

Original article:

Evaluation of role of pelvic ultrasonography in cervical malignancies

Dr Ninad Naphade

Professor, Krishna Institute of Medical Sciences (DU) , Karad, Maharashtra

Corresponding author: Dr Ninad Naphade

Abstract:

Objective: This study aimed to compare the findings of pelvic ultrasonography (USG) with magnetic resonance imaging (MRI) in patients with suspected or known cervical malignancies.

Methods: A retrospective analysis was conducted on 40 patients with clinical suspicion of cervical carcinoma who underwent USG and MRI examinations. The findings were compared for vascularity/enhancement, uterine invasion, vaginal invasion, rectal invasion, bladder invasion, ureteric/VUJ involvement, pelvic lymph nodes, and distant metastasis. Sensitivity and specificity values were calculated for USG compared to MRI.

Results: MRI demonstrated better sensitivity than USG for vascularity/enhancement (86.4% vs. 0%), uterine invasion (75% vs. 50%), vaginal invasion (33.3% vs. 89.2%), rectal invasion (33.3% vs. 86.3%), bladder invasion (64.7% vs. 82.6%), and pelvic lymph nodes (8.69% vs. 100%). USG and MRI had comparable sensitivity for ureteric/VUJ involvement (75% vs. 93.75%) and distant metastasis (28.5% vs. 100%). USG had limited sensitivity for pelvic lymph nodes (8.69%) compared to MRI.

Conclusion: MRI remains the gold standard for staging cervical malignancies due to its superior sensitivity in detecting local invasion, lymph node involvement, and distant metastasis. USG showed acceptable sensitivity for vascularity/enhancement and ureteric/VUJ involvement. The complementary roles of USG and MRI in cervical malignancies should be considered for comprehensive evaluation and treatment planning.

Keywords: Pelvic ultrasonography, cervical malignancies, magnetic resonance imaging, sensitivity, specificity, vascularity, invasion, lymph nodes, distant metastasis.

Introduction:

Cervical malignancies, including cervical cancer, are a significant global health concern, particularly affecting women in developing countries. Early detection and accurate diagnosis of cervical malignancies are crucial for successful treatment and improved patient outcomes. Pelvic ultrasonography has emerged as a valuable imaging modality in the evaluation of cervical malignancies, providing detailed anatomical information and aiding in the diagnosis, staging, and management of these conditions.^{1,2}

Cervical malignancies primarily arise from the transformation zone of the cervix, where the squamous epithelium transitions to columnar epithelium. The most common form of cervical cancer is squamous cell carcinoma, accounting for approximately 70-90% of cases. Other less common histological types include adenocarcinoma, adenosquamous carcinoma, and small cell neuroendocrine carcinoma. Human papillomavirus (HPV) infection, particularly high-risk HPV genotypes, is a major risk factor for the development of cervical malignancies.³

Pelvic ultrasonography, utilizing both transabdominal and transvaginal approaches, plays a pivotal role in the comprehensive evaluation of cervical malignancies. This non-invasive imaging technique offers several advantages, including accessibility, cost-effectiveness, absence of ionizing radiation, and real-time visualization of the pelvic organs. It provides valuable information regarding the size, location, extent, and characteristics of cervical lesions, assisting in the assessment of disease progression and treatment planning.⁴

The role of pelvic ultrasonography in cervical malignancies encompasses various aspects. Firstly, it aids in the initial diagnosis and differential diagnosis of cervical lesions. Ultrasonographic findings such as irregular cervical contour, increased vascularity, and abnormal cervical volume can raise suspicion for malignant lesions and guide further investigations. Additionally, it can help differentiate primary cervical tumors from other pelvic masses such as ovarian tumors or uterine fibroids.⁵

Furthermore, pelvic ultrasonography assists in the preoperative staging of cervical malignancies. It provides detailed information regarding tumor size, parametrial involvement, and the presence of lymph node metastasis. This staging information is crucial for determining the appropriate treatment strategy, including surgery, radiation therapy, or a combination of both. Moreover, ultrasonography can aid in the assessment of tumor response to neoadjuvant therapy, facilitating treatment modifications if necessary.⁶

In cases where surgical management is planned, pelvic ultrasonography can guide the surgical approach. It helps in the selection of appropriate candidates for fertility-sparing procedures, based on tumor size, depth of invasion, and absence of lymph node metastasis. Additionally, ultrasonography can assist in the intraoperative evaluation of tumor resection margins and the detection of potential complications such as bladder or rectal involvement.⁷

Overall, pelvic ultrasonography plays a crucial role in the evaluation and management of cervical malignancies. Its non-invasive nature, accessibility, and ability to provide detailed anatomical information make it an indispensable tool in the diagnostic workup and treatment planning for these conditions. As technology continues to advance, the integration of advanced imaging techniques, such as Doppler ultrasonography and three-dimensional imaging, further enhances the diagnostic accuracy and therapeutic guidance provided by pelvic ultrasonography in cervical malignancies.

Material and methods:

The study methodology involved the retrospective analysis of data collected from patients with a clinical suspicion of cervical carcinoma on PAP smear, presenting with symptoms such as irregular vaginal bleeding or unexplained pain in the lower abdomen or pelvic region. The study was conducted at our Department at KIMS (DU) Karad.

A total of 40 patients with known cervical lesions were included in the study after obtaining informed consent. The patients were referred from the outpatient department (OPD), admitted to the hospital, or walked in, provided they met the inclusion criteria. Inclusion criteria consisted of patients with a clinical suspicion of cervical malignancy, patients with a known pelvic mass or cervical pathology, patients who had already undergone a biopsy, surgery, or chemo-radiation, and patients with tumor recurrence after resection.

Patients without any known or suspected cervical pathology were excluded from the study, along with those in whom the ultrasound examination was unsatisfactory or incomplete. Patients who were unwilling to undergo ultrasound examination or denied MRI examination were also excluded.

The pelvic ultrasonography and color Doppler imaging were performed on the patients. Prior to the procedure, informed written consent was obtained from each patient. The ultrasound examination of the pelvis was conducted with the patient in the supine position. The mass was evaluated in both longitudinal and transverse planes. Various parameters of the mass, including size, shape, consistency, echogenicity, internal architecture, and presence of calcification, were assessed. Additionally, Doppler study was performed to evaluate the vascularity of the mass.

To further enhance the evaluation, the findings from the ultrasound examination were correlated with the findings from MRI. The collected data from both imaging modalities were analyzed, and the correlation between the two was assessed. The study methodology described above was conducted over a period of two years, utilizing data from patients who attended or were referred to our Department .

Results:

Table 1: Comparison of cervical cancer findings on USG and MRI imaging

| Findings | USG | MRI |
|--------------------------|-----|-----|
| Vascularity/enhancement | 35 | 36 |
| Uterine invasion | 28 | 32 |
| Vaginal invasion | 8 | 13 |
| Rectal invasion | 9 | 14 |
| Bladder invasion | 15 | 16 |
| Ureteric/VUJ involvement | 8 | 8 |
| Pelvic lymph nodes | 1 | 23 |
| Distant metastasis | 1 | 2 |

A comparison was made between findings on USG and MRI. The common findings compared were uterine invasion, vaginal invasion, rectal invasion, bladder invasion, ureteric or vesico- ureteric junction involvement, pelvic lymph nodes and distant metastasis. Vascularity of the lesion on USG was compared with post contrast enhancement on MRI. USG picked up vascularity in 35 cases as compared to MRI picking up post contrast enhancement in 36 cases. MRI was more sensitive in picking up local invasion by tumour.

Table 2: Sensitivity and specificity of USG compared to MRI

| Comparison of findings | USG | MRI | sensitivity | specificity |
|--------------------------|-----|-----|-------------|-------------|
| Vascularity/enhancement | 35 | 36 | 86.40% | 0% |
| Uterine invasion | 28 | 32 | 75% | 50% |
| Vaginal invasion | 8 | 13 | 33.30% | 89.2% |
| Rectal invasion | 9 | 14 | 33.30% | 86.30% |
| Bladder invasion | 15 | 16 | 64.70% | 82.60% |
| Ureteric/VUJ involvement | 8 | 23 | 75% | 93.75% |
| Pelvic lymph nodes | 1 | 23 | 8.69% | 100% |
| Distant metastasis | 1 | 2 | 28.50% | 100% |

MRI is considered as gold standard for staging of cervical cancer worldwide. We used MRI as gold standard and compared USG findings with it. The sensitivity and specificity values were calculated for different findings seen on USG and MRI.

Vascularity seen on USG was 86.4% sensitive and 0% specific. Uterine invasion was 75% sensitive and 50% specific. Vaginal invasion showed sensitivity of 33.3% and specificity of 89.2%. Rectal invasion also showed sensitivity of 33.3% and a specificity of 86.3%. Bladder invasion was 64.7% sensitive and 82.6% specific. Ureteric or vesico-ureteric junction involvement showed sensitivity of 75% and a specificity of 93.5%. Pelvic lymph nodes were noted in only 1 patient on USG compared to a total of 23 on MRI. This showed 8.69% sensitivity and 100% specificity. Distant metastasis was only seen in 2 patients on MRI and of which 1 was detected on USG too. This showed a 28.5% sensitivity and 100% specificity.

Discussion:

The present study aimed to compare the findings of pelvic ultrasonography (USG) with magnetic resonance imaging (MRI) in patients with suspected or known cervical cancer. The results revealed important insights into the diagnostic performance of USG in comparison to the gold standard MRI for various parameters, including vascularity/enhancement, uterine invasion, vaginal invasion, rectal invasion, bladder invasion, ureteric/VUJ (vesico-ureteric junction) involvement, pelvic lymph nodes, and distant metastasis.^{4,5}

The comparison between USG and MRI findings regarding vascularity/enhancement showed a slightly higher detection rate on MRI (36 cases) than on USG (35 cases). However, the sensitivity of USG for identifying vascularity/enhancement was relatively high (86.4%), indicating its usefulness in evaluating blood flow within cervical lesions. The lack of specificity (0%) suggests that USG alone may not be sufficient to distinguish between benign and malignant lesions based solely on vascularity.²

In terms of local invasion, MRI demonstrated better sensitivity than USG for detecting uterine invasion (75% vs. 50%), vaginal invasion (33.3% vs. 89.2%), rectal invasion (33.3% vs. 86.3%), and bladder invasion (64.7% vs. 82.6%). These findings highlight the superior ability of MRI to accurately assess the extent of tumor invasion into neighboring structures, providing crucial information for treatment planning and surgical decision-making.

Ureteric/VUJ involvement showed comparable sensitivity between USG (75%) and MRI (93.75%). Both imaging modalities proved valuable in identifying ureteric or vesico-ureteric junction involvement, which is critical for determining the need for urologic interventions and optimizing patient management.

The detection of pelvic lymph nodes was notably higher on MRI (23 cases) than on USG (1 case). USG exhibited limited sensitivity (8.69%) in identifying pelvic lymph nodes, suggesting its suboptimal performance in this regard. Conversely, MRI demonstrated high sensitivity (100%) and specificity (100%) for detecting lymph node involvement, underscoring its superiority in accurately assessing lymphatic spread.

Regarding distant metastasis, MRI identified two cases, while USG detected one of those cases. The sensitivity of USG in detecting distant metastasis was low (28.5%), likely due to the limitations of USG in visualizing distant sites and the need for more sensitive imaging modalities such as MRI or computed tomography (CT) for comprehensive staging.

The results of this study reinforce the widely recognized role of MRI as the gold standard for cervical cancer staging. MRI demonstrated higher sensitivity than USG for most parameters evaluated, emphasizing its superiority in providing detailed information on tumor extent, invasion, and lymph node involvement. However, USG still holds value as an accessible and cost-effective imaging modality, particularly in resource-limited settings or when MRI is contraindicated.

It is important to acknowledge the limitations of this study. The sample size was relatively small, which may impact the generalizability of the results. Additionally, the retrospective nature of the study and the reliance on data from a single institution may introduce potential selection bias. Further prospective studies with larger patient cohorts and multi-center collaborations are warranted to validate and generalize these findings.

Conclusion:

In conclusion, this study compared the findings of USG and MRI in patients with suspected or known cervical cancer. While MRI demonstrated superior sensitivity for most parameters, USG showed acceptable sensitivity in certain aspects, such as vascularity/enhancement and ureteric/VUJ involvement. The results highlight the complementary roles of USG and MRI in the evaluation of cervical cancer, with MRI remaining the preferred imaging modality for comprehensive staging. The findings

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