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Imaging techniques for the evaluation of cervical cancer

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Improvements in the treatment of cervical carcinoma have made it possible to offer optimal and personalised treatment. Cervical cancer staging is based on clinical examination and histological findings. Many diagnostic methods are used in clinical practice. Magnetic resonance imaging is considered the optimal method for staging cervical carcinoma because of its high accuracy in assessing local extension of disease and distant metastases. Ultrasound has gained increased attention in recent years; it is faster, cheaper, and more widely available than other imaging techniques, and is highly accurate in detecting tumour presence and evaluating local extension of disease. Magnetic resonance imaging and ultrasound are often used together with computed tomography or positron emission tomography combined with computed tomography to assess the whole body, a more accurate detection of pathological lymph nodes and metabolic information of the disease.

Cervical cancer

Epidemiology

Cervical cancer is the second most common malignancy in women worldwide [1]. Effective screening and prevention programmes in developed countries have resulted in a 75% decrease in

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incidence and mortality of cervical cancer over the past 50 years [2]. In less developed countries, however, where screening and prevention programmes are not available, cervical cancer continues to be one of the most common causes of cancer-related morbidity and mortality among women [3,4].

Aetiology and risk factors

Invasive cervical cancer is related to age, with a mean age of 47 years at diagnosis in the USA [2]. The major cause of cervical cancer is infection with high-risk human papillomavirus. The role of human papillomavirus in the cause of cervical cancer is tightly correlated with over-expression of two oncogenes (E6 and E7); their continuous expression is a necessary condition for the transformation of neoplastic cells [5]. Other risk factors are represented by early onset of sexual activity, multiple sexual partners, and cigarette smoking.

Treatment

Treatment of invasive cervical cancer depends on clinical stage. Progress in therapeutic strategies allows tailoring of treatment: women with advanced disease will require neoadjuvant treatment (e.g. radiotherapy or chemotherapy alone or combined) possibly followed by surgery. In early disease, minimally invasive surgery is possible. The radicality of surgery needs to be tailored depending on tumour extension to minimise postoperative morbidity but also to preserve childbearing potential in young women.

Staging

The International Federation of Gynecology and Obstetrics (FIGO) recommends a clinical staging system for cervical cancer. It is well known, however, that the accuracy of such a system is suboptimal compared with surgical and pathological data. Tumour diameters, parametrial involvement, vaginal spread, infiltration of bladder wall, rectum mucosa, or both, hydroureter, hydronephrosis, and distant metastases are the fundamental parameters in the FIGO classification. Pelvic extension of cervical cancer can be assessed clinically by palpation, but other diagnostic examinations are required to assess distant metastasis or ureteral involvement.

In 20–30% of cases of early stage disease (defined on the basis of clinical examination), a significant discrepancy was reported between clinical staging and histological finding for tumour diameters and parametrial involvement [6]. Cranio–caudal extension and parametrial infiltration are parameters that are not easy to estimate during the clinical examination; in particular, this is difficult in obese women. Indeed, FIGO staging does not include some of the tumoral parameters now recognised as significant prognostic factors, such as lymph-node metastases: 5-year survival of early stage cervical cancer (clinical FIGO stage) is 90% if no lymph-node metastases are present, but only 65% if they are [7]. The degree of stromal infiltration, the distance between the upper limit of the cervical cancer, and the internal uterine orifice are other important prognostic factors [8].

Even if imaging techniques can provide information on significant prognostic factors, and is more accurate than clinical staging, clinical staging remains the only recognised gold standard worldwide. This is because clinical staging can also be used in low-income countries, where the prevalence of cervical cancer is greater than in high-income countries.

The National Comprehensive Cancer Network (NCCN) suggests that cross-sectional imaging techniques (computed tomography scan, magnetic resonance imaging [MRI], positron emission tomography [PET] combined with computed tomography), be used in stages equal to or higher than IB [9]. Also, FIGO now encourages its use in the staging of cervical cancer for assessing prognostic factors, such as tumour size, parametrial and pelvic side wall invasion, adjacent organ invasion, and lymph-node metastases [10]. Magnetic resonance imaging has been suggested as the optimal modality for staging cervical carcinoma FIGO stage IB1 or greater [11]. Computed tomography has not proven accurate for assessing parametrial invasion or tumour size because of its limited contrast resolution [12,13]. Whole-body PET-CT has now entered into clinical practice, in particular to define local extension and distant spread of cervical cancer, and to estimate its metabolic aspect.