 150 can be challenging, but this case demonstrates that the presence of regular neck pulsations termed “cannon A waves” can help secure the diagnosis.

## 2. Case report

A 90-year-old woman was brought to the emergency department by emergency medical services for shortness of breath that started 1 h prior to arrival. On arrival to the emergency department, her temperature was 96.4 °F (oral), heart rate 144, blood pressure 124/74, respiratory rate 37, and oxygen saturation 95% on room air. Physical exam revealed clear lungs and prominent neck pulsations (Video E1). A 12-lead ECG was obtained (Fig. 1).

We attempted chemical cardioversion with adenosine 6 mg via intravenous push followed by 12 mg without success. The patient was then pre-medicated with fentanyl and successfully cardioverted via synchronized electrical cardioversion with 100 J (biphasic). The patient's heart rate immediately decreased to 100, respiratory rate to 18, the prominent neck pulsations abated, and symptoms resolved. Fig. 2 shows the post-cardioversion ECG.

## 3. Discussion

While the 12-lead ECG is the diagnostic cornerstone of arrhythmias, this case highlights the utility of the history and physical examination. This case also highlights the diagnostic considerations for a regular, narrow complex tachycardia with ventricular rate around 150.

The presenting ECG (Fig. 1) reveals a regular, narrow complex tachycardia with ventricular rate of 148 without discernable P waves. Lack of P waves, tachycardia beyond the maximum expected heart rate, and lack of R-R variation favor atrioventricular nodal reentrant tachycardia (AVNRT), but other considerations exist. The differential includes sinus tachycardia, AVNRT, atrioventricular reentrant tachycardia (AVRT), and atrial tachycardia (focal or macro re-entrant - i.e. flutter).

In the setting of regular, narrow complex tachycardia, P waves can aid the diagnosis but are often absent. At faster rates, sinus tachycardia can be obscured when P waves are buried within the T waves. P waves in a sawtooth pattern favors atrial flutter (2:1 conduction usually has a ventricular response rate around 150) [1–3]. While most cases of AVNRT do not have visible P waves, up to 1/3 of AVNRT cases will show retrograde P' waves immediately following the QRS complex, giving the appearance of a “pseudo-S wave” in the inferior limb leads, or a “pseudo-R wave” in V1. Rarely, atypical “fast-slow” AVNRT can produce retrograde P' waves that immediately precede the QRS complex [1,4]. Our patient's ECG lacks P waves, but the diagnosis can be made by recognizing a salient feature of the examination.

A sensation of neck pounding is a symptom shared by nearly all patients with AVNRT, but not other tachyarrhythmias. In a study of 370

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Fig. 1. ECG on presentation.

consecutive patients undergoing an electrophysiologic study for paroxysmal, regular, narrow complex tachycardias, the sensation of regular neck pounding was the only symptom (of nine) that was observed more frequently in patients with AVNRT [5]. Gürsoy, et al. surveyed patients with supraventricular tachycardia about their symptoms, and found that 50 out of 54 patients with electrophysiologic-proven AVNRT had regular neck pounding. This same group proposed the physiologic mechanism of neck pounding via invasive hemodynamic monitoring [6]. When the right atrium attempts to contract against a closed tricuspid valve, an abrupt increase in venous pressure is encountered [5,6]. This increase in venous pressure manifests as prominent neck pulsations termed “cannon A waves” [7,8] When this phenomenon occurs under conditions of AV dissociation such as complete heart block or ventricular tachycardia, cannon A waves are irregular owing to inconsistent synchrony of atria and ventricular contractions. In AVNRT, however, the atria and ventricles contract nearly simultaneously and with regular synchrony leading to regular cannon A waves that exactly match the heart rate [8,9]. Cannon A waves are best observed with the patient in a semi-recumbent or upright position, thereby avoiding confusion with the normal venous

waveform that is better appreciated in a supine position. The presence of regular cannon A waves secures the diagnosis of AVNRT (Video E1).

The differential of regular, narrow complex tachycardia includes sinus tachycardia, AVNRT, atrioventricular reentrant tachycardia (AVRT), and atrial tachycardia (focal or macro re-entrant – i.e. flutter). P waves, when present, can help make the diagnosis, but they are often absent. The astute physician will search for corroborating historical and examination findings. The subjective sensation of regular neck pulsations and the objective finding of prominent regular neck pulsations termed “cannon A waves” strongly favor the diagnosis of AVNRT as demonstrated by this case.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ajem.2018.11.016>.

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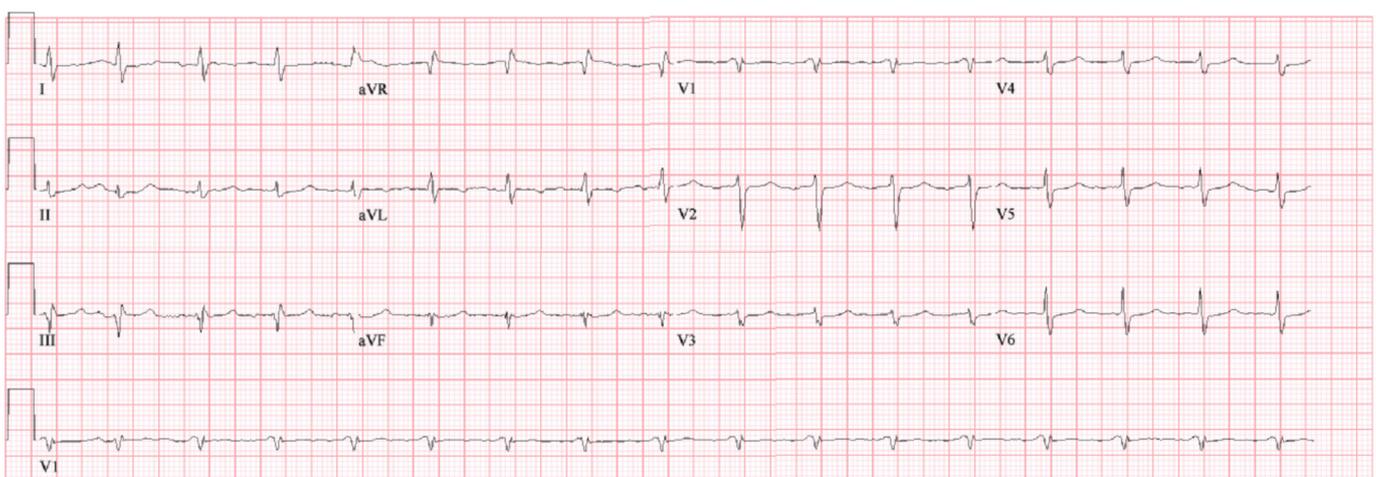


Fig. 2. Post-cardioversion ECG reveals sinus rhythm with rate of 100.

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