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Research Article

Development and Implementation of an Electronic Learning Module for Volumetric Image-Guided Radiation Therapy

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ABSTRACT

Background: Image-guided radiation therapy (IGRT) through daily cone-beam computed tomography (CBCT) has significantly impacted the role of the radiation therapist at our institution; continuing education is crucial to ensure safe practice of technology in the clinical environment. The purpose of this work was to develop and implement an electronic learning (eLearning) module as a yearly refresher for CBCT-practicing radiation therapists.

Methods: To provide an innovative interface to engage the learner's interest, a module themed "Myths in Cone Beam Computed Tomography Practice" was developed by content experts at our institution. The eLearning tool focused on the technical aspects and fundamental theory of CBCT acquisition, with an aim to refresh the user's knowledge and confidence in image fusion and assessment. Ten myths were identified in the module and evidence-based content was referenced within each myth to support theory. Evaluation of the learner was performed through a multiple choice quiz at the end of the module. The tool and 12 multiple choice questions were reviewed and validated by subject matter and non-subject matter experts in CBCT-IGRT before departmental implementation.

Results: The CBCT eLearning module has been clinically implemented and used over the last 3 years by radiation therapists in our department. Completion of the tool is an annual mandatory requirement for CBCT-practicing therapists; over 100 participants completed the module per year. The median time for module completion decreased over the 3-year interval, from 42 minutes 25 seconds during the first year of implementation to 20 minutes and 48 seconds in the third year.

Conclusions: An electronic online training tool for CBCT refresher training has been developed and implemented at our institution, with an aim to equip staff with the critical thinking skills and clinical judgment required to operate in a CBCT-IGRT environment. The

module's format ensures delivery of consistent information as a component of yearly continuing education for radiation therapists.

RÉSUMÉ

But : La radiothérapie guidée par l'image (RTGI) par tomographie à faisceau conique quotidienne (TDM FC) a eu des répercussions importantes sur le rôle des radiothérapeutes dans notre institution; la formation continue est essentielle pour assurer la pratique sécuritaire de la technologie dans l'environnement clinique. Le but de ce travail était de développer et de mettre en place un module d'apprentissage électronique pour la formation de rappel annuelle des radiothérapeutes œuvrant en RTGI.

Méthodologie : Afin d'offrir une interface stimulante et de susciter l'intérêt de l'apprenant, un module a été développé par des experts en la matière de notre établissement, sous le thème « Mythes de la pratique en radiothérapie guidée par l'image ». L'outil d'apprentissage électronique met l'accent sur les aspects techniques et les fondements théoriques de l'acquisition d'images en TDM FC, dans le but de rafraîchir les connaissances et la confiance de l'utilisateur en matière de fusion et d'évaluation des images. Dix mythes ont été recensés dans le module, et un contenu fondé sur des données probantes a été mis en référence pour chacun des mythes afin d'appuyer la théorie. L'évaluation de l'apprenant se fait par un questionnaire de 12 questions à choix multiples à la fin du module. L'outil et les questions à choix multiple ont été examinés et validés par des experts et des non-experts en RTGI/TDM FC avant la mise en œuvre dans le service.

Résultats : Le module d'apprentissage électronique en RTGI a été mis en place dans le milieu clinique et est utilisé depuis trois ans par les radiothérapeutes de notre service. Son utilisation est une exigence annuelle obligatoire pour les thérapeutes en RTGI; plus de 100 participants utilisent le module chaque année. La durée

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médiane de l'exercice a diminué au fil des trois années d'utilisation, passant de 42 minutes 25 secondes durant la première année à 20 minutes et 48 seconds durant la troisième.

Conclusions : Un outil de formation électronique en ligne pour la formation de rappel en RTGI a été développé et mis en place dans notre institution, dans le but de fournir aux membres du personnel

Keywords: Image-guided radiation therapy (IGRT); cone-beam computed tomography (CBCT); electronic learning (eLearning); refresher training

Introduction

Advances in image-guided radiation therapy (IGRT) have been facilitated by the availability of 3-dimensional cone-beam computed tomography (CBCT) guidance systems [1, 2]. CBCT allows online volumetric visualization of patient anatomy and has the capability to correct for daily setup variations while monitoring patient changes and deformations in real-time. As more information is immediately available to front line users of the technology, it has been identified that IGRT through CBCT has significantly impacted the role of the radiation therapist [3].

In the changing environment of volumetric IGRT technology, skill development and integration of knowledge is essential to ensure clinical competence of radiation therapists [4]. At the onset of clinical implementation of CBCT technology at our institution, to ensure therapists were readily equipped to manage daily decision-making regarding patient setups, a two-level training program was designed and implemented [5]. The first level of training focused on the basic hardware and software components of the CBCT system, arranged within the first week of work on a CBCT unit. The second level of training focused on consolidation of knowledge, where therapists are led through a series of cases for image matching and registration and are given an opportunity to observe and ask questions. Other centres have also implemented training programs at the onset of CBCT implementation to increase staff confidence for the clinical introduction of volumetric IGRT technology [6].

Aided by education, well-defined processes, and critical analysis skills, radiation therapists are readily making online decisions about patient setups through volumetric IGRT. Therefore, to ensure consistency in practice, education and training for CBCT-IGRT should adapt to the needs of the radiation therapists. The training model previously developed was only performed and received by therapists during their initial placement on a CBCT machine [5]. There was a lack of refresher training provided to therapists at our institution on a continuous basis to reinforce theory and concepts to guide clinical image guidance decision making. Thus, education strategies for front-line users of CBCT technology have to evolve to ensure that daily use of CBCT is effective and efficient on a longitudinal spectrum [7].

The successful implementation of electronic learning (eLearning) education tools has been identified in the nursing

les outils de réflexion critique et de jugement clinique nécessaires pour fonctionner dans un environnement RTGI/TDM FC. Le format du module permet d'assurer la présentation d'une information uniforme dans le cadre de la formation continue annuelle des radiothérapeutes.

profession [8–16]. E-learning was used to facilitate undergraduate nursing education on topics such as pain management [15] and infection control [9]. At the graduate level, advanced practice nurses responded positively to online learning to facilitate their education [13]. In another graduate level study, evidence-based online case studies were found to be an effective strategy for teaching nursing students about complementary medical therapies [16]. Various health care professions have used an electronic module to assess acute asthma severity on pediatric patients in the clinical setting with positive results [17]. The need for continuing education through an electronic platform has been previously recognized in radiation therapy [18].

We hypothesize that an eLearning refresher module is relevant and effective for practicing radiation therapists in the CBCT-IGRT era. The aim of this study was to develop, validate, and implement an electronic module for volumetric imaging as an essential component of continuing education for radiation therapists.

Methods

Development

Format

As the focus on developing yearly refresher training sessions was to ensure IGRT concepts are understood and enforced, various platforms and clinical requirements for educational delivery were considered. It was decided that ideally, refresher training would require low yearly maintenance, and the format should require minimal requirements of oversight and facilitator resources once developed. An electronic online platform was deemed most feasible to deliver consistent information in a timely manner. The benefits associated with an electronic learning tool include: delivery of consistent information; reduction in instruction time; convenience and increased accessibility for the learner; improved tracking; and no time constraints on the learner as staff can complete the module at their own pace [8, 10, 11]. As such, based on the literature and current continuing education models, an electronic learning module developed through the institution's consolidated platform (SumTotal Systems, LLC, Skillsoft Company) was deemed the most appropriate media for education dissemination.

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