Diagnostic Accuracy of 16 Slice Contrast Enhanced CT Scan for Detection of Malignancy in Patients with Complex Adnexal Masses on Ultrasonography (Taking Histopathology as Gold Standard)

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ABSTRACT

Objective: To determine the diagnostic accuracy of a 16-slice contrast-enhanced CT scan (CECT) for the detection of malignancy in patients with complex adnexal masses on Ultrasonography (USG) (taking histopathology as the gold standard).
Study Design: Cross-sectional study.
Place and Duration of Study: Pakistan Naval Ship Shifa Hospital, Karachi Pakistan, from Jul to Dec 2020.
Methodology: Seventy-five patients with adnexal masses were included. All patients had 16-slice contrast-enhanced CT scans. All the patients then had exploratory laparotomy, followed by histopathology as the gold standard. The diagnostic accuracy of CECT (contrast-enhanced computed tomography) was detected by determining sensitivity, specificity and diagnostic accuracy.
Results: 16-slice contrast-enhanced computed tomography showed a sensitivity of 92.2%, specificity of 93.4%, and diagnostic accuracy of 93.1%.for correctly diagnosing adnexal malignancy.
Conclusion: Due to its high sensitivity, specificity and diagnostic accuracy, 16 slice contrast-enhanced CT scan is a reliable test for diagnosing malignancy among patients with unexplained adnexal masses on USG.

Keywords: 16-slice contrast-enhanced computed tomography, Diagnostic accuracy, Unexplained adnexal mass.

INTRODUCTION

Malignancies of the female reproductive tract are amongst the most serious causes of mortality and morbidity. One of the leading causes of adult female deaths in the developed world is the neoplasia of the adnexa.[1] In Pakistan, too; it is one of the most common female cancers.[2] It is the fifth leading cause of adult female mortality in the world. The estimated prevalence of ovarian carcinoma in the United States 2008 was 177,578. In 2008, almost 58 out of every 100,000 women lived with or had a history of ovarian carcinoma.[3]

Radiologists use ultrasonography as their first tool to investigate adnexal pathology. Nevertheless, most of the time, ultrasound is not sufficient enough to accurately assess and discriminate benign vs malignant masses.[4,5] It only describes how complex the mass is, regarding its components like internal echoes, septae, increased vascularity on colour Doppler etc.[6] The estimated prevalence of complex adnexal lesions in one of the studies was about 3.2%, and the frequency of ovarian cancer in women with persistent complex cysts was 6.1%.[7] CT of the abdomen and pelvis can

depict the masses and local or regional invasion. CECT not only demonstrates detailed findings and the nature of the primary lesion, but in addition, it also provides information regarding lymph nodal metastasis and peritoneal deposits with any malignant ascites, even if minimally present.[8] CECT scan accurately elucidates the mass lesion's characteristics regarding their possibility of being benign or malignant.[9] 16-slice CT scanners are fast, less time-consuming and feasible for obtaining thin slices for detailed and precise imaging. Due to thin section acquisition and collimation, we can accurately describe whether the mass is within the ovary or is extra ovarian, i.e., pelvic/ intra peritoneal in origin.[10]

Multi-slice Computed Tomography also improvises the evaluation of intra-peritoneal metastatic deposits, peritoneal nodularity or nodular omental thickening, also known as omental caking. We can assess and diagnose even the sub-centimetric deposits with the help of image reformatting in multiplanar sequences. This technique also helps to visualise curved or angulated structures like the diaphragm and paracolic gutters and evaluate vasculature. The precise assessment of tumour extension and adjacent visceral involvement, as well as its relation to nearby vessels, is assessed, which provides valuable information for

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further surgical resection of the tumour if indicated. In an underdeveloped country like Pakistan, there is no availability of more advanced CT scanners due to limited resources, and many of our armed forces hospitals at periphery setups have only 16 slice CT scanners, if available.

METHODOLOGY

The cross-sectional study was conducted at PNS Shifa Hospital, Karachi, after obtaining approval from the hospital ethical review committee (No. PF/10580/2022). The sample size was calculated by taking sensitivity=91% and specificity=97%.[11]

Inclusion Criteria: Female patients aged 20-50 years referred from Gynecological OPD with complex masses on USG were included in the study.

Exclusion Criteria: Hemodynamically unstable patients or patients having any prior gynaecological surgical or interventional procedures were excluded from the study.

A total of 75 female patients, ranging in age from 20 – 50 years and having complex adnexal masses on USG, were included in the study. On transabdominal ultrasound, the adnexal mass was considered complex if any of the following is present;1)Partially solid/cystic components, 2).Thick internal septations of more than 3mm, 3) Internal echoes, 4)Vascularity of the internal septae, internal solid components or walls of the cyst, on colour Doppler ultrasound.[12,13]

Demographic data and detailed history were taken. Informed, written consent was taken from all patients. All patients underwent a 16-slice contrast-enhanced CT scan (CECT), which was performed on TOSHIBA AQUILION 16-SLICE CT Scanner with axial, sagittal and coronal reformatting, both before and after IV contrast administration. The scanning protocol was 5mm slice thickness, reconstruction interval 1mm, scan delay 50 sec, 200 mAs and 140kV. A Fellow of Radiology made the image interpretation of the tumour with a minimum of 5 years of experience.

All the patients underwent surgery (exploratory laparotomy), and the tissue specimens were obtained from the lesion, which were sent to the Department of Pathology, where a histopathologist performed histopathology with at least five years of experience. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of the CECT scan were calculated, and the gold standard was considered the histopathological findings/report of surgically obtained tissue samples.

Statistical Package for the social sciences (SPSS) version 25:00 was used for data analysis. Sensitivity, specificity, positive predictive value, negative predictive values and diagnostic accuracy of contrast-enhanced CT scan were calculated.

RESULTS

Our study showed the sensitivity of contrast-enhanced computed tomography of adult female patients to be 94.1%, with initial ultrasounds showing indeterminate adnexal masses. The study was conducted on 75 patients, and CECT detected malignancy in 20 patients. Among these 20 patients labelled as having malignant lesions by CECT, 16(21.3%) were finally proved to be malignant by histopathology, hence, labelled to be true positive for malignancy. In contrast, the remaining 4(5.3%) patients were labelled to be false positives. CECT scan was negative for malignancy in 55 patients out of 75. Out of these, 1(1.3%) was positive on histopathology (false negative), and 54(72%) were negative on histopathology (true negative). These patients had a specificity of 93.1% on CECT scans. The positive predictive value was 80%, and the negative predictive value was 98.1%. The diagnostic accuracy was calculated to be 93.3% (Table).

Table: Comparison of 16-slice Contrast-Enhanced CT scan with Histopathology for Detection of Adnexal Malignancy (n=75)

Malignancy on CECT	Malignancy on Histopathology (Taken as the Gold Standard)		Total
	Positive	Negative	
Positive	16(21.3%)	4 (5.3%)	20(26.6%)
Negative	1(1.3%)	54 (72%)	55(73.3%)
Total	17(22.6%)	58(77.3%)	75(100%)

Sensitivity=TP/(TP+FN)=94.1%, Specificity=TN/(TN+FP)=93.1%, Positive Predictive Value=80.0%, Negative Predictive Value=98.1%, Diagnostic Accuracy= 93.3%

DISCUSSION

Adnexal masses are commonly observed in our daily practice in the radiology department while using different radiological modalities. Once any investigation labels an adnexal mass, the next step is accurately characterising its benignity or malignancy, which is the real diagnostic challenge. It is necessary because our findings and conclusion provide a foundation for the following line of management to be opted, hence, saving the patient from the unnecessary investigation. In our routine practice, USG is the first modality to assess the adnexal masses, which is only reliable sometimes. Therefore, we evaluated the diagnostic accuracy of the CECT scan for detecting malignancy in patients with adnexal masses. The

results of our study showed CECT a proper and reliable investigation by showing a high accuracy (93.3%), sensitivity (94.1%) and specificity (93.1%) in detecting malignancy. The positive predictive value was lower (80%), and the negative predictive value was high, i.e.,98%.

Gatreh-Samani *et al*.[9] detected that for the detection of malignant masses, the sensitivity of CECT was 92.8%, specificity was 88.0%, positive predictive value was 95.5%, negative predictive value was 81.4%, and diagnostic accuracy was 91.5%. A study by Mubarak *et al*.[12] showed that CECT is an excellent modality to differentiate benign vs malignant adnexal masses with a very high sensitivity, specificity and diagnostic accuracy of 97%, 91% and 96%, respectively. The PPV was 97%, and NPV was 91%.

Another meta-analysis was conducted by Kinkel *et al*.[13] which designated that post-contrast CT scan imaging has very high predictive values to diagnose adnexal malignancies with very high sensitivity as well as specificity, which could have remained unspecified on ultrasound otherwise. While Liu et al. showed that CT scan is 100% specific.[14]

In another study of 178 patients the evaluation of pelvic mass with CT showed that it had a very high sensitivity to determine malignancy in adnexal masses, i.e., of 92-95%, but at the same time, this study had a relatively low specificity of 74-80% only.[15]

Advanced radiological techniques, which include newer computed tomography scanners with more slices and hence the possibility of significantly reduced slice thickness, the improved spatial resolution of the images, decreased acquisition times and the possibility of acquiring 3-D reconstructed and multiplanar images, have made the confident radiological characterisation of adnexal tumours as either benign or malignant, possible.[16,17] For these reasons, contrast-enhanced images taken by this modality are also used to stage malignant adnexal tumours by acquiring images of the chest and abdomen along with the pelvis to rule out the involvement of adjacent pelvic organs, metastatic deposits/secondaries, whether visceral, lymphoid or bony and also to see for the presence of other suspicious features such as ascites or pleural effusion.[18,19] These additional features on contrast-enhanced computed tomography scans add to the confidence level with which the Radiologist can label an adnexal mass as either malignant or benign. In this manner, the need for pre-surgery biopsy to establish malignancy or otherwise is annulled, and the patient can proceed with appropriate surgical or oncological therapy and management; thus, carrying out contrast-enhanced computed tomography in patients with adnexal masses is crucial in their management.

LIMITATIONS OF STUDY

One of the limitations was that all referred patients were involved in our study, which could have resulted in selection bias. A single radiologist reported the CECT scans hence, inter-observer reliability could not be established.

CONCLUSION

This study concludes that contrast-enhanced Computed tomography has shown a high sensitivity, specificity and diagnostic accuracy in detecting malignancy among patients with an adnexal mass. Therefore, it can be considered a reliable investigation among patients presenting with unexplained adnexal mass and can help us define an adequate management plan.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SS & AAK: Data acquisition, critical review, concept, approval of the final version to be published.

NM & FK: Study design, drafting the manuscript, data interpretation, approval of the final version to be published.

MU & US: Critical review, data analysis, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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