How Good are Orthopaedic Surgeons at Interpreting ECGs?

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ABSTRACT

This study is to find out how good orthopaedic surgeons are at interpreting electrocardiograms and to compare the results between surgical specialties with physicians. It showed that surgeons were considerably weaker than physicians in this aspect. The difference between the surgical specialties was not significant, but the orthopaedic surgeons were marginally better than other surgical specialists. Improper interpretation of electrocardiogram may compromise patient care. A formal training may be required in surgical portfolio.

中文摘要

這項研究要考察骨科醫師在詮釋心電圖(EGCs)的能力有多好，並比較外科與內科醫生在這方面的分別。結果顯示內科醫生在這個方面的能力比外科醫生優勝很多。但在各外科專科醫生之間的差別不大，其中骨科醫師比其他外科專科醫生稍微優勝，不恰當的心電圖詮釋可以損害病人的健康，故可能需要在外科訓練中加入詮釋心電圖。

Introduction

Orthopaedic surgeons including orthopaedic trainees appear to have a bad reputation of being notoriously weak at interpreting electrocardiograms (ECGs) when compared to their colleagues in other specialties. Orthopaedic surgeons frequently request and interpret ECGs for their patients. This is in particular true for junior orthopaedic trainees. Errors in interpretation of ECGs could greatly influence patient management as shown by the study of Srikantha et al. He found that 8.5% of patients got change of management plan because of a review of ECGs by cardiologists following the initial diagnosis by senior house officers.

Several studies were carried out in the ECG interpretation skills of cardiologists and non-cardiologists. However, the literature is sparse on studies of the efficacy of surgeons in interpreting ECGs. The present study aims to evaluate the discrepancy, if any, between the interpretation skills in reading ECGs of orthopaedic surgeons, general surgeons, other speciality surgeons [ear, nose, and throat (ENT), urology], and accident and emergency doctors and physicians.

Methods

Four standard ECGs (8 × 3 cm in size), a normal ECG and ECGs of patients with atrial fibrillation, evolving anterior subendocardial myocardial infarction (MI), and extensive anterior MI, were selected. These had been independently interpreted by two cardiologists who concurred in their findings. They were made anonymous with regard to the diagnosis. A questionnaire was sent to all doctors in various specialties of medicine and surgery including accident and emergencies with a copy of these ECGs. A total of 150 questionnaires were sent out to doctors in the major hospitals in the Liverpool region. In the questionnaire, the doctors were asked to do and record their own interpretations on rate, rhythm, and diagnosis without any textbook reference or help. The exact rate had been determined by the cardiologists. An answer was counted correct if there is ± 5 beats/min deviated from the model answer. No clinical information was provided. The ECGs did not have computer-generated reports on them. We received 38 replies (response rate ~25%). The results of the questionnaire were checked with the reference gold standard answers given by the two cardiologists. Every correct answer for rate, rhythm, and diagnosis was given 1 mark each and incorrect answers were given 0.
Therefore, the score would be from 0 to 12 for four sets of ECG. The scores were then compared among different specialties and grades by using analysis of variance.

**Results**

Thirteen answered questionnaires were obtained from physicians (four consultants, three registrars, four senior house officers, one house officer, and one staff grade), 22 questionnaires were received from surgeons (11 from orthopaedics, 5 from general surgery, 3 from urology, and 3 from ENT), and 3 from accident and emergency doctors. Replies from surgeons included 7 consultants, 4 registrars, 10 senior house officers, and 1 staff grade. Table 1 shows the percentage distribution of the various specialities. Table 2 shows the percentage of the accuracy of interpretations between physicians and surgeons. Figure 1 shows the overall ECG assessment results in various specialities. Figure 2 shows the percentage of accurate answers across specialties; for purposes of calculation, other surgical specialities included general surgery, ENT, and urology.

It was observed that the surgeons as a whole were weaker than the physicians and accident and emergency doctors in all the three areas of assessment. In the area of diagnosis, orthopaedic surgeons were marginally better than the accident and emergency doctors. Figure 3 shows the results among the subspecialties in surgery. Within the surgical specialties, orthopaedic surgeons were marginally better than general surgeons and other specialty surgeons in assessing ECGs.

**Discussion**

ECG interpretation is often a neglected learning objective in surgical training. Even the American Board of Internal Medicine has not specified a minimum number of supervised ECG interpretations as a requirement to appear for “the Internal Medicine Board Certification”. A study carried out by Montgomery et al\(^3\) by looking at interpretation skills of doctors found that 74% did not have sufficient knowledge to measure a PR interval, 64% were unable to define the PR interval, and 41% were unaware of the time interval represented by a small square on an ECG at standard recording speed. Of interest, all 10 general surgeons questioned failed to identify the PR interval. Another study carried out to look into the impact of a clinical scenario in the diagnostic accuracy of ECG found that a clinical scenario had little influence on ECG diagnostic accuracy of the 3rd year medical students. However, the cardiologists changed 14% of their initial ECG diagnosis when further clinical information was provided.\(^4\) Salerno et al\(^2\) found that “most studies on ECG interpretation by cardiologists report the proportion of abnormal diagnosis that are correctly identified, as determined by a consensus panel”. As a result of this, our gold standard could be based on the opinions of two cardiologists. Goodacre et al\(^2\) looked into the influence of computer-generated ECG reports on interpretation skills of accident and emergency senior house officer. They found that major errors, 18.4%, were made by SHOs with access to the computer-generated report compared to 22.4% made without a computer-generated report. Logistic regression showed no evidence of a relationship between

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**Table 1**

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopaedics</td>
<td>11</td>
<td>28.9</td>
</tr>
<tr>
<td>Other surgery (ENT and urology)</td>
<td>6</td>
<td>15.8</td>
</tr>
<tr>
<td>Medicine</td>
<td>13</td>
<td>34.2</td>
</tr>
<tr>
<td>A&amp;E</td>
<td>3</td>
<td>7.9</td>
</tr>
<tr>
<td>General surgery</td>
<td>5</td>
<td>13.2</td>
</tr>
<tr>
<td>Total</td>
<td>38</td>
<td>100.0</td>
</tr>
</tbody>
</table>

ENT = ear, nose, and throat; A&E = accident and emergency.

**Table 2**

<table>
<thead>
<tr>
<th></th>
<th>Physicians</th>
<th>Surgeons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>65.39</td>
<td>35.20</td>
</tr>
<tr>
<td>Rhythm</td>
<td>82.69</td>
<td>53.40</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>76.92</td>
<td>46.58</td>
</tr>
</tbody>
</table>

**Figure 1.** Overall electrocardiogram assessment accuracy in various specialities. Ortho = orthopaedics; Surg = surgery; Med = medicine; A&E = accident and emergency.

**Figure 2.** Percentage accurate answers across specialties. A&E = accident and emergency.

These differences were not statistically significant. However, the numbers are too small for definite conclusions. But in the case of ECG-2 (anterior subendocardial MI), the \(\chi^2\) test showed a statistically significant difference (\(p < 0.05\)).

**Figure 3.** Accuracy of electrocardiogram assessment in various subspecialties in surgery. Diag = diagnosis; assess = assessment; Gen = general; ENT = ear, nose, and throat.
the use of a computer-generated report and major errors of interpretation by the SHO.

Salero et al found “despite the limitations, evidence suggests that computer interpretation software is a useful adjunct to physician interpretation. In some reports, computers have detected abnormalities missed by physicians”. Gillespie et al interviewed 57 junior hospital doctors: the major abnormality of anterior MI was recognized by almost all the doctors. However, there was difficulty in the interpretation of posterior MI and second-degree heart block. Studies showed that residents in family practice have considerable deficiencies in ECG interpretation skill.7

Even after an extensive search in the English literature, we are unaware of previous publications comparing the interpretation skills of surgeons with physicians or studies on orthopaedic surgeons though surgeons are not good at interpreting ECGs as found in previous studies.3 Gillespie et al proposed to introduce more formal training in the interpretation of ECG abnormalities for junior hospital doctors, as their results were of concern. In 2001, the American College of Cardiology/American Heart Association recommended interpretation of 500 supervised ECGs.2 The limitation of our study is the lower response rate of the questionnaires. Further large-scale study may be required in comparison with surgical specialties. However, failure of adequate interpretation of ECGs by surgeons may have impact on patient management. This is a serious issue, which needs to be addressed as orthopaedic surgeons usually take care of the aged patients with cardiovascular compromise. As a result of this, it might be worthwhile to include formal training and assessment of ECG interpretation in the surgical portfolio.

References