Staging and diagnosis of carcinoma of the uterine cervix: A MR imaging study

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Abstract
The incidence of carcinoma cervix was 86-90% of all genital cancer of women in India. Estimation of disease extent and staging is crucial in the management of carcinoma cervix. Evaluation of disease staging by cystoscopy, sigmoidoscopy and pelvic examination provided insufficient information. Hence, MRI and CT has become accurate imaging modalities for clinical staging of carcinoma cervix. Among these, MRI is the accurate imaging modality in the assessment of disease staging and extent. This study was aimed to assess the efficacy of MR imaging in the diagnosis and staging of carcinoma cervix. A total 90 cases newly diagnosed and histo-pathologically confirmed with carcinoma of uterine cervix and treated with chemoradiotherapy were included. International Federation of Gynecology and Obstetrics (FIGO) staging was applied to MRI grading of the tumor. All the study participants were subjected to MRI pelvis performed with 1.5 tesla machine. Suspected masses were seen in 86.84% newly diagnosed cases and in 80.7% recurrent cases. The diagnostic accuracy, sensitivity, specificity, PPV and NPV in newly diagnosed cases was 89.82%, 90.20%, 18%, 93.14% and 95.45% respectively. Whereas in recurrent cases, diagnostic accuracy, sensitivity, specificity, PPV and NPV was 68.54%, 91%, 42%, 72.36% and 76% respectively. MR imaging is the better diagnostic modality than clinical examination in the tumor staging, extension of disease and assessment of treatment response in the carcinoma cervix.

Keywords: Magnetic resonance imaging (MRI), carcinoma cervix, FIGO staging, diagnostic accuracy

Introduction
Uterine cervical cancer is the third foremost cause of cancer related deaths and 2nd commonly diagnosed cancer among women in developing countries between age group 45-50 years. In India, around 72,000 deaths occurs every year due to cervical cancers [1, 2]. Most common type of cervical cancers are squamous cell carcinoma and adenocarcinoma with incidence of 69% and 25% respectively [3, 4]. In carcinoma cervix cases within 2 years of post treatment, disease recurrence was seen in 60-70% cases and recurrence within 5 years in 89-98% cases [5]. Disease management and prognosis is depends on grade and histologic subtype of disease. International Federation of Gynecology and Obstetrics (FIGO) staging system is the most accepted and used staging system for carcinoma cervix. The revised FIGO staging suggests that MRI and CT are the better diagnostic imaging modalities for cervical cancer [6]. Studies suggest that MRI is the efficient diagnostic tool in cases with early stage invasive cervical tumors with 94% diagnostic accuracy. It is laso best imaging technique for Properative assessment of myometrial invasion depth and cervical involvement [7]. National comprehensive cancer network (NCCN) refers MRI only to assess in cases of type II endometrial cancer, whereas The american college of radiology promote MRI as the preferred imaging technique for treatment palnning and staging of cervical cancers [8, 9]. With the reference of above literature, this study was designed to assess the efficacy of MR imaging in the diagnosis and staging of carcinoma cervix.

Materials and Methods
The present observational study was conducted in Department of Radiology, MNR Medical College and Hospital during April 2018 to September 2019. A total 90 cases newly diagnosed and histo-pathologically confirmed with carcinoma of uterine cervix and treated
with chemoradiotherapy were included. Cases confirmed with carcinoma cervix histo-pathologically, newly diagnosed cases, cases willing to participate, cases with adequate renal and haematological function and cases on post treatment follow up were included. Cases with contraindications to MRI, pregnant or lactating, with cardiovascular complications, psychiatric illness and not willing to participate in this study were excluded. Informed consent was obtained from all the cases and study protocol was approved by institutional ethics committee. Collected detailed history and cases undergone to clinical examination prior to the commencement treatment. International Federation of Gynecology and Obstetrics (FIGO) staging was applied to MRI grading of the tumor. All the study participants were subjected to MRI pelvis performed with 1.5 tesla machine. Various MRI sequences have been used in multiple planes like T1W FSE axial and sagittal, T2W TSE axial and sagittal and TRUFI coronal, STIR axial and FST1 WTSE axial, coronal and sagittal planes. The parameters like tumor size, extension, enhancement, invasion of rectal and urinary bladder wall, involvement of parametrial and pelvic wall and post treatment complication were noted. Clinical followup was done once in 3-6 months. The data was collected into Microsoft Office Excel 2010. The processes of exporting the coded data from excel to SPSS version 20.0 was employed.

Results

A total 90 cases histopathologically conformed to carcinoma cervix were recruited. Among the study cases majority cases were in between age group 41-50 (42.2%) followed by 51-60 years (26.67%). Among the study participants, 38 cases (42.2%) were newly diagnosed and 52 cases (57.78%) had recurrent symptoms.

Table 1: Descriptive data of study participants

| Parameter                                      | Total cases | Percentage |
|-----------------------------------------------|-------------|------------|
| Associated symptoms                           |             |            |
| Per vaginal bleeding                          | 31          | 34.4%      |
| Pain abdomen                                  | 59          | 65.5%      |
| White discharge                               | 38          | 42.2%      |
| Menstrual status                              |             |            |
| Pre-menopausal                                | 32          | 35.5%      |
| Post-menopausal                               | 48          | 53.3%      |
| Post hysterectomy                             | 10          | 11.1%      |
| Duration between radiation therapy and MRI (n=64) |             |            |
| Up to 6 months                                | 17          | 26.5%      |
| 6-12 months                                   | 14          | 21.8%      |
| 13-60 months                                  | 25          | 39.06%     |
| More than 60 months                           | 08          | 12.5%      |

Fig 1: Age wise distribution of study participants
Table 2: MRI findings in newly diagnosed cases (n=38).

| Parameters                  | Newly diagnosed cases (n=38) | Recurrent cases (n=52) |
|-----------------------------|-----------------------------|------------------------|
|                             | Number | Percentage | Number | Percentage |
| Squamous cell carcinoma     | 35     | 92.1%      | 48     | 92.3%      |
| Adenocarcinoma              | 03     | 7.9%       | 04     | 7.6%       |
| Presence of suspected masses|        |            |        |            |
| Not present                 | 05     | 13.15%     | 10     | 19.2%      |
| Present                     | 33     | 86.84%     | 42     | 80.7%      |
| Correlation between MRI and clinical findings |        |            |        |            |
| Correlated                  | 36     | 94.7%      | 24     | 46.1%      |
| Not correlated              | 02     | 5.3%       | 06     | 11.53%     |
| Involvement of lymph nodes  |        |            |        |            |
| Inguinal group              | 01     | 2.6%       | 03     | 5.7%       |
| Para aortic group           | 01     | 2.6%       | 01     | 1.9%       |
| Iliac group                 | 07     | 18.4%      | 08     | 15.3%      |
| Obturator group             | 03     | 7.89%      | 03     | 5.7%       |
| Parametrial group           | 04     | 10.52%     | 05     | 9.61%      |
| Cystoscopy findings         |        |            |        |            |
| Normal                      | 31     | 81.5%      | -      | -          |
| Invasion of bladder         | 05     | 13.1%      | -      | -          |
| Nor performed               | 02     | 5.26%      | -      | -          |
| Sigmoidoscopy findings      |        |            |        |            |
| Normal findings             | 32     | 84.2%      | -      | -          |
| Sigmoid diverticulitis      | 02     | 5.26%      | -      | -          |
| Rectal invasion             | 01     | 2.6%       | -      | -          |
| Growth rectum               | 01     | 2.6%       | -      | -          |
| Not performed               | 02     | 5.26%      | -      | -          |

Table 3: Correlation between clinical and MRI FIGO staging

| FIGO staging | Clinically diagnosed | MRI diagnosed |
|--------------|----------------------|---------------|
| IA           | 03                   | NIL           |
| IB           | 02                   | 03            |
| IIA          | 05                   | 02            |
| IIB          | 12                   | 11            |
| IIIA         | 01                   | NIL           |
| IIIB         | 06                   | NIL           |
| IVA          | 02                   | 10            |
| IVB          | NIL                  | 05            |

Table 3: Post-radiation therapy complication in the study participants

| Symptoms                     | Total cases |
|------------------------------|-------------|
|                              | Number | Percentage |
| Pelvic lipomatosis           | 05     | 5.5%       |
| Pyosalpinx                   | 04     | 4.4%       |
| Vesico vaginal fistula       | 02     | 2.2%       |
| Cystitis                     | 15     | 16.67%     |
| Bone marrow changes          | 21     | 23.3%      |
| Proctitis                    | 18     | 20%        |

Table 3: Efficacy of MRI sequences in newly diagnosed and recurrent cases

| Findings        | New diagnosis (n=38) | Recurrent (n=52) |
|-----------------|----------------------|------------------|
| T2W             | 92.1%                | 92.3%            |
| DW1             | 97.3%                | 86.5%            |
| Contrast        | 92.1%                | 84.6%            |
| T2W+DW1         | 86.8%                | 84.6%            |
| T2W+Contrast    | 81.5%                | 73.07%           |

Discussion

Carcinoma cervix accounting 9% of newly diagnosed malignancies and 3rd most common gynaecological malignancies in females around globally [10, 11]. Most common type of cervical carcinoma is Squamous cell carcinoma accounts approximately 69% followed by adenocarcinoma, accounting for approximately 25% [3, 4]. In carcinoma cervix cases within 2 years of post treatment, disease recurrence was seen in 60-70% cases and recurrence within 5 years in 89-98% cases [5]. The common sites of recurrence is vaginal vault, parametrium, cervix, pelvic wall and paraaortic lymphnodes [12, 13]. Factors indicating recurrence were size >3cm, LVSI, deep stromal invasion and type of adenocarcinoma [14]. International Federation of Gynecology and Obstetrics (FIGO) staging system is the most accepted and used staging system for carcinoma cervix which suggest investigations for staging carcinoma cervix like tissue biopsy, urine analysis, chest radiographs, cystoscopy, proctoscopy, dilatation and surettage and barium enema studies [15, 16]. This study was designed to assess the efficacy of MRI in the management of cases with
carcinoma cervix. A total 90 cases, containing 42.2% newly diagnosed and 57.78% recurrent were included. Majority cases were in between age group 41-50 (42.2%) followed by 51-60 years (26.67%) (Figure 1). Study by Narender Reddy P et al., observed incidence of carcinoma cervix was more in between age group 40-65 years with peak incidence between 45-50 years [17]. In majority cases, pain abdomen (65.5%) was commonly associated symptom followed by white discharge (42.2%) and per vaginal bleeding (34.4%). 53.3% cases are post menopausal, 35.5% cases were premenopausal and 11.1% cases underwent hysterectomy. The duration between radiation therapy and MR imaging was between 13-60 months in 39.06% cases, with in 6 months in 26.5% cases and 6-12 months in 21.8% cases (Table 1). Histopathological examination confirms that in newly diagnosed carcinoma cervix cases 92.1% cases had squamous cell carcinoma and 7.9% had adenocarcinoma. In recurrent cases, 92.3% had squamous cell carcinoma and 7.6% had adenocarcinoma (Table 2). Suspected masses were seen in 86.84% newly diagnosed cases and in 80.7% recurrent cases. The diagnostic accuracy, sensitivity, specificity, PPV and NPV in newly diagnosed cases was 89.82%, 90.20%, 18%, 93.14% and 95.45% respectively. Whereas in recurrent cases, diagnostic accuracy, sensitivity, specificity, PPV and NPV was 68.54%, 91%, 42%, 72.36% and 76% respectively (Figure 2). Study by Mangal Mahajan et al., found that FIGO stage IA is not visible on MRI. Tumor of stage IB and higher only visible on MRI [18]. Usually stage 1 tumors limited to cervix. In this study, none of stage IA cases found on MRI. Stage 2 tumors are extends beyond the cervix upto upper two third of vagina is seen as segmental loss of the normally seen T2 hypointense vaginal wall and is termed as stage II A. In stage II B tumor normally seen hypointense peripheral stroma on T2W images and extends in the parametrium [19, 20]. Stage 3 tumors extends to the lower third of the vagina or lateral pelvic wall associated with hydrenephrosis [21, 22]. Parametrial invasion up to the pelvic wall mentioned as stage III B. On MRI, stage III B is diagnosed as the distance between the tumor and the pelvic wall is <3mm or else partial or complete loss of hyposignal od pelvic wall musculature under T2W sequences. In this study none of cases were diagnosed as stage III tumors [23]. Stage 4 tumors extends to bladder or rectal mucosa. Presence of bladder and rectal invasion was normally seen in stage IVA. Whereas spread of tumor to the liver, spleen, pancreas, kidney, GI tract is referred as stage IV B [24]. Study by Narender Reddy P et al., observed majority cases belong to stage IB (9 cases) followed by IVA (8 cases) [17]. In newly diagnosed cases, primary group of lymphnodes (Iliac, parametrial and obturator) was involved in 14 cases, inguinal nodes in 1 case and paraaortic nodes in 1 case. whereas in recurrent cases primary group of lymphnodes was involved in 15 cases, followed by inguinal nodes in 3 cases and paraaortic nodes in 1 case (Table 2). Lymphnode involvement plays a major role in the tumor diagnosis, staging, treatment and prognosis of cervical cancer [25-27]. In carcinoma cervix, lymphatic spread occurs usually along obturator, external iliac, internal iliac, common iliac, and paraaortic nodes [28]. In newly diagnosed cases, cystoscopy findings showed normal in 81.5% cases, invasion of bladder in 13.1% cases.

In 5.26% cases cystoscopy was not performed. The sigmoidoscopy showed normal findings in 84.2%, sigmoid diverticulitis in 5.26% case, rectal invasion in 2.6% cases and rectal growth in 2.6% cases. In 5.26% cases sigmoidoscopy procedure was conducted (Table 2). In this study, bone marrow changes, proctitis and cystitis are common post radiation therapy complications in 23.3%, 20% and 16.67% cases respectively.

**Conclusion**

MRI is the useful tool in the staging of disease, tumor spreading to local and distant lymph nodes. The results of this study shown that MR imaging is the better diagnostic modality than clinical examination in the tumor staging, extension of disease and assessment of treatment response in the carcinoma cervix. Studies suggest that MRI-aided radiotherapy planning may reduce the possibility of geographic errors when compared to conventional radiotherapy planning.

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