

Knowledge of Electrocardiogram Interpretation in Medical Interns at a Peruvian University

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ABSTRACT

The electrocardiogram (ECG) is the most widely used cardiovascular diagnostic test and its interpretation depends on the physician's knowledge.

Objective: To evaluate the knowledge of ECG interpretation and its associated factors in medical students during their medical internship at a Peruvian university.

Methods: This is an observational, analytical and cross-sectional study. The sample consisted of 148 medical students evaluated by means of the "Electrocardiography Knowledge Questionnaire".

Results: 53.38% (n=79) of the medical interns had a medium level of knowledge of ECG interpretation, 43.25% (n=64) a high level and 3.37% (n=5) a low level. In the bivariate analysis, the statistically significant factors associated with knowledge were: weighted grade point average p=0.000; PR=1.285; 95%CI [1.158-1.426], having taken the Critical Patient Management course p=0.019; PR=1.148; 95%CI [1.025-1.286], orientation towards a medical specialty p=0.033; PR=0.881; 95%CI [0.785 -0.989]. In the multivariate analysis, the statistically significant factors were: weighted average of "Good" ratings p=0.000; PR=4.738; 95%CI [2.216-10.133] and orientation to a clinical specialty p=0.025; PR=2.382; 95%CI [1.114-5.094].

Conclusions: final year medical students predominantly present a medium and high level of knowledge of ECG interpretation and the significantly associated factors were: having a weighted grade point average in the good category, having taken the Critical Patient Management course, and having an orientation towards a clinical specialty.

Keywords -Knowledge, electrocardiogram, education, medical.

Introduction

The electrocardiogram (ECG) is the most widely used cardiovascular diagnostic test and its interpretation will depend on the knowledge and skills acquired by the physician during his or her years of study (Cook et al., 2020).

ECG interpretation remains one of the basic topics in medical school curricula, the purpose of which is to provide students with the ability to detect cardiovascular alterations (Ohn et al., 2018) (Getachew, 2020), to develop a correct diagnosis and propose appropriate treatment (Kopeć et al., 2018).

The World Health Organization (WHO) reported that cardiovascular diseases are one of the leading causes of death worldwide and approximately 17.9 million people died in 2016, representing 31% of deaths worldwide, and of these, 85% are caused by strokes and heart attacks (World Health Organization, 2017). Likewise, the American Heart Society (AHA), reports that in the United States approximately 2200 Americans die every day from cardiovascular diseases, one death every 40 seconds, estimating that 92.1 million Americans would have some type of cardiovascular disease or the sequelae of stroke. Furthermore, the death toll from cardiovascular disease is estimated to increase by more than 23.6 million by 2030 (Benjamin et al., 2017).

In Peru, non-communicable diseases account for more than 50% of morbidities, affecting different age groups and representing a heterogeneous group of ailments, among the four main causes are cardiovascular diseases (INEI, 2020). According to the Ministry of Health (MINSa), the mortality rate due to ischemic heart disease represents 28.77% (Ministerio de Salud, 2013).

For this reason, basic knowledge of the electrocardiogram is fundamental because it is an accessible and inexpensive management tool available in most health care facilities (González et al., 2016).

According to Aldea Vasquez et al. (2019), on the adequate interpretation of the electrocardiogram in medical personnel in various countries indicated that there is a deficit regarding knowledge of the ECG, which is alarming, since this instrument provides a quick and accurate diagnosis in emergencies. It also refers that a deficient formation of the knowledge of the undergraduate student is related to the university curriculum that focuses more on technical information than on the practice.

Therefore, the objective of this study was to evaluate the level of knowledge about the interpretation of the electrocardiogram and its associated factors in medical interns at a Peruvian university.

Methodology

The study design of this research is observational, analytical and cross-sectional.

Population and sample

The population consisted of 190 senior medical students doing their hospital internship at the Faculty of Human Medicine of the Ricardo Palma University, enrolled in the academic year 2020. The sample was 148 interns. In the present study, an expected proportion of 60.2% was taken in the exposed group and a proportion of 39% in the unexposed group, a ratio between the groups of 1:1, a confidence level of 95%, for which a statistical power of 81.2% was obtained. Simple random sampling was performed. Undergraduate students with a second career related to health sciences, students working in a health facility and students who refused to take part in this study were excluded.

Variables and instruments

The main outcome variable was knowledge of electrocardiogram interpretation. The instrument used was the "Electrocardiography Knowledge Questionnaire", validated by Alcantara L. (Alcantara Guerrero, 2017), which consists of 20 questions where 1 point is assigned to each correct answer and 0 point to the incorrect answer. Likewise, the questionnaire evaluates 4 dimensions independently: knowledge about cardiac anatomy and physiology, knowledge about the performance of the electrocardiogram, knowledge about the normal electrocardiographic tracing, and knowledge about the main arrhythmias and their interpretation. The total score of the questionnaire was obtained with the sum of all the dimensions and was graded as: "high" from 13.4 to 20, "medium" from 6.7 to 13.4 and "low" from 0.0 to 6.7.

The independent variables evaluated were: weighted grade point average in medical school, classified as: Failed (0 -10.4), Passed (10.5-13.5), Good (13.6-16.4), Very Good (16.5-18.5), Excellent (18.6-20); having taken the "Critical Patient Management" course (elective, theoretical-practical course, with an exclusive chapter on ECG, carried out at the Clinical Simulation Center of the Ricardo Palma University), having taken an extracurricular course on electrocardiogram, and having an orientation towards a medical specialty classified as: clinical and surgical (Taype-Rondan et al., 2017)(Alarcon & Zevallos, 2017)

Statistical analysis

The analysis of the results was processed in the statistical program Stata version 15. The qualitative variables were processed to obtain relative and absolute frequencies, and the quantitative variables with measures of central tendency and dispersion. In the bivariate and multivariate analysis, the Chi-square test was used with a confidence level of 95% to determine the association between the factors, and the prevalence ratio (PR) was used for its quantification.

Ethical Aspects

The study was approved by the Research Ethics Committee of the Faculty of Human Medicine of the Ricardo Palma University. Likewise, the surveys were applied after the acceptance and informed consent of the participants. The research was developed in the context of the VII Thesis Workshop Course according to the published approach and methodology (De La Cruz-Vargas et al., 2019).

Results

The sample consisted of 148 final year medical students, 64.19% (n=95) female and 35.81% (n=53) male. Regarding the level of knowledge about the interpretation of the electrocardiogram, 53.38% (n=79) of the medical students (medical interns) had a medium level of knowledge, and 43.25% (n=64) had a high level of knowledge (Figure 1).

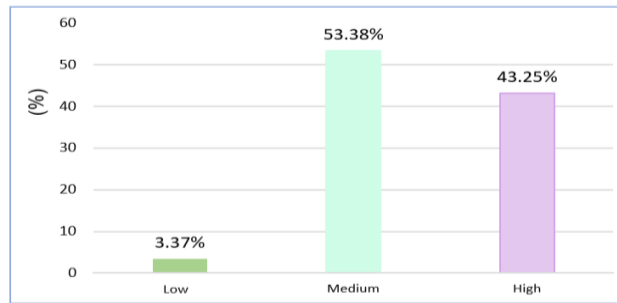


Figure 1. Total percentage of the level of knowledge on the interpretation of the electrocardiogram.

Source: Institute for Research in Biomedical Sciences - Ricardo Palma University

According to the level of knowledge of ECG interpretation, according to the dimensions of the questionnaire, in the dimension of anatomy and physiology, 50% of medical interns have a high level of knowledge, in the dimension of ECG performance, 60.14% have a medium level of knowledge, in the dimension of ECG tracing, 51.35% have a medium level of knowledge and in the dimension of main arrhythmias, 45.95% have a high level of knowledge (Figure 2).

An association analysis was performed between the levels of knowledge on ECG interpretation and the study factors, where an association was found between the level of knowledge and the weighted average of the career $p=0.000$; $PR=1.285$; 95% CI [1.158 -1.426], which indicates that having a weighted average in the "Good" category is associated with having a high level of knowledge (Table 1).

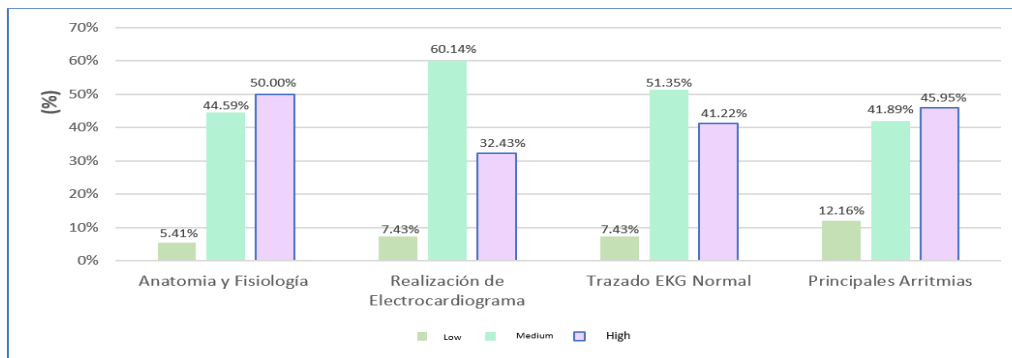


Figure 2. Percentages of the level of knowledge on the interpretation of the electrocardiogram by dimensions.

Source: Biomedical Sciences Research Institute -Universidad Ricardo Palma

Table N°1: Bivariate analysis between knowledge level and study variables.

Variables	Knowledge level				X ²	Valor p	RP	IC (95%)	
	High		Medium - Low					Inferior	Superior
	n	(%)	n	(%)					

Global		6 4	(43. 24)	84	(56.76)					
Weighted Average	Good (14 - 16)	3 5	(23. 65)	17	(11.49)	18,91	0,00	1,28	1,15	1,426
	Approved (11 - 13)	2 9	(19. 59)	67	(45.27)	5	0	5	8	
Critical Patient Management Course	Yes	4 5	(30. 41)	43	(29.05)	5,51	0,01	1,14	1,02	1,286
	No	1 9	(12. 84)	41	(27.70)					
Extracurricular course on electrocardiogram	Yes	1 2	(8.1 0)	9	(6.08)	1,926	0,16	1,11	0,96	1,293
	No	5 2	(35. 14)	75	(50.68)					
Orientation to a medical specialty	Clinics	4 6	(31. 08)	46	(31.08)	4,523	0,03	0,88	0,78	0,989
	Surgical	1 8	(12. 16)	38	(25.67)					

X²: Chi-square; Significance p<0,05

Source: Biomedical Sciences Research Institute -Universidad Ricardo Palma

In relation to the association between the level of knowledge and taking the Critical Patient Management course, it was found to have a statistically significant association $p= 0.019$; $R_p= 1.148$; 95% CI [1.025-1.426], therefore, taking the Critical Patient Management course is associated with having a high level of knowledge.

However, in the association between the level of knowledge and taking an extracurricular course on electrocardiography, no statistically significant association was found $p= 0,165$; $R_p=1,115$; IC 95% [0,961 – 1,293].

There was a statistically significant association between the level of knowledge and orientation to a medical specialty $p=0.033$; $R_p=0.881$; 95% CI [0.785 -0.989]. That is to say that having an orientation towards a surgical specialty is a factor for having a medium-low level of knowledge.

A multivariate analysis was performed between the high level of knowledge and the statistically significant study factors, where only the following were found as independent factors: the weighted average "Good" $p=0.000$; $R_p= 4.738$; 95% CI [2.216-10.133] and the orientation towards the Clinical specialty $p=0,025$; $R=2,382$; IC 95% [1,114 - 5,094] (Table 2).

Table N°2:Multivariate analysis between high level of knowledge and study variables.

Variables	P value	RP	IC (95%)	
			Inferior	Superior
Weighted Average Good (14 - 16)	0,000	4,738	2,216	10,133
Critical Patient Management Course	0,102	1,852	0.885	3,875
Orientation to a medical specialty	0,025	2,382	1.114	5,094

X2: Chi-square
 Significance $p < 0,05$

Source: Biomedical Sciences Research Institute -Universidad Ricardo Palma.

Discussions

In this research study, 96.63% of the final year medical interns have a medium and high level of knowledge about ECG interpretation. However, in a study conducted by Cornejo Arias (Cornejo Arias, 2020), the highest percentage of medical interns had a fair level of knowledge (41.49%) on the assessment of electrocardiographic parameters.

Likewise, the highest percentage of students obtained a low level of knowledge in the dimension of arrhythmias and interpretation which contained images of tracings of cardiac pathologies, a similar result had the study of CairoBarquero et al. (Barquero et al., 2019) in the dimension of identification of rhythm disorders in the electrocardiogram applied to medical interns, resulting deficient and only 51% of the ECG tracings were recognized correctly. Therefore, it is important to incorporate new strategies aimed at improving knowledge and skills in this area.

The study by AbdulmajeedMobrad (Mobrad, 2020) obtained results similar to this research, and found that a high weighted average is associated with competence in ECG interpretation. This would be justified given that high academic performance requires constant learning on the part of the student, which would bring him/her a broad knowledge in different subjects.

Regarding the level of knowledge and taking an extracurricular course on ECG, no significant association was found $p = 0.165$; $R_p = 1.115$; 95% CI [0.961-1.293]. In contrast to this study, Ortiz Kaemena et al. (2017) found that taking an extracurricular course is significantly related to obtaining a better level of knowledge ($p < 0.0001$). It should be noted that for both studies neither the duration nor the modality of the extracurricular course was specified.

According to the study by Grzegorz Kopeć et al. (2020), competence on ECG interpretation was not significantly associated ($p = 0.99$) with medical student's attendance to theoretical classes that included ECG topics during undergraduate. For this reason, another study by Grzegorz Kopeć et al. (2018) showed that the use of collaborative learning model based on group discussions and the use of multimedia tools is associated with better competence in ECG interpretation. These

findings reinforce the significant association with interns who took the Critical Patient Management course, which is theoretical-practical, in addition to having medical simulators and diagnostic equipment available.

These results agree with Ochoa Castro et al. (2014) where significant association between a high level of ECG knowledge was found in residents of clinical specialties. This is because clinical specialties have a greater daily practice using the electrocardiograph and interpreting ECGs, which strengthens learning, compared to other specialties.

Conclusion

In conclusion, most of the medical students in their last year of medical school have an acceptable level of knowledge (medium and high) of electrocardiogram interpretation. The factors significantly associated were: having a weighted grade point average in the "Good" category, having taken the Critical Patient Management course and having an orientation towards a clinical specialty.

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