

# A Misleading Preoperative Electrocardiogram

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## Abstract

A 57-year-old male with a history of hyperlipidemia and mild pulmonary hypertension presented for a left inguinal hernia repair. Preoperative electrocardiogram showed severe right axis deviation at 177 degrees and abnormal repolarization. Right ventricular hypertrophy secondary to pulmonary hypertension was the primary differential but was quickly ruled out due to the patient being asymptomatic and having great exercise tolerance. Dextrocardia was also ruled out due to normal progression on the precordial leads. The simultaneous severe right axis deviations of P, R, and T waves raised suspicion for erroneous lead placement. The repeat electrocardiogram confirmed the diagnosis.

**Keywords:** electrocardiogram, pulmonary hypertension, right axis deviation, dextrocardia, technical errors

## Introduction

Electrocardiogram (EKG) is frequently part of the routine workup for patients undergoing elective surgeries, especially for those with a prior cardiac history. EKG monitoring is also a standard practice of perioperative care. Abnormal EKG readings often lead to further workup or consultation that may delay surgery and disrupt the workflow in the operating rooms.

## Case Presentation

A 57-year-old male with a history of hyperlipidemia and mild pulmonary hypertension presented for left inguinal hernia repair. He reported no other significant medical problems. Preoperative EKG showed severe right axis deviation at 177 degrees and abnormal repolarization (Figure 2). Despite abnormal EKG findings, the patient denied dyspnea or chest pain and reported good exercise tolerance with a Metabolic Equivalent (MET) score > 10. Therefore, progression of pulmonary hypertension, as suggested by severe right axis deviation, was unlikely [1].

Upon further reviewing his EKG, severe right axis deviations were noted on P and T waves as well. With all three axes (P, R, and T) severely deviated to the right (142°, 177° and 155° respectively), dextrocardia was initially suspected. However, normal progression on the precordial leads precluded this diagnosis [2].

Simultaneous deviations of P, R and T axes raised suspicion for technical errors in lead placement, specifically a possible switch of the right arm and left arm leads. A repeat EKG was obtained after switching the leads back, and it revealed normal morphology with no evidence of right axis deviation or repolarization abnormalities (Figure 2).

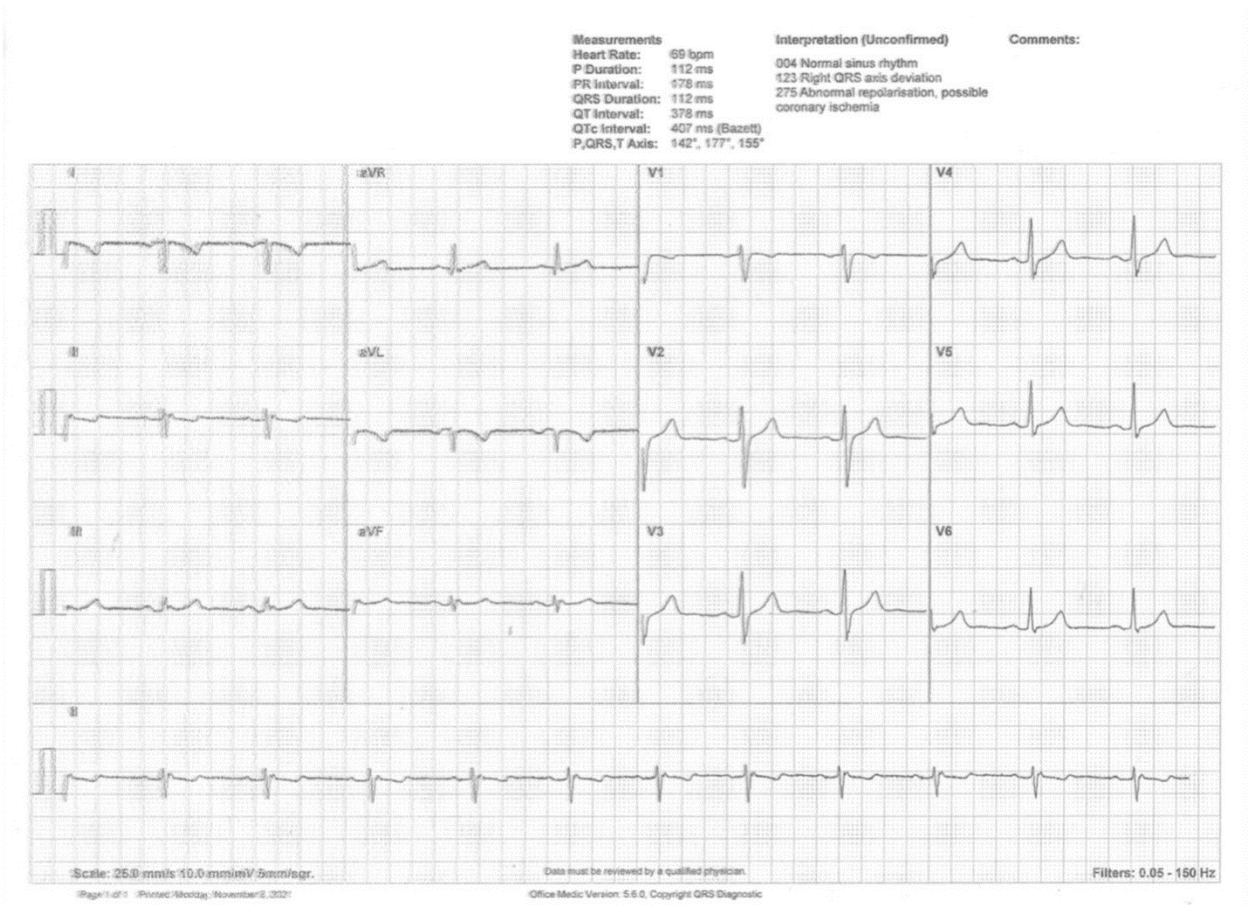


Figure 1. Preoperative EKG showing normal sinus rhythm, severe right axis deviation, and abnormal repolarization. The axes of P, R and T are 142°, 177° and 155°

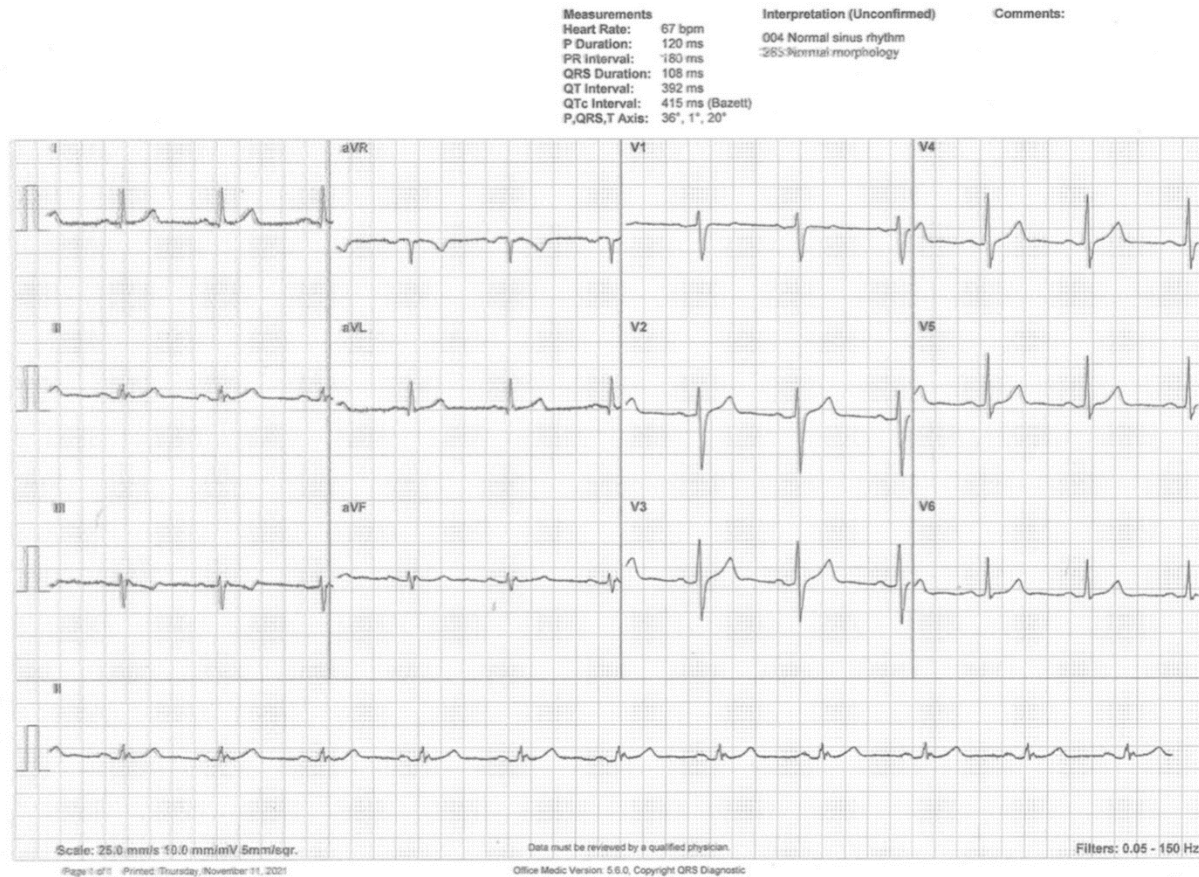


Figure 2. Repeat EKG with correct lead placements showing normalized axes. The axes of P, R and T are 36°, 1°, and 20°.

## Discussion

Technical errors in preoperative EKG recordings are not uncommon [3]. Our patient came in for a routine inguinal hernia repair. Preoperative EKG showed severe right axis deviation at 177 degrees and abnormal repolarization. If the technical errors weren't recognized, the surgery would have likely been delayed to obtain further testing and consultation, especially given the patient's history of mild pulmonary hypertension.

Although severe right axis deviations of P, R and T waves were suggestive of dextrocardia in this patient, normal progression in the precordial leads precluded this diagnosis [2]. A true dextrocardia will produce dominant S waves in all precordial leads in addition to inverted P, R, and T waves in lead I, and positive P, R and T waves in lead aVR [2].

Right axis deviation could also be seen in patients with right ventricular hypertrophy due to pulmonary hypertension [1]. However, the normal appearance of R wave in V1 was inconsistent with right ventricular hypertrophy. The absence of P pulmonale in the inferior leads (II, III, aVF) and V1 and V2 was

also inconsistent with right atrial enlargement, a possible accompanying sign of right ventricular hypertrophy [1].

Other differentials of right axis deviation include excess strain on the right heart (pulmonary embolism, pulmonic stenosis, cor pulmonale), lateral wall myocardial infarction, WPW syndrome, left posterior fascicular block, ventricular ectopy, hyperkalemia, COPD, and a normal variant in some children and young adults. Oftentimes, these EKGs would show normal axes on P and T waves [4].

Therefore, technical errors of the right and left arm lead placement were suspected. When the right arm and left arm leads are switched, we expect to observe the following: reversed polarity of lead I, swapped lead II and III, swapped lead aVR and aVL, and unaffected aVF and precordial leads [3]. This is exactly what was shown on repeat EKG when the leads were correctly placed. Recognizing technical errors in an EKG recording could prevent additional, unnecessary tests and/or consults for patients, especially in the time-sensitive preoperative setting.

## References

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## Declarations

1. There is no conflict of interest.
2. There is no funding.
3. A written consent was obtained from the patient.