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A Total Analysis on Radiological and Per Operative Findings in Gynaecological Malignancy

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Abstract

Background: Identification and staging of gynaecological cancer can be performed by radiology. Earlier identification and staging can save a patient's life which requires conformity. In this study, radiological findings and surgicopathologic diagnosis are compared for gynaecological malignancy to find the best way before surgical attempt. The aim of this study was to compare the diagnostic performance and interobserver variability of computed tomography (CT) and magnetic resonance (MR) imaging in the pretreatment evaluation of early invasive cervical cancer. **Material & Methods:** This retrospective study was conducted in the Department of Obstetrics & Gynaecology in Popular Medical College and Hospital, Dhaka, Bangladesh during the period from March 2018 to March 2023. This study had institutional review board approval and informed consent for evaluation of preoperative CT (n= 40) and/or MR imaging (n= 70) studies in 110 women (median age, 43 years; range, 22–81 years). Our radiologists (experience, 7-15 years) interpreted the CT outputs, and four radiologists (experience, 12-20 years) interpreted the MR studies retrospectively. Tumor visualization and detection of parametrial invasion were evaluated with receiver operating characteristic curves (P≤0.05). Descriptive statistics for staging and k statistics for reader agreement were calculated. Surgical pathologic findings were the reference standard. **Results:** For CT multirater k value was 0.26 and for MR imaging 0.44 for staging, 0.16 and 0.32 for tumor visualization respectively, and 20.04 and 0.11 for detection of parametrial invasion; for advanced stage cancer (≥IIB), sensitivities were 0.14–0.38 and 0.40–0.57, positive predictive values (PPVs) were 0.38–1.00 and 0.32–0.39, specificities were 0.84–1.00 and 0.77–0.80, and negative predictive values (NPVs) were 0.81–0.84 and 0.83–0.87. MR imaging was found significantly better than CT for tumor visualization (P < .001) and detection of parametrial invasion (P= .047). **Conclusion:** According to the observers, MR imaging was significantly better than CT for tumor visualization and detection of parametrial invasion. The modalities were similar for staging, sharing low sensitivity and PPV but relatively high NPV and specificity.

Keywords:- Gynaecological cancer, radiological findings, surgicopathologic findings, sonography, MR, CT.

INTRODUCTION

Almost 8268 women are diagnosed with cervical cancer and 4971 die from the disease every year. Cervical cancer ranks as the 2nd most frequent cancer among Bangladeshi female patients and the 2nd most frequent cancer among women between 15 and 44 years of age. Almost 0.64% patients are diagnosed with vaginal cancer and vulva cancer. In Southern

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Asia, specifically in Bangladesh region, about 4.4% of women in the general population are estimated to harbour cervical HPV-16/18 infection at a given time, and 80.3% of invasive cervical cancers are attributed to HPVs 16 or 18.[1] Radiological findings are most common system to assess gynaecological malignant and their stage. Ovarian cancer has the most noteworthy mortality rate of all gynecologic malignant tumors.[2,3] Almost 66% of all ovarian carcinomas have advanced to disease stage III or IV (Fédération Internationale de Gynécologie et d'Obstétrique) at the hour of first finding since they might remain clinically asymptomatic for extended periods.[4,5] This reality highlights the significance of early location of these cancers and of the right assurance of epithelial ovarian growths of low harmful potential (alleged marginal cancers).[6,7] Sonography has been demonstrated to be a sensitive, however generally vague method, prompting superfluous surgical resection of many benign lesions.[8] The combination of sonomorphology and additional ovarian-blood flow estimations with Doppler sonography has been proposed to further develop explicitness.[9] Other than transvaginal sonography, CT is a choice as an extra imaging strategy. Due to its moderately poor soft-tissue contrast, the usefulness of CT in separating ovarian processes is limited. It is of specific use in instances of gynecologic malignancies to assess potential hematogenous, peritoneal, and lymphogenic spread.[8] Treatment for endometrial carcinoma, another type of gynaecological malignancy, depends on the extent of the disease. Hence, a reliable strategy for stagingendometrial carcinoma is fundamental. The most reliable evaluation of infection results from surgical staging procedures. Compared with surgical staging, the clinical staging criteria of the Cancer Committee of the Worldwide Organization of Gynecology and Obstetrics (FIGO) are suboptimal. Staging by means of x-ray computed tomography (CT) has been advocated. Preliminary reports of MR imaging of endometrial carcinoma was prompted.[10,11] As of late, MR imaging has been progressively utilized due to its absence of radiation exposure and its great tissue contrast. On one hand, a prospective study has recommended that unenhanced MR imaging is mediocre compared to transvaginal sonography in the conclusion of adnexal lesions.[12] Improved MR imaging, however, has been displayed to have higher demonstrative precision than transvaginal sonography.[5,13] The job of positron discharge tomography (PET) with fluorine-18 FDG for the determination of ovarian cancers has stayed disputable, with responsive qualities somewhere in the range of 83% and 86% and specificities somewhere in the range of 54% and 86%.[14,15,16,17] Simultaneous assessment of ovarian processes with each of the three demonstrative strategies (transvaginal sonography, MR imaging, and FDG PET) has, to our knowledge, not yet been contemplated. Thus, the purpose of our study was to retrospectively compare diagnostic performance and interobserver variability for CT and MR imaging in the pretreatment evaluation of early invasive gynaecological malignancy, with surgicopathologic findings as the reference standard.

Objective of the study

- General objective: The study aims to find the effectiveness of the radiological findings in gynaecological oncology treatment.

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- Specific objective: The purpose of this study was to compare the radiological diagnosis and per operative finding in gynaecological malignancy.

MATERIAL AND METHODS

This retrospective study was conducted in the Department of Obstetrics & Gynaecology in Popular Medical College and Hospital, Dhaka, Bangladesh. In a 5 years period, 110 consecutive patients, 22–81 years old (average age, 43 years), underwent transvaginal sonography, MR imaging, FDG PET and CT.

Inclusive criteria: Female patients with biopsy-confirmed and previously untreated gynaecological malignancy (including invasive squamous cell carcinoma, and adenosquamous carcinoma) who were scheduled for surgery on the basis of results of clinical assessment were included in this study.

Exclusion criteria: The study did not include any individuals who were unable or unwilling to undergo contrast-enhanced CT and MR imaging. Patients who were not considered surgical candidates for reasons of comorbidity, pregnant patients, and patients who were unable to give informed medical consent were also excluded.

The study commenced in March 2018 and was closed in March 2023 after 110 patients were enrolled. Of the 186 patients enrolled, 76 were excluded from the final data analysis because of incomplete data, including nine patients whose disease was deemed too extensive for surgery after imaging was performed. Imaging findings reminiscent of metastatic nodal involvement were allowed to impact the choice to perform (or drop) surgery.

Patients were required to be willing to undergo both contrast material–enhanced CT and MR imaging before surgery. They were enrolled before surgical exploration and after they signed a study-specific informed consent form. The median age of the 110 patients included in this secondary study (ie, patients in the CT analysis set, the MR imaging analysis set, or both) was 43 years (range, 22–81 years). All MR imaging and CT assessments fulfilled or surpassed guidelines consented to by the review specialists. Required standards for CT included spiral data acquisition at 5-mm collimation during suspended respiration after administration of 120-150 mL of 60% iodinated contrast medium conveyed by power injector at 2.0-3.0 mL/sec, scans extending from the diaphragm to the symphysis pubis. All patients received oral differentiation material (1000 mL of diatrizoate sodium or equivalent) given in separated dosages over the 60-an hour and a half prior to examining, with the last portion allowed 10-15 minutes prior to filtering. Rectal difference material was directed at the circumspection of every foundation. The use of phased-array surface coils, rapid acquisition with relaxation enhancement T2-weighted transverse and sagittal images of the pelvis, and spin-echo or gradient-echo T1-weighted transverse images extending from the symphysis pubis to above the renal hilum were among the requirements for pelvic MR imaging. For all groupings, the field of view was 20-28 cm, the part thickness was 5 mm or less, the grid was 256 3 192 or more prominent, and at least two signs were procured. Understanding among readers was surveyed with unweighted k statistics for pairs and with multirater k measurements for the full arrangement of readers16. Before calculating the unweighted k

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values, the ordinal rating scale was not dichotomized. k values were evaluated as follows: Poor agreement was indicated by 0.00 # k, 0.40; 0.40 # k # 0.75, reasonable for great understanding; and k. 0.75, amazing understanding. Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of Popular Medical College and Hospital, Dhaka, Bangladesh.

RESULTS

Total 110 female patient's surgicopathologic report and their CT ad MRI report were compared in this study. 88 (80%) of the patients included in our study had surgicopathologic findings reliable with a FIGO stage in the range of IA to IIA, and 22 (20%) had surgicopathologic findings consistent with a FIGO phase of IIB or higher. For tumor visualization, k values ranged from 0.12 to 0.29 for CT (multirater k= 0.16) and from 0.22 to 0.41 for MR imaging (multirater k= 0.32). For parametrial invasion, pairwise k values ranged from -0.02 to 0.13 for CT (multirater k= -0.04 averaged over left and right sides). For MR imaging the range is 0.05 to 0.29 (multirater k= 0.11 averaged over left and right sides). For staging, pairwise k values ranged from 0.23 to 0.34 for CT (multirater k= 0.26) and from 0.34 to 0.56 for MR imaging (multirater k= 0.44) [Table 1]. Tumor visualization was significantly better with MR imaging than with CT [Table 2]. For CT readers, it ranged from 0.52 to 0.63 (average 0.58) [Figure 1] while for MR imaging readers, the AUC ranged from 0.67 to 0.86 (average 0.77) [Figure 2]. The difference in average AUC between MR imaging and CT was 0.20 (95%), with a P value of less than 0.001. In [Table 3], of the 40 cases read by the CT readers, 8 (20%) had a pathologic stage greater than IIA, 32 (80%) had a pathologic stage of IIA or lower. Of the 70 cases read by the MR imaging readers, 24 (34.2%) had a pathologic stage greater than IIA, 46 (65.8%) had a pathologic stage of IIA or lower. For CT readers, the average sensitivity for advanced stage cancer was 0.28, and the average specificity was 0.90. MR imaging readers had higher average sensitivity (0.47) but lower average specificity (0.79). Positive predictive values were low for both CT (average 0.55) and MR imaging (average 0.36). The negative predictive values were similar for readers of CT (average 0.83) and MR imaging (average 0.85) studies [Table 4].

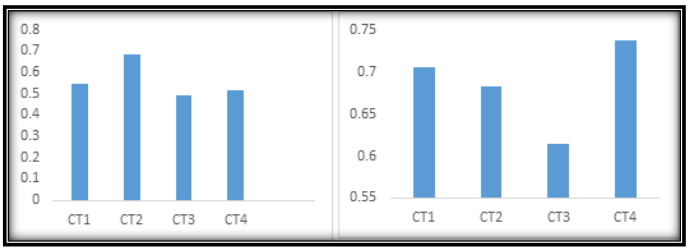

Figure 1: Bars for left and right parametrial invasion as assessed by CT readers respectively

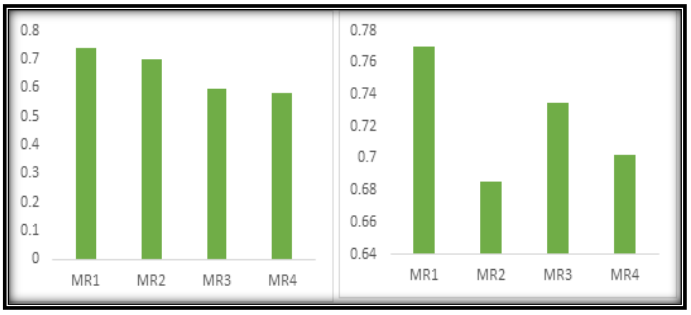

Figure 2: Bars for left and right parametrial invasion as assessed by MR imaging readers respectively

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Table 1: Reader Agreement in Retrospective Interpretation of CT and MR Imaging Studies

Parameter	Multirater k Value		P Value	
	CT	MR Imaging	CT	MR Imaging
Tumor visualization	0.16 (0.12 to 0.29)	0.32 (0.22 to 0.41)	<.001	<.001
Invasion of right parametrium	-0.04 (-0.02 to 0.13)	0.10 (0.06 to 0.27)	.961	<.001
nvasion of left parametrium	-0.05 (-0.01 to 0.11)	0.12 (0.05 to 0.29)	.981	<.001
Overall parametrial invasion	-0.04 (-0.02 to 0.13)	0.11 (0.05 to 0.29)	. . .	. . .
Staging	0.26 (0.23 to 0.34)	0.44 (0.34 to 0.56)	<.001	<.001

Table 2: AUC Values for Retrospective Interpretation of CT and MR Imaging Studies

Parameter	Mean AUC		Difference in AUC Imaging between Studies	P Value
	CT	MR		
Tumor visualization	0.58 (0.52–0.63)	0.77 (0.67–0.86)	0.20 (0.12, 0.27)	<.001
Parametrial invasion	0.62 (0.54–0.68)	0.68 (0.64–0.75)	0.07 (0.001, 0.15)	.047

Table 3: Understaging and overstaging by CT and MR imaging readers.

Modality and Reader	Pathologic Stage	No. of Cases not Staged	No. of Cases Understaged	No. of Cases Correctly Staged	No. of Cases Overstaged	Total
CT						
1	≤IIA	0	…..	32 (100%)	0	32
	>IIA	1 (3)	5 (62%)	1 (13%)	….	8
2	≤IIA	0	…..	29 (89.1%)	4 (10.9%)	32
	>IIA	1 (3)	2 (25%)	2 (27%)	….	8
3	≤IIA	1 (0.9)	…..	26 (82.7%)	7 (16.4%)	32
	>IIA	1 (3)	3 (37.5%)	3 (37%)	….	8
4	≤IIA	0	…..	28 (88.2%)	5 (11.8%)	32
	>IIA	1 (3)	2 (25%)	2 (30%)	….	8
MRI						
1	≤IIA	0	….	35 (76.9%)	11 (23.1%)	46
	>IIA	0	10 (43%)	14 (57%)	….	24
2	≤IIA	2 (1.7)	…..	36 (78.6%)	9 (19.7%)	46
	>IIA	0	13 (53%)	12 (47%)	….	24
3	≤IIA	0	….	37 (79.5%)	10 (20.5%)	46
	>IIA	0	14 (57%)	11 (43%)	….	24
4	≤IIA	4 (3.4)	….	35 (75.2%)	10 (21.4%)	46
	>IIA	0	15 (60%)	10 (40%)	….	24

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Table 4: Detection of advanced stage (>IIB) cancer by retrospective readers of CT and MR imaging studies.

Parameter	CT	MRI	P Value
Mean sensitivity	0.28 (0.14–0.38)	0.47 (0.40–0.57)	.104
Mean specificity	0.90 (0.84–1.00)	0.79 (0.77–0.80)	.099
Mean positive predictive value	0.55 (0.38–1.00)	0.36 (0.32–0.39)	.001
Mean negative predictive value	0.83 (0.81–0.84)	0.85 (0.83–0.87)	.305

DISCUSSION

The two main dimensions of variation among radiologists were evaluated in our study; level of understanding in making explicit demonstrative conclusions and varieties in symptomatic execution. We found significant fluctuation among both MR imaging and CT readers in making specific diagnostic determinations.

In current study, k Values indicating levels of reader agreement in detection of parametrial invasion, tumor visualization and staging were higher for MR imaging in comparison with CT but were relatively low for both modalities. As well as, the estimates of diagnostic performance per reader varied substantially for both modalities. These findings suggest that MR imaging and CT are inherently imperfect for the evaluation of gynaecological cancer and that further technologic advances are required to improve the imaging assessment of various types of gynaecological cancer. On average, MR imaging readers performed similarly to CT readers in overall staging. But for tumor visualization and detection of parametrial invasion, MRI was significantly better than CT. Both CT and MR imaging had a relatively high negative predictive value for the same stage IIB cancer (ie, disease with parametrial invasion), which helps to decide that both methods are helpful in identifying patients who may be candidates for surgery. Furthermore, because MR imaging is outstanding (and superior to CT) for tumor visualization and the assessment of cervical tumor size (as was shown in a separate analysis of our multicenter clinical trial data17) in patients with stage IB cancer, it is also valuable for choosing between surgery and concurrent chemotherapy and radiation therapy.[18,19,20]

However, the other study results have not demonstrated that this method is significantly superior to conventional T1- and T2-weighted MR imaging.[21,22] Although, the utilization of difference material has acquired acknowledgment in the imaging of endometrial malignant growth, it has not been all around acknowledged in that frame of mind of cervical disease. Since our study was closed to enrollment, no new evidence-based imaging guidelines for CT or MR imaging have been published. We believe that the CT and MR imaging techniques used in our study were valid. Aftereffects of earlier single-foundation studies have shown better execution for both MR imaging and CT and have additionally shown MR imaging to be more precise than CT in cervical disease arranging.[23,24] A study found the diagnostic accuracy of MRI is comparable to the authors Eun Jung Lee, Pakkal

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MV, Hricak H, Ricardo Manfredi, Sironi S, Fatima et al,[24] findings on accuracy of MRI in staging of endometrial carcinoma with 79% sensitivity and 85% specificity. This represents, a limitation of this study. However, malignant peritoneal cytologic findings are found in 12%-19% of patients with endometrial carcinoma, and malignant peritoneal cytological features have not been prognostic in women with early-stage disease.[25]

Another study examined multiple radiographic features and clinical characteristics in an attempt to develop a reliable mechanism for predicting surgical outcome for patients with advanced ovarian carcinoma. An important feature of this retrospective investigation is that the database incorporated the surgical results of nine different gynecologic oncologists. One must realize that there is a great deal of variability among surgeons operating on women with ovarian carcinoma, both in terms of their surgical expertise and their philosophical approach to the treatment of this disease. Any model developed to predict surgical outcome for advanced ovarian carcinoma must be applicable to both highly seasoned and less experienced surgeons alike. Therefore, the relatively large number of surgeons operating at multiple institutions probably serves to broaden the applicability of our predictive model.[26]

Limitations of the study

Possible limitation in our study was based on imaging studies that were obtained from a variety of sources and are now up to 5 years old. Some patients change their decision regarding surgery venue which also limits our data.

CONCLUSIONS

In summary, although agreement was higher among MR imaging readers than among CT readers, the level of agreement was low for both modalities in the pretreatment assessment of early invasive gynaecological malignancy. MR imaging was significantly better than CT for tumor visualization and detection of parametrial involvement when compared with surgicopathologic findings. The two modalities were found quite similar for overall staging, sharing low sensitivity and positive predictive value but also relatively high negative predictive value and specificity. Which indicates, readers need to be more careful and diagnosis modalities may need further development for identification and staging or making any decision for surgery.

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