Open Access

Original Article

Improvement in Competency and Confidence Level of House Officers in ECG Interpretation after a Goal-Directed ECG Workshop

Jamal Azfar Khan, Nadia Aziz Ather, Ghulam Abbas Khan Niazi, Muhammad Irfan Khattak, Kashif Razzaq

Pakistan Naval Ship Shifa Hospital, Karachi Pakistan

ABSTRACT

Objective: To determine if a goal-directed ECG workshop improves ECG interpretation competency and confidence among the house officers in PNS Shifa Hospital.

Study Design: Prospective comparative study.

Place and Duration of Study: Pakistan Naval Ship Shifa Hospital, Karachi Pakistan, from Jan to Dec 2021.

Methodology: ECG workshops were conducted for House Officers in batches. The participants were asked to complete a questionnaire testing their ECG interpretation competency before and after the workshop and self-report their confidence level in ECG interpretation.

Results: Sixty-eight house officers participated in the workshops and completed the test. There were 41(60.29%) female and 27(39.7%) male participants. The statistics showed significant improvement in ECG competency (p<0.001). In addition, the pre and post-workshop confidence levels also showed significant improvement (p<0.001).

Conclusion: A goal-directed ECG workshop improves house officers' competency and confidence in ECG interpretation.

Keywords: Assessment, Clinical skills, Competency, Electrocardiogram.

How to Cite This Article: *Khan JA, Ather NA, Niazi GAK, Khattak MI, Razzaq K. Improvement in Competency and Confidence Level of House Officers in ECG Interpretation after a Goal-Directed ECG Workshop. Pak Armed Forces Med J 2023; 73(1): 46-49. DOI: https://doi.org/10.51253/pafmj.v73i1.8015*

INTRODUCTION

ECG is one of the most common and useful investigations done in hospitals.[1] ECG interpretation is an essential skill for every doctor,[2] including house officers (HOs). The HOs work inwards, Accident and Emergency departments and OPDs where they see ECGs multiple times daily. Incorrect interpretation or failure to identify a critical finding on ECG may affect the patient outcome adversely.[3]

ECG learning and interpretation is part of the MBBS curriculum in Pakistan.[4] However, ECG teaching at the undergraduate level only sometimes raises the interpretation competency level of medical students to the desired standard where they can interpret ECGs confidently.[5] For many doctors, gaining expertise in ECG interpretation remains a challenge.[6] This may be because different students have different learning styles. ECG is considered a difficult subject to teach; hence, alternate teaching methods are increasingly being used.[7] Effective communication, interactive questioning and feedback are essential in quality teaching.[8] Teaching ECG interpretation by lecture workshop has shown better results than self-directed learning.[9,10] Thus, to boost the competency in ECG interpretation, we conducted a goal-directed ECG workshop for the HOs in the PNS Shifa Hospital using interactive sessions, multimedia and actual ECGs from clinics. We hypothesized that the workshop would improve the HOs' interpretation competency and confidence in interpreting ECGs, as students tend to learn better if they are actively engaged in the learning process.

METHODOLOGY

The prospective comparative study was conducted at Pakistan Naval Ship Shifa Hospital, Karachi Pakistan, from January to December 2021. The Ethics Review Committee approved the study (vide Letter No. ERC/2021/MEDICINE/71). Consecutive sampling was employed to include all the house officers working in PNS Shifa Hospital during the study period.

Inclusion Criteria: All the house officers working in PNS Shifa Hospital during the study period were included in the study.

Exclusion Criteria: The HOs who did not choose to attend the ECG workshop were excluded from the study.

House officers working in PNS Shifa hospital were included. We divided the HOs into groups, thus keeping the number of participants in the workshops limited so that the participants could easily interact

Correspondence: Dr Jamal Azfar Khan, Classified Medical Specialist, Pakistan Naval Ship Shifa Hospital, Karachi, Pakistan

Received: 13 Jan 2022; revision received: 15 May 2022; accepted: 18 May 2022

with the facilitator. We arranged ECG workshops for HOs. Participation in the workshop was voluntary. A consultant medical specialist conducted a series of workshops in the Hospital Conference Hall. The attendees were limited to 20 individuals in each workshop. The workshop consisted of a pre-workshop test, an interactive session about the ECG and a post-workshop test. The test was made online on Google Forms.

The participants were informed about the study at the beginning of the workshop, and consent was taken. The link to the pre-workshop test was shared with the participants so they could take it on their cell phones. The test consisted of a few questions in the beginning to gather the participants' demographic data. Then, the best of 5 scenario-based multiple-choice questions (MCQs) were given to ascertain their knowledge of ECG. There was no negative marking. An additional question was included in the test at the end to gauge the confidence level of the participants in interpreting ECGs. They were supposed to grade their confidence level from 1 to 5 on a Likert chart, one being "not confident at all" and five being "very confident".

The pre-workshop test was followed by an interactive session which covered the following topics: introduction, ECG recording, heart rate, rhythm, axis deviation, heart blocks and ischemia and infarction. The contents of the interactive session had been approved beforehand by the head of the department of medicine at PNS Shifa hospital. The participants were encouraged to interact actively with the facilitator. Real ECGs were used as case studies for discussion. At the end of the session, the participants were given the post-workshop test. The post-workshop test consisted of the same questions as the pre-workshop test and the confidence survey.

The data analysis was done using Statistical Package for the social sciences (SPSS) version 23.00. Quantitative variables were summarized as mean±SD and qualitative variables were summarized as frequency and percentages. The comparison between the pre-and post-workshop tests was made using the paired sample t-test. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

There were 68 HOs who participated in the workshops and completed the test. There were 41 (60.29%) female and 27(39.7%) male participants. The mean age of participants was 24.17±0.70 years (Range: 23-27 years). The participants were asked questions about their previous modes of learning about ECG. The questions and their responses were tabulated in Table-I.

Table-I: Previous Methods used by the Participants to Learn ECG (n=68)

Questions	Yes n(%)	No n(%)
Have you ever attended ECG tutorial before?	44(64.70)	24(35.30)
Have you ever used Internet online resources to learn ECG?	55(80.88)	13(19.12)
Were you taught ECG before graduation?	62(91.17)	6(8.83)
Have you ever read a book about ECG?	41(60.29)	27(39.71)

The participants were tested regarding their ECG interpretation. They took the test before and after the ECG workshop. The pre-and post-workshop test scores were analyzed for any improvement in their ECG interpretation. The statistical analysis showed significant improvement in ECG interpretation competency ($p<0.05$), as shown in Table-II. The pre and post-workshop confidence level also showed significant improvement ($p<0.05$), as shown in Table-III.

Table-II: Pre-and Post-Workshop ECG Interpretation Competency Test Score (n=68)

Score (Out of 10)		*p*-value
Pre-test (n=68)	Post-test (n=68)	
4.00±1.62	6.38±1.65	<0.001

Table-III: Pre- and Post-Workshop Confidence Level Score (n=68)

Score (Out of 5)		*p*-value
Pre-test (n=68)	Post-test (n=68)	
2.18±0.93	3.12±0.84	<0.001

DISCUSSION

Teaching ECG interpretation remains a challenge for medical educators despite its clinical importance. Medical educators have traditionally taught ECG via lecture-based format.[11,12] ECG interpretation has also been taught to medical students at the bedside in Emergency departments, medical wards, and outpatient clinics. Some educators have recently used other newer methods for teaching ECG interpretation to actively involve the maximum number of students in the learning process. However, only a few studies have been conducted to gauge which teaching methods are effective for teaching ECG.[13,14] Getachew *et al.* conducted a study in Ethiopia in which they assessed the ECG interpretation competency among

medical interns. They concluded that attending ECG classes did not result in competency in ECG interpretation.[15] Thus, some change in the traditional ECG teaching method is warranted. The most commonly employed teaching tools medical teachers use are workshops, lectures and self-directed learning modules.[16,17]

We chose a workshop with hands-on practice of ECGs as a teaching methodology. We observed in our study that most house officers had attended ECG lectures and tutorials, read books or used online sources during their undergraduate years. This shows that they already have background knowledge of ECG interpretation. Despite their learning in undergraduate years, using different formats, the mean pre-test workshop score was 4±1.62 out of 10. The scores were significantly improved after the workshop, evidenced by the mean post-workshop test score of 6.35±1.69. The pre-and post-workshop confidence level also showed improvement, which was statistically significant (p<0.05).

A similar study was conducted in the UK, where 145 participants completed the pre-test and 44 completed both the pre-and post-test. The mean pre-test and post-test scores were 9.7/20 questions (48.9%) and 11.2/20 questions (56.2%), respectively, with a mean improvement of 1.5/20(7.3%) from pre- to post-test (+7.3%, 95% CI: +1.8 to +12.8%, p=0.01).[18] Various studies also observed similar results, with a significant improvement in mean post-workshop test scores.[4,19] Another local study showed a significant improvement in test scores after the workshop,[20] thereby underscoring the effectiveness of this method of teaching ECG interpretation.

Many new ways of learning have been incorporated into medical education in the modern era. ECG interpretation is a basic and essential clinical skill for all doctors. One of the reasons for this situation may be that one teaching method only suits some students. Thus, the individual learner is increasingly emphasized nowadays, as every student learns differently. Many supplemental strategies for teaching are being incorporated into medical teaching, and the same holds as far as teaching an important skill like ECG interpretation. These strategies include self-directed learning (SDL) modules, verified YouTube instructional videos, mnemonics, simulation, puzzle solving and problem-based learning. If the learner knows which learning technique suits his learning style best, he/she can learn with the greatest understanding and retention of concepts. Furthermore, there may be more than one style of learning which suits a particular student.[20] While the optimal strategy for teaching ECG interpretation to medical students, in general, is yet to be defined, the medical literature does suggest that the lecture- or workshop-based teaching formats yield optimum results while teaching ECG interpretation to medical students. Thus, if an approach of "blended learning" is adopted, that is, combining two or more methods of teaching, like e-learning and group discussion, we can expect better outcome as the students will be actively engaged in the whole process.

STUDY LIMITATIONS

The different teaching methods for ECG interpretation and the students' retention of concepts need to be compared over a while.

CONCLUSION

ECG interpretation can be successfully taught to newly graduated doctors (House officers) by employing the interactive goal-directed workshop, which, consequently, also increases their confidence in interpreting ECGs.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

JAK: Conception, study design, drafting the manuscript, approval of the final version to be published.

NAA & GAKN: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

MIK & KR: Concept, critical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

REFERENCES

1. Habibzadeh H, Rahmani A, Rahimi B, Rezai SA, Aghakhani N, Hosseinzadegan F, et al. Comparative study of virtual and traditional teaching methods on the interpretation of cardiac dysrhythmia in nursing students. J Educ Health Promot 2019; 8: 202. doi: 10.4103/jehp.jehp_34_19.
2. Barthelemy FX, Segard J, Fradin P, Hourdin N, Batard E, Pottier P, et al. ECG interpretation in Emergency Department residents: an update and e-learning as a resource to improve skills. Eur J Emerg Med 2017; 24(2): 149-156. doi: 10.1097/MEJ. 000312.
3. Antiperovitch P, Zareba W, Steinberg JS, Bacharova L, Tereshchenko LG, Farre J, et al. Proposed In-Training Electrocardiogram Interpretation Competencies for Undergraduate and Postgraduate Trainees. J Hosp Med 2018; 13(3): 185-193. doi: 10.12788/jhm.2876.
4. Omidifar N, Yamani N, Yousefi A. The Effect of ECG Training Workshop on Medical Students Knowledge of ECG Reading and Interpretation. Strides Dev Med Educ 2007; 3(2): 118-125.

5. Kopeć G, Magoń W, Hołda M, Podolec P. Competency in ECG Interpretation Among Medical Students. Med Sci Monit 2015; 21(1): 3386-3394. doi: 10.12659/msm.895129.
6. Nilsson M, Östergren J, Fors U, Rickenlund A, Jorfeldt L, Caidahl K, et al. Does individual learning styles influence the choice to use a web-based ECG learning programme in a blended learning setting? BMC Med Educ 2012; 12(1): 5. doi:10.1186/14-6920-12-5.
7. Viljoen CA, Scott Millar R, Engel ME, Shelton M, Burch V. Is computer-assisted instruction more effective than other educational methods in achieving ECG competence amongst medical students and residents? A systematic review and meta-analysis. BMJ Open 2019; 9(11): e028800. doi: 10.1136/bmjopen-2018-028800.
8. Jelovsek FR, Catanzarite VA, Price RD, Stull RE. Application of teaching and learning principles to computer-aided instruction. MD Comput 1989; 6(5): 267-273.
9. Granero-Molina J, Fernández-Sola C, López-Domene E, Hernández-Padilla JM, Preto LS, Castro-Sánchez AM. Effects of web-based electrocardiography simulation on strategies and learning styles. Rev Esc Enferm USP 2015; 49(4): 650-656. doi: 10.1590/S0080-623420150000400016.
10. Ahmed AKM, Qureshi Z, Siddiqui A. Learning of ECG with puzzles. Pak J Physiol 2018; 14(3): 56-59.
11. Balhi S, Baati R, Mrabet MK, Mekki L, Ben Mansour A, Mrabet A. Effectiveness of ECG educational workshops among undergraduate medical students. Tunis Med 2020; 98(11): 783-788.
12. Cook DA, Oh SY, Pusic MV. Accuracy of Physicians' Electrocardiogram Interpretations: A Systematic Review and Meta-analysis. JAMA Intern Med 2020; 180(11): 1461-1471. doi: 10.1001/jamainternmed.2020.3989.
13. Jablonover RS, Lundberg E, Zhang Y, Stagnaro-Green A. Competency in electrocardiogram interpretation among graduating medical students. Teach Learn Med 2014; 26(3): 279-284. doi: 10.1080/10401334.2014.918882.
14. Breen CJ, Kelly GP, Kernohan WG. ECG interpretation skill acquisition: A review of learning, teaching and assessment. J Electrocardiol 2022; 73(1): 125-128.
15. Getachew M, Beyene T, Kebede S. Electrocardiography Interpretation Competency of Medical Interns: Experience from Two Ethiopian Medical Schools. Emerg Med Int 2020; 2020: 7695638. doi: 10.1155/2020/7695638.
16. Mahler SA, Wolcott CJ, Swoboda TK, Wang H, Arnold TC. Techniques for teaching electrocardiogram interpretation: self-directed learning is less effective than a workshop or lecture. Med Educ 2011; 45(4): 347-353.
17. McAloon C, Leach H, Gill S, Aluwalia A, Trevelyan J. Improving ECG Competence in Medical Trainees in a UK District General Hospital. Cardiol Res 2014; 5(2): 51-57. doi: 10.14740/cr333e.
18. Baral R, Murphy DC, Mahmood A, Vassiliou VS. The effectiveness of a nationwide interactive ECG teaching workshop for UK medical students. J Electrocardiol 2020; 58: 74-79. doi: 10.1016/j.jelectrocard.2019.11.047.
19. Kondrashova T, Sexton WL, Baer RW, Kondrashov P. Integration of didactic knowledge with procedural skill: learning cardiac electrophysiology and electrocardiography using ultrasound. Med Sci Educ 2015; 25(2): 141-147.
20. Khan SP, Tariq S, Rizwan R, Abbas M, Jivani Z, Adeel A, et al. Pre and Post Workshop Knowledge Assessment Regarding ECG and Arrhythmia Management in Medical Undergraduates. J Bahria Uni Med Dental Coll 2020; 10(4): 301-306.

.....