

MEDICAL PHYSICS EDUCATION, TRAINING AND PROFESSIONAL RECOGNITION IN IRAQ

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Abstract — The history of diagnostic and therapeutic radiation services in Iraq dates back to 1920s. The growth of the medical physics specialty in Iraq started with increasing the establishment of new radiotherapy centers in most of the Iraqi governorates and the rapid developed of the radiation therapeutic and diagnostic techniques which requires the presence of qualified clinical medical physicists. Many Iraqi private and governmental universities established BSc, MSc. and PhD programs, which are found in most of the Iraqi provinces. Increasing the capacity of the of radiotherapy units in the governmental hospitals as well the opening of many private centers all over the Iraqi provinces led to increasing the numbers of the radiotherapy devices and the diagnostic radiology techniques. Nowadays, most of the radiation therapy units have LINACs, CT, MRI, Ultrasound, and other advanced techniques like PET/ CT and SPET/CT. The clinical training programs are considered very limited in Iraq, there is a necessity for providing trainings in the fields of quality control and quality assurance. The improvement and the recognition of medical physics specialty in Iraq was greatly supported by the establishment of the Iraqi Medical Physics Society (IMPS), 2011. Currently IMPS have about 120 (70% females and 30% males) medical physicists who are affiliated to different medical and academic institutions of the Iraqi provinces.

Keywords — medical physicist, radiotherapy, nuclear medicine, diagnostic radiology, Iraq.

I. INTRODUCTION

The history of diagnostic and therapeutic radiation services in Iraq dates back to 1920s, when the first Radiology Institute was established in Baghdad. Then the number of the radiology institutions expanded to cover the main Iraqi provinces like Mousel, and Basra. At that time the field of medical physics was not recognized in Iraq, and few numbers of medical physicists who served in these institutions graduated from the medical physics departments of UK and USA universities, where there was no academic program of medical physics found in the Iraqi universities.

The growth of the medical physics specialty in Iraq started with increasing the establishment of new radiotherapy centers in most of the Iraqi governorates. The rapid developed of the radiation therapeutic and diagnostic techniques required the presence of qualified clinical medical physicists to work together with the oncologists to introduce the optimum medical services to the cancer patients. This motivated the academic medical physicists to work on the establishment of postgraduate programs to provide the Iraqi

health institutions with medical physicists who are capable of dealing with the advanced therapeutic and diagnostic technologies in the fields of radiotherapy, nuclear medicine, radiation protection, dosimetry, the applications of laser in medicine, and other imaging techniques. For this purpose, in 1989, the first Msc. Program of medical physics in Iraq was found in Mustansiriyah Medical College in Baghdad. Since that time, the medical physics unit of Mustansiriyah medical college received large number of Msc. Students from different regions of Iraq as well from the neighboring countries like Jordan. The medical physics researches varied in terms of subspeciality. Many of these researches had obtained local and international awards. The Iraqi ministries of health and higher education recognized this program and the graduates employed in different health institutions to enhance the quality of the medical services. In 2016, another M.Sc. Medical physics program has been established in Al-Nahrain medical college, and many B.Sc. Medical physics programs have been established in the colleges of science of the Iraqi universities.

The improvement and the recognition of medical physics specialty in Iraq was greatly supported by the establishment of the Iraqi Medical Physics Society (IMPS), 2011. The IMPS works on keeping the medical physics specialty in Iraq within the international standards through the updating of the BSc. And MSc. Curriculums in collaboration with the medical physics departments of the Iraqi universities, and by identifying and implementing of applied research projects that contribute significantly in raising the standards of the medical services which are introduced to the patients not only to the cancer patients but it includes many other fields where the physical aspects can be applied in the medical field. The current dependent MSc. Program's curriculum in both of the medical colleges of Al-Nahrain and Mustansiriyah universities is derived from the AAPM MSc. Curriculum. Currently IMPS have about 120 (70% females and 30% males) medical physicists who are affiliated to different medical and academic institutions of the Iraqi provinces.

II. ACADEMIC PROGRAMS

Teaching of medical physics subject was limited during the last few years. It was only included within the curriculums of the first-grade medical college students. All of the medical colleges in Iraq have about 40 hours for the theory part of this subject and about 60 hours for the practical

part where the physical principals of the medical diagnostic and therapeutic devices introduced to the first-grade medical students as experiments in the medical physics laboratories. These universities are located in Baghdad, Basra, Mousel, Erbil, Sulaymania, Duhok, Babil, Missan, Al-Qadisiyah, Thi-Qar, Al-Kufa, Al-Anbar, Karbala'a and Diyala. After 2014, the academic programs of medical physics in Iraq have witnessed great expansion, where many governmental and private universities established BSc. Medical physics programs, these newly opened departments receive annually students from all over the country, the matter which led to increase the postgraduate students who shows their interest in obtaining MSc. Degree in medical physics. So that, the ministry of higher education and scientific research increases annually the number of seats in the universities that offer MSc, programs to receive larger number of the applicants. Moreover, the establishment of new radiotherapy centers in the capital "Baghdad" and the other provinces requires more medical physicists to be employed. Table 1. shows the number of the governmental and private universities that offer BSc, MSc, and Ph.D medical physics programs in each Iraqi province.

Table 1 The number of the governmental and private universities that offer BSc, MSc, and PhD medical physics programs in each Iraqi province

Province	University	Academic Program	Annual no. of graduates
Baghdad	University of Baghdad/ College of Science (females)	BSc. & MSc.	50 females
	Al-Karch university for applied sciences	BSc.	45
	Al-Elm private University/ College of Science	BSc.	45
	Al-Nahrain University/ Al-Nahrain Medical College	MSc.	15
	University of Baghdad/ Baghdad Medical College	MSc.	10
Al-Anbar	University of Mustansiriyah/ Mustansiriyah Medical College	MSc.	10
	University of Falloja/ College of Sceince	BSc.	45
Diyala	University of Diyala/ College of Science	BSc.	45
Erbil	University of Hwler/ Hwler Medical college	MSc. & PhD.	30-40
	University of Salah Al-Din/ Education college/ Physics Dept.	BSc.	35
	University of Salah Al-Din/ college of science/ Physics Dept.	MSc.&PhD	10
Sulaymania	University of Sulaymania	MSc.	10
Babil	Al-Mustaqbal private University/ College of Science	BSc.	40

For the time being, there is limited Ph.D programs of medical physics in Iraq, it is only offered by two universities in Erbil province/ Kurdistan region, the universities of Erbil and Salah Al-Din in Kurdistan as mentioned in Table 1. The reason behind the limited number of the Ph.D programs is the shortage in the research institutions that can support the research projects. Adding to that, the working load on the therapeutic and diagnostic devices in the health institutions which obstacle the research process and real data obtaining.

III. TRAINING PROGRAMS

The clinical training programs are considered very limited in Iraq. The number of the trainings that were introduced to the physicists and medical physicists of the radiotherapy centers don't cover the needs of the trainees for the advanced technical information of the modern therapeutic and diagnostic devices such as the IMRT, and VMAT techniques, as well the necessity of providing trainings in the fields of quality control and quality assurance. The period of each offered training differs according to the contract with the medical institutions that received the Iraqi medical physicists' trainees. Some of these trainings took place outside Iraq such in American University of Lebanon (AUB), the Turkish radiotherapy centers, and the radiotherapy centers of UK, while some other trainings were taken place in the radiotherapy center of Baghdad and the other Iraqi provinces, Table 2 shows the radiotherapy centers where the Iraqi medical physicists had trainings on the advanced radiotherapy techniques. These trainings were under the supervision of qualified Turkish, Egyptian and Lebanese medical physicists.

Table 2 The distribution of radiotherapy centers in Iraq and the number of medical physicists trainees.

Province	Institution	No. of medical physics trainees
Baghdad	Al-Jawad Radiotherapy Center	4
	Baghdad radiotherapy and nuclear medicine hospital/ Baghdad Medical City	15
	Al-Amel radiotherapy center	14
Najaf	The Middle Euphrates radiotherapy center	9
Erbil	Rezgary radiotherapy center	4
	Hwler radiotherapy center	4
Sulaymania	Zynawa radiotherapy center	5
Basra	The radiotherapy center of Basra hospital	5
Mousel	The radiotherapy center of Al-Mousel teaching hospital	4
Babil	Al-Marjan radiotherapy center	7

IV. REGULATION OF MEDICAL PHYSICS

There is no recognized residency program for the Iraqi medical physicists. The IMPS made communications with the ministry of health through its representation in the Iraqi Cancer Board (ICB) to explain the necessity of establishing clinical training program which is recognized by both of the ministries of health and higher education. The role of IAEA is of great importance in improving the field of medical physics in Iraq, but there is no noticeable and known projects for the IAEA in this regard. The IMPS aims to cooperate with the IAEA to benefit from the educational and training programs through the IAEA representatives in the ministry of higher education. There is a real need to evaluate the needs of the medical physicists especially in the clinical field and, especially those that contribute in improving the skills of the medical physicists. IMPS is looking for the cooperation of the other medical physics societies in the region to exchange experiences. IMPS is going to revise the medical physics curriculums of the BSc. Programs due to the defects in some of these curricula, which affect the quality of the medical physicists' graduates. The poorly equipped laboratories of some newly established departments has a negative impact on the graduates. So that, IMPS consider this issue as a priority point that should be discussed with the ministry of higher education which should have a control on the quality of the BS, programs.

The lack of a clear and detailed described job description for the Iraqi medical physicist is considered as one of the most important issues. There isn't any document that stated the duties of the sub-specialized medical physicists, where many of them are working in different specialty of their experience or academic qualifications. IMPS highlights this point and tried to discuss it with the ministry of health in order to write new job descriptions that matches the sub-specialty of each employed medical physicists.

IV. THE ROLE OF IMPS IN IMPROVING THE MEDICAL PHYSICS IN IRAQ

The IMPS aims to raise the standards of medical physics specialty in the Iraqi academic and health institutions through gathering the medical physicists in one society. Since its establishment, the IMPS administrative board built the links among the Iraqi physics and medical physicists to share the experiences and to get new idea that contribute in improving the qualifications of its members and to spread the advances of medical physics to the largest number of beneficiaries.

The IMPS targeted the junior medical physicists in the newly opened medical physics departments to make them aware of the importance of this field in the quality of the medical care. This is achieved by conducting seminars, workshops and conferences in these newly established departments. The IMPS contributed positively with head of departments to assure that the curriculums cover all the aspects of medical physics. The IMPS provides trainings in

the physics principals of the radiotherapy and nuclear medicine techniques.

The goals of the IMPS extended to the implementation of applicable projects which are based on the available materials in the Iraqi markets to manufacture materials with new physical and chemical properties to be used as shielding materials by the staff of the radiation units of the hospitals. Some of these developed materials are currently under the examination of the laboratories of the quality control institution in the ministry of science and technology.

Moreover, the IMPS keen on creating a generation of medical physicists who have excellent experience in the medical physics subspecialties through involving them in MSc. Or Ph.D research projects in the fields of radiotherapy, dosimetry, radiation protection and the techniques of diagnostic radiology. This step enables the Iraqi medical physicists from the participation the IMPCB examination to get the Board of medical physics and be certified as qualified clinical medical physicists, because the current number of the sub-specialized medical physicists is considered very low as compared to the actual need of the radiotherapy centers, especially in the field of nuclear medicine. Table 3. shows the certified sub-specialized medical physicists in Iraq.

The IMPS members have an important role in identifying and implementing projects that support the community assistance through the financial help for the cancer patients' kids by the volunteering activities of the members.

Table 3 Number of the sub-specialized medical physicists in Iraq

Medical physics Subspecialty	Number of certified medical physicists (registered in IMPS)	The total number of medical physicists
Radiotherapy	12	15
Dosimetry		
Radiation protection	9	12
Diagnostic radiology	10	14
Audiology	4	6
Applications of laser in medicine	10	30

Increasing the capacity of the of radiotherapy units in the governmental hospitals as well the opening of many private centers all over the Iraqi provinces led to increasing the numbers of the radiotherapy devices and the diagnostic radiology techniques. Nowadays, most of the radiation therapy units have LINACs, CT, MRI. Ultrasound, and other advanced techniques like PET/ CT and SPET/CT, while the last two techniques are limited or not available in some Iraqi provinces. Table 4 shows the approximate numbers of the diagnostic and radiotherapy equipment's in the country. The increment in the number of devices and the usage of the modern techniques requires increasing the number of the qualified clinical medical physicists to be able to manage these devices efficiently in order to provide the optimum

health services to the cancer patients. In this regard, the IMPS focused on the type of the research projects and support the clinically applied projects by making collaborative work with the Iraqi National Center of Cancer and Medical Genetics, the Iraqi National Center of Radiation Protection and the radiotherapy units of the Iraqi health institutions in order to identify projects that help in finding applicable solutions for any problem that face the medical physicists and the oncologist during the routine clinical work.

Table 4 The approximate numbers of the diagnostic and radiotherapy equipment in the country.

Equipment	Total
LINAC	26
PET/CT	6
SPECT/CT	1
Gamma Camera	5
Gamma Knife	3
Dose calibrators	23
CT	400-550
MRI	250-300
Ultrasound	900-1000
Mammography	200-300

V. CONCLUSION

There is no designed plan or strategy by the Ministry of Health or the Ministry of Higher Education regarding finding employment to the increased numbers of graduates of medical physicists, especially those who have postgraduate degrees. In addition to the absence of a clear job description for the medical physicists which reflects negatively on the standards of the health care. Most of the medical physics departments of the Iraqi universities are not equipped with research laboratories. The poorly equipped ones have difficulty performing research especially in the field of nuclear medicine. The participation of the Iraqi medical physicists in the IMPCB exam is still limited because of the lack of clinical trainings that enable them from having good clinical experience, many of the Iraqi medical physicists are

academic staff and they do not have continuous clinical attachment with the radiotherapy units of the hospitals, the experience that they have is limited to only the MSc. or BSc. research works. The number of the register medical physicists as IMPS members is still low in comparison with the number of students and staff of the medical physics departments.

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