



Review Article

Comparison of computed tomography and magnetic resonance imaging in cervical cancer brachytherapy: A systematic review

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ABSTRACT

PURPOSE: The aim of this overview was to assess the accuracy of computed tomography (CT)–based imaging technology and to compare it with magnetic resonance imaging (MRI) for the treatment planning of high–dose rate brachytherapy in cervical cancer.

METHODS AND MATERIALS: A systematic search in PubMed, Embase, and the Cochrane Central was performed to identify clinical studies involving brachytherapy of cervical cancer and published before February 1, 2016. Outcomes of interest were geometric dimensions, dose parameters, and clinical results.

RESULTS: After screening 675 articles, 13 clinical studies involving 465 patients were included for critical appraisal; 10 studies compared CT with MRI and three compared hybrid (CT/MRI based) with MRI only–based imaging technologies. The geometric dimensions of the high-risk clinical target volume (HR-CTV), dose parameters, and clinical outcomes were reported in 11, 10, and 1 studies, respectively.

CONCLUSIONS: Among those geometric parameters of HR-CTV, width was significantly overestimated on CT compared with MRI. Height might be underestimated, and thickness was comparable. The dose parameters for HR-CTV were lower on CT only–based technique compared with MRI-based one. It is proposed that at least one pre- or at brachytherapy MRI is required to assess the tumor extension. With the help of MRI information, CT contouring will be much more accurate in cervical cancer brachytherapy. © 2016 American Brachytherapy Society. Published by Elsevier Inc. All rights reserved.

Keywords:

Cervical cancer; Brachytherapy; CT; MRI

Introduction

Radiation therapy plays an important role in the treatment of cervical cancer. In addition to external beam radiation therapy, intracavitary brachytherapy (BT) has been shown to increase survival and local control (1). Image-guided BT (IGBT) describes the incorporation of diagnostic radiology modalities into the process of BT applicator insertion, treatment planning, and treatment delivery. The increased use of imaging and three-dimensional (3D) treatment

planning for cervical cancer have helped us improve cancer control and reduce treatment-related toxicity.

CT and magnetic resonance imaging (MRI) are widely used in 3D BT of cervical cancer nowadays. Radiation oncologists are very familiar with the interpretation of CT-based treatment planning. It provides useful information, such as the tandem position within the uterus, the thickness of the recto-vaginal septum, and the relationship between the bladder/recto-sigmoid and the applicator. They provide a delineation of organ at risk (OAR) comparable with MRI (2). It also allows for optimization of the dose to OARs. At the same time, it also maintains the dose to parameters used in reporting (e.g., Point A) (3). CT is not able to accurately identify the target volume: it does not clearly distinguish between cervix, uterus, and vagina and provides poor definition of parametrial tumor infiltration (4). Contouring may be improved by incorporating information from MRI and clinical examination (5).

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MRI is superior to CT for soft tissue visualization. It enables distinction of the tumor from normal cervix and uterus and visualization of tumor infiltration into adjacent tissues (parametria, vagina) (6). Accurate delineation of the tumor ensures that an adequate radiation dose is prescribed to the target, thus leading to excellent control rates. MRI requires training and experience in accurate contouring and special nonmagnetic BT applicators. They are considerably more expensive than metallic applicators. Presently in China, most institutions do not have availability of MRI for BT planning. In 2005, the Group European de Curiethérapie-European Society for Therapeutic Radiology and Oncology (GEC-ESTRO) provided recommendations for target delineation using MRI-contoured tumor volumes (7). However, CT scanners are often more widely available than MRI over the world. Various survey reports suggest the limited availability of MRI and logistics with radiology units (2, 8). There has been an increased interest in the use of CT during IGBT in cervical cancers, and the

following publications compare CT with MRI or hybrid (CT/MRI based) with MRI contours of cervical cancer with an applicator in place (2, 5, 8–18).

Here we chose to use a systematic review methodology to compare CT with MRI. Systematic reviews are different from narrative reviews. They can reduce bias introduced by the subjective opinion (19). Therefore, we decided to carry out systematic review of studies comparing MRI with CT or hybrid (CT/MRI) method in dimensions, dose parameters, and clinical outcomes, so as to achieve the aim of better delineation compare the modalities of CT with MRI.

Methods and materials

Literature search strategy

A systematic search was performed in PubMed, Embase, and the Cochrane Central for studies published in the English language, from inception to February 1, 2016.

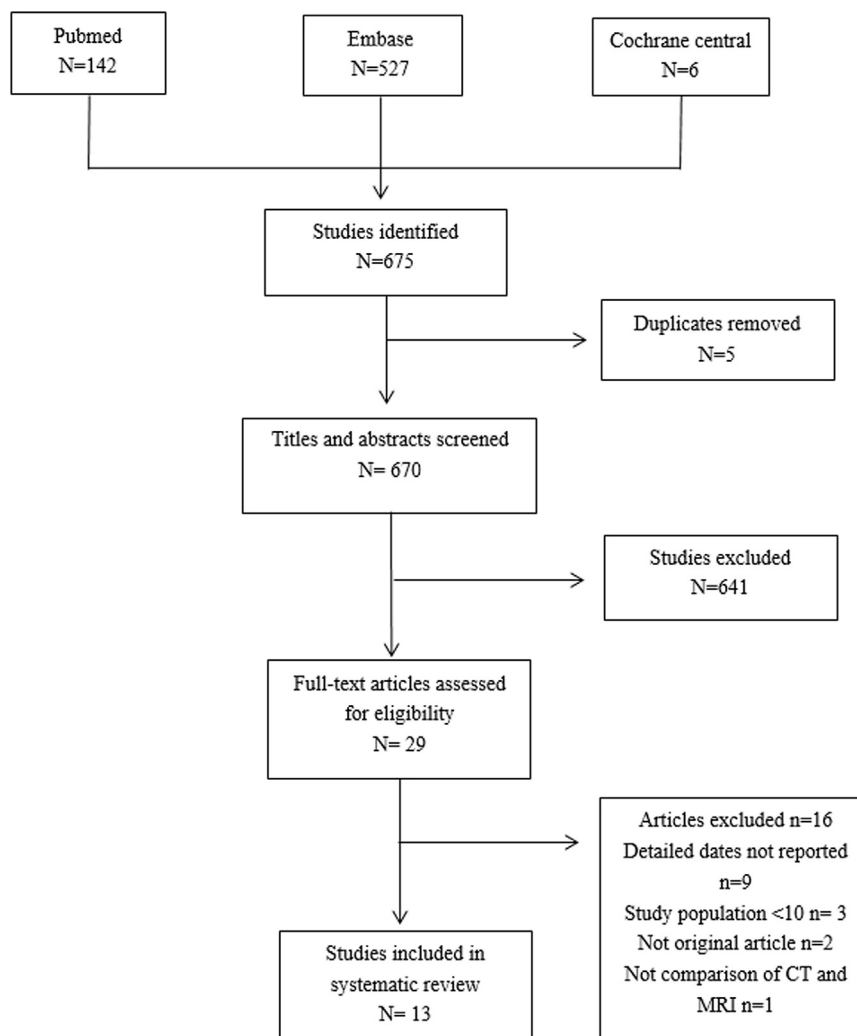


Fig. 1. Study flow chart of article selection.

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