Original Research Article

Accuracy of imaging findings compared with that of histopathological findings of the ovarian lesions

Ponnam Bharath Kumar[1]*, Prem Sai Reddy[2]

[1]Department of Radio diagnosis, Malla Reddy Medical College for Women, Quthbullapur Municipality, Hyderabad, Telangana, India
[2]Consultant Radiologist, Manipal Hospital, Bangalore, Karnataka, India

*Correspondence:
Dr. Ponnam Bharath Kumar,
E-mail: bharath.ponnam@gmail.com

ABSTRACT

Background: Newer imaging techniques have emerged, and it is necessary to study their accuracy in comparison to the gold standard of histopathology for increasing accuracy of diagnosis. Ovarian tumors are difficult to diagnose when they are of small size. But their diagnosis should be done at an earlier stage for effective outcome of the management of these tumors. The objective was to study accuracy of imaging findings compared with that of histopathological findings of the ovarian lesions.
Methods: This study was done for a period of two years from December 2010 to May 2012. A total of 30 patients who were clinically suspected to have ovarian pathology were referred to us for ultrasonography. In 30 patients, who were referred for sonography a total of 36 ovarian masses was found? Each patient was examined by Trans abdominal sonography / Trans vaginal sonography, MRI (Pre and Post contrast) and CT when required.
Results: Sonography could detect the origin of mass accurately in 29 (80.5 %) masses and MRI could detect the origin accurately in 34 (94.4%) masses. Sonography characterized 33/36 (91.6%) masses correctly. MRI correctly characterized 34/36 (94.5%) cases and tissue content was identified correctly. The sensitivity of imaging findings for correctly identifying malignant lesions was 100% and sensitivity for correctly making a benign diagnosis was 92.5%. The specificity of imaging findings for correctly identifying malignant lesion was 92% and specificity for correctly making a benign diagnosis was 84.6 %.
Conclusions: MRI is significantly superior to US in all respects due to the excellent soft tissue contrast and organ-specific information generated in the pelvis.

Keywords: Accuracy, Endometriosis, MRI, Sonography, Teratoma

INTRODUCTION

Ovarian tumors constitute around one third of the total genital cancers among women. Incidence of ovarian tumors is 2-6 per 1 lakh females in Asia. Cancer of the ovaries is on the fourth place among the cancers in women and also at fourth place responsible for cancer deaths in women.[1]

These tumors are difficult to diagnose when they are of small size. But their diagnosis should be done at an earlier stage for effective outcome of the management of these tumors. One of the most common indications of Trans vaginal sonography is to characterize an adnexal mass better, suspected on trans abdominal ultrasound. TVS might also be performed when a mass is suspected on bimanual examination or when the ovaries are not visualized on Trans abdominal ultrasound. Studies are

currently been undertaken to evaluate TVS as a means of screening for ovarian cancers. Such studies will need to assess whether the increased resolution leads to reliable identification of post menopausal ovaries and changes associated with every ovarian cancer. Recent studies have shown a very high sensitivity (>95%) in detecting early stage ovarian cancer of TVS.[2,3]

Advances in imaging technology have provided computed tomography (CT) and magnetic resonance imaging (MRI) as newer non-invasive methods for imaging. CT may prove valuable in the primary diagnosis of pelvic tumors where obesity, previous surgery or an unstable bladder precludes satisfactory ultrasound imaging. It is also valuable in the staging of malignant ovarian tumors. Contrast enhancement may help differentiate the primary tumors from the uterus and assist in evaluating local invasion. CT is more accurate in demonstrating peritoneal seedling especially in the presence of ascites. However, ultrasound is the primary imaging investigation of choice in most cases since it is both accurate and much cheaper than CT. CT utilizes X-ray radiation in imaging which limits its use in pregnancy and young patients.[4]

MRI has been found to be the better option over USG and CT scan. It has ability to accurately recognize benign adnexal lesions. Ovarian fibrothecomas, exophytic uterine, dermoids and broad ligament fibroids are some examples of benign adnexal lesions which can be accurately diagnosed with the help of MRI. Not only this, it can also characterize the cystic ovarian mass which is complex.[5]

Present study was carried out to study accuracy of imaging findings compared with that of histopathological findings of the ovarian lesions.

METHODS

All patients presenting with ovarian pathology in R.L. Jalappa Hospital and Research Center are included in this study. The consent of the patients will be taken prior to the investigation. This prospective study included evaluation of cases over a period of two years i.e. from December 2010 to December 2012 (30 cases). The investigation was performed with Trans abdominal scan-SIEMENS SONOLINE G50, C5-2 MHz, Trans vaginal scan- SIEMENS SONOLINE G50, EC9-4 MHz, MRI-SIEMENS 0.35 tesla MAGNETOM CI, SIEMENS Esprit single slice Spiral CT unit by taking post contrast thin contiguous sections of pelvis and ovarian in the axial plane in supine position. Imaging findings was correlated with post surgical and histopathological findings as and when required.

Inclusion criteria

Ovarian pathology suspected clinically and confirmed on ultrasound.

Exclusion criteria

- Past history of contrast allergic reactions
- Patients suffering with renal failure
- Pregnant women

The data collected from these patients will be analyzed using descriptive statistic tools like proportions.

The following features of a mass were noted on USG like Origin, Unilocular/Multilocular, Anechoic/ Hyper echoic/ Heterogeneous, Thin wall/ Thick wall, Thin septae/ Thick septae, Solid component, Mural nodule, Calcifications, Debris, Fluid- fluid level, Vascularity, Ascites.

MR imaging of pelvis was done for patients using an MRI- SIEMENS 0.35 tesla MAGNETOM CI machine. Patient's position was kept supine with head first, phased array body coil was fixed to gluteal region to study the pelvis.

MRI was evaluated for Origin of the lesion. Unilocular/Multilocular, T1 Hypo/ Hyper, T2 Hypo/Hyper, gradient images, stir images, Thin wall/ Thick wall, Thin septae / Thick septae, A solid mass or large solid component, Mural nodule, Calcifications, Contrast enhancement and Ascites.

RESULTS

Out of the 30 patients, 24 patients had unilateral ovarian mass while 6 had bilateral ovarian masses. On imaging findings 23 masses were determined as benign and 13 masses were determined as malignant. Thus, it can be said that the tumors usually have unilateral location as it is evident from the table that 80% of the tumors were unilateral. Bilaterality is very less amounting to about 20% only. Most of the tumors were benign in nature as it is evident from the table that 76.7% were benign tumors and only 22.3% were malignant tumors (Table 1).

Table 1: Distribution of cases as per laterality and type of lesion.

Characteristics		Number	%
Laterality	Unilateral	24	80
	Bilateral	6	20
Type as per imaging findings	Benign	23	76.7
	Malignant	13	22.3

Table 2: Age wise distribution of study subjects.

Age group (years)	Number	%
0-20	3	10
21-40	12	40
41-60	14	46.7
61-80	1	2.3
Total	30	100

In this study, the youngest patient was 18 yrs old and the eldest patient was 66 yrs old. The maximum number of patients was found in the range of 41-60 yrs, accounting for 14 patients, followed by 12 patients in 21-40 years. Thus, it can be said that the tumors are more common in the age group of 41-60 years amounting to 46.7% of the cases i.e. nearly half. 21-40 years age group was second most affected group. Younger age and old age were least affected. Only one case in the age group of 61-80 years may indicate that some of the patients might have died (Table 2).

Two lesions were completely missed on ultrasound were as they were picked up on MRI. MRI could detect the origin accurately in 34 (94.4 %) masses. The origin of 2 masses were not accurately detected on MRI due to non-detection of the normal ovary bilaterally and separate from the large lesion (Table 3).

Table 3: Effectiveness of imaging in comparison to histopathology findings in detecting origin of lesion.

Investigation	Total no. of lesions	Origin of lesion accurately detected	% Origin of lesion accurately detected
Sonography	36	29	80.5
MRI	36	34	94.4

Sonography characterized 33/36 (91.6%) masses correctly. MRI correctly characterized 34/36 (94.5%) cases. Sonography could not characterize a case of endometriotic cyst and 2 cases of cystadenofibroma, whereas the endometriotic cyst was correctly diagnosed on MRI but the 2 masses of cystadenofibroma was diagnosed as serous cystadenocarcinoma due to the presence of solid mass and thick septae within the lesion (Table 4).

Table 4: Effectiveness of imaging in comparison to histopathology findings in detecting characterization of lesion.

Investigation	Total no. of lesions	Lesions accurately characterized	% Lesions accurately characterized
Sonography	36	33	91.6
MRI	36	34	94.4

The ovarian masses were diagnosed based on various ultrasound and MRI imaging characteristics. The various ovarian lesions diagnosed are simple cyst, serous cystadenomas, serous cystadenocarcinoma, cystadenofibroma, Mucinous Cystadenoma, Mucinous cystadenocarcinoma, endometrioma, cystic teratoma, fibroma, dysgerminoma, malignant germ cell tumor. Out of malignant tumors, four were found to have metastasis, one was malignant solid tumor, five were serous cystadenocarcinoma, one was with mucinous cystadenocarcinoma. Out of benign tumors, eight were

Serous Cystadenoma, five were Simple Cyst, two were Cystadenofibroma, four were Mucinous Cystadenoma, two were Hemorrhagic Cyst, one was Endometriosis and three were cystic teratoma (Table 5).

Table 5: Total number of each lesion detected in the present study.

Final diagnosis	Malignant/ benign	Number of lesions	%
Simple cyst	Benign	5	16.7
Serous cystadenoma		8	26.7
Cystadenofibroma		2	6.7
Mucinous cystadenoma		4	13.3
Hemorrhagic cyst		2	6.7
Endometriosis		1	3.3
Cystic teratoma		3	10
Metastasis	Malignant	4	13.3
Malignant solid tumor		1	3.3
Serous cystadenocarcinoma		5	16.7
Mucinous cystadenocarcinoma		1	3.3

Out of the 36 masses, sonographically and MRI combined determined 23 masses as benign and 13 masses were determined as malignant. Sonography could not characterize a case of endometriotic cyst and 2 cases of cystadenofibroma, whereas the endometriotic cyst was correctly diagnosed on MRI but the 2 masses of cystadenofibroma was diagnosed as serous cystadenocarcinoma due to the presence of solid mass and thick septae within the lesion. Imaging findings (USG and MRI) correctly diagnosed 11 malignant lesions and incorrectly classified 2 benign lesions as malignant. Of the remaining 25 benign diagnoses, imaging findings correctly characterized 23 of the lesions. The sensitivity of imaging findings for correctly identifying malignant lesions was 100% and sensitivity for correctly making a benign diagnosis was 92.5%. The specificity of imaging findings for correctly identifying malignant lesion is 92% and specificity for correctly making a benign diagnosis was 84.6% (Table 6).

Table 6: Imaging determination of benignity and malignancy of a lesion.

	Benignity (%)	Malignancy (%)
Sensitivity	92.5	100
Specificity	84.6	92

DISCUSSION

The prospective study confirms previous reports suggesting that imaging investigations (USG and MRI) is helpful in the evaluation of ovarian pathological entities.

This study reveals that sonography performs comparatively poorly than MRI for determining the origin of the mass which is the first essential step in characterizing a pelvic mass. For example, large mass size and non-visualization of the adjacent normal ovary are contributing factor to an indeterminate diagnosis of origin of the lesion with ultrasonography.

Salem S et al, is of the view that sonography is commonly used to evaluate a pelvic mass.[6] Occasionally it may be impossible to determine the exact origin of the mass by sonography and MRI may be helpful.

Sittig KM et al, are of the opinion that USG is useful in patients with acute abdominal pain because, it provides rapid, safe, low cost evaluation of abdominal and pelvic organs.[7]

Sarti DA et al, is of the opinion that large pelvic masses can be difficult to separate on ultrasound.[8] Various masses in the pelvic may have confusing appearances on ultrasound.

Jenkins PR et al, is of the view that MRI is well suited to the evaluation of the pelvis, providing high soft-tissue contrast resolution and clear anatomical depiction of the pelvic organ.[9] MRI had become invaluable in the evaluation of malignant disease within the pelvis.

Valentin L et al, says that ultrasound can be considered as first choice of imaging technique in certain conditions like tubal pregnancy etc, as well as adnexal tumors diagnosis whereas MRI should be taken as secondary test in conditions like adenomyosis etc.[10]

Hricak H et al, are of the view that Gadolinium-enhanced MR imaging depicted 176 (94%) of 187 adnexal masses, with an overall accuracy for the diagnosis of malignancy of 93%.[11] Komatsu T et al, concluded from their study that "both trans vaginal US and gadolinium-enhanced MR imaging were highly sensitive in identification of solid components within an adnexal mass.[12] Gadolinium-enhanced MR imaging was specific, whereas Trans vaginal US was non-specific for adnexal lesions."

Scoutt LM et al, McCarthy SM, Lange R, Bourque A, Schwartz PE determined the sensitivity, specificity, predictive value, and accuracy of pelvic MRI in the prospective evaluation of women with a clinically suspected pelvic mass.[13] Magnetic resonance was 100% sensitive and 99% specific in prospectively diagnosing dermoids, 96% sensitive and 100% specific in diagnosing subserosal leiomyomas, and 92% sensitive and 91% specific in diagnosing endometrioma.

CONCLUSION

The study has showed that ultrasound, which currently is the initial imaging modality in the investigation of pelvic pathology, is inaccurate in characterizing few ovarian lesions and can confidently identify the tissue of origin of the lesion in only 80.5% of cases. MRI is significantly superior to US in all respects due to the excellent soft tissue contrast and organ-specific information generated in the pelvis. The tissue contrast provided by MRI in the pelvis results specific technique-based advantages. Hence, we suggest that all patients with a pelvic abnormality identified on US or in whom there is a strong clinical suspicion of disease should undergo MR pelvic imaging because of its better soft tissue resolution and multiplanar capability resulting in higher accuracy rates.

REFERENCES

1. Rashid S, Sarwas G, Ali A. A Clinico-pathological study of ovarian cancer. Mother Child. 1998;36:117-25.
2. DePriest PD, Gallien HH, Pavlik EJ, Krysolo RJ, Van Nagell Jr. Trans vaginal sonography as a screening method for the detection of early ovarian cancer. Gynecol Oncol. 1997;65(3):408-14.
3. Fleischer AC, McKee MS, Gordon AN, Page DL, Kepple DM, Worrell JA, et al. Trans vaginal sonography of postmenopausal ovaries with pathologic correlation. J Ultrasound Med. 1990;9:637-44.
4. Iyer VR, Lee SI. MRI, CT, and PET/CT for Ovarian Cancer Detection and Adnexal Lesion Characterization. AJR. 2010;194:311-21.
5. Morikawa K, Hatabu H, Togashi K, Kataoka ML, Mori T, Konishi J. Granulosa cell tumor of the ovary: MR findings. J Comput Assist Tomogr. 1997;21:1001-4.
6. Shai S. Diagnostic ultrasound, Carol M. Rumack, 2nd ed, Published by Mosby; 1998:565.
7. Sittig KM. Sabiston's textbook of surgery, 16th Ed. Published by Harcourt Publishers; 2001:808.
8. Sarti DA. Textbook of Diagnostic Ultrasound, Dennis A Sarti, 2nd ed., published by Year Book Medical Publishers; 1987:800,814.
9. Jeremy PR. Jenkins, textbook of Radiology and Imaging, David Sutton, 7th ed, published by Churchill Livingstone; 2003:1007.
10. Valentin L. Imaging in Gynecology. Best Pract Res Clin Obstet Gynaecol. 2006 Dec;20(6):881-906.
11. Hricak H, Chen M, Coakley FV, Kinkel K, Yu KK, Sica G, et al. Yu, Gregory Sica, Peter Bacchetti, and C. Bethan Powell. Complex adnexal masses: Detection and characterization with MR Imaging-Multivariate Analysis Radiology. 2000;214:39-46.
12. Komatsu T, Konishi I, Mandai M, Togashi K, Kawakami S, Konishi J, et al. Adnexal masses: transvaginal US and gadolinium-enhanced MR imaging assessment of intratumoral structure. Radiol. 1996 Jan; 198(1):109-15.

13. Scoutt L, McCarthy S, Lange R, Bourque A, Schwartz P. MR evaluation of clinically suspected adnexal masses. J Comput Assist Tomogr. 1994;18:609-18.