International Journal of Clinical Oncology and Cancer Research
2022; 7(2): 17-20
http://www.sciencepublishinggroup.com/j/ijcocr
doi: 10.11648/j.ijcocr.20220702.11
ISSN: 2578-9503 (Print); ISSN: 2578-9511 (Online)

Challenges and Prospects for Providing Radiotherapy Services in Nepal

Saloni Chawla*, Subhash Thakur

Department of Radiation Oncology, Chitwan Medical College, Bharatpur, Nepal

Email address:
salonionco@gmail.com (S. Chawla)
*Corresponding author

To cite this article:
Saloni Chawla, Subhash Thakur. Challenges and Prospects for Providing Radiotherapy Services in Nepal. *International Journal of Clinical Oncology and Cancer Research*. Vol. 7, No. 2, 2022, pp. 17-20. doi: 10.11648/j.ijcocr.20220702.11

Received: March 14, 2022; **Accepted**: March 30, 2022; **Published**: April 9, 2022

Abstract: In Nepal, the incidence of cancer in both males and females increased drastically in the last decade and is predicted to increase as well in the near future. The increase in Cancer burden could be a serious concern due to an underdeveloped national cancer control program. Around 50–60% of cancer patients require radiotherapy at some point during their illness which establishes it as an integral component of comprehensive cancer care. The current status of radiation facilities in the country is so scarce that it will be impossible to address the issue with available resources. It is high time for the authority to formulate a national cancer control program including the development of radiotherapy equipment and human resources. This article discusses the number of radiotherapy facilities, available equipment, and trained manpower in Nepal. Whether the available facilities are as per standard recommendation and will those be enough to handle the increasing load of cancer patients requiring radiotherapy in the future has been emphasized. Along with those challenges, the opportunities for developing radiotherapy facilities in Low Middle-Income countries like Nepal have been stressed out.

Keywords: Radiotherapy in Nepal, Challenges, Opportunities

1. Introduction

From the year 1990 to 2017, the incidence of cancer and cancer-related deaths has increased by 92 and 95% respectively. Adoption of a sedentary lifestyle, consumption of tobacco, poor air quality, and lack of awareness are the major risk factors [1]. Common cancers prevalent in Nepal are breast, lung, cervical, and head and neck cancers, which all require radiotherapy (RT) at some point during illness [2]. With the available radiotherapy services, Nepal will face the grim prospect of providing comprehensive cancer care leading to thousands of untimely deaths. In this article, the current status of radiotherapy services, challenges with infrastructure and human resources along prospects for providing RT service has been described.

2. Current Status of Radiotherapy Services in Nepal

According to an article published by Karn A in 2017, there are only 7 centers having radiotherapy machines. There are 4 tele cobalt, 5 linear accelerators (LINAC), and 5 High Dose Rate (HDR) brachytherapy machines. Out of seven RT centers, five are in Kathmandu valley and only two are outside the valley, one in Manipal College of Medical Sciences, Pokhara, and another in B. P. Koirala Memorial Cancer Hospital (BPKMCH), Bharatpur [3]. At 1 machine per 3 million people, this falls far below the International Agency for Atomic Energy (IAEA) recommendation of 1 machine for 0.25 million people [4]. This shows the huge scarcity as well as disparity in the distribution of RT centers in the country. Usually, RT treatment is given for several days continuously so patients along with their caretakers need to stay at a place far away from home which increases the financial burden on already economically stretched people. Recently there has been the addition of 1 LINAC and 1 HDR brachytherapy machine in east Nepal at Purbanchal Cancer Hospital which will help the people from the far east.

3. Challenges – Infrastructure and Construction

The first step for setting up an RT center within the hospital is the selection of location which should be done very carefully as RT has a role in multidisciplinary cancer management, including the requirement for diagnosis, referral, and follow-up of patients. The size of the land acquired should be enough to accommodate the current plan as well as future expansion. As per IAEA, the minimum area required for RT set up should be 3500 m^2 excluding access roads and parking areas, and a geological survey of the location including recognition of flood lines, earthquake zones, and the ground conditions should be done to design the foundation of the building[5]. The construction of a bunker for treatment equipment is an engineering challenge that needs professionals to ensure the long-term integrity of the structure.

A qualified medical physicist should be included in the construction team whose primary responsibility is to do shielding calculation based on workload, occupancy factors, and ensure a design that accommodates desired clinical workflow and future expansion. As radiation is a health hazard, bunker shielding is done in a way to ensure radiation exposure outside the bunker is within acceptable limits.

Special consideration should be given to the electrical survey conducted by the electrical engineer which includes confirmation of 3 phase power for smooth functioning of radiation equipment, chiller, air conditioner, and simulator. Provision for emergency backup systems like diesel generators and uninterrupted power supply (UPS) should be made. It is most important to ensure the fire protection for the building by incorporating a fire protection engineer in the construction team whose responsibility would be to design the system to ensure effective detection and extinguishing of fire events at the earliest [5].

3.1. Challenges – Equipment

The expense of setting up a new radiation therapy center or improvising the existing one is a barrier to improving comprehensive cancer care in an economically poor country like Nepal. Despite being perceived as an expensive modality; radiotherapy has been proven cost-effective for doing definitive as well as palliative treatment [6-8]. Involvement of many facets like infrastructure and construction, equipment, human resources, and maintenance of equipment makes the process of calculating the cost for setting up a radiotherapy facility a challenge which is further complicated by political instability and difficult geographical location. A study published in The Lancet Oncology has shown that equipment accounts for 30% of the cost in high-income countries whereas it can reach as high as 81% of the cost in low-income countries [9]. Another challenge is choosing between the LINAC and cobalt teletherapy. According to Giessen et al [10], prices of machines from mid-1980 to 2001 increased significantly with LINAC costs ranging from US$129,532 to US$1,800,000, whereas cobalt teletherapy machine costs ranged from under US$70,000–US$480,000. Though the cost to install cobalt teletherapy is lower, it has associated issues regarding source security and appropriate source disposal. Low-cost LINACs with single energy have been designed and marketed in LMIC [11]. In 2002, IAEA published an article providing a detailed outline of the expected capital cost for HDR brachytherapy approximately US$440,000 [12]. Other than that, there are very limited publications regarding the cost of brachytherapy. The estimated cost of a basic radiotherapy center includes 2 teletherapy units, a simulator, a treatment planning system (TPS), an HDR afterloading brachytherapy system, a mould room, dosimetry, and quality assurance (QA) types of equipment is the US $ 300,000 [13].

For smooth functioning of the radiotherapy center, operational and maintenance costs must be considered. The study by Datta et al [14] has shown annual recurring cost which includes maintenance and source replacement range between 5.5 and 15% of the initial investment. Similar to the initial lower cost of cobalt teletherapy, they have lower maintenance costs too as LINACs consume more electricity and have higher-power costs. Though cobalt teletherapy can be used for 20 years, its source needs to be changed every 5–7 years which encompasses extra cost. Van der Giessen et al[10] calculated the median annual cost for maintenance and QA to be US$41,390 for LINAC vs US $5790 for cobalt. For brachytherapy, the radioactive source used is Iridium-192, which has a half-life of 74 days and requires replacement at an interval of 3 months accounting for US$15,000-25,000 operational cost [12].

As most manufacturers are in North America or Europe, developing countries like Nepal face issues with the warranty and service contract exaggerated by the scarcity of qualified engineers for maintenance and repair.

3.2. Challenges – Human Resources

Adequately trained human resources are required for the installation, commissioning, and providing of radiation therapy services to the patients. Radiation human resource includes radiation oncologist, medical physicist, radiation therapy technicians, dosimetrists, and nurses. The deficiency of these human resources poses a huge challenge in LMICs like Nepal. The exact number of radiation staff could not be figured out but studies have mentioned 35 Radiation Oncologists and 16 medical Physicists currently working in Nepal [14, 17]. Though radiotherapy with cobalt teletherapy was started in 1991 at Bir Hospital, Kathmandu, it could not flourish due to various factors like political instability and poor management. This institute provides Postgraduate training for medical students but it does not have any medical physics education and training program. Efforts have been done to start the medical physics program with assistance from IAEA but the desired result is yet to be seen[17]. Training radiotherapy staff in Nepal is a huge challenge as there are no institutions with academic programs. The cost of training in Europe is enormously high standing at euro 1,850,000 to Euro 2,516,000 for a radiation team including 4 radiation oncologists, 3 medical physicists, and 7 radiation therapy technicians [15]. Major issues with training in western countries are the risk of brain drain and the inability to replicate the learnings in Nepal due to deficient working infrastructures.

4. Prospects

4.1. Innovations in Treatment Technology

With the increasing cancer burden in Nepal, there is a need for treatment technology innovations that can make radiotherapy services more affordable. Lower cost equipment can change the lives of millions of people living in LMICs including Nepal. An approach can be to manufacture the radiotherapy equipment in the country itself which will not only reduce the cost, it will be more adapted to the local working conditions. One example is India, where a remote afterloading cesium Low Dose Rate (LDR) brachytherapy system is manufactured whose cost is about one-fifth of the imported one [16]. This serves as a model for developing countries like Nepal.

4.2. Training Opportunities for Radiation Therapy Professionals

With only one institute i.e., the National Academy of Medical Sciences (NAMS) providing a post-graduate Radiotherapy training program, there is a need for the incorporation of Radiation Oncology as a medical subspecialty in other medical institutes as well. Since Nepal does not have medical physics and radiation therapy technology education and training programs, it's high time to establish centers with an academic interest in radiation oncology. Physicists from government centers participate in various IAEA projects, including RAS6077 RCA projects, RAS6087 RCA projects, and RAS6088 projects [17]. Professional societies like the American Society for Therapeutic Radiation Oncology (ASTRO) and the American Association of Physicists in Medicine (AAPM) have developed online educational platforms for radiation therapy professionals in LMICs [18].

5. Conclusion

In summary, there are challenges associated with infrastructure, equipment, and human resources in the development of radiation oncology facilities and their incorporation into the comprehensive cancer care system. It is high time for authorities to formulate a national cancer control program and a body for monitoring and regulating atomic energy in Nepal. Addressing these issues will be crucial to preventing Nepal's impending cancer care crisis.

Statement Conflict of Interest

All the authors do not have any possible conflicts of interest.

References

[1] Shrestha G, Thakur RK, Singh R, Mulmi R, Shrestha A, Pradhan PMS. Cancer burden in Nepal, 1990-2017: An analysis of the Global Burden of Disease study. PLoS One. 2021 Aug 3; 16 (8): e0255499. doi: 10.1371/journal.pone.0255499. PMID: 34343216; PMCID: PMC8330909.

[2] World Health Organization (WHO). Union for International Cancer Control. Nepal fact sheet: GLOBOCAN 2018. [cited 12 Jun 2020]. Available: https://gco.iarc.fr/today/data/factsheets/populations/524-nepal-fact-sheets.pdf

[3] Karn, Ambuj. (2017). Current status of availability of radiotherapy machines in Nepal. Journal of Clinical Oncology. 35. e18042-e18042. 10.1200/JCO.2017.35.15_suppl.e18042. e18042.

[4] Grover S, et al. A systematic review of radiotherapy capacity in low- and middle-income countries. Front Oncol. 2014; 4: 380. [PubMed: 25657930].

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiotherapy Facilities: Master Planning and Concept Design Considerations, Human Health Reports, 2014.

[6] Hanna, TP. Radiation oncology in the developing world. In: Halperin, EC., et al., editors. Principles and Practice of Radiation Oncology. Philadelphia: Lippincott Williams & Wilkins; 2013. p. 552-559.

[7] Barton MB, Frommer M, Shafiq J. Role of radiotherapy in cancer control in low-income and middle-income countries. Lancet Oncol. 2006; 7 (7): 584–595. [PubMed: 16814210]

[8] Jeremic B, et al. Patterns of practice in palliative radiotherapy in Africa—Case revisited. Clin Oncol (R Coll Radiol). 2014; 26 (6): 333–343. [PubMed: 24746747]

[9] Atun R, Jaffray DA, Barton MB, Bray F, Baumann M, Vikram B, Hanna TP, Knaul FM, Lievens Y, Lui TY, Milosevic M, O'Sullivan B, Rodin DL, Rosenblatt E, Van Dyk J, Yap ML, Zubizarreta E, Gospodarowicz M. Expanding global access to radiotherapy. Lancet Oncol. 2015 Sep; 16 (10): 1153-86. doi: 10.1016/S1470-2045(15)00222-3. PMID: 26419354.

[10] Van Der Giessen PH, Alert J, Badri C, Bistrovic M, Deshpande D, Kardamakis D, Van Der Merwe D, Da Motta N, Pinillos L, Sajjad R, Tian Y, Levin V. Multinational assessment of some operational costs of teletherapy. Radiother Oncol. 2004 Jun; 71 (3): 347-55. doi: 10.1016/j.radonc.2004.02.021. PMID: 15172152.

[11] Samiei, M. Challenges of Making Radiotherapy Accessible in Developing Countries, 2013. Available from: <http://globalhealthdynamics.co.uk/cc2013/wp-content/uploads/ 2013/04/83-96-Samiei-varian-tpage-incld-T-page_2012.pdf>

[12] Nag S, et al. Recommendations for implementation of high dose rate 192 Ir brachytherapy in developing countries by the Advisory Group of International Atomic Energy Agency. Radiother Oncol. 2002; 64: 297–308. [PubMed: 12242118]

[13] Datta NR, Samiei M, Bodis S. Are state-sponsored new radiation therapy facilities economically viable in low- and middle-income countries? Int J Radiat Oncol Biol Phys. 2015; 93 (2): 229–240. [PubMed: 26232854]

[14] Gyawali, B., Sharma, S., Shilpakar, R., Dulal, S., Pariyar, J., Booth, C. M., & Sharma Poudyal, B. (2020). Overview of Delivery of Cancer Care in Nepal: Current Status and Future Priorities. *JCO Global Oncology*, *6*, 1211–1217. https://doi.org/10.1200/go.20.00287

[15] Zubizarreta EH, et al. Need for radiotherapy in low and middle income countries—The silent crisis continues. Clin Oncol (R Coll Radiol). 2015; 27: 107–114. [PubMed: 25455407].

[16] Samiei, M. [Cited March 25, 2016] Challenges of Making Radiotherapy Accessible in Developing Countries, 2013. Available from: <http://globalhealthdynamics.co.uk/cc2013/wp-content/uploads/ 2013/04/83-96-Samiei-varian-tpage-incld-T-page_2012.pdf>.

[17] Adhikari, K. P. (2020). *Medical Physics in Nepal: A Narrative on its Development.* MEDICAL PHYSICS INTERNATIONAL. Retrieved from http://www.mpijournal.org/pdf/2020-03/MPI-2020-03-p440.pdf

[18] Ngwa W, et al. Closing the cancer divide through Ubuntu: Information and communication technology-powered models for global radiation oncology. Int J Radiat Oncol Biol Phys. 2016; 94 (3): 440–449. [PubMed: 26867873]