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EKG Changes in Hyperkalemia: Just How Sensitive are they?

As an EM intern (or even as a higher level medical student) some of the most important points that are hammered into our brains as learners revolve around "Hyperkalemia and EKG Changes". Often we are taught that EKG changes in hyperkalemia typically follow a progressive pattern and at certain K+ levels you can expect to see a certain change in the EKG. While this is good baseline knowledge to have and some great info to keep in mind it got me curious… just how sensitive are these EKG changes to K+ levels? Fortunately this is not a question that needs to be pondered or guessed upon as there has been a study to find out the answer to just this question.

Retrospective Review of the Frequency of ECG Changes in Hyperkalemia
Brian T. Montague, Jason R. Ouellette, and Gregory K. Buller

Question being answered: **How sensitive are EKG changes for hyperkalemia / do changes always occur in a specific order?**

Methods:

- Retrospective chart review
- Inclusion criteria were potassium ≥6 with a concurrent electrocardiogram
- Exclusion criteria were the lack of availability of a paper chart, lack of documented hyperkalemia, absence of an ECG coincident with the documented hyperkalemia episode, peak potassium levels of <6.0, laboratory notation of a hemolyzed sample without evident ECG changes, and elevated serum potassium with a baseline paced ECG with QRS and T-wave abnormalities limiting assessment of ECG changes.
- Data was abstracted regarding comorbid diagnoses, medications, and treatment
- EKGs coincident to the time of the hyperkalemia were reviewed and compared with baseline and follow-up EKGs when available.

Results:

- A total of 250 cases were identified and of these, 160 were excluded. The primary reasons for exclusion were absence of identifiable hyperkalemia (n = 19), low-grade elevations in serum potassium concentration with peak concentrations of <6 mg/dl (n = 68), and lack of an ECG coincident to the time of hyperkalemia (n = 50).
- The sample consisted of slightly more men than women (57%). The median age of patients was 73, ranging between 20 and 93 with a disproportionate number of older patients.
- Renal failure, both obstructive (n = 11) and nonobstructive (n = 39), were the most commonly identified diagnoses at admission followed by non–urinary tract infection (n = 23).
- The most frequently noted comorbid illnesses were diabetes (n = 50), chronic renal insufficiency (n = 43), and a history of coronary artery or peripheral vascular disease (n = 30).
- New QRS prolongation (QRS >120 ms) was noted in only six ECGs at time of hyperkalemia with maximum QRS duration of 140 (range 130 to 140).

- Of the 90 cases, only 24 were noted by the reading cardiologist to have T-wave findings, the majority (n = 21) of which were described as nonspecific.
- Only 3 cases were assessed by cardiology w/ peaked T waves (none of which was described as concerning for ischemia).
- There was no significant correlation between presence of T-wave changes either by cardiologist assessment or by serum potassium concentration as assessed by logistic regression (P = 0.21).

Discussion:

- Consistent with the previous reviews of ECG changes in patients with hyperkalemia, **the sensitivity of the ECG for the diagnosis of hyperkalemia was poor.**
- The ECG, whether by cardiology assessment or by study criteria, was an insensitive tool for diagnosing hyperkalemia.
- Overall, the likelihood of identifying ECG changes increased with increasing levels of potassium.
- There is potential for confounding at many levels in the interpretation of ECG changes in the presence of hyperkalemia.

Conclusion:
Given the poor sensitivity and specificity of ECG changes as a diagnostic test for hyperkalemia and the uncertainty with regard to its prognostic significance, there is no clear support for their use to guide management in otherwise clinically stable patients.

Will this change my practice?
Yes… sort of ☺ I believe that the standard logic of "hyperkalemia = get an EKG" should still be followed, BUT, the inverse does not appear to be as applicable. You simply cannot look at an EKG and see a normal EKG (or even an abnormal EKG) and infer what a patient's serum K+ level "should" be. Doing so opens up the chance to harm your patient and yourself and can quickly result in a bad outcome. My future practice will be to always order EKGs in someone you know or strongly suspect to be hyperkalemic but not to immediately jump to "everything is OK" if there is nothing found on an EKG in a patient w/ an unknown K+ level.

References // Further Reading
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