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Radiodiagnosis

ROLE OF TRANSVAGINAL ULTRASOUND AND MAGNETIC RESONANCE IMAGING IN STAGING OF CANCER CERVIX

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ABSTRACT The study is a cross sectional study conducted during October 2015 to October 2017, comprising of 62 patients with biopsy proven carcinoma cervix, who were referred to the department of Radiodiagnosis, K.S Hegde Hospital, Deralakatte, Mangalore. A total of 62 patients who satisfied the inclusion criteria were included in this study. The role of transvaginal sonography (TVS) and magnetic resonance imaging (MRI) in staging of carcinoma cervix was studied in respect to the various parameters like size of the lesion, parametrial infiltration, vaginal wall infiltration, pelvic side wall invasion, invasion of bowel and bladder, hydroureteronephrosis, regional lymph nodes involvement and distant metastases.

In our study Transvaginal sonography (TVS) showed good agreement with Magnetic resonance imaging (MRI) in staging of carcinoma cervix. A multi disciplinary approach of combined transvaginal sonography and MRI can be used in staging carcinoma cervix. Though MRI has higher efficiency than TVS in staging carcinoma cervix, TVS has an advantage of low cost and can be considered as an adjunct for MRI in preoperative or pre treatment evaluation of carcinoma cervix.

KEYWORDS : Carcinoma cervix, Transvaginal ultrasound (TVS), Magnetic resonance imaging (MRI).

INTRODUCTION:

Cervical cancer is the fourth most common cancer in women worldwide and most frequent in Indian women, with a large number of deaths each year.[1] For treatment planning it is very crucial to assess the disease thoroughly and to stage it. The International Federation of Gynecology and Obstetrics (FIGO) recommends a clinical staging system, which has a risk of underestimating the disease as compared to radiological and pathological staging. Revised FIGO staging incorporates cross sectional imaging for initial evaluation and treatment planning of cervical carcinoma.[2]

The transvaginal ultrasound is used to evaluate the size, regional extent of the tumor and regional lymph nodes involvement. Parametrial involvement can be identified by irregular or nodular margins, parametrial vascular encasement. Extension into the sidewall is detected if the parametrial lesion is within 2-3 mm of musculature. Advanced disease may involve the pelvic side wall muscles, encase the iliac vessels, or may extend directly into the bladder or rectal wall.

Because of poor resolution, possibility of over staging in presence of coexisting pathologies of uterus and inability to assess lymph nodes and distant sites of metastases, transvaginal ultrasound is considered less effective than MRI in assessing all these parameters.

MR imaging has been proven to be an excellent modality to evaluate the tumor size, extent, nodal involvement and distant metastases. The mucosa of cervix appears hyperintense and stroma appears hypointense. The transverse slices should be parallel to the short axis of cervix in order to identify the interruption in the normal cervical hypointense stroma. The tumors appear hyperintense on T2 weighted images as compared to hypointense surrounding normal stroma, which makes it easy to detect. Contrast enhanced T1-weighted images act as a compliment for evaluation of the tumor.

Even though soft tissue contrast of MRI exceeds that of the ultrasound, ultrasound has effectiveness similar to that of MRI. In this study we are trying to evaluate the role of ultrasound and MRI in identifying the parametrial involvement and staging cancer cervix and to identify the agreement of USG as compared to MRI. Identification of the role of each modality in staging and identifying parametrial involvement helps to recognize the better modality among both, thereby helping in treatment planning. If ultrasound is as efficient as MRI in staging and identifying parametrial involvement, the cost of the imaging comes down and will be accessible to all the people and in places where MRI is not available. The aims of the study are:

- To study the role of Transvaginal Ultrasound and Magnetic Resonance Imaging (MRI) for staging of cancer cervix.
- To study the agreement of transvaginal ultrasound with magnetic resonance imaging.

MATERIALS AND METHODS

The present study is a cross sectional observational study performed in 62 patients who fulfilled the inclusion criteria between October 2015 to October 2017, in the department of Radio Diagnosis, justice K.S. Hegde hospital, Deralakatte, Mangalore.

After Gynecologist does the clinical staging, the patients are subjected to radiological staging in the department of Radio diagnosis by:

1. Transvaginal Ultrasound using VOLUSON 730 EXPERT with transvaginal probe (5 -7.5 MHZ).
2. Patients with clinical FIGO staging of Stage 1B or more are subjected to MRI staging using 1.5 Tesla MRI (MAGNETOM AVANTO SIEMENS MEDICAL SYSTEMS). The following sequences are used-T1WI, T2WI, STIR and Post contrast T1 Fat sat sequences in all planes.

Inclusion criteria

Patients of age >35 years with clinically detectable growth over cervix of clinical FIGO staging more than stage 1B, positive for cancer cervix with pap smear and cervical biopsy.

Exclusion criteria

- Patients currently on chemotherapy, radiotherapy and neoadjuvant chemotherapy
- Patients with lesion of stage IB or less.
- Patients who are critically ill

Data collected is subjected to standard statistical tests like Cohens Kappa coefficient for agreement and analyzed using statistical software. MRI, Ultra sound was considered as primary outcome variables. Many studies proved that MRI is relatively superior to USG and almost comparable to histopathological staging. [4,5,6,7,8,9,10] MRI is considered as the superior modality in our study and agreement of Transvaginal ultrasound with MRI is calculated.

IBM SPSS version 22 was used for statistical analysis*.

*Machines IB. IBM SPSS Statistics for Windows, Version 22.0. IBM Corp Armonk, NY; 2013.

RESULTS:

Table1: Descriptive analysis of Transvaginal ultrasound features of cervical lesions in study population (N=62)

Transvaginal USG features	No. of patients (n=62)	%
Echogenicity		
· Hypoechoic	60	96.8
· Hyperechoic	2	3.2
Echo texture		
· Homogeneous	10	16.1
· Heterogeneous	52	83.9
Margins		
· Well defined	19	30.6
· Ill defined	43	69.4
Vascularity on colour Doppler		
· Increased	58	93.54
· Not increased	4	6.45
Size		
· >4cm	38	61.3
· <4cm	24	38.7
Parametrial invasion		
· Present	44	71.0
· Absent	18	29.0
Tumour invasion into vagina		
· Present	17	27.41
· Absent	45	72.58
Endometrial collection		
· Present	42	67.7
· Absent	20	32.3
Tumour invasion into adjacent organs		
· Present	21	33.9
· Absent	41	66.1
Tumour invasion to pelvic sidewalls		
· Present	3	4.8
· Absent	59	95.2
Hydroureter		
· Present	5	8.1
· Absent	57	91.9
Regional Lymph nodes involvement		
· Present	22	35.5
· Absent	40	64.5

Table 2: Descriptive analysis of MRI features of cervical lesions in study group (N=62)

MRI features	No. of patients (n=62)	%
Size		
· >4cm	48	77.4
· <4cm	14	22.6
Characteristics (on T2W images)		
· predominantly isointense	3	4.83
· predominantly hypo intense	1	1.6
· predominantly hyper intense	58	93.54
Enhancement		
· Present	62	100.0
· Absent	0	0.0
Vaginal wall invasion		
· Present	21	33.9
· Absent	41	66.1
Parametrial involvement		
· Present	55	88.7
· Absent	7	11.3
Pelvic sidewall invasion		
· Present	11	17.7
· Absent	51	82.3
Bowel or bladder mucosal involvement		
· Present	25	40.3
· Absent	37	59.7
Hydroureteronephrosis		
· Present	7	11.3
· Absent	55	88.7
Lymphadenopathy		
· Present	46	74.2
· Absent	16	25.8
Any other findings		
· Nil	60	96.8
· Hepatic mets	1	1.6
· Ileal loop involvement	1	1.6

Table 3: Descriptive analysis of TNM staging of cervical lesions on Transvaginal ultrasound in the study group (N=62) (T – tumor, N - lymph node, M – metastasis)

USG staging	No. of patients (n=62)	%
T		
2	1	1.61
2a	17	27.41
2b	28	45.16
3a	1	1.61
3b	2	3.22
4	9	14.51
4a	4	6.45
N		
0	52	83.9
1	10	16.1
M		
0	0	0.0
X	62	100.0

Table 4: Descriptive analysis of TNM staging of cervical lesions on MRI in the study group (N=62) (T – tumor, N - lymph node, M – metastasis)

MRI staging	No. of patients, (n=62)	%
T		
2a	7	11.3
2b	30	48.4
4	16	25.8
4a	8	12.9
4b	1	1.6
N		
0	16	30.65
1	46	69.35
M		
1	2	3.2
X	60	96.8

Table 5: Table demonstrating agreement of TVS with MRI

Imaging variable	Kappa coefficient	Percentage of agreement	Agreement
Size	0.632	83.6%	Substantial
Parametrial involvement	0.475	82.2	Moderate
Vaginal wall invasion	0.888	95.16	Almost perfect
Tumor invasion into adjacent organs	0.862	93.54%	Almost perfect
Tumor extending to pelvic side walls	0.382	87.09%	Fair
Hydroureter	0.816	96.7%	Almost perfect
Enlarged lymph nodes	0.321	61.29%	Fair

The agreement between ultrasound and MRI was found to be substantial (k=0.632, percentage of agreement 83.6%) for tumor size and moderate (k=0.475, percentage of agreement - 82.2%) for parametrial infiltration.

The agreement for tumor invasion into vaginal walls (k=0.888, percentage of agreement - 95.16%), bowel and bladder (k=0.862, percentage of agreement - 93.54%) and hydroureter (k=0.816, percentage of agreement - 96.7%) was found to be strong

The agreement between ultrasound and MRI for tumor invasion to pelvic side walls (k=0.382, percentage of agreement - 87.09 %) and regional lymph nodes involvement (k=0.321, percentage of agreement - 61.29 %) was found to be fair

Table 6: INTERPRETATION OF KAPPA

KAPPA	AGREEMENT
< 0	Less than chance agreement
0.01-0.20	Slight agreement
0.21-0.40	Fair agreement
0.41-0.60	Moderate agreement
0.61-0.80	Substantial agreement
0.81-0.99	Almost perfect agreement

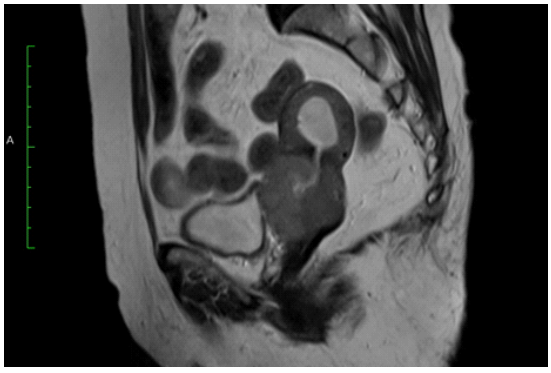

Fig 1: Sagittal T2W MR image demonstrating carcinoma cervix with vaginal wall infiltration.

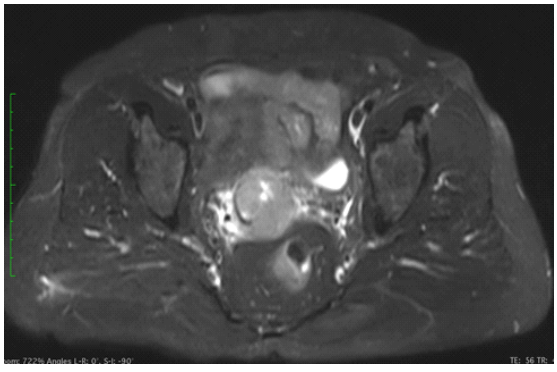

Fig 2: Axial post contrast MR image of pelvis demonstrating carcinoma cervix with parametrial invasion on left side, with disrupted hypointense cervical rim.

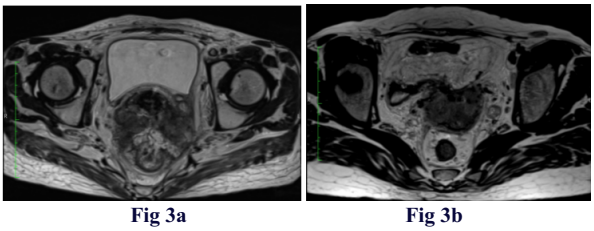

Fig 3a **Fig 3b**

Fig 3: Axial 3D MP-RAGE image of pelvis demonstrating malignant cervical lesion with bilateral parametrial invasion, left ureter infiltration and reaching up to the pelvic sidewall on the left side (Fig 3a) and enlarged lymph node in the left parametrium (Fig 3b)

Fig 4: Transvaginal ultrasound image of carcinoma cervix demonstrating nodularity and parametrial infiltration

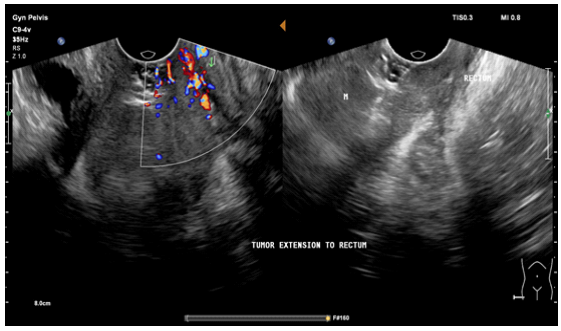

Fig 5: Transvaginal ultrasound image of carcinoma cervix demonstrating tumor extension into the rectum.

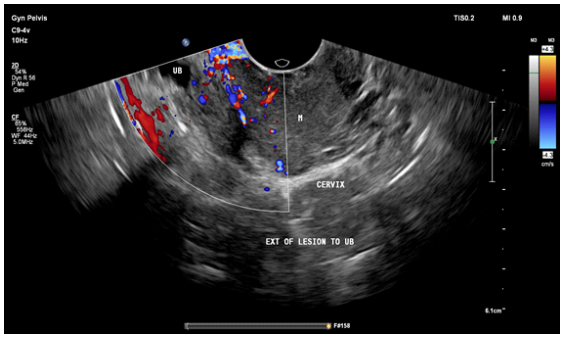

Fig 6: Transvaginal ultrasound image of carcinoma cervix demonstrating extension of the lesion to the posterior wall of urinary bladder

DISCUSSION

In this study, we used Transvaginal ultrasound and magnetic resonance imaging as the primary variables. Many studies compared MRI, CT and TVS to histopathology in staging carcinoma cervix and proved that the accuracy of MRI is high among all the modalities for preoperative staging carcinoma cervix. MRI is considered as a superior modality and first choice of investigation for staging carcinoma cervix.

To the best of our knowledge, till date only two studies were performed by Chiappa et al and Arriba et al comparing agreement between TVS and MRI. Chiappa et al found that the agreement between two modalities for assessing parametrial infiltration was moderate (k = 0.508). They also performed a much more detailed evaluation of cervix, dividing it into six imaginary sectors to detect the parametrial infiltration more precisely. [5]

Another study by Arribas et al found that three dimensional ultrasound showed good agreement with MRI for assessing bladder involvement and parametrial infiltration in cases of carcinoma cervix. [6]

The patterns of parametrial infiltration were observed in various forms like nodularity, linear strands radiating into the parametrium, tumor mass extension to the parametrium and encasement of vessels.

Our study had few limitations. First single radiologist performed all the ultrasounds and hence intraobserver and interobserver variability were not assessed, questioning the generalizability of the results. Second, MRI is not the gold standard and hence sensitivity and specificity were not calculated. Therefore the diagnostic performance of the modalities included in the study could not be assessed. Ideally histopathology is considered as the gold standard method for assessing the accuracy of any method of investigation. Since surgery is contraindicated in locally advanced cervical carcinomas, staging histopathology was not available to calculate the sensitivity and specificity of both the imaging modalities used in this study. Locally advanced cervical cancers are treated with chemoradiation.

Transvaginal ultrasound itself has few limitations. It is dependent on the radiologist performing the scan and hence over diagnosis or under diagnosis can occur. Lymph nodes could not be assessed easily with Transvaginal ultrasound. Transabdominal ultrasound was required in addition to TVS for assessing the kidneys and the liver.

CONCLUSION

Carcinoma cervix is a disease which has a high mortality rate. Early diagnosis of the disease can help reduce the number of deaths associated with the disease.

In our study MRI showed better results in staging cervical carcinoma and the agreement of Transvaginal ultrasound with MRI was found to be good for some parameters and fair for few others. Though the agreement of TVS for assessing the tumor invasion into pelvic side walls and regional lymph nodes involvement was fair, a multi disciplinary approach of combined USG and MRI can be used in preoperative staging of carcinoma cervix. Ultrasound can also be used as a method of investigation for staging in areas where MRI is not available, in patients who cannot afford MRI, who are claustrophobic and in whom MRI is contraindicated.

Though MRI has a slightly higher efficiency than TVS in staging carcinoma cervix, TVS has an advantage of low cost and can be considered as an adjunct for MRI in preoperative or pre treatment evaluation of carcinoma cervix.

REFERENCES

1. Fact sheets by Cancer [Internet]. Globocan.iarc.fr.2017 [Cited 16 september 2017]. Available from: http://globocan.iarc.fr/pages/fact_sheets_cancer.aspx
2. Hoskins WJ, Perez CA, Young RC. Principles and practice of Gynecologic Oncology. Lippincott Williams & Wilkins: Philadelphia, PA, 2000; 846-849.
3. Testa AC, Ludovisi M, Manfredi. 2009. Transvaginal ultrasonography and magnetic resonance imaging for assessment of presence, size and extent of invasive cervical cancer. Ultrasound Obstet Gynecol. 2009; 34: 335-344.
4. Seung Hyup Kim, Byung Ihn Choi, Hyo Pyo Lee, Soon Bum Kang, Young Min Choi. 1990. Uterine cervical carcinoma: Comparison of CT and MR findings. Radiology, 175, 45-51.
5. Chiappa V, Di Legge A, Valentini A, Gui B, Miccò M, Ludovisi M. Agreement of two-dimensional and three-dimensional transvaginal ultrasound with magnetic resonance imaging in assessment of parametrial infiltration in cervical cancer. Ultrasound Obstet Gynecol 2015; 45: 459-469.
6. Sara Arribas, MD, Juan Luis Alcazar, Maria Arraiza. 2016. Three-dimensional Transvaginal sonography and magnetic resonance imaging for local staging of cervical cancer. J Ultrasound Med 2016; 35:867-873.
7. Hricak H, Gatsonis C, Coakley F, Snyder B, Reinhold C, Schwartz L. Early Invasive Cervical Cancer: CT and MR Imaging in Preoperative Evaluation—ACRIN/GOG Comparative Study of Diagnostic Performance and Interobserver Variability. Radiology. 2007;245(2):491-498.
8. Michniewicz K, Oellinger J. Diagnostic imaging in invasive cervical carcinoma: MRI, CT and Ultrasonography. ZentralblGynakol 2001 Apr, 123(4):222-8.
9. R.Manfredi, B. Gui, A. Giovanzana, S. Martini, M. Di Stefano, G Zannoni, G. Scambia, L. Bonomo. 2009. Localized cervical cancer (stage < IIB): Accuracy of MR imaging in planning less extensive surgery. La radiologicamedica 2009, Volume 114, Issue 6, PP 960-975.
10. Fiachra M, David R, Maria T. Comparison of MRI and high-resolution transvaginal sonography for the local staging of cervical cancer. Journal of Clinical Ultrasound 2016; 44(2): 78-84.