

Uncertainty concerning the 4-field box technique for Stage-IB2 carcinoma of the uterine cervix

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ABSTRACT

Radiation Therapy (RT) plays a pivotal role in the curative approach for carcinoma of the cervix. In spite of the emergence of various new conformal techniques in RT, conventional techniques still hold vital importance. Majority of the patients worldwide are treated with 2D-RT techniques. 2D-RT techniques have been proven to be non-inferior and simpler in comparison to 3D-RT in the context of carcinoma of the cervix. However, inadequate target volume coverage with improper portal design can preclude the chances of cure. We demonstrate the need for abolishing guesswork in terms of target volume determination through the example of a patient's sagittal magnetic resonance image showing a case of the retroverted uterus which would have been likely to be missed from the treatment portals if they were designed using definitions based on bony landmarks.

Key words: Carcinoma cervix, clinical-target-volume, four-field box technique, gynaecological radiation oncology, lateral portals for carcinoma cervix, uterine cervix

Introduction

The success of radiotherapy (RT) depends not upon the expense and complexity involved, but upon the correctness of techniques. Correct portal-design calls for correct knowledge regarding the location of the target volumes to be treated. Traditional bony-landmarks may have been used as a surrogate, but they do not always correlate with the actual location of the soft-tissue target-volumes. The four-field-box (4FB) technique for cervical carcinoma is often utilized to improve dose homogeneity. The exact placement of the posterior border on the lateral portals of this technique is unfortunately

not supported by stone-hard consensus; placing it at the S2-S3 junction may increase the chance of sparing rectum but at the risk of target-miss. We intend to demonstrate the potential benefits with the use of sectional imaging in safely delineating target-volumes.

Case Report

A lady on evaluation and referral from her gynecologist, presented to us with the diagnosis of Stage-IB2 cervical-carcinoma staged as per the FIGO (federation of international gynaecologists and obstetricians) system. As we were preparing to initiate this patient on a course of concurrent chemo-RT, we had the opportunity to review her magnetic-resonance imaging (MRI) films obtained earlier by her gynecologist. We noticed a stark retroversion of the uterus, which almost abutted the sacrum [Figure 1]. This finding made us ponder over the potential perils associated with the conventional 4FB technique, which is widely utilized worldwide for portal design for cervical-carcinomas. Given that the uterine and cervical lymphatics are interconnected, and that disease extension from the cervix to the uterus is highly probable, the current consensus state that the entire uterine-corpus should be a part of the clinical-target-volume (CTV) for every patient of cervical-carcinoma. The uterus, being a mobile organ may manifest various positions, which cannot be taken into account during bony-landmark based planning. Unless the true position of the uterus can be determined with imaging,

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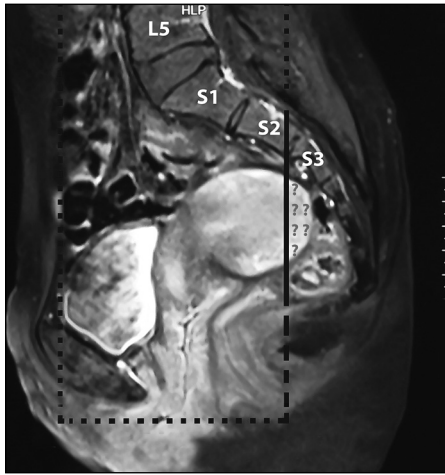


Figure 1: Magnetic resonance imaging showing a retroverted uterine corpus extending well beyond the posterior border of the S2-S3 junction

it would be risky to place the posterior-margin of lateral fields at the S2-S3 junction.

Discussion

Concurrent chemo-RT is a standard of care in the curative approach for Stage-IB2 cervical-carcinoma. Though there has been a recent emergence of the use of 3D-imaging based techniques, however, a considerable majority of patients across the world are treated with traditional RT techniques even to this day, mainly owing to the fact that cervical-cancer is mainly a disease of the developing world which suffers shortages with regards to advanced planning and treatment systems.

Conventional techniques may involve either the opposed anteroposterior-posteroanterior (AP/PA) two-field technique, or the 4FB technique-planned using radiologically determined bony-landmarks. In the 4FB technique, lateral portals are added with an intention to reduce the dose to the bowel anteriorly and to the rectum posteriorly. Conventional techniques have been found to provide equivalent results in comparison to 3D-RT, which is more expensive and complex.^[1] However, inadequate coverage with improper portal-design can preclude chances of cure.

The AP and PA field definitions are similar with the two-field and the 4FB technique. The caveat with the implementation of the 4FB technique has always been (and still continues to be) the fact that there are no unanimous guidelines regarding the margin definitions for the lateral portals. The controversy lies in the definition of the posterior-margin of the lateral-portal. Some authorities recommend its placement at or 0.5 cm posterior to the anterior-border of the S2-S3 interspace.^[2,3]

With particular reference to the treatment of Stage-IB carcinomas, one definition suggests that the posterior

border be placed in such a way as to cover at least 50% of the rectum.^[2] However, our point of contention would be that such a definition would be oblivious to the status of the uterine-position [Figure 1] and rectal-distension.

Placing the posterior-margin of the lateral-portals at S2-S3 junction using bony references from radiographs was found to be inadequate to cover the CTV in patients with bulky-disease.^[4] An evaluation of the CTV coverage by using the S2-S3 junction for the posterior border of the lateral fields revealed an inability to cover the optimal target-volumes in about half of the Stage-IB patients.^[5-7] The consequent effects on local-control were also quantified. Among Stage-IB patients, the local-control at 3-years was 100% for patients who had adequate margins, compared to a drastically reduced value of 71% for patients of the same stage with inadequate margins.^[6]

Since cervical carcinoma is staged clinically with the FIGO-system (which gives no regard to the utility of imaging to describe uterine-corporis involvement), it would be potentially dangerous to apply a “one definition fits all” philosophy in designing portals for patients with staged IB2 with the FIGO system.

The current consensus recommends the inclusion of the entire uterine-corporis into the CTV mainly since the uterine and cervical lymphatics are interconnected.^[8]

Retroverted uterus (after all, a normal variation of the uterine-position) may extend well beyond the line falling from the S2-S3 junction [Figure 1]. The presence of uterine-retroversion is unlikely to be detected unless use is made of CT or MRI. Given that the CTV would be incomplete without the inclusion of the entire uterus, the design of lateral portals of the 4FB technique should never be based on bony references. It should be individualized to the patient’s soft-tissue imaging (with CT/MRI) obtained in the treatment position.

Usage of bony-landmarks for portal definition is insensitive to uterine flexion/version, which would be influenced by bladder and rectal filling. MRI, if used in treatment planning provides a very accurate definition of the individual morbid anatomy. Lateral portals designed using sagittal MRI would help in a safe and confident placement of posterior margins. CT would be a reasonable alternative if MRI based planning is unavailable, given that vivid soft-tissue detail and accurate reconstructions can be had with helical CT-scanners.^[9,10]

In concluding, we remind the reader that as per current consensus, the CTV for cervical-carcinoma would be incomplete without the inclusion of the entire uterus.^[8] The uterus is not a fixed organ, and has many possible variations in its position, which cannot be encompassed by bony-landmark based planning. CT/MRI based target

delineation provides an opportunity to take the uterine position and bulk into account.

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