MEDICAL PHYSICS IN KUWAIT

M.Alnaaimi[1,2], M. Alduaij[2] and M. Omer[2]

[1] Radiation Physics Department, Kuwait Cancer Control Center, Kuwait
[2] Medical Physics Unit, Kuwait Cancer Control Center, Kuwait

Abstract — **Medical Physics is a branch of applied of physics in science concerned with the application of the concepts and methods of physics to assist the diagnosis and treatment of human disease. It is allied with medical electronics engineering, instrumentation and bioengineering. An access to the quality and affordable health care is one of the priority areas of the government. For decades, the biggest user of nuclear and radiation technology in Kuwait has been the health sector. Unfortunately Medical Physics training programs are currently not available in Kuwait. All local medical physicists obtained medical physics degrees from abroad.**

Keywords — **medical physicist, radiotherapy, nuclear medicine, Kuwait, KCCC.**

I. Introduction

There is a growing incidence of cancer especially in the developing world as clearly outlined in the Kuwait cancer registry. The estimated cancer incidence in Kuwait was 2,467 new cases of cancer in Kuwait in 2020.This is expected to increase to 4440 by 2035, i.e., an 80% increase. It was estimated that 41% of these cases will benefit from having radiation therapy thus at the present time at least 1776 patients have been receiving radiation therapy.

The Kuwait Cancer Control Center (KCCC) is a governmental center affiliated to the Ministry of Health (MOH) of the State of Kuwait. KCCC is a comprehensive center dedicated entirely to provide cancer care across the Arab States of Gulf Cooperation Council (Kuwait, Saudi Arabia, the United Arab Emirates, Qatar, Bahrain, and Oman). The center utilizes all available resources to serve cancer patients with a wide number of competent medical staff and several available treatment modalities.

KCCC is primarily made up of 4 specialized buildings; Hussain Makki Juma building for Specialized Surgery, Sheikha Badriya Al Sabah Medical Oncology Building, Faisal Sultan Ibn Issa Diagnostic Imaging building, and Bahbahani building for hematology and stem cell transplantation. It is a 200-bed hospital complex located in Shuwaikh that treats over 3000 new cancer patients each year. The center has all areas of cancer management, the surgical oncology, the medical oncology, hemato-oncology, and the radiation oncology.

Medical physics contributions and supports to both nuclear medicine and radiotherapy are well-established disciplines in the country with the availability of competent professionals and technical staff performing advanced medical imaging systems and procedures. KCCC's nuclear medicine department is currently equipped with one cyclotron facility for the production of short-lived radioisotopes associated to two Positron Emission Tomography – Computed Tomography (PET/CT) scanners, four Single-Photon Emission Computed Tomography (SPECT/CT) scanners, and a radionuclide therapy suite for treatment with I-131, Lu-177, Ac-225. Its central radio-pharmacy unit supplies on a daily basis all nuclear medicine services in Kuwait with ready-to-use radiopharmaceuticals, starting materials for compounding radiopharmaceuticals locally and PET radiopharmaceuticals.

The KCCC is dedicated entirely to the purpose of providing cancer care across the State of Kuwait and hosts the country's only radiation oncology facility. Currently, the KCCC's radiotherapy department has four linear accelerators, three of which are modern linacs with 0.5cm MLCs and CBCT capabilities. The fourth one has 1cm MLC and portal imaging, this linac is dedicated to electron treatments and palliative cases. The department provides High Dose Rate (HDR) brachytherapy services with an after-loader machine (Ir-192 source) for gynecological applications. The department also has a CT simulator and a traditional simulator. The department offers radiotherapy, paediatric oncology and palliative treatment services. Most cases are treated with 3D conformal radiotherapy. Intensity modulated radiotherapy (IMRT) services started ~~in~~ at the department in 2016, and currently head and neck, and prostate cancer patients are treated with this technique. Volumetric arc therapy was introduced in 2018. MOH is currently constructing a new cancer center which will have six bunkers for linacs and a bunker for brachytherapy. The new center would also be equipped with 2 CT simulators and an MRI simulator.

In addition, the IAEA have recently honored KCCC in recognition of its distinguished efforts in nuclear medicine by an official ceremony held at its headquarters in Vienna, the agency lauded the KCCC as an outstanding regional training center. Honoring the center is an evidence of several experiments and progresses made by Kuwait is this field. This honoring establishes a start of a key scientific cooperation between the institutions and the centers of nuclear medicine in Asia through the current cooperation between Kuwait and the IAEA.

For any expansion to take place to meet the growing needs to fight against cancer, trained professionals including medical physicists will be required. Currently, all local

medical physicists joined the service after obtaining MSc or PhD degree from overseas universities.

In order to address the shortage of medical physicists and the lack of taught medical physics degree in Kuwait extensive training were provided for local staff with the assistance of the IAEA. In addition, the government recruited a number of experienced medical physicists from abroad to assist in training medical physicists locally. A summary of medical equipment for medical imaging and radiation therapy is shown in Table 1.

II. INFRASTRUCTURE

Kuwait, with a population of approximately 4.27 million people, has one radiotherapy and 11 nuclear medicine facilities providing clinical services including imaging and non-imaging studies. Table 1 shows a summary of equipment for medical imaging and radiation therapy available in Kuwait.

Table 1 Medical equipment for medical imaging and radiation therapy

Equipment	Total
Cyclotron	2
PET/CT	14
SPECT	33
Dose calibrators	22
Accelerator	4
MRI	23
CT	45
Mammography	15
Standard Radiology	208
Interventional	40

III. REGULATION OF MEDICAL PHYSICS

In the regulatory framework of Kuwait, the presence of a medical physicist is mainly for Radiation therapy and Nuclear Medicine centers. Currently, the MOH are reviewing the structure and organization of medical physics profession in the country. Distribution of Medical Physicists in the country is given in Table 2.

Table 2 Distribution of medical physicists in Kuwait

Medical Physicists	Total
Radiotherapy	10
Nuclear Medicine	18
Radiology	4
Health physics	6
Total	38

IV. EDUCATION AND TRAINING

Medical physics education and training in Kuwait has traditionally been completion of a BSc degree in Physics or Allied health science followed by a postgraduate degree abroad. At the moment, no proper medical physics academic education and training program available at national level. After completion of the degree program, graduates would be allowed to work as Medical Physicists for two years under the supervision of Clinically Qualified Medical Physicists, after which they would be allowed to carry out independent clinical work as Medical Physicists.

V. CONCLUSION

The Ministry of Health is currently constructing a new cancer center which will have six bunkers for linear accelerators, or LINACs, a machine used to deliver radiotherapy in cancer treatment. It will also provide services in brachytherapy. The new center would also be equipped with two computed tomography simulators and a magnetic resonance imaging simulator. In addition, two PET/CT and a PET/MRI will be installed in the new center. Therefore, there an ever-increasing demand of qualified medical physicists in the country. In addition, a proper medical physics educational and training program is a priority that have been taken into account within the MOH strategic plan.

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Contacts of the corresponding author:

Author: Dr. Meshari Abdulrahman Al-Nuaimi
Institute: Kuwait cancer control centre
Street: Alsabah medical area
City, Country: Shweikh, State of Kuwait
Email: maalnuaimi@moh.gov.kw