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Evaluation Of The Knowledge Of Medical Doctors, Graduates, And Students About The Field Of Clinical Neurophysiology

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Abstract

Clinical neurophysiology is a branch of medicine that analyses the central and peripheral nervous systems using bioelectrical activity recordings. Electromyography and nerve conduction tests, Electroencephalography, Evoked potentials, and Polysomnography are among the most common diagnostic modalities used. Clinical neurophysiology is a new subspecialty of neurology and physiology in Iraq. Clinical neurophysiology is still underrepresented in medicine, and there is a paucity of useful understanding and education in this discipline. A survey structure by using google form is created and 330 participants were involved in the study from different cities in Iraq and different grades. The data shows that the majority of participants (70%) enrolled in the study are partially aware of the clinical neurophysiology, and Approximately (90%) of participants answer the basic knowledge question about the EMG uses truly, and the higher true answer rate was among the specialist doctor, in contrast to the medical students who get the lower right answers rate. Nevertheless, the basic question about the NCS gets only (37%) right responses and the lowest rate of true response was among the rotator residents. On the other hand, the question about the EEG principle was truly answered in (78%) of participants, and same as EMG response, the higher rate was for specialist doctors and the lowest rate was for medical students. Furthermore, the question of VEP uses was solved correctly in (55%) of persons only with the lowest response rate among medical students. In addition to this, (71%) of participants answered the question of MND diagnosis correctly with the same pattern of response which is higher for the specialists and lower for the medical students. Finally, as it was expected the best response was for those of neurological related specialties that include neurology, neurosurgery, and neurophysiology.

Introduction

In Iraq, clinical neurophysiology is emerging as a new sub-specialty of neurology and physiology. Clinical neurophysiology is a branch of medicine that investigates the central and peripheral neural systems by monitoring bioelectrical activity (Spyros, 2021).It is a part of neurology or psychiatry in some countries, such as the United States and Germany. In certain countries, such as Spain, Portugal, Italy, the United Kingdom, Finland, Sweden, and Norway, it is a separate specialization (American Board of Psychiatry and Neurology, 2017). Clinical neurophysiology departments are usually found in hospitals with neurologists and neurosurgeons. Typically, they are larger hospitals with more specialized staffing units.

Electromyography and nerve conduction studies are diagnostic procedures of the peripheral nervous system, particularly effective in evaluating disorders of the muscles, nerves, and nerve roots, and are commonly used at hospitals with clinical neurophysiology facilities. The electrical activity of muscles and their transmission along nerves in the limbs are recorded in these tests (Kamen, 2004).It also includes Electroencephalography, which is a diagnostic test of thalamocortical rhythms (brain waves) that is useful in evaluating seizures and other central nervous system abnormalities. It is performed by attaching electrodes to the surface of the scalp to record currents from the cerebral cortex (Niedermeyer et al. 2004).Furthermore, evoked potentials are a diagnostic test that evaluates certain tracts of the central and peripheral nervous systems. These may include visual, auditory, or somatosensory evoked potentials, and they record the electrical responses of the brain and spinal cord to sensory stimulation (Vanden et al. 2015).There is also a clinical neurophysiological test known as polysomnography, which is a sort of sleep study used to diagnose illnesses linked to irregular sleep behavior (báez et al. 2018). Intraoperative neurophysiologic monitoring, on the other hand, is the use of electrophysiological methods such as electroencephalography (EEG), electromyography (EMG), and evoked potentials to monitor the functional

integrity of certain neural structures (e.g., nerves, spinal cord, and parts of the brain) during surgery (Howick et al. 2015).

The teaching and education of neurophysiology in Iraqi universities, at the medical colleges, is restricted to part of the curriculum during the second year of the medical degree as a part of physiology subject, in addition, a clinical knowledge at relation is given to the student as a part of neurology subject during their fifth year of medical studying of bachelor's degree. This study aims to evaluate the knowledge of medical doctors, graduates, and students about the field of clinical neurophysiology in Iraq. It argues that clinical neurophysiology is still to be underrepresented and there is a lack of effective knowledge and education about this field of medicine.

Methods

A survey structure by using google form is created and published on social media in different medical and student groups in Iraq from 19th to 24th of July 2020. This form consists of three sections, the first section tries to identify the personal information and characteristics by using questions related to the age, sex, city of work or study, and the status of enrolled person whether a medical student, resident, or specialist doctor and try to determine the specialty. The second section tries to identify a basic knowledge and information about the clinical uses and application of neurophysiological studies by asking scientific questions in form of multiple choices about some scientific point related to electroencephalography, electromyography, nerve conduction study, evoked potential and the answer was tic as either true or false to identify the level of knowledge among the different groups of enrolled persons. The third part of the questionnaire contains certain questions related to the knowledge about the field of clinical neurophysiology and the behavior of participants with neurophysiological reports and their awareness about the presence of this specialty in Iraq. In total 335 participants were involved in the study from different cities in Iraq and different grades (students, residents, specialists). The statistical analysis was done by using SPSS (Statistical Package for the social sciences) version 20, the categorized variables were expressed by count and percentage, the results were expressed in form of tables, the association between the variables was assessed by using the Qi square test and the significance threshold was set at a P value less than 0.05.

Results

Three-hundred-thirty-five participants were involved in the study. The personal information and the characteristics of the participant are represented in table(1) that describes the age, sex, city of work or study, the status of participants whether they are students, residents, or specialist doctors, in addition to the specialties of them if present.

Table(1) The characteristics of participants

Age	**Mean**	**Standard deviation**	**Maximum**	**Minimum**	
	31.16	**7.64**	**60**	**21**	
Sex	**Male**		**Female**		
	149 (44.5%)		**186 (55.5%)**		
City	**Basra**	**Baghdad**	**Other cities**		
	232 (69.3%)	**58 (17.3%)**	**45 (13.4%)**		
Status	**Medical Student**	**Rotator resident**	**Permanent resident**	**Specialist doctor**	
	50 (14.9%)	**88 (26.3%)**	**111 (33.1%)**	**86 (25.7%)**	
Specialty	**Medical specialty**	**Surgical specialty**	**Neurological specialty**	**General practitioner or basics**	**No specialty**
	62 (18.5%)	**62 (18.5%)**	**20 (6%)**	**53 (15.8%)**	**138 (41.2%)**

To clarify the basic knowledge of participants about the clinical uses and application of neurophysiological studies, table(2) below demonstrates the answers of the participants to five questions in form of multiple choices about some scientific points related to electroencephalography, electromyography, nerve conduction study, evoked potential.

Table(2)The answers to the basic knowledge questions

EMG uses	**Myopathy, Neuropathy and MNJ (true)**	**Encephalitis (false)**	**Epilepsy (false)**
	303 (90.4%)	**1 (0.3%)**	**31 (9.3%)**
NCS uses	**Both peripheral and cranial (true)**	**Peripheral (false)**	**Cranial (false)**
	126 (37.6 %)	**202 (60.3%)**	**7 (2.1%)**
EEG principle	**Brain waves**	**AP**	**CV**

	(true)		(false)	(false)
	263 (78.5%)		42 (12.5%)	30 (9%)
VEP uses	Multiple sclerosis (true)		MND (false)	MG (false)
	185 (55.2%)		93 (27.8%)	57 (17%)
MND diagnosis	EMG&NCS (true)	SSEP (false)	EEG (false)	VEP (false)
	240 (71.6%)	41 (12.2%)	15 (4.5%)	39 (11.6%)

Furthermore, table (3) summarizes the response to certain questions related to the knowledge about the field of clinical neurophysiology and the behavior of participants with neurophysiological reports and their awareness about the presence of this specialty in Iraq.

Table(3) The answers to the awareness questions					
Are you aware about the Clinical application of Neurophysiology?					
Fully	51 (15.2%)	Partially	235 (70.1%)	Unaware	45 (13.4%)
Did you study Clinical neurophysiology during your medical degree?					
Basic lectures	302 (90.1%)		Clinical practice	33 (9.9%)	
Do you know what the job of clinical neurophysiologist is?					
Yes	246 (73.4%)		No	89 (26.6%)	
Did you hear about the 10/20 international montage of EEG?					
Yes	27 (8.1%)		No	308 (91.9%)	
Did you hear about motor neuron disease?					
Yes	326 (97.3%)		No	9 (2.7%)	
Did you know that there is a degree for this specialty in Iraq?					
Yes	239 (71.4%)		No	96 (28,7%)	
Do you have interest to be a clinical neurophysiologist?					
Yes	81 (24.2%)		No	254 (75.8%)	
Did you previously see a clinical neurophysiology report as EEG or EMG report?					
Yes	265 (79.1%)		No	70 (20.91%)	
Can you understand the Figures and the Numbers of these reports?					
Yes	58 (17.3%)		No	277 (82.7%)	
Do you know a clinical neurophysiologist in your city?					
Yes	249 (74.3)		No	86 (25.7%)	
Did you hear about the intra-operative Electrophysiological Monitoring during brain or spinal surgery?					
Yes	156 (46.6%)		No	179 (53.4%)	
Did you hear about the somatosensory evoked potential?					
Yes	122 (36.4%)		No	213 (63.6%)	
Did you send a request for any neurophysiological test? If yes which one you commonly send ?					
EMG	37 (11%)		VEP	3 (0.9%)	
NCS	42 (12.5)		SSEP	Zero	
EEG	57 (17%)		No	196 (58.5%)	

On the other hand, the association between the proportion of right answers about the basic knowledge and the status of participants is assessed by using the Qi square test, and table(4) below demonstrates the cross-tabulation between these two variables.

Table(4) The association between basic knowledge questions and status of participant											
Participant 's status	EMG uses		NCS uses		EEG principle		VEP uses		MND diagnosis		T
	True	false	true	false	True	false	True	false	true	false	

Student	39 78%	11 22%	24 48%	26 52%	39 78%	11 22%	20 40%	30 60%	29 58%	21 42%	50
Rotator	78 88.6%	10 11.4 %	26 29.5%	62 70.5%	64 72.8%	24 27.2%	38 43.2%	50 56.8	65 73.9%	23 26.1	88
Permanent	103 92.8%	8 7.2%	43 38.7%	68 61.3%	89 80.2%	22 19.8%	72 64.9%	39 35.1%	81 73%	30 27%	111
Specialist	83 96.5%	3 3.5%	33 38.4%	53 61.6%	71 82.6%	15 17.4	55 64%	31 36%	65 75.6%	21 24.4%	86
Total	303	32	126	209	263	72	185	150	240	95	**335**
Statistical numbers	**P value : 0.003**		**P value : 0.491**		**P value : 0.271**		**P value : 0.001**		**P value : 0.530**		

Moreover, the association between the proportion of right answers about the basic knowledge and the specialty of participants is assessed by using the Qi square test, and table(5) below demonstrates the cross-tabulation between these two variables.

Table(5) The association between basic knowledge questions and specialty of participant

Participant's specialty	**EMG uses**		**NCS uses**		**EEG principle**		**VEP uses**		**MND diagnosis**		**T**
	true	false	True	false	True	false	true	false	true	false	
Medical	61 98.4%	1 1.6%	19 30.6%	43 69.4%	51 82.3%	11 17.7%	39 62.9%	23 37.1%	49 79%	13 21%	62
Surgical	57 91.9%	5 8.1%	26 41.9%	36 58.1%	50 80.6	12 19.4%	41 66.1%	21 33.9	43 69.4%	19 30.6%	62
Neurological	20 100%	Zero	13 65%	7 35%	19 95%	1 5%	20 100%	Zero	18 90%	2 10%	20
GP/Basics	48 90.6%	5 9.4%	19 35.8%	34 64.2%	40 75.5%	13 24.5%	26 49.1%	27 50.9%	36 67.9%	17 32.1	53
Non	117 84.8%	32 15.2%	49 35.5%	89 64.5%	103 74.6%	35 25.4%	59 42.8%	79 57.2%	94 68.1%	44 31.9%	138
Total	303	32	126	209	263	72	185	150	240	95	**335**
Statistical numbers	**P value : 0.018**		**P value : 0.175**		**P value :0.165**		**P value : 0.001**		**P value : 0.492**		

Discussion

To our knowledge, this is the first research on the evaluation of the education of medical graduates and doctors about the field of neurophysiology. A total of (335) participants were enrolled in this study with mean age (31.6) years and a Standard deviation of (7.64) years. They were either medical students or medical doctors who were either residents or specialists. As was shown in the results in the previous section, the full awareness about neurophysiology is presented only in (15%) of the participants and there is a pipeline leak in many pieces of information that they might study during the medical degree which unfortunately was concentrated mainly on basic lectures with no or minimal opportunity about the clinical application (9.9%) and what surprising is that there is approximately one-quarter of participants who they do not know the job of neurophysiologist and approximate percentage (28%) who they did not know about the presence of degree for this specialty in Iraq, additionally such same percentage of participants who do not know any neurophysiologist in their locality. Generally, Prior research has illustrated there is a knowledge gap in residents' neurophysiology education (kate et al. 2018).

Furthermore, the answers about the basic knowledge questions were not very satisfactory, as these questions were very simple, and they must be solved by any medical graduate as it includes only the basic principles. Turing to compare these results with the results of a study conducted in the United States of America, it appears of faraway differences although Kate et al. claimed that their participant's response was unsatisfactory, as 85% of their graduating residents met high level in EEG and only 75% in EMG (kate et al. 2018).

Many prior studies argued that Students perform comparatively poorly in neuroscience courses. It is probably true that neurophysiology is hardly taught with many active learning experiences or examples (Lake, 1999) or the students are not able to associate the concepts to previous knowledge or experiences on which the teacher can build upon (Michael, 2001)

Finally, a study of medical students conducted in Nigerian medical schools found that students' performance in neurophysiology was significantly lower than their performance in cardiovascular and endocrinology aspects of

the subject over the course of three years on the second professional examinations. Uninteresting, abstract concepts, a lack of concrete examples, and facts that contradicted their prior basic knowledge were among the reported students' perceptions of their neurophysiology learning. For the neuroscience courses, more than half of the graduates assessed their learning experiences as poor, extremely poor, or below average (Nwobodo et al. 2009).

Conclusions and Recommendations

The branch of neurophysiology continues to be under-presented and there is a lack of awareness among medical students and doctors about this field. Consequently, it is important to highlight this branch of physiology and neurology to achieve a better outcome in the diagnosis and treatment of many neurological diseases. On the other hand, one of the key limitations of this study is that it was applied mainly to a single governorate in Iraq with a small sample size from other cities. finally, it is worthy to recommend improving the study of the clinical application of neurophysiology during the medical degree to increase the awareness and the knowledge of medical students which in turn will become future residents and specialists.

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