

A MEDICAL PHYSICS PERSPECTIVE: RADIATION THERAPY IN NEPAL

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I. INTRODUCTION

Radiation Oncology is an essential requirement for the safe and effective utilization of nuclear technology in the health care sector. Radiotherapy is highly effective cancer treatment and leads to cancer cure in patients. Cancer is one of the most rapidly growing diseases in Nepal. Over half of all cases of cancer in the world arise in people in low and middle-income countries. About 60% of the cancer cases worldwide occurs in low and middle income countries [1] This proportion will rise to fifty percent by 2020 [2]. In developing country like Nepal, at least sixty percent of all cancer patients can benefit from radiotherapy. However, the existing infrastructure is far behind to successfully cope with this increasing threat not only to public health but also national economies. Technological advancement in radiation therapy has dramatically increased the reduction of side effects and also increased survival rate in some cases and enhanced the quality of life after recovery. Modern Radiation Therapy treatments require trained and qualified professionals and big investment. However, the developing country like Nepal does not benefit from this advancement due to lack of radiotherapy machines and insufficient number of specialized medical professionals mainly medical physicists. Medical Physicists are one of the key components in Radiation Oncology and plays a vital role in improving cancer cure through technology. Upon pursuing the improvement of the situation, timely training in treatment planning, treatment technique and quality control is significant because the investment on human resource, investment on equipment and facility does not bring out an immediate result. Therefore, it is necessary to develop human resources in Radiation Therapy by properly responding to the growing demand for cancer treatment and by overcoming the poor situation of limited resources

The main point to cope with the current situation of radiotherapy service in Nepal is to improve the knowledge, skill and competency of radiation oncology professionals to treat the massive increase in cancer patients in particular throughout the country and also to improve cancer treatment by means of strengthening the application of radiation therapy.

II. CURRENT STATUS

In Nepal the first radiation therapy service was started way back in 1976 at Maternity Hospital with Brachytherapy service (Radium Needle) donated by USA. In 1991, Bir Hospital started first tele-therapy service with cobalt-60. During those initial days of its establishment, the radiotherapy unit was operated with help of experts from India. In 2002, B.P. Koirala Memorial Cancer introduced first Linear Accelerator and HDR Brachytherapy service in the country. Recently newer technology has been introduced by two private clinics with True-beam linear accelerator from Varian and Synergy from Elekta.

Nepal is a developing country with about 26.6 million population and cancer still remains disease of the elderly. The incidence of cancer is 100-120 per 100 thousand populations. Due to the lack of advanced technology, research and proper education, cancer treatment in Nepal has become very challenging. About eighty percent of patients present with advanced stage cancer and can only be treated palliatively.

According to Hospital based National Cancer Registry, the most common cancers in Males and Females are shown in following tables [4].

Table 1: Hospital Based National Cancer Registry Males

Cancer Site	Number	Percentage
Lung cancer	692	17.2
Stomach cancer	305	7.6
Larynx cancer	247	6.2
Bladder cancer	150	3.7
Rectum	139	3.5

Table 2: Hospital Based National Cancer Registry Females

Cancer Site	Number	Percentage
Uterine cervix	852	17
Breast	826	16.4
Lung	549	10.9
Ovary	350	7
Stomach	223	4.4

Table 3: Radiation Workers in Radiotherapy

Profession	Total number	Number per million* inhabitants
Radiotherapy Technician	24	0.90
Medical physicists	11	0.41
Radiation Oncologists	33	1.24

Table 4: Status of Radiotherapy Equipment

Therapeutic Equipment	Total number	Number of megavoltage treatment units per million*
Cobalt- 60	3 (-1)	0.112
Linac	5 (-3)	0.189
Brachytherapy	4 (- 3)	0.150
Simulator	3	0.113
Blood Irradiator	1	0.037

Unfortunately, Nepal still does not have population based cancer registry system. In the past, patients had to go abroad for radiotherapy. Right now, Nepal has six cancer centers providing radiation therapy services. Out of the six, four cancer centers are confined at Kathmandu valley. Only two cancer centers are out of the Kathmandu, one at Bharatpur middle of the Nepal and one at the Pokhara (currently not functioning). If we look at the map of the Nepal, patient has to travel a long way either from eastern or from western part of the Nepal.



Fig. 1: Map of Nepal

And for the typical course of radiotherapy patients would need to find accommodation close to the cancer center putting additional financial strain on patients.

The following table shows the present status of radiation therapy service in Nepal [5] [6] [7].

Negative sign means equipment is not functioning at present
 * Population 26.6 million based on November, 2012
 (Source: Central Bureau of Statistics)

The above table illustrates the very complicated situation in radiation therapy in Nepal. Table 2 (a) indicates that radiation oncology professionals working in radiation therapy are far below the national need. Table 2 (b) shows the alarming situation of the equipment used radiation therapy. The negative sign in the table means the equipment is not functioning. This means right now we are falling behind in terms of equipment compared to in the past. Because of this, cancer patients have to wait for long time to get treatment which significantly affects the outcome. At present facing cancer is even tougher as radiation therapy machine is decreasing. At present two cobalt tele therapy machine at public and semi- public cancer center are in functional. Only two linear accelerators used in private center are functioning.

From the year 2003, Bir hospital has been converted into an Academic Institution as National Academy of Medical sciences and is undertaking the teaching activities in MD Radiation Oncology.

At present, Nepal is below the World Health Organization (WHO) recommendation of one megavoltage machine per million populations which means that Nepal should have at least 27 megavoltage machines. WHO figure also estimate the incidence of cancer in low or medium income countries like Nepal, is likely to increase by 50% to 60% by 2020 [2]. This is a major problem facing Nepal at present: there is a lack of vital equipment needed to effectively diagnose and treat this disease accurately, efficiently with appropriate quality. We still do not have true data on cancer incidence in the country and the cancer

center in this field is very limited if compared to the population of Nepal. Radiation Therapy is one of the widely used and the cheapest modality in cancer care. According to the IAEA, almost sixty percent of the cancer patients require radiation treatment during the course of treatment. [3]

III. ISSUES

Though the history of radiation practice is long, Nepal still don't have any radiation act, nor any legal standards for radiation. There are no official records on radiological facilities in operation. The number and types of units, radiation workers and their qualifications, safety measures and conditions of workplace remain virtually unknown. No governmental or private organization has accurate statistics. According to Globocan 2012 data, Nepal had 18802 new cancer cases in 2012 which is predicted to increase to 29206 in year 2030. As about sixty percent of new cancer patients would require radiotherapy during their course of cancer. If we calculate accordingly, Nepal would require at least 32 tele therapy machines, around 65 Radiation Oncologists and at least 40 medical physicists by the year 2030. In order to work towards this target, it is important that Nepal must initiate more projects focused on Radiation Therapy. To meet that target the Ministry of Health, Ministry of Science & Technology of Nepal including cancer institutes and Radiation Oncology professionals must actively participate and contribute. To improve the current situation Radiation Oncology departments have to collaborate with international Societies like the International Organization of Medical Physicists (IOMP), the American Society for Radiation Oncology (ASTRO), the European Society for Radiotherapy and Oncology (ESTRO), the Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM) and local professional societies of medical physicists and radiation oncologist. Here is a lot to be gained: the existing facilities in Nepal are insufficient and most of the radiation therapy departments need additional equipment, expansion of the building and recruitment of the new manpower.

IV. WAY FORWARD

Nepal became a member county of International Atomic Energy Agency (IAEA) in 2008. From 2012 onwards, we have also been involved in various Technical Cooperation (TC) projects associated with the IAEA including the establishment of a radiation regulatory framework and development of health services. Radiation Oncology Professionals working at different institutions have been trained through various IAEA TC projects. We are also participating in various Regional Cooperative Agreement (RCA) projects on Cancer management, Cancer Staging, Education and training of Medical Physicists, IMRT,

Brachytherapy, Nuclear Medicine, Diagnostic Radiology and human health related projects. Recently, the IAEA TC project, Developing Radiation Health Service Infrastructure (NEP 9001) was started in 2012. From 2018, one new project on Strengthening Modern Application of Radiation Therapy (NEP 6003) is going to start which main objective is to improve competency of radiation oncology professionals and to standardize radiation therapy treatment techniques. Additionally, there has been a strong interest in more developed countries in participating in clinical training in the region, notably through the development of resources and teaching contributions. Nepal with little infrastructure in radiation oncology, these national projects will provide an avenue for the building up of best practice in radiation oncology.

Some encouraging news is that NAMS, Bir Hospital is going to start its service form new TomoTherapy machine from Accuracy. Bhakatpur Cancer Hospital came with the tender for new Linear Accelerator. B.P. Koirala Memorial Cancer Hospital is buying new linear accelerator [8]. All this means Nepal is going to have three new radiation therapy machines in 2018. This is a good start; however, a lot more work needs to be done before Nepal can offer all its cancer patients the radiotherapy services every patient deserves.

Conflict of Interest

The authors declare that they have no conflict of interest.

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