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Assessment of carcinoma of cervix with the Use of MRI and CT scan Methods

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Abstract
Magnetic Resonance Imaging (MRI) is the preferred imaging modality because of its ability to assess soft tissue in detail, permitting thereby better identification of stromal and parametrical invasion as compared to computed tomography (CT). The purpose of the study is to compare CT and MRI findings, in the evaluation and staging of uterine cervical carcinoma with special emphasis on detection of earliest lesion.
The 15 patients of suspicion of uterine cervical carcinoma were enrolled in the present study. The patients were referred to the Department of Radiology in PMCH, Patna from July 2018 to Dec 2018.CT Images of the pelvis will be obtained on a Toshiba, Asteion TSX -021A Spiral CT unit. Matrix size of 512 * 512 and slice section of 10 mm. MRI was performed on the 1.5 Tesla system (GE Healthcare) using a pelvic array coil for the pelvic scan and a torso phased-array coil for the para aortic scan.
MR imaging is an essential modality for diagnosing cervical lesions because the signal intensity or configuration of the lesion demonstrated on MR images reflects the pathologic findings. MRI has been shown to minimize costs in some clinical settings by limiting or eliminating the need for further expensive or more invasive diagnostic or surgical procedures. In conclusion, MR imaging is superior to CT in the evaluation of parametrial status. Overall, the accuracy rates of CT and MR imaging for pelvic lymph node metastasis were equal in our study. MR imaging has the ability to differentiate between fibrosis and recurrence in post radiotherapy cases.

Keywords: carcinoma of cervix, MRI, CT scan

Introduction
Cervical cancer arises from the cervix, which is the lower part of the uterus that opens into the vagina. It is caused due to the abnormal growth of cells on the cervix. Initially, in cervical cancer, no symptoms are seen, but in the later stages symptoms start to appear. It is mainly caused by human papillomavirus (HPV). HPV infection is very common and it may not cause serious symptoms, but in some cases it results in cervical cancer. Regular pap tests can spot changes in the cervical cells before they turn into cancer [1].
Cancer is the uncontrolled growth of body cells and can start almost anywhere in the human body. When cancer develops in the cervix of female it is termed as cervical cancer or cancer cervix. Cervix is the lower part of the uterus and connects the body of the uterus to the vagina (birth canal).The lower part of the cervix (ectocervix) lies within the vagina and the upper two thirds of the cervix (endocervix) lies above the vagina. Most cervical cancers originate in the area where the endocervix and ectocervix join.
Cervical cancer is the fourth most common cancer in women worldwide and second most common cancer in women living in less developed regions. World Health Organization (WHO) estimated 530 000 new cases of cervical cancer globally (estimations for 2012), with approximately 270 000 deaths (representing 7.5% of all female cancer deaths). More than 85% of these deaths occurred in low- and middle-income countries. The highest estimated incidence rates for cervical cancer are in sub-Saharan Africa, Melanesia, Latin America and the Caribbean, south-central Asia and south-east Asia.
India has a population of 436.76 million women aged 15 years and older who are at risk of developing cervical cancer. Every year 122844 women are diagnosed with cervical cancer and 67477 die from the disease (estimations for 2012). In India cervical cancer is the second most common cancer among women and also the second most common cancer among women between 15 and 44 years of age.
Nearly all cases of cervical cancer can be attributable to Human papillomavirus (HPV) infection. HPV is a group of viruses and one of the causative agents in the sexually transmitted infections (STIs) in men and women with and without clinical lesions. HPV types (16 and 18) cause 70% of cervical cancers and precancerous cervical lesions worldwide. Based on Indian studies about 82.7% of invasive cervical cancers showed the presence of HPVs 16 or 18 (Systematic reviews and meta-analyses of the literatures by ICO HPV Information Centre) [2].
Other epidemiological risk factors for cervical cancer are early age at marriage, multiple sexual partners, multiple pregnancies, poor genital hygiene, malnutrition, use of oral contraceptives, and lack of awareness. India also has the highest (age standardized) incidence rate as 22 (per 100,000 women per year) of cervical cancer in South Asia (estimations for 2012), compared to 19.2 in Bangladesh, 13 in Sri Lanka, and 2.8 in Iran.
Cervical cancer can be prevented by vaccinating all young females against the HPVs and by screening and treating precancerous lesions in women. In addition if cervical cancer is detected early and treated in earlier stages it can be cured.
CT and MRI are valuable imaging techniques in the pre-treatment evaluation of cervical cancer allowing direct

visualization of the tumour. MRI, however, can better delineate cervical tumour size, location and extension into adjacent structures and lymph node metastasis with its excellent soft-tissue contrast resolution and multiplanar scanning capabilities.

Human papillomavirus (HPV) is found in about 99% of cervical cancers. There are over 100 different types of HPV, most of which are considered low-risk and do not cause cervical cancer. High-risk HPV types may cause cervical cell abnormalities or cancer. More than 70 percent of cervical cancer cases can be attributed to two types of the virus, HPV-16 and HPV-18, often referred to as high-risk HPV types.

HPV is estimated to be the most common sexually transmitted infection in the United States. In fact, by age 50 approximately 80% of women have been infected with some type of HPV. The majority of women infected with the HPV virus do NOT develop cervical cancer. For most women the HPV infection does not last long; 90% of HPV infections resolve on their own within 2 years. A small number of women do not clear the HPV virus and are considered to have "persistent infection. A woman with a persistent HPV infection is at greater risk of developing cervical cell abnormalities and cancer than a woman whose infection resolves on its own. Certain types of this virus are able to transform normal cervical cells into abnormal ones. In a small number of cases and usually over a long period of time (from several years to several decades), some of these abnormal cells may then develop into cervical cancer [3].

The cervix (mouth of the uterus) can be examined by the Pap smear test. It is a simple test performed by the gynaecologist to detect early pre-cancer changes in the cervix. Women with suspicious changes are offered colposcopy (visualization of the cervix under magnification) to help identify and biopsy the exact site for possible pre-cancer changes. Identification and treatment at this stage will help prevent cervical cancer that may develop 10 to 20 years later. The Human Papilloma Virus vaccine plays a major role in the reduction of cases of cervical cancer. Ovarian cancer has eluded early diagnosis in both developed and developing countries alike. More than two thirds are still detected in Stage III and the mortality is high. A multi modal approach – a family history, ultrasound scan and tumour markers, especially CA 125, will help identify women at risk. Women at risk of Cancer of the uterine body – endometrial cancer – should be offered a trans-vaginal ultrasound every 6 months after menopause. This will recognize an increase in the endometrial thickness even in women without symptoms. A biopsy can then be performed to confirm the diagnosis. Modern methods of treating Gynaecological cancers include Surgical, Medical, Radiation procedures or a combination of these, but regular health checks are the best defense against gynaecological cancers [4].

Magnetic Resonance Imaging (MRI) is the preferred imaging modality because of its ability to assess soft tissue in detail, permitting thereby better identification of stromal and parametrical invasion as compared to computed tomography (CT). Radiation exposure and inaccuracies in detection of parametrical invasion are the other limitations of CT. MRI tells the exact volume, shape, and direction of the primary lesion, local extent of the disease, and nodal status accurately, which helps the clinician in treatment planning. Tumor behaviour to chemo radiation is also better evaluated with MRI. The purpose of the study is to compare CT and MRI findings, in the evaluation and staging of uterine cervical carcinoma with special emphasis on detection of earliest lesion.

Methodology

The 15 patients of suspicion of uterine cervical carcinoma were enrolled in the present study. The patients were referred to the Department of Radiology in PMCH, Patna from July 2018 to Dec 2018. The approval of ethical committee had been taken along with the consent from the patients were also taken. The objective of the present study were conveyed to patients. CT Images of the pelvis will be obtained on a Toshiba, Asteion TSX -021A Spiral CT unit. Matrix size of 512 * 512 and slice section of 10mm.MRI was performed on the 1.5 Tesla system (GE Healthcare) using a pelvic array coil for the pelvic scan and a torso phased-array coil for the para aortic scan.

Results & Discussion

The 15 patients included in the study were having clinical suspicion of uterine cervical carcinoma were included in this study. All the enrolled patients were diagnosed with the MR & CT imaging.

Table 1: Age group of the Patients

Age group	Number of cases
20-30	0
31-40	0
41-50	6
51-60	5
61-65	4
Total	15

Table 2: Staging of Carcinoma of Cervix

Age group	Number of cases
Stage IB	6
Stage IIA	1
Stage IIB	1
Stage III	0
Stage IVB	4
Stage IVB	3
Total	15

Table 3: Detection of Uterine Extension3

Observation	Total Cases	Detected by MRI	Detected by CT
Uterine Extension	7	7	6
Bladder Extension	6	6	5
Renal Extension	5	5	4
Parametrial Extension	5	6	4
Vaginal Extension	4	4	3
Lymph Node Extension	3	3	3
Metastasis	1	1	1

Error rates in clinical examination are significantly high, hence clinical staging may not be accurate in each and every patient [5]. Important parameters that the clinicians want to know are accurate size of the tumor, status of parametrium, pelvic side walls, presence of lymph nodes, and spread to local and distant organs. MRI answers all these questions. Identification of early disease from advanced disease is crucial for treatment planning [6]. Standard treatment for stage IA1 is cervical conization or total hysterectomy. In total hysterectomy, removal of uterus, cervix, adjacent tissue, and small cuff of the upper vagina in a plane outside the pubocervical fascia is performed. Pelvic lymphadenectomy is generally not advisable because the risk of pelvic lymph node metastasis is less than 1%. In stage IA2, modified radical hysterectomy with bilateral pelvic lymph node dissection is

recommended because the risk of pelvic lymph node metastasis increases to 5%. In modified radical hysterectomy, uterus, cervix, 1-2 cm of upper vagina, paracervical tissue, and medial half of cardinal ligament and uterosacral ligament are removed [7]. Stages IB and IIA are treated either with combined external beam radiation and brachytherapy (BT) or radial hysterectomy and bilateral pelvic lymph node dissection. Effectiveness of both these treatments is equal, and the survival rate in both varies between 80% and 90%.

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. In young women, cervical carcinoma usually originates from the squamocolumnar 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 [8].

MR imaging can provide highly accurate information on the exact extent of tumors because of its fine contrast resolution. Cervical cancers appear as hyperintense masses on T2-weighted images regardless of histopathologic type. The usefulness of dynamic contrast material–enhanced studies in diagnosing parametrial invasion and predicting radiosensitivity has been reported [9-10], although sagittal T1-weighted and T2-weighted images and oblique axial T2-weighted images obtained perpendicular to the uterine axis are sufficient for staging in most cases [11]. MR urography and computed tomography (CT) are also indicated in diagnosing hydronephrosis associated with cancer invasion, paraaortic lymph node metastases, or other distant metastases.

Flueckiger *et al*. noted that all tumours regressed completely within 6 months of radiotherapy, showing a characteristic drop in relative signal intensity following radiotherapy. This decline was most precipitous during the first 3 months and was almost complete at 6 months [12]. This suggests that it is useful to obtain MRI 3 months after completion of treatment to evaluate the effect of radiation. Several prognostic factors including clinical evaluation (Patients age and Karnofsky Performance status), histological finding (tumour grade) and morphological features such as tumour size, location, depth of stromal invasion, local tumour extension and lymph node metastasis have been shown to affect the therapeutic outcome [13-14]. Hricak, *et al* mentioned that tumor size and response to radiation showed a strong correlation [6]. In their report, a significant relationship was found between tumor size, disease stage and invasion to adjacent tissue and organs. However, in this report, the analysis was focused on tumor response with short follow-up, so survival influence was not mentioned. Mayr, *et al* also reported size and volume to be strong prognostic factors for local control [15]. The three-dimensional tumor volume was calculated by the summation of all tumor areas and multiplication by the section profile. Using this volumetric technique, they reported that the volume regression rate during treatment would predict local control more accurately than the initial and residual volume. However, in another report [16], DFS was influenced by both initial tumor size and follow-up examination, but not by regression rate. Toita, *et al* failed to show a significant influence for volume calculated in the same manner with DFS in their previous report, although tumor size was a significant prognostic factor for DFS [13]. This was chiefly because of their small patient numbers with a non-stage-limiting analysis.

Tumor recurrence is defined as development of new local tumor or metastasis at least 6 months the treated lesion has regressed. Tumor stage, size, histological findings, depth of stromal invasion, and nodal status at initial presentation are the risk factors for recurrence [17-18]. It usually occurs in the pelvis at vaginal cuff , cervix, parametrium, pelvic lateral walls, bladder, and rectum within 2 years of completion of the primary treatment. Tumor can also recur in local or distant lymph nodes and in at-risk organs for metastasis. Challenge to the radiologist is to diff erentiate between post-radiation changes and recurrent tumor. MRI has high sensitivity but low specificity for recurrent disease. Dynamic contrast imaging increases the accuracy by identifying the early enhancing, intermediate to high T2-signal intensity recurrent mass lesion [5]. A fibrotic scar appears as low signal intensity on T2W images.

Conclusion

MR imaging is an essential modality for diagnosing cervical lesions because the signal intensity or configuration of the lesion demonstrated on MR images reflects the pathologic findings. MRI has been shown to minimize costs in some clinical settings by limiting or eliminating the need for further expensive or more invasive diagnostic or surgical procedures. In conclusion, MR imaging is superior to CT in the evaluation of parametrial status. Overall, the accuracy rates of CT and MR imaging for pelvic lymph node metastasis were equal in our study. MR imaging has the ability to differentiate between fibrosis and recurrence in post radiotherapy cases.

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