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Electrocardiograms and Education

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INTRODUCTION

The electrocardiogram (ECG) remains a widely used diagnostic tool for cardiovascular disease and emergencies. Despite its importance in both inpatient and ambulatory practice, medical stu-dents and residents report deficiencies in their interpretation abilities.[1-4] This becomes critical to optimal patient care as house staff are often the first to analyze ECGs, sometimes several hours prior to an official attending read. Despite its clinical importance, teaching ECG interpretation remains a challenge for medical educators. The three most commonly employed methods for teaching ECG interpretation include workshops, lectures and self-directed learning modules. Newer strategies involve utilization of mnemonics for rapid pattern recognition and Internet re-sources.

Although medical educators strive for optimal instruction in ECG interpretation to max-imize retention, few studies have been conducted to determine the effectiveness of the various ECG teaching modalities. Given the differing learning styles among medical students, it is un-likely that a "one-size-fits-all" approach will suffice. Individualization of teaching ECG interpre-tation may be necessary to achieve effective education. Here a brief overview of several studies investigating various approaches to teaching ECG interpretation is provided and, importantly, some of the new approaches that can be applied in future medical education are introduced.

ECG EDUCATION: TRADITIONAL VS. NONTRADITIONAL APPROACHES

ECG interpretation, a staple in the medical school curriculum, continues to be taught in various formats with mixed results in level of skill achieved by students. A randomized control trial ex-amined the ability of 4th year medical students to correctly interpret ECGs after instruction in lecture-based, workshop and self-directed learning (SDL) formats. Lecture-based and workshop formats had significantly better outcomes as compared to SDL.[5] When compared against each other, lecture-based and workshop formats were both similarly effective in level of ECG interpre-tation skill achieved. The type of assessment is also an important component in the process of teaching ECG interpretation. Summative assessments led to more correct ECG identification than formative assessments.[6] While these studies favor a more traditional approach to teaching ECG interpretation, the evolving landscape of technology and medical education has allowed for new nontraditional modalities that can be incorporated to augment traditional education.

New techniques to instruct medical students on ECG interpretation include puzzle-based teaching, e-learning via YouTube, and teaching mnemonics for pattern recognition. A puzzle-based approach was investigated at the University of Michigan; it required students to engage in sessions in which they used puzzle pieces with basic ECG diagnoses and accessory pieces for secondary findings, in addition to traditional lectures. These puzzle pieces would only fit togeth-er if they made diagnostic sense. While this approach was more interactive and learner-centered, ability to interpret ECGs correctly was no different as compared to the lectures-only approach.[7] YouTube offers another new approach to ECG instruction that is increasingly used as an e-learning resource. More than 100 YouTube videos related to ECG instruction were assessed for useful and accurate content. While most videos uploaded by universities and hospitals possessed clinically pertinent and correct information, there were many more that provided inaccurate and misleading instructions.[8] Another approach involves teaching medical students the Diagonal Line Lead Rule to enhance pattern recognition as a foundation in ECG interpretation. This entails rec-ognizing that leads III, aVL, and V1 may have Q waves or inverted P and T waves as normal findings. This cannot be applied to ECGs with a wide QRS complex other than a RBBB. Figure 1 summarizes how to apply the Diagonal Line Lead Rule when interpreting an ECG. This inter-pretation technique has been shown to be useful in identifying abnormal ECGs which correlates with prognosis.[9] These are just a few of the new approaches to ECG interpretation that are being investigated in medical education.

CONCLUSION

ECG interpretation remains an essential clinical tool of which all physicians must possess at least a basic level of skill. However, current literature demonstrates that medical students and resi-dents possess suboptimal skills at ECG interpretation. At this point in time, the evidence indi-cates that lecture-based or workshop teaching formats with summative assessments provide the highest level of skill with ECG interpretation among medical students. In this new era of medical education emphasizing the individual learner, supplemental components of an ECG interpretation course may include SDL modules, novel modalities including a puzzle-based approach, e-learning via verified YouTube videos, or clever mnemonics for pattern recognition. While further studies are required to assess the optimal ECG teaching strategy among the general medical student pop-ulation, it is necessary for the individual student to understand what techniques contribute best to

his own education and competency. I believe that medical education in the future will supple-ment a more standard lecture-based and workshop teaching sessions with SDL modules that al-low the individual student to reinforce foundational knowledge with puzzle based approaches, e-learning or mnemonics most appropriate to the individual's learning style.

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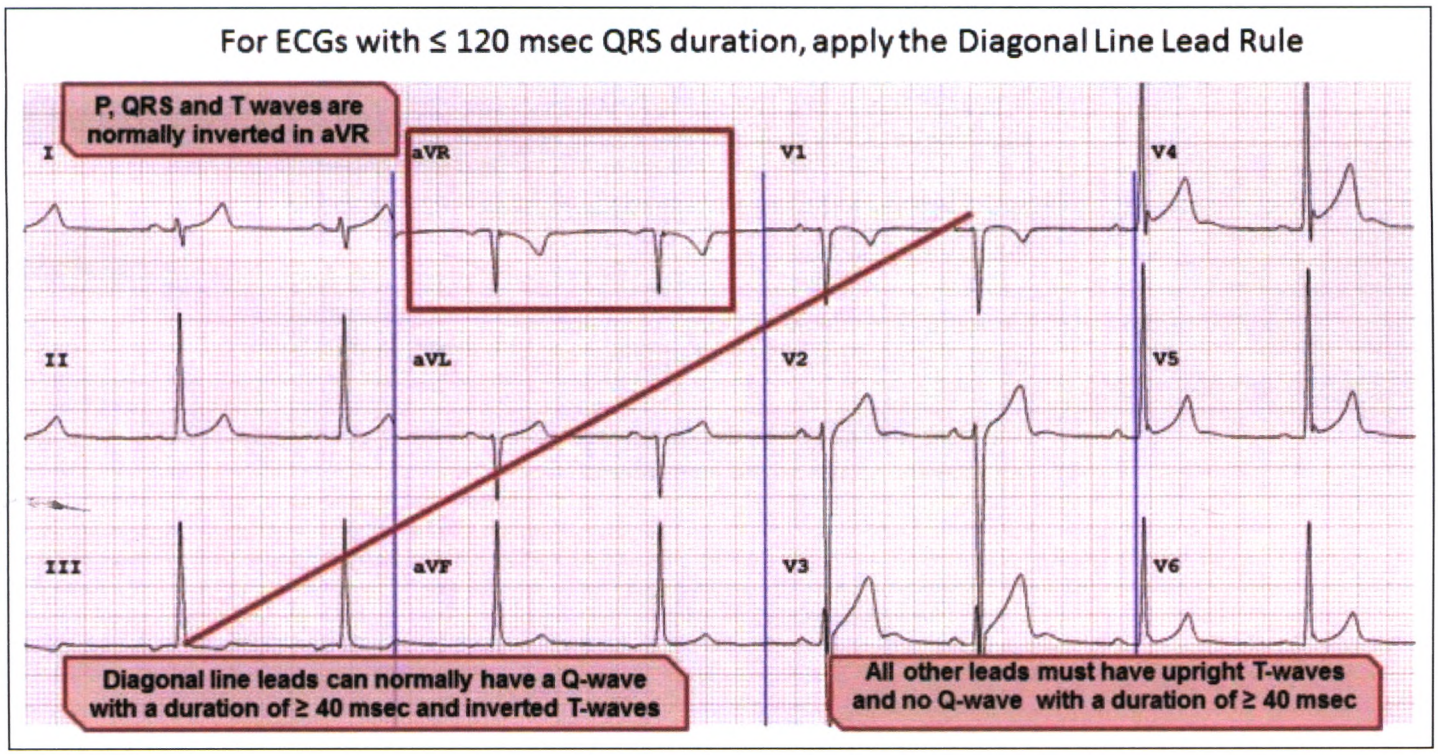

FIGURE 1. Diagonal Line Lead Rule mnemonic of Sibbitt. The diagram demonstrates how to apply the Diagonal Line Lead Rule to an ECG.