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ROLE OF IMAGING MODALITIES IN THE DIAGNOSIS OF GYNECOLOGIC MALIGNANCIES

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INVASIVE CERVICAL CANCER

Introduction

The evaluation of cancer prognostic factors is essential to making appropriate treatment decisions. Important clinical factors in cancer of the cervix include the patient's age, the stage of disease, and the size of the tumor. Inportant histologic factors are tumor garde, depth of stromal invasion, invasion of the lymph-vascular space, and lymph node metastasis (Morrow CP et al., 1993; Hoskins WJ et al., 1989). The significant independent prognostic factors in predicting disease-free survival in patients with early stage cervical cancer are tumor size, depth of invasion, invasion of the lymph-vascular space (Delgade G et al., 1990; Kamura T et al., 1992: Stehman FB et al., 1991). In advanced cervical cancer, factors related to disease-free survival include status of paraaortic and pelvic lymph nodes, tumor size, and the patient's age (Stehman FB et al., 1991). Morphologic risk factors such as tumor size, depth of stromal invasion, stage of disease and lymph node metastasis are all well evaluated by means of cross-sectional imaging (Hricak H et al., 1988; Kim SH et al., 1993; Subak LL et al., 1995).

Sonography

Transabdominal sonography plays a limited role in the evaluation of cervical cancer. The main Limitation is low contrast resolution with resultant difficulties in direct visualization of tumor and differentiation between tumor and adjacent normal cervical tissue. Sonography is not useful in the evaluation of lympy nodes. It is mostly used to evaluate obstruction of the urinary tract in patients with advanced disease.

CT

The value of CT in the evaluation of invasive cervical cancer is in the assessment of advanced disease (stage greater than IIB) and in the detection and biopsy of suspected lymph node metastasis. CT does not allow consistent visualization of tumor at the primary cervical sites until now. Up to 50% of stage IB tumors are isodense with normal cervical tissue and the only finding may be cervical enlargement (Lee JKT er al., 1989; Walsh JW, 1992). CT criteria for parametrial invasion include irregular cervical margin, thick parametrial strands, eccentric parametrial soft tissue mass, obliteration of

the paraureteral fat plane (Lee JKT et al., 1989; Walsh JW, 1992). The latter is the only reliable finding for parametrial invasion. CT criteria for pelvic side wall invasion include a tumor less than 3mm from the muscular wall and encasement of distortion of iliac vessels (Lee JKT et al., 1989). CT criteria for lymph node metastasis is lymph node size greater than 1cm in the short axis, and its sensitivity is 44%, whereas the specificity is 93% (Kim SH et al., 1993, Subak LL et al., 1995).

MR Imaging

T2-weighted MR imaging allows consistent tumor visualization and is 93% accurate in determining tumor size to within 0.5cm of measurements of surgical specimens (Hricak H et al., 1988; Subak LL et al., 1995, Lien HH et al., 1989, Burghardt E et al 1989). Up to a 19% overestimation of tumor size by MR imaging compared with pathologic studies has been attributed to the inability of MR imaging to enable differentiation of tissue edema occuring after biopsy from tumor and to inherently greater in vivo measurements compared with in vitro size (Hricak H et al., 1988; Greco A et al., 198 9). With most update MR machines a cervical cancer mass which is smaller than 5 mm in the depth of invasion is not detected so far (Kim JS et al., 1996; Choi DI et al., 1996). The diagnostic accuracy of tumor detection, tumor sizing, and evaluation of locoregional extent of disease reported in recent publications based on high Tesla MR machine is 87-92%. MR imaging diagnosis of parametrial invasion requires the finding of full-depth invasion of the stroma and one or more of the following findings must be added: irregular interface between the tumor and the parametrium, asymmetric tumor bulge, or vascular encasement. The PPV for detection of parametrial invasion by MR imaging is 67% and the NPV is 95% (Kim SH et al., 1993; Subak LL et al., 1995; Sironi S et al., 1993). MR imaging criteria for pelvic side wall invasion include tumor less than 3 mm from the pelvic side wall, vascular encasement, increased signal intensity of the adjacent muscle on T2-weighted images. Detection of lymph node metastasis is similar to detection on CT scans, as both techniques rely on the morphologic criterion of nodal size greater than 1 cm in short axis. Detection of intranodal necrosis is best seen on contrast enhanced images.

Conclusion

MR imaging should be the initial examination of choice in the evaluation of clinical stage I disease, when tumor diameter is larger than 2cm, or when the tumor is endocervical.

ENDOMETRIAL CANCER

Introduction

The depth of myometrial invasion in patients with endomtrial cancer is known as the most important prognostic factor closely related to the risk of lymphatic tumor spread and 5-year survival rate (Boronow RC et al., 1984; Berman ML et al., 1980). The International Federation of Gynecology and Obstetrics (FIGO) has adopted a surgical staging system of endometrial cancer that subdivides the stage I disease into stage IA, IB, and IC. Improved imaging resolution of TVUS and MR imaging can differentiate these three accurately.

TVUS vs CT vs MR Imaging

The reported accuracy / sensitivity / specificity in the differentiation of deep

myometrial invasion from no and superficial myometrial invasion (IC from IA & IB): TVUS 69-76% / 76-86% / 65-93% , CT 50-76% / 40% / 90%, MR 71-95% / 54-100% / 50-93%(Yamashita Y et al., 1993; Delmaschio A et al., 1993; Gordon AN et al., 1989; Throrvinger BT et al., 1989; Hricak H et al., 1991; Kim SH et al., 1995; Scoutt LM et al., 1995). With TVUS, endometrial thickness greater than 10mm is considered as abnormality in postmenopausal women. With MR imaging, contrast enhanced MR images are superior to unenhanced T2-weighted images and TVUS and junctional zone in MR imaging is important in determination of myometrial invasion depth.

There are several pitfalls of images in the evaluation of myometrial invasion. Overestimation can occur in patients having a polypoid tumor, distension of the endometrial cavity by secretion (pyometra), presence of myoma, atrophy of the myometrium (old age, absence of junctional zone), poor tumor / myometrial contrast. Underestimation can occur in patients having a tumor with superficially spreading growth or microinvasion, an infiltrative tumor (Yamashita Y et al., 1993; Scoutt LM et al., 1995).

Comclusion

In posmenopausal women with vaginal spotting, endometrial thickness greater than 5mm estimated by TVUS is considered as abnormality and endometrial biopsy is recommended for confirmation of endometrial pathology. Contrast enhanced MR imaging should be taken for evaluation of myometrial invasion depth for patients with endometrial cancer.

OVARIAN CANCER

Introduction

Ovarian cancer is the second most common gynecologic malignancy in the USA and is the leading cause of mortality in cancer of the reproductive tract (Boring CC et al., 1994). Since the majority of patients have advanced disease at time of presentation, early detection is of great importance. Exploratory laparotomy is the mainstay for the managing ovarian cancer, as it offers both surgicopathologic staging and tumor debulking. However, as many as 30-40% of patients are understaged at initial laparotomy (Johnson RJ, 1993; Walsh JW, 1992; Young RC et al., 1989). Cross sectional imaging can provide staging information which can assist in surgical planning and in selection of treatment options. Ovarian malignancy tumors are usually larger than 4cm in diameter. Image findings suggestive of malignancy are vegetations (papillary ecdocystic projections), solid lesions, large solid parts or necrosis, a thick wall and septa of more than 3 mm (Forstner R et al., 199 5; Outwater EK et al., 1995).

Sonography

US plays a pivotal role in ovarian tumor detection and characterization, but its use in staging is limited. US is capable in most patients of differentiating between functional cysts, dermoids, some endometriomas, ectopic pregnancies and more complex cystic masses. TVUS is the most effective imaging modality in ovarian cancer screening and in the differentiation of benign and malignant lesions with sensitivity ranges from 82% to 100% and specificity ranges from 83% to 95% (Yamashita Y et al., 1995; Sassone AM et al., 1991; Granverg S et al., 1990;

BenacerrafBR et al., 1990).

CT

CT is the single best and most practical approach in staging ovarian cancer with the staging accuracy of 70% to 90%. CT and MR are comparable each other in staging of ovarian cancers. The benefit of CT compared with MR imaging in management of ovarian cancer is followings: CT is more familial in both radiologists and clinicians, CT is more widely available, CT has shorter imaging and interpretation times, CT demonstrates calcification more reliably. The main limitation of CT is the inability to detect small peritoneal and mesenteric implants; current CT scanners can detect 50% of peritoneal implants as small as 5 mm. (*MRI accuracy of depicting spread of ovarian cancer through the pelvis and the abdomen is 75%). In comparison with MR imaging, CT is superior in detection of cancer involvement in the mesentery or implants on large & small bowel. CT is equal in detection of pelvic sidewall and retroperitoneal involvement, omental deposit, peritoneal implants. CT is inferior in detection of cancer involvement of uterus, sigmoid colon, urinary bladder, dome of diaphragm, and liver surface. CT and MR have similar accuracy in depicting lymph nodes with high sensitivity and lacking specificity in diagnosing malignant involvement of nodes.

MR Imaging

MR imaging is emerging as a problem-solving modality useful for lesion characterization and staging, including evaluation of locoregional extent, lymph code metastasis, and liver surface implants. In order to properly detect and characterize the ovaries and ovarian lesions, MR images should be obtained in at least two orthogonal planes. Axial and saggital planes should be routine, but coronal images may prove useful in large tumor. In addition to T1 and T2-weighted images, several techniques are recently developed and used in patient management. T1-weighted images are necessary for lesion characterization especially in diagnosis of fat and hemorrhage within the mass, and detection of lymph nodes. T2-weighted images are useful in detection of high signal intensity ovarian follicle helping in depicting the ovaries, and in differentating ovary from bowel loop, and in helping the adnexal or uterine origin of a pelvic mass, and needed for lesion characterization and staging. Compared with conventional spin echo(CSE), fast spin echo (FSE) technique significantly shortens the acquisition time, resulting in better resolution by increased signal to noise ratio, decreased motion artifact and increased patient throughput (Hricak H et al., 1993; Smith RC et al., 1992; Nghiem HV et al., 1992). Gd-enhanced T1-weighted images significantly improve lesion characterization, and detection of peritoneal and omental implants. Fat saturation technique can differentiate fat from hemorrhage, resulting in differentiating dermoid from endometrioma. The use of phase array coils further improves the signal to noise ratio allowing superb image quality with a reduced field of view of down to 20cm(Hricak H et al., 1993; Smith RC et al., 1992). Gd-enhanced images should be taken routinely in the evaluation of patients with ovarian cancer because of accurate characterization of some lesions, especially for delineation of necrosis, papillary vegetations, solid components, septations, peritoneal implants, and omental disease. Papillary vegetations in an ovarian cyst establish the lesion as an

ovarian neoplasm. These identify the lesion as an epithelial neoplasm, but these can also be seen in benign and malignant ovarian neoplasms (Granberg S, 1993; Granberg S, 1991). As an isolated finding in an otherwise simple cyst, they are considered more compatible with a borderline lesion (Granberg S, 1993). The problem in detection of papillary vegetations with TVUS is that it lacks specificity in detection of papillary vegetations will enhance whereas adherent clot and debris will not. For this reason, in this hospital (Donsan medical center) we obtained T1 and T2-weighted FSE axial images, T2-weighted FSE sagittal image, and Gd-enhanced T1-weighted axial image with fat suppression technique with 1.5T machine using phase array coil.

Conclusion

TVUS in combination with serum Ca 125 level shows promising results for ovarian cancer screening. CT is established as the primary imaging modality for characterization of ovarian tumors and ovarian cancer staging. MR is emerging as a problem-solving modality with better results than CT in lesion characterization, in evaluation of local extent of tumor, and in tumor implants involving the hemidiaphragn and liver surface.

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