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Electrocardiogram and rhythm strip interpretation by final year medical students

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SUMMARY

The pre-registration house officers (PRHO) is often called upon to interpret electrocardiograms ECG. We invited final-year medical students who had successfully completed their written final examinations, to interpret three rhythm-strip tracings, and three 12-lead ECG tracings. The rhythm-strips were of ventricular fibrillation (VF), ventricular tachycardia (VT), and complete heart block. Of the three 12-lead ECG tracings, one was an inferior myocardial infarction (MI), one was atrial fibrillation (AF), and one showed no abnormality. Forty-six medical students attended. Of these, 50% had received no formal training in ECG interpretation, although 89% had tried to learn ECG interpretation from books. Only 9% felt confident in their interpretation of ECG tracings. Of the rhythm-strips, 100% correctly identified VF, 96% recognised VT, and 67% identified complete heart block. Of the 12-lead ECG tracings, 61 % recognised the MI, 54% recognised AF, and only 46% successfully identified the normal ECG as such. The group were significantly worse at 12-lead ECG interpretation compared to rhythm-strips ($p<0.01$). The members of the group who had received formal training in ECG interpretation were significantly better at interpreting both rhythm-strips and 12-lead ECG tracings ($p<0.05$). It would appear that formal ECG training as an undergraduate improves PRHO interpretation of ECG tracings, and the PRHO should not interpret 12-lead ECG tracings without consulting more senior medical staff.

INTRODUCTION

Pre-registration house officers are the first-on-call doctors for the wards they cover. Frequently, house officers are called upon to perform an ECG and to interpret its findings. The House Officer is expected to be able to detect significant ECG abnormalities, and to show abnormal ECG tracings to more senior medical staff. The purpose of this study was to establish the level of training that medical students receive prior to qualification, the degree of confidence they had in their own ability, and how successful they were at detecting major rhythm and ECG abnormalities.

METHODS

Final-year medical students who had completed their written examinations attended a lecture two weeks prior to their clinical finals, and were invited to complete the ECG questionnaire. Regarding their training, they were asked (i) Had they ever received formal tuition from a Doctor regarding ECG interpretation, (ii) Had they tried to self-teach ECG interpretation, and (iii) Did they feel confident in their ECG interpreting skills. They were then shown three rhythm strips and three 12-lead ECG tracings, for one minute each. They were required to record their interpretation of the rhythm-strip or ECG. The rhythm strips were: ventricular fibrillation, ventricular tachycardia, and complete heart block. The 12-lead ECG tracings were: inferior myocardial infarction, atrial fibrillation, and a normal ECG. The completed questionnaires were then collected and marked by one author (B.L.)

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RESULTS

Forty-six final year medical students completed the questionnaire. Of these, only 23 (50%) of the group had received formal training from medical staff, but 41 (89%) had tried to teach themselves ECG interpretation by private study. Only 4 (9%) of the group regarded their own ECG interpretation skills with confidence.

Overall, 88% of rhythm-strips were correctly assigned, with 46 (100%) of the group identifying VF, 44 (96%) identifying VT, and 31 (67%) recognising complete heart block. The 12-lead ECG tracings were correctly assigned in 54%. The inferior myocardial infarct was the most recognised, with 28 (61 %) of the group detecting it. Atrial fibrillation was correctly diagnosed by 25 (54%), and the normal ECG was categorised as such by 21 (46%) of the group. Comparing the groups identification of rhythm-strips to their interpretation of 12-lead ECG tracings using a single-tailed T-test (paired sample, equal variance), rhythm strips were significantly more likely to be correctly interpreted ($p<O. 0 1$).

The subgroup that had previously received formal ECG instruction had correct rhythm-strip identification in 93% of cases, and correct 12-lead ECG interpretation in 64% of cases. The subgroup without previous formal instruction had lower rates of 83% and 43% respectively. The difference in correct interpretation rates was significant (T-Test, unpaired sample, unequal variance) for both rhythm-strips and for 12-lead ECG tracings ($p<0.05$). This suggests that previous formal teaching on the interpretation of ECG tracings produced a statistically significant improvement in ability.

DISCUSSION

Interpretation of ECG tracings can be difficult. In the setting of a casualty department, a study examining S-T segment elevation found that it was misinterpreted in 5.9% of cases of patients attending A&E with chest pain, however the clinical consequences of missed diagnosis were minimal [1]. A previous study had addressed the question of cardiology review of ECG tracings. After a review of 1,000 ECG tracings, thirty-eight patients had been discharged with 'abnormalities that could potentially alter case management'. Interestingly, after review by a panel of emergency physicians, only eight were felt to merit chart review, and no review altered case management. Cardiology review of all ECG tracings was not therefore commenced[2]. The provision of a correct history supplementing the ECG has improved accuracy of ECG interpretation by 4-12%, but a misleading history reduced accuracy by 5% for cardiologists, 25% for residents, and 19% for students[3]. In this study we omitted history, as the aim was solely to assess interpretation of ECG. Providing access to computer interpretation of the ECG tracing also has limitations, as it has a false positive reporting rate of 16.5%, and a false negative report rate of 10.5%. Computer interpretation is 18 times more likely to yield a false positive report than a trainee physician.[4]

The seniority of the doctor interpreting the ECG also has relevance. A recent study asked for interpretation of 30 ECG tracings, with respect to whether the interpreting individual would prescribe thrombolysis on the basis of it. All cardiology consultants correctly diagnosed all acute myocardial infarctions. Of acute MI tracings, house officers correctly identified only 76%, albeit in a small sample of 10 house officers[5].

In this study, interpretation of rhythm abnormalities was reasonably good, with 88% analysed correctly. However, the incorrect diagnosis rate for an acute inferior myocardial infarction was 39%. In addition, only 46% of the assessed group were able to successfully identify an ECG without abnormalities as such. This would suggest that house officers are not reliable in their interpretation of 12-lead ECG tracings, at the time of qualification, and only 9% are confident in their ECG interpreting ability. It may be necessary to incorporate formal ECG training and assessment into the undergraduate curriculum, as this improved diagnostic accuracy. It may also be necessary to require House Officers to show ECG tracings to a more senior doctor for the early part of their pre-registration year, until competence is demonstrated.

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