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Role of MRI in staging of carcinoma cervix in correlation with USG and CT scan

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Abstract
Background: Uterine cervical cancer is the most common gynecologic malignancy and the second most common cancer in women worldwide in terms of incidence and mortality. The present study was conducted to assess MR imaging staging in uterine cervical carcinoma.
Materials & Methods: This study was conducted on 60 patients of neoplastic etiology involving endocervix. Patients were scanned on 1.5Tesla MRI Scanner. Contrast enhanced scans were performed wherever indicated. The contrast used in the study was Gadolinium-DTPA at the rate 0.1 ml mol/kg. MR characteristics of different sequences including the contrast-enhanced sequences were noted and recorded.
Results: MRI showed high rate of detection (96.7 %) as compared to CT scan and USG with failure of detection only in lesion staged Ia1 or Ia2 which represents microscopic involvement of carcinoma of cervix. CT scan was able to detect nodes in 80 % cases. USG failed to demonstrate enlarged nodes in 6 cases. Maximum stage was IV seen in 21% followed by IIb in 20% and Ib2 in 16%. The difference was significant (P< 0.05).
Conclusion: Authors found that MRI is highly sensitive in detection of early stage of carcinoma of cervix.

Keywords: CT scan, MRI, USG

Introduction
Cervical cancer is one of the main causes of cancer death in women, most of which is caused by human papillomavirus (HPV) infection. Approximately 86% of women who die from cervical cancer are in developing countries [1-4]. According to the clinical stage standard issued by FIGO, cervical cancer was staged based on the depth of tumor invasion and the degree of invasion to surrounding tissues. Patients with cervical cancer with FIGO stage I–II were divided into early cervical cancer. Although these were not mentioned in FIGO stage, lymph node metastasis has a very close relationship with the prognosis of cervical cancer and is the most important in cervical cancers [4-6].
Magnetic Resonance Imaging (MRI) has radically modified the practice of medicine in general and radiology in particular. Nowadays Magnetic Resonance imaging (MRI) in evaluation of gynecological malignancy especially carcinoma of cervix is considered the primary modality of choice [8].
Like its predecessor, computed tomography (CT), MRI is a computer based imaging modality, which displays the body in thin tomographic slices [9]. MRI is based on the safe interaction between radio waves and hydrogen nuclei in the body in presence of a strong magnetic field. The physical characteristics of a volume element or 'voxel' of tissue are translated by the computer into a two dimensional image composed of picture elements or 'pixels' [10]. The pixel intensity in MRI reflects the density of hydrogen, generally as water or fat. To be more exact, MR signal intensity reflects the density of mobile hydrogen nuclei modified by the chemical environment, that is, by the magnetic relaxation times, T1 and T2, and by motion.
Availability of higher magnetic strength magnets and superior coil technology has led to the development of highly sophisticated MR sequences that has boosted the potential of magnetic resonance imaging [11]. However MRI has certain limitations. MRI is contraindicated in patients with cardiac pacemakers, cochlear implants, metallic prosthesis and fixators.

Also MRI is relatively contraindicated in first trimester of pregnancy. CT has advantage over MRI in evaluation of any bony involvement [12]. The present study was conducted to assess MR imaging staging in uterine cervical carcinoma.

Materials & Methods

This prospective study was conducted on 60 patients visited to the department for MRI. All patients diagnosed as having uterine cervical carcinoma were included in this study. All were informed regarding the study and their consent was obtained. Ethical clearance was obtained before starting the study.

Data such as name, age etc. was recorded. Relevant history of illness and significant clinical findings of all patients were recorded. Patients were scanned on 1.5 Tesla MRI Scanner. Contrast enhanced scans were performed wherever indicated. The contrast used in the study was Gadolinium-DTPA at the rate 0.1 ml mol/kg. MR characteristics of different sequences including the contrast-enhanced sequences were noted and recorded. The results of this study were analyzed. P value less than 0.05 was considered significant.

Results

Table I: Detection of lesion

Modality	No. of patients (out of 60)	Percentage
USG	50	83.33
CT	42	70
MRI	58	96.7

Table I shows that MRI showed high rate of detection (96.7 %) as compared to CT scan and USG with failure of detection only in lesion staged Ia1 or Ia2 which represents microscopic involvement of carcinoma of cervix.

Table II: Lymph node involvement:

Modality	No. of patients (out of 60)	Percentage
USG	6	50
CT	10	83.33
MRI	12	100

Table II shows that CT scan was able to detect nodes in 83.33 % cases. USG failed to demonstrate enlarged nodes in 6 cases.

Table III: Assessment of Staging on MRI

Stage	MRI (%)	P value
Ia1	0	0.02
Ia2	0	
Ib1	22	
Ib2	32	
IIa	36	
IIb	40	
IIIa	20	
IIIb	8	
IV	42	

Table III shows that maximum stage was IV seen in 21% followed by IIb in 20% and Ib2 in 16%. The difference was significant (P< 0.05).

Discussion

Cervical cancer is particularly harmful to women in developing countries, and screening its level is very important. However, two imaging techniques, CT and MRI, play a vital role in the early stage of cancer, treatment strategy and treatment of response evaluation.

Cervical carcinoma has intermediate signal intensity at T2-weighted imaging and is seen disrupting the low-signal-intensity fibrous stroma. The tumor can demonstrate a wide variety of morphologic features and may be exophytic, infiltrating, or endocervical with a barrel shape [13]. In young women, cervical carcinoma usually originates from the squamo-columnar junction and tends to be more exophytic, whereas in older women it originates more often in the endocervical canal. The bulk of the lesion is centered at the level of the cervix, with either protrusion into the vagina or invasion of the lower myometrium. This permits differentiation from an endometrial mass (polyp or adenocarcinoma), which is centered in the endometrial cavity but protrudes into the endocervical canal. Prolapsed submucous fibroids are distinctly more hypointense at T2-weighted imaging than cervical carcinomas [14]. The present study was conducted to assess MR imaging staging in uterine cervical carcinoma.

In this study, MRI showed high rate of detection (96 %) as compared to CT scan and USG with failure of detection only in lesion staged Ia1 or Ia2 which represents microscopic involvement of carcinoma of cervix. CT scan proved unrewarding with respect to lesion differentiation due to lack of contrast difference with adjacent tissue. USG showed presence of bulky cervix without any clear demarcation of lesion during early stages [15].

In general, cervical carcinoma is better defined at T2-weighted imaging, but small tumors may be more readily identified by their early enhancement after dynamic injection of gadopentetate dimeglumine. A visible tumor indicates stage IB or higher. The size of the tumor (ie, whether greater or less than 4 cm in diameter) has a great impact on the choice of therapy, and there is good correlation between MR imaging findings and macroscopic measurements. However, the size of the lesion may rarely be overestimated at T2-weighted imaging due to inflammation or edema. The shape and direction of growth should be noted because they are important for brachytherapy planning [16].

We observed that CT scan was able to detect nodes in 80 % cases. USG failed to demonstrate enlarged nodes in 6 cases. Lymph node disease detection is based only on a size criterion, the most widely accepted being a transverse diameter exceeding 10 mm. Lymph nodes are best detected with T2-weighted imaging, at which they demonstrate intermediate signal intensity and are well differentiated from the hypointense muscles and blood vessels. A slightly hyperintense ring flow artifact is often found in the iliac veins and should not be confused with adenopathy. When treatment planning changes due to a suspicious increase in the volume of a lymph node, biopsy should be performed because the node may be falsely positive due to inflammation [17].

We found that maximum stage was IV seen in 21% followed by IIb in 20% and Ib2 in 16%. Okamoto *et al.* [18] reviewed the diagnostic performance of computed tomography (CT) and magnetic resonance imaging (MRI) in staging of cervical carcinoma. 49 cases were included in the

study. Sensitivity estimates that MRI and CT had comparable specificities for parametrial invasion and lymph node involvement. For bladder invasion and rectum invasion the sensitivities for MRI were higher compared with CT. The specificity in evaluating bladder invasion for MRI was significantly higher compared with CT. The specificities for rectum invasion were comparable. Differences in patient sample size, publication year, methodological criteria, and MRI techniques had no effect on the summary estimates. They concluded that for overall staging of cervical carcinoma, MRI is more accurate than CT.

Luo *et al*. compared sensitivity, specificity and diagnostic accordance rate, the diagnostic value and clinical significance of MRI, CT and MRI combined with CT in the diagnosis of lymph node metastasis of early cervical cancer. The sensitivity, specificity and diagnostic accordance rate of MRI in the diagnosis of lymph node metastasis of early cervical cancer in stage Ia-Ib were 75.00, 72.92 and 77.50%, respectively, which were significantly higher than those of PET/CT in the same period (P<0.05). The sensitivity, specificity and diagnostic accordance rate of MRI combined with CT in the diagnosis of early cervical cancer in stage Ia-Ib were 78.13, 87.50 and 83.75%, respectively, which were significantly higher than those of MRI or CT alone (P<0.05). However, the sensitivity, specificity and diagnostic accordance rate of MRI combined with CT in the diagnosis of lymph node metastasis of early cervical cancer in stage IIa-IIb were 91.66, 82.81 and 88.13%, respectively, which were significantly higher than those of MRI or CT alone (P<0.05). MRI is superior to CT in the diagnosis of lymph node metastasis of early cervical cancer. However, the diagnostic efficiency of combined scans of the two is far higher than that of MRI or CT alone, which has more diagnostic value. In clinic, MRI and CT should be combined to improve the diagnostic accuracy of diseases [19].

Dempsey C, *et al*. [20] also recommended MRI is as the best modality for image-guided brachytherapy due to its high image resolution and clear target volume definition.

Conclusion

Authors found that MRI is highly sensitive in detection of early stage of carcinoma of cervix.

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