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abstract

Identifying Challenges and Opportunities during Implementation of MR-guided Radiotherapy Technology in Low-and-middle-income countries

Anoud Alnsour, Mohammad Abdulraheem, Abdelatif Almousa

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abstract

Identifying Challenges and Opportunities during Implementation of MR-guided Radiotherapy Technology in Low-and-middle-income countries

Authors: Anoud Alnsour, Mohammad Abdulraheem, Abdelatif Almousa

Affiliation: King Hussein Cancer Center KHCC

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Introduction: Jordan, a low- and middle-income country (LMIC) in the Middle East, has an estimated population of 11 million. Cancer poses a significant health challenge in Jordan, ranking as the second leading cause of death after cardiovascular diseases. Despite the region's volatility, Jordan has maintained a steadfast commitment to adopting cutting-edge medical practices in cancer care, particularly in radiotherapy. Magnetic Resonance-guided radiotherapy (MRgRT) is very instrumental in cancer management. It offers superior image guidance for therapy, which makes tracking of tumors in real time possible, along with precise dose delivery. These capabilities minimize radiation to healthy tissues and consequently help improve the outcomes of patients. The King Hussein Cancer Center (KHCC) is one of the pioneers in this aspect and became the first cancer center in Jordan and among the few in the Middle East region to adopt MR-guided radiotherapy. Implementing such technology in such a country presents both significant challenges and potential opportunities. In this Paper we will highlight both the challenges we faced and the solutions.

Methodology: A qualitative analysis was conducted using semi-structured interviews with radiation oncologists, medical physicists, RTT, and administrative staff at KHCC, alongside operational reports and data from the first six months of MRgRT implementation.

Results: One of the main challenge was the Cost and Financial Investment as the (MRgRT) system is expensive not only to acquire and to install but also to maintain and to get all the needed specialized equipment, therefore KHCC secured the needed funds from the government, partnerships and donations as well as doing a departmental operational efficiency policy ensuring the equipment can generate sufficient patient volumes to justify this investment. The second main challenge was the Infrastructure requirements, including dedicated space with specialized shielding and power requirements, to ensure all thatwas adequately KHCC built a new radiation building close to the main radiation department with all the needed specialized equipment and re-quirements, and implemented regular quality assur-

ance (QA) testing. Moreover, the installation of MR-Linac requires trained radiation oncologists, medical physicists, and therapists for this new technology; therefore, comprehensive training for the MRgRT team was done, covering all the radiation therapy aspects of the MR-Linac with hands-on practice inside and outside Jordan, with encouraging collaboration between the team. Ensuring patient safety during MR-Linac treatments was one of the main challenges, which we tried to overcome by developing strict safety protocols, including written screening for ferromagnetic implants or devices before patient entry into the MR-Linac room. Because of the high cost of the ferromagnetic detector device, it is still not yet available at the current time. Finally, the ongoing maintenance and technical support were also one of the main challenges, as the complex nature of the system means that downtime can significantly affect treatment schedules, which could negatively impact patient care. We set up a service and maintenance contract with the manufacturer to ensure that technical support is available and that any system issues are addressed promptly. Our future direction is obtain more experience by collaborating with well-experienced centers, obtaining accreditation from relevant bodies, and providing local expertise and trained professionals for inside and outside Jordan.

Conclusion: The installation of an MR-Linac system in a radiation oncology department is complex, especially in LMICs. KHCC is a real –life example for overcoming the key challenges associated with infrastructure, integration, training, ongoing maintenance, and other obstacles. By addressing these obstacles with well-thought-out solutions, KHCC implemented MR-Linac systems successfully and startedthe first patient treatment three months ago. The introduction of MR-guided radiotherapy in Jordan serves as an opportunity for training and capacity building in radiotherapy personnel in the region, which could enhance the overall strength of the healthcare workforce in LMICs and improve local expertise, and could lead to regional collaborationand distribution of MR-guided radiotherapy technology across multiple countries in the region.

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