

Current opportunities and challenges in a period of 2D to 3D transition in Radiation therapy in Mongolia

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The NCCM has taken number of measures to increase its diagnostic and therapeutic capacity by financial support of Ministry of Health, one of which was to build a three-storey expansion building with 5 bunkers for radiotherapy in 2009-2017 and an implementation of the project "Improving quality and access to cancer diagnostics and treatment" funded by soft loans of Austrian Government.

Phase I project implemented through soft loans from Austrian government resulted in big advance in a history of radiation therapy in Mongolia which is an introduction of Linear accelerators first time in June 2019 and 3D conformal radiation therapy has become available.

Up to this point, many efforts have been made and step-by-step measures have been taken to improve radiotherapy facility.

- i. 2006: Introduction of shaped Cerrobend blocks improved the protection of healthy tissues during radiation therapy
- ii. 2007: With the installation of SOMATOM Emotion 6 CT simulator for radiation therapy planning it became possible to accurately determine the location of tumor and nearby healthy organs and to plan volume based treatment.
- iii. 2010: With the introduction of CMS XiO 3 dimensional treatment planning system volume based calculations have become available
- iv. 1995 –2006: In a part of quality control, quality control of radiation therapy equipment became available with the introduction of dosimetry system through the IAEA project.
- v. After receiving complete PTW dosimetry system the commissioning of radiation monitoring measurements for the installation of linear accelerators with automatic water phantom, as well as radiation monitoring and annual measurements of Cobalt-60 teletherapy units and linear accelerators were carried out in accordance with IAEA standards.

Cervical cancer is the second leading cancer for women in Mongolia and patients with cervical cancer occupy 38% of patients undergoing radiation therapy. Over 200 cervical cancer patients receive Brachytherapy and about 800 applications are performed each year.

Brachytherapy has reached its current level through the following steps:

- i. 2002: The installation of mobile C-arm unit has improved the quality of treatment by introducing brachytherapy x-ray image guidance.
- ii. 2010: With the installation of "Gynsource" brachytherapy unit it has become possible to accurately calculate treatment dose at the point in accordance with international standards using Manchester method of calculation.
- iii. 2018: Volume based accurate treatment calculation has been started with the introduction of CT based 3D technique.

The successful implementation of this project will contribute towards national efforts to respond to the growing demand for radiotherapy in the country with the latest techniques and quality in line with international best practices and standards. We face following issues to solve:

1. In order to further improve access to radiation therapy technological advancement in radiation therapy such as intensity modulated radiation therapy (IMRT), 4D gating, stereotactic body radiation therapy (SBRT) has to be introduced for reduced damage to normal tissue, enhanced quality of life for cancer patients and increased survival rate.
2. Delayed building of Premise of linacs that caused warranty period to expire only after 1 year. It has been built with insufficient air circulation system,
3. Commissioning: It was a first experience for medical physicists to commission our first linacs and it was a learning process at the same time. As a Member State of the IAEA since 1973, Mongolia has been closely involved with the Agency for decades, and it was one of many assistance that Mongolia has received in using nuclear applications to better the lives of its people.
4. Mongolia also suffered some very significant exogenous shocks during the transition, including insufficient supply of some devices and applications of the linear accelerators
5. Maintenance of equipment: as a landlocked nation located within the interior of a vast continent, Mongolia faces extraordinary challenges given by its topography. Sometimes it takes hours or days, even weeks to

repair linear accelerators

6. Along with introduction of new technologies and equipment, there is need to improve radiation control and protection, and safety practices in accordance with IAEA's and other international standards and guidelines. Any transition period in implementing higher technology needs solid experience of its previous adopted technology and successful cooperation with international organization like IAEA with excellent experts would help us in safe introduction of new nuclear technology.

Country or Int. Organization

MONGOLIA

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