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Imaging in preoperative staging of cervical cancer

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Key words: Uterine Cervical Neoplasms; Diagnostic Imaging; Neoplasm Staging; Magnetic Resonance Imaging; Tomography, X-Ray Computed; Positron-Emission Tomography; Preoperative Period

Cervical cancer is the second most common malignancy in Serbia, usually detected in a locally advanced disease. Incidence and mortality rates of this cancer have declined in Western countries due to introduction of screening programs, which detect tumor in the stage of a pre-invasive disease. Imaging plays a significant role in the evaluation of tumor size, detection of parametrial invasion and assessment of the involvement of the pelvic sidewall and adjacent organs, as well as assessment of nodal involvement and distant metastases. MRI has superior soft tissue delineation and multiplanar capability, versus CT. The overall staging accuracy of MRI ranges from 75-96%. MRI is very accurate in determining tumor size and location, the depth of stromal invasion and the local extension of the tumor. The most important issue in staging cervical cancer is to distinguish an early disease (stages IA-IB), which can be treated with surgery or combined chemoradiation therapy, from an advanced disease. MRI is highly accurate in the assessment of tumor size, assessing tumors within 5 mm of the surgical size in 70–90% of cases, with an overall accuracy of 93%, for FIGO IAstage. In FIGO IIstage MRI is highly sensitive (up 93%) in the depiction of vaginal infiltration where it can rule out parametrial invasion with a high negative predictive value, which is of the greatest importance clinically for radical surgery planning. MRI technique and patient preparation are critical to ensuring high-quality images. Patients are imaged in the supine position using a surface phased-array coil, which provides higher signal-to-noise ratio than a body coil, with increases spatial resolution and reduces imaging time. An anterior presaturation band is used to reduce breathing motion artifacts. Presaturation pulses above and below the imaged volume reducing intravascular signals from pelvic vessels. At our Institute, we used standard imaging protocol. Intravenous contrast application can be useful only in detection of small tumors with a depth of stromal invasion of 3.1-5.0 mm and it can distinguishing recurrent tumors from radiation fibrosis. Although not incorporated in the FIGO staging system, nodal stage has significant prognostic and treatment consequences. MRI can easily demonstrate lymph node size, shape and internal structure. Using only standard size criteria (10 mm), the sensitivity for detecting nodal metastases on MRI is low, ranging from 29-86%, due to inability to detect micrometastases in normal-sized nodes. The presence of visible necrosis within the node, seen as pockets of high T2 signal intensity, has a positive predictive value of 100% for nodal involvement. New techniques are developing to improve the assessment of lymph node involvement: diffusion weighing imaging, specific MRI contrast-ultrasmall superparamagnetic iron oxide particles have been demonstrated to increase the sensitivity for the detection of nodal metastases with no loss of specificity and PET/CT. MR has crucial role in cervical cancer staging, monitoring patient's response and detecting recurrence. It is an important modality for determining the feasibility of uterus preserving surgery, demonstrating the complications of the disease itself and of treatment and in planning radiotherapy.

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FDG PET/CT in diagnosis of gynecological malignancies

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Key words: Genital Neoplasms, Female; Diagnostic Imaging; Magnetic Resonance Imaging; Positron-Emission Tomography; Tomography, X-Ray Computed; Fluorodeoxyglucose F18

Due to the capability of positron emission tomography/computed tomography (PET/CT) by use of 18F-fluoro-deoxyglucose (FDG) to visualize both glucose metabolic and anatomic imaging data in a single diagnostic session, this integrated hybrid technique has opened a new field in clinical oncologic imaging. Though generally, the role of FDG PET/CT in oncology has been mainly to assess lymph nodes (N) and distant metastases (M), rather than to determine tumor extent and its relationship with surrounding tissues (T), FDG PET/CT has been used successfully for staging, defined by the International Federation of Gynecology and Obstetrics (FIGO), but also optimization of treatment, re-staging, therapy monitoring, and prognostic prediction of gynecological malignancies, including cervical and endometrial uterine cancer. Apart from that, FDG PET/CT has an effective role in staging patients with advanced stage, providing useful information on extra-pelvic sites, such as supraclavicular lymph nodes, para-aortic lymph node metastases, peritoneum, omentum, bones and muscles.
However, the spatial resolution of 4-6 mm of currently available PET/CT scanners, and the fact that FDG is not a specific radionuclide tracer, still makes the detection of microscopic lesions very challenging. Although there is still a place for improvement in diagnostic accuracy with PET combined contrast enhanced CT (PET/CECT), magnetic resonance imaging (MRI) probably remains optimal diagnostic tool for primary tumor evaluation in the pelvis and initial primary tumor staging, especially if high-resolution MRI sequences accompanied by diffusion-weighted imaging (DWI) are available, providing the anatomical information of the primary tumor size, parametrial and pelvic wall involvement and vaginal invasion. On the other hand, since FDG PET/CT provides a high contrast between the tumor and surrounding tissue, it has been reported to have a better diagnostic accuracy in certain clinical situations, including restaging, especially for the assessment of peritoneal dissemination, lymph node metastases, and the presence of bone or muscle metastases, but also for detection of local recurrence. Another advantage of FDG PET/CT is that the whole body can be covered in a single examination. Enabling the measurement of tumor metabolic activity, FDG PET/CT shows the greatest utility in patients in whom the tumor marker levels are rising and conventional morpho-anatomical imaging studies show negative or equivocal findings. Knowing that metabolic changes often precede morphological changes in tumor response, FDG PET/CT can demonstrate the therapeutic response sooner than CT alone or MRI, significantly improving patient management by reducing the use of ineffective gynecological cancer therapies, and reducing the delay before administering a more effective treatment.
In recent years, the technological advances in development of integrated PET/MRI systems have become reality. It is to expect that PET/MRI should introduce improved soft-tissue contrast, the possibility of performing truly simultaneous instead of sequential acquisitions. That would enable sophisticated MRI sequences, such as DWI, perfusion imaging, functional MRI, diffusion tensor imaging (DTI) and MR spectroscopy, adding the important information in a single PET/MRI hybrid exam.

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Treatment and new modalities, especially in brachytherapy

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Key words: Uterine Cervical Neoplasms; Epidemiology; Incidence; Survival Rate; Radiotherapy; Brachytherapy; Radiation Dosage; Antineoplastic Agents; Diagnostic Imaging; Treatment Outcome

Cervical cancer incidence worldwide is about 500,000 new cases per year with most of them being detected at locally advanced stages, despite the possibility of screening (for instance, in France, legislative decision to make testing: 1978). This highlights a relative failure of prevention, which may be offset by the anti HPV vaccine prevention (Lancet on line, may 2011 with Gardasil (Merck & Co., 2006), the first vaccine against the genotypes 6, 11, 16 and 18 human papillomavirus most involved in precancerous lesions of the cervix and cervical cancers).
It is a tumor of intermediate prognosis (median survival time: approximately 65% at five years when technical resources are available, but less than 30% in the developing countries (with 258,000 deaths in 2008).
No decisive progress has been made since the addition of concurrent chemotherapy (1) to irradiation, which dramatically improved the cure rates (1999). However, technical evolutions of external beam radiation from 2D to IMRT and rotational radiotherapy were able to minimize morbidity and even mortality treatments.
Brachytherapy still plays an important role in the therapeutic approach of patients with FIGO stage I-IV cervical carcinomas. The accuracy of brachytherapy allows a high dose of radiation targeted at the cervix, as this technique minimizes radiation exposure to adjacent tissues and organs. Patients are treated with techniques using customized vaginal mold or ovoids. However, vaginal mold allows better morphologic congruence throughout the treatment course, which takes into account internal organ motion during the course of brachytherapy. This material is applicable for a low dose-rate (LDR), a pulsed dose-rate (PDR) and a high dose-rate brachytherapy (HDR). Although the overall survival and relapse-free survival are the same with these three treatments, an important advantage of HDR is that each treatment dose can be delivered on an outpatient basis with a short time of administration that provides greater convenience for many patients in developing countries.
PDR brachytherapy with optimized dose distribution (2) is often chosen in Western countries versus traditional treatments (iridium wires, cesium, LDR) despite higher costs (including remote after-loading source projectors and miniaturized sources).
Treatment planning has also changed: traditionally using reference points (A and B), new techniques need CT or MRI (2) imaging for better assessment of gross tumor volume (GTV) and delineation of target volume (CTV) as well as OAR (organs at risk, essentially bladder and rectum). Dose limits to normal tissues are now defined as the dose received in the 2 cm3 most exposed to the vaginal applicator (5).
With these new techniques, recent data show improvement in local control with no increase of complications (4).
Brachytherapy can be used alone in stage Ia2 in combination with surgery (recommended dose: 60 Grays) or in combination with CCR (concomitant chemo radiation) in distal stages IIb and III (recommended dose: 20 Grays).

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Is surgery possible after pelvic irradiation?

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Key words: Uterine Cervical Neoplasms; Hysterectomy; Radiotherapy, Adjuvant; Chemotherapy, Adjuvant; Brachytherapy; Pelvic Exenteration

The role of adjuvant postradiation hysterectomy for patients with large ("bulky") International Federation of Gynecology and Obstetrics (FIGO) stage IB cervical cancer has been a source of controversy. At the present time, two treatment options are available: neoadjuvant chemotherapy followed by completion surgery, and concurrent chemoradiotherapy followed by intracavitary brachytherapy. This second option has become a standard treatment since 2001. The place of completion surgery after chemoradiotherapy is debated, as no evidence of benefit in terms of overall survival and disease-free survival but a high postoperative morbidity have been demonstrated. Failure to control local disease is however, a major cause of treatment failure and exenteration in case of recurrence is sometimes the only solution. The rate of residual cervical tumor after hysterectomy is estimated at 40–50% and is a major prognostic factor but, unfortunately, most studies included patients to hysterectomy or not, without taking into account the therapeutic response. Intraoperative complications appear infrequent in experienced hands, but postoperative complications such as ureterohydronephrosis or lymphatic sequelae are difficult to predict. Overall morbidity rates are about 20% after hysterectomy and 46.7% after pelvic exenteration. In half of the cases, morbidity is urinary. The use of flaps may decrease morbidity. Laparoscopic approach has emerged in the attempt to reduce postoperative complications. All these elements have to be discussed with patients as no randomized trial can define the interest of post radiation surgery in an individual setting.

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