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Research Article

From Computed Tomography–Guided to Magnetic Resonance Imaging–Guided Intracavitary Brachytherapy for Cervical Cancer: What Do the Key Stakeholders Have to Say about the Transition?

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ABSTRACT

Background: International brachytherapy consortiums are advocating for the incorporation of magnetic resonance imaging (MRI) into the cervical brachytherapy process as a standard-of-care. Although some evaluations have been performed to quantify the effect on procedural time, little is known about the views and experiences of key stakeholders during the transition from computed tomography to MR-guided brachytherapy. This qualitative research project explored insights from key stakeholders related to a change in the gynaecologic brachytherapy process.

Methods and Materials: Semi-structured interviews were designed using Lean Methodology principles and all key members in the gynaecologic brachytherapy team were approached for participation: radiation oncologists, medical physicists, radiation therapists, the lead MR technologist, and the ward nurse manager. Interviews were recorded and transcribed, and analysis was performed to identify themes from the data.

Results: Ten of 12 (83% participation rate) key members of the team were interviewed. Four themes emerged from the data: challenges to efficiency, staff availability, patient history and disease characteristics, and team communication. The stakeholders expressed that the challenges during this transition were procedural inefficiency (sharing of the MRI scanner and increased procedure length because of increased complexity in contouring and planning), and staff availability (radiation oncologist and transportation staff). The clinical team identified the value of communicating patient history and disease characteristics ahead of the brachytherapy procedure day and also using an inclusive mode of communication during the procedure was beneficial.

Conclusions: This research provides nuanced insights into process and practice changes that occur when one imaging technology is simply swapped for another, emphasizing how intertwined and complex brachytherapy procedures can be. It emphasizes that not all challenges to efficiency are considered Lean Wastes, and that seemingly simple procedural changes can result in unanticipated differences in staff availability, communication pathways, and knowledge requirements.

RÉSUMÉ

Contexte : Les consortiums internationaux de brachythérapie plaident en faveur de l'intégration de l'imagerie par résonance magnétique (IRM) dans le processus de brachythérapie cervicale comme norme de soin. Bien que certaines évaluations aient été faites pour quantifier l'effet sur la durée de la procédure, on sait peu de choses sur les vues et l'expérience des intervenants clés durant la transition de la brachythérapie guidée par TDM vers le guidage par IRM. Ce projet de recherche qualitative a exploré les points de vue des intervenants clés sur un changement dans le processus de brachythérapie gynécologique.

Méthodologie Et Matériel : Des entrevues semi-structurées ont été préparées en appliquant les principes de la méthodologie Lean et les auteurs ont approché tous les intervenants clés de l'équipe de brachythérapie gynécologique: radio-oncologues, physiciens médicaux, radiothérapeutes, technologues IRM principaux et infirmière-chef. Les entrevues ont été enregistrées et transcrites et une analyse a été faite pour dégager les thèmes des données.

Résultats : Dix des 12 membres clés de l'équipe (taux de participation de 83%) ont répondu à l'entrevue. Quatre thèmes émergent des données: les défis pour l'efficacité, la disponibilité du personnel, les antécédents des patients et les caractéristiques de la maladie et la communication au sein de l'équipe. Les intervenants ont indiqué que les défis durant la transition portaient sur l'inefficacité de la procédure (partage de l'appareil d'IRM et durée accrue de la procédure en raison de la plus grande complexité du contourage et

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de la planification), la disponibilité du personnel (radio-oncologue et personnel de transport). L'équipe clinique a mentionné la valeur de la communication des antécédents du patient et des caractéristiques de la maladie avant le jour de la procédure de brachythérapie ainsi que l'utilisation d'un mode de communication inclusif durant la procédure parmi les éléments bénéfiques.

Conclusions : Cette recherche a permis d'obtenir des points de vue nuancés sur les changements au processus et à la pratique qui se produisent lorsqu'une technologie d'imagerie est simplement remplacée par une autre, soulignant à quel point les procédures de brachythérapie peuvent être entrelacées et complexes. Elle souligne que ce ne sont pas tous les défis d'efficacité qui sont considérés comme des pertes Lean, et que des changements d'apparence simples aux procédures peuvent entraîner des différences imprévues dans la disponibilité du personnel, les voies de communication et les besoins en connaissances.

Keywords: MR-guided brachytherapy; cervical cancer; process improvement; workflow development

Introduction

In traditional brachytherapy (BT) planning, the dosimetry focused on standard radioactive source loading patterns and point dose assessments. More recently, there has been a trend toward using image-guidance techniques to delineate the pelvic structures and more accurately describe the dose received by the tumour and surrounding normal tissues. A large spectrum of imaging modalities and strategies are available to assist with pelvic organ delineation, such as ultrasound [1], computed tomography (CT) [2], or magnetic resonance imaging (MRI) [3, 4]. Using these modalities, three-dimensional (3D) dose distributions and dose volume histograms can display the dose delivered based on the images acquired from each patient's unique anatomy.

MRI is considered optimal for identifying the subtle differences between the pelvic soft tissue organs for cervix cancer BT [5, 6]. As such, the use of MRI is now widely considered a prerequisite in designing a high-quality BT program for cervical cancer [7, 8]. Although the potential benefits of MRI are evident, introducing this imaging modality into an established BT process can be challenging. Many centres may not have the luxury of a dedicated MR scanner and therefore the inter-departmental handoffs can result in process inefficiencies that can waste staff time and may lead to patient dissatisfaction. More importantly, any delay between the acquisition of images and the delivery of pelvic BT can result in changes in the position of the BT applicator and substantial variation between the planned and delivered doses.

Research Environment

At the time of the study, CT-guided BT was the standard of care for cervical cancer at our institution. Figure 1 describes the health care team, their interactions, and the CT-based workflow. Briefly, the patient was transported from the ward to the operating room (OR); intra-uterine applicator inserted using transabdominal ultrasound guidance under general anesthesia; two-dimensional (2D) orthogonal images taken; patient recovery; transported to the CT scanner; transported to ward. The oncologist identified the treatment length on the 2D image then contoured the target and the organs at risk (OAR) such as bladder, rectum, and sigmoid on the CT images. The therapist then planned the BT treatment using a standard prescription point (Point A). Doses to target and OARs were calculated on the CT images. These doses were reported but the treatment plan was not optimized based on this information.

To facilitate an evidence-based transition to an MRI-guided procedure, the program implemented a prospective clinical trial to examine the feasibility of MR-guided BT (MRgBT) for cervical cancer [9]. One hundred MRgBT procedures had been completed at the time of the study. Figure 2 describes the MRgBT workflow. Table 1 describes the detailed comparison between the two workflows. The key difference being that an MRI replaced the CT, and that the MR image dataset was used to delineate the target and OARs, and a personalized treatment plan was generated. The planning responsibility was also transferred from the therapists to the physicists.

During the pilot phase, the time required for MRgBT (from applicator insertion to radiation delivery) ranged from 6–9 hours [10, 11]. Positional changes of the applicator placement could take place during that time, and the newly implemented process likely held several opportunities for significant improvements in procedure efficiency. Therefore, this qualitative study aimed to gain stakeholders' insight on the challenges and barriers to the process and to look for process improvement strategies.

Methods and Materials

Participant Identification

This was a single centre, prospective qualitative study undertaken in the Radiation Medicine Program at the Princess Margaret Cancer Centre. After local Research Ethics Board approval, the key members (stakeholders) of the gynecological BT team were identified. No sampling techniques or inclusion/exclusion criteria were applied, all stakeholders were invited to participate in semi-structured interviews and provided written informed consent before any data collection (Table 2). It was thought that the transition from CT to MR would not affect the perioperative team (anesthesia and nursing); therefore, they were not included in this research.

The Study Instrument

The study design followed Lean Methods [12-14], which is a management philosophy that is used to systematically identify and eliminate "waste" in a system to improve process