


# A Rare Case of Ciprofloxacin-Induced Bradycardia Recognized by a Smartwatch

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## Abstract

Fluoroquinolones are known to cause cardiac side effects. The most common are ventricular arrhythmias and QT prolongation. We present a case of symptomatic bradycardia secondary to ciprofloxacin use in a patient who presented to the hospital after a smartwatch alert for bradycardia. We believe that the integration of wearable technology in the practice of medicine could provide valuable data and improve patient care in different settings.

## Keywords

cardiology, bradycardia, ciprofloxacin, wearable device, smartwatch

## Introduction

Bradycardia is an uncommon side effect of fluoroquinolones; ciprofloxacin appears to be the less arrhythmogenic of the group.<sup>1</sup> The use of commercially available wearable technology may allow us to identify less commonly reported medication side effects. We present a patient with dizziness and lightheadedness on exertion who presented to the hospital after a smartwatch alert for bradycardia.

## Case

A 32-year-old female presented 2 days post-hospital discharge after undergoing common bile duct (CBD) dilation via endoscopic retrograde cholangiopancreatography for cholangitis secondary to CBD stent occlusion. Upon discharge, she had been prescribed ciprofloxacin and metronidazole.

She described new onset dizziness upon minimal exertion. Her smartwatch had triggered an alert for a sustained heart rate of less than 40 beats per minute (bpm), prompting her to present to the Emergency Department at an outside hospital. On telemetry, her heart rate (HR) was confirmed to be between 30 and 50 beats per minute (bpm). The patient was subsequently transferred to our hospital for cardiology evaluation.

Upon arrival she was asymptomatic. Her physical examination and vitals were unremarkable besides bradycardia with a HR between 40 to 50 bpm. Initial electrocardiogram (ECG) during this admission showed sinus bradycardia with a HR of 51 bpm and corrected QT (QTc) of 420 ms. ECG performed prior to the initiation of antibiotics showed

normal sinus rhythm with HR of 66 bpm and QTc of 438 ms.

The medications given during the procedure 2 days earlier were 1 liter normal saline, 4 mg ondansetron, 160 mg succinylcholine, 100 µg fentanyl, 2 mg midazolam, 4 mg dexamethasone, and 200 mg propofol. The records indicated that her HR remained more than 60 bpm during the admission. At discharge, her blood pressure was 136/78 mmHg, oxygen saturation 94% on room air, HR 65 bpm, she was euvolemic, and only 1 dose of ciprofloxacin had been given.

She was placed on continuous telemetry and ciprofloxacin was replaced with ceftriaxone. Her complete blood count, basic metabolic panel, thyroid stimulating hormone, Lyme serology, urine drug screen, and echocardiogram results returned unremarkable and non-actionable. The following day, her HR improved to 60 to 70 bpm with repeat ECG showing normal sinus rhythm with HR of 75 bpm and QTc of 477 ms.

She was discharged on cefpodoxime and metronidazole to complete her antibiotic therapy for cholangitis.

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## Discussion

The most well-known cardiac side effects of fluoroquinolones include QTc prolongation and torsades de pointes.<sup>1</sup> Of the arrhythmias reported in the literature, the majority are ventricular arrhythmias.<sup>2-7</sup> Among these studies, there is only 1 case of bradycardia as a side effect.<sup>3</sup> It appears that ciprofloxacin has the lowest risk for cardiac side effects, including QTc prolongation and arrhythmias.<sup>1</sup>

Bradycardia can be secondary to a wide variety of factors. Propofol, succinylcholine, fentanyl, midazolam, dexamethasone, ondansetron were administered during the patients procedure and each of them can cause bradycardia. However, these drugs have a short half-life and bradycardia secondary to any of these would have been expected to happen at the time of administration or shortly after. Volume status can also be implicated in arrhythmias, our patient was euvoletic. Given that other causes of bradycardia were ruled out and that with discontinuation of ciprofloxacin her heart rate normalized, we concluded that ciprofloxacin was likely the cause of her symptomatic bradycardia.

Our patient's symptoms were somewhat vague. The combination of symptoms and smartwatch notification prompted her presentation to the hospital. Early recognition of bradycardia prevented a potential adverse event.

Wearable technology devices detect heart rate by photoplethysmography (PPG). Using infrared or green light, a PPG device can detect the significant blood flow variations seen in arteries during systole and diastole. The device emits light and a photodetector measures its reflection from the tissue. The amount of reflected light is proportional to intravascular volume variation. PPG can be affected by any movement artifact or pressure changes.<sup>8</sup> Muscle contraction,<sup>9</sup> Changes in skin temperature,<sup>10,11</sup> and darker skin tones<sup>12,13</sup> have been identified as causes for inaccuracies when using PPG.

Heart rate monitoring by wearable technology has been reported to have <10% error.<sup>14</sup> Variability at rest is reported between 4.5b pm and 22.6 bpm depending on the type of device.<sup>15,16</sup> Evidence so far appears to indicate that wearable PPG devices are more accurate at rest than strenuous physical activity. A meta-analysis performed by Zhang et al included 44 studies for a total of 1738 patients and compared HR measurements of 15 brands of commercial wearable PPG devices against measurements from ECG or chest strap and found no statistically significant differences during sleep, rest, treadmill use, post exercise, and daily living activities. However, they found statistically significant differences during resistance training and cycling.<sup>17</sup> These devices could provide valuable, easy-to-access information than can later be confirmed by conventional methods. Although it appears that wearable devices allow for acceptable HR readings under certain conditions, several factors have not yet been elucidated and more

research needs to be done to fully integrate them into the health care system.

## Conclusions

Ciprofloxacin can be a cause for symptomatic bradycardia.

Despite having less accuracy than conventional methods, hear rate measurements done by wearable technology are widely available, easily accessible, and could provide valuable information for patient care in different settings.

## Author Contributions

A.C.S.: conceptualizing and writing original draft; M.C.: conceptualizing and writing original draft; O.O.: review and editing; C.W.: supervision and review.

## Declaration of Conflicting Interests

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## Ethics Approval

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

## Informed Consent

Informed consent for patient anonymized information to be published in this article was not obtained from the patient because our institution does not require informed consent for individual case reports with information anonymized.

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