MULTIDETECTOR COMPUTED TOMOGRAPHIC EVALUATION OF ADNEXAL MASSES WITH HISTOPATHOLOGICAL CORRELATION

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ABSTRACT

Adnexal mass can arise from ovaries, fallopian tubes or any of the surrounding connective tissue and can be malignant or benign. Differentiating benign and malignant mass is imperative for management and is most commonly done by various imaging modalities.

Materials and Methods: 36 patients who underwent multi-detector computed tomography and histo-pathological examinations of adnexal masses were selected for the study. The true positive, false positive, true negative and false negative cases were determined considering histopathology as gold standard. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy were calculated.
Results: Among 36 patients, 19 (52.8%) were diagnosed as benign masses and 17 (47.2%) as malignant masses on Computed tomography, whereas, 20 (55.6%) cases were diagnosed as benign masses, 13 (36.1%) as malignant masses and 3 (8.3%) as borderline masses on histopathology. The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of Computed tomography in detecting benign adnexal masses was 95%, 93.7%, 95%, 93.7% and 94.4% respectively. Likewise, the sensitivity, specificity, positive predictive value, negative predictive value and accuracy of Computed tomography in detecting malignant adnexal masses was 92.3%, 82.6%, 75%, 95% and 86.1% respectively.
Conclusion: Multidetector computed tomography was found to be a valuable modality of imaging in differentiating benign and malignant adnexal masses with accuracy of 93.9%. Multidetector computed tomography can be helpful to differentiate various benign and malignant adnexal masses based on typical characteristics.
KeyWords: adnexal mass; benign; histopathology; malignant; Multidetector computed tomography,

INTRODUCTION

Adnexa refers to the structures closely related structurally and functionally to the uterus such as ovaries, fallopian tubes or any of the surrounding connective tissue. When a mass occurs in this region, it is referred to an adnexal mass. Adnexal masses commonly involve ovary, because of the propensity of ovary for neoplasia, fewer neoplasms occur in fallopian tubes which is commonly involved in inflammatory process.[1]

Non gynaecological masses like abdomino-pelvic abscesses, urinary tract masses and metastatic diseases may also present as adnexal masses.[2] Adnexal masses pose a special dilemma to the attending gynaecologist because the differential diagnosis is often difficult and complex. Also, the nature of the adnexal mass needs to be ascertained, whether benign or malignant, so that the patient gets the appropriate treatment for the condition.

Adnexal masses are usually identified either through clinical examination or through USG examination of the pelvis for symptoms caused by the mass or incidentally.Ultrasonography (USG) is the primary modality used for detection and characterization of adnexal masses.[2]

Computed tomography (CT) is the most commonly used primary imaging study for evaluating the extent of adnexal malignancies and for detecting persistent and recurrent tumors. CT of abdomen and pelvis can depict masses as well as probable local or regional invasion. CT scan is used for tumor delineation, characterization and increasing conspicuity of peritoneal implants. While the staging accuracy of CT imaging is only moderate, prediction of tumor resectability is excellent.[3] CT is the preferred technique in the pre-treatment evaluation of ovarian cancer to define the extent of disease and assess the likelihood of optimal surgical cytoreduction.[4] However, PET/CT is superior to CT and MR imaging for depiction of recurrent disease.[5]

Very few studies have been done in Nepal to detect the role of various imaging modalities in diagnosing adnexal masses. In a retrospective study of all the cases of ovarian tumours operated in Nepal Medical College Teaching Hospital from January 2006 to July 2008, the incidence of ovarian tumour was 16.7% among total gynaecological admissions, out of which malignant ovarian tumour was 9.5%.[6] By this study, the detailed information of the demographic features, characteristic features of adnexal masses on computed tomography scan obtained will help in best possible diagnosis and treatment of adnexal masses in our setting.

MATERIALS AND METHODS

The study was carried out on prospective basis in the Department of Radio diagnosis & Imaging, B P Koirala Institute of Health Sciences, over a period of one year. Patient with clinical suspicion of adnexal masses referred for CT scan of abdomen and pelvis were included in the study.

The CT examination was performed on 16-slice MDCT (ECLOS 16 HITACHI) machine available in the department. Non-contrast and contrast enhanced CT of abdomen and pelvis were done in supine position in helical mode with single breath hold technique. Bowel opacification was achieved orally with 1000ml of 2% diluted contrast (20 ml of 350mg I/ml of non-ionic iodinated contrast diluted in 1000ml of water). Volumetric acquisition of abdomen and pelvis was obtained by taking 10x10 and 7.5/7.5mm axial sections before and after administration of iodinated intravenous contrast. CT protocol was modified based on the nature of pathology for which the patients were referred. Reconstruction was done in axial slice thickness of 0.625 mm.

The CT findings were recorded on a proforma for the analysis of the data. For each mass, the size in three perpendicular dimensions was measured and recorded. The largest single dimension was used for statistical analysis. The adnexal masses were categorized as solid, cystic or solid-cystic. For cystic and solid cystic lesions; wall thickness, wall enhancement, presence of internal septations, thickness of internal septa and septal enhancement were assessed. Wall thickness ≥3mm was considered as thick wall, whereas, <3mm was considered as thin wall. Similarly, septal thickness ≥3mm was considered as thick septa and <3mm as thin septa. Presence of enhancing solid component, calcification and fat content was assessed in all adnexal masses. Ancillary findings, including peritoneal nodules, thickened enhancing peritoneum, omental nodules, thickened heterogeneous omentum, ascites and enlarged lymph nodes were also recorded.

Histopathological analysis of all the cases were done and findings were recorded on Pro-forma for correlation with CT findings.

SELECTION CRITERIA

Inclusion criteria

- All female patients with clinical suspicion or ultrasonographic diagnosis of adnexal mass who were referred for CT scan were included in this study.

Exclusion criteria

- Any patient with contraindication to iodinated contrast agent.
- Previous operated cases for adnexal mass.
- Patients who were receiving chemotherapy/ radiotherapy for adnexal mass.
- Cases in which histopathological report was not available.

The study was approved by Institutional Review Committee (IRC), BPKIHS (Ref no.: Acd/843/074/075). Census method was adapted for collection of study sample. The data collected were tabulated in Microsoft Excel and analysis was carried out using Statistical Package for Social Sciences (SPSS) version [11].

For analysis, mean with SD, frequency and percentage were used. Sensitivity, specificity, positive predictive value, negative predictive value and accuracy of MDCT were calculated considering HPE as gold standard. Fisher's exact test and Goodman and Kruskal tau statistics were used to compare between CT findings of different adnexal masses. One-way ANOVA test was used to compare between the size of different adnexal masses. P value <0.05 was set for significance.

RESULTS

In this study, 36 cases were included and analyzed, all of which were ovarian masses. The mean age of patients was 36.6± 14.8 years (range: 9 to 66 years). Distribution of patients according to age is summarized in table I, with the maximum number of patients (11, 30.6%) in the age group of 21-30 years. Mean age of patients with benign masses was 33.7±12.1 years (range: 14 to 55 years), malignant masses was 41.3±19.02 years (range: 9 to 66 years) and borderline masses was 36.0 ±8.1 years (range: 27 to 43 years).

Table I: Age distribution of patients with adnexal masses

Age in Years	Frequency	Percentage
0-10	1	2.8
11-20	2	5.6
21-30	11	30.6
31-40	8	22.2
41-50	7	19.4
51-60	5	13.9
>60	2	5.6
Total	36	100

Among 36 patients, 19(52.8%) were diagnosed as benign masses and 17(47.2%) as malignant masses on CT, whereas, 20 (55.6%) cases were diagnosed as benign masses, 13 (36.1%) as malignant masses and 3 (8.3%) as borderline masses on histopathology.

Present study showed that MDCT had sensitivity of 95%, specificity of 93.7%, positive predictive value of 95%, negative predictive value of 93.7% and accuracy of 94.4% to detect benign adnexal masses. Similarly, for detection of malignant adnexal masses, MDCT had sensitivity of 92.3%, specificity of 82.6%, positive predictive value of 75%, negative predictive value of 95% and accuracy of 86.1%.Likewise, for differentiating benign from malignant adnexal masses, MDCT had sensitivity of 95%, specificity of 92.3%, positive predictive value of 95%, negative predictive value of 92.3% and accuracy of 93.9% as shown in table II

Table II: Values of MDCT for differentiating benign from malignant adnexal masses

Parameters	Results
True positive	19
True negative	12
False positive	1
False negative	1
Sensitivity	95%
Specificity	92.3%
Positive predictive value	95%
Negative predictive value	92.3%
Accuracy	93.9%

The size of benign masses ranged from 4.8 to 29.3cm with mean size of 9.7±5.3cm, size of malignant masses ranged from 8.6 to 27.2cm with mean size of 16.2±5.7cm and that of borderline masses ranged from 14.2 to 25.2cm with mean size of 19.1±5.5cm. However, the association of size with type of adnexal mass was found to be statistically insignificant (p value 0.103 by one-way ANOVA test).

Among 36 patients, 5(13.9%) had solid masses, 21(58.3%) patients had cystic masses and 10(27.8%) patients had solid cystic masses on CT as shown in figure II.

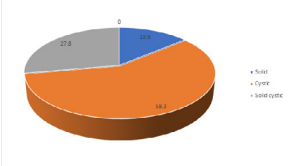

Table III: Pie chart showing distribution of adnexal masses according to consistency on CT

In our study, among 20 benign adnexal masses, 16 (80%) were cystic, 3 (15%) were solid cystic and 1 (5%) was solid on CT. Likewise among 13 malignant masses, 3 (23.1%) were solid, 6 (46.2%) were solid cystic and 4 (30.8%) were cystic. Among 3 borderline masses, one each were solid (33.3%), cystic (33.3%) and solid cystic (33%). The association of consistency with type of adnexal mass was found to be statistically significant with majority of benign masses being cystic and majority of malignant masses being solid cystic and solid (p value 0.02). The distribution of different adnexal masses according to consistency on CT is shown in table III.

Table III: Distribution of adnexal masses according to consistency on CT

Adnexal mass(n=36)	Consistency			P value*
	Solid	Cystic	Solid cystic	
Benign (n=20)	1	16	3	0.02
Malignant(n=13)	3	4	6	

*p value calculated by Goodman and Kruskal tau statistics

The individual CT features of malignant adnexal masses were analysed considering histopathology as gold standard. The present study showed that accuracy of each feature ranged from 69.4 to 90.3%, sensitivity ranged from 15.3% to 100 % and specificity from 66.6% to 100% as shown in table IV.

Table IV: Diagnostic index of CT features to detect malignant adnexal masses

CT features	Sensitivity	Specificity	PPV	NPV	Accuracy	P value*
Thick wall (≥3mmm)	90	85.7	75	94.7	87.0	<0.001
Wall enhancement	80	95.2	88.8	90.9	90.3	<0.001
Thick septa(≥3mm)	100	80	72.7	100	86.9	<0.001
Septal enhancement	100	66.6	61.5	100	78.2	0.004
Enhancing solid component	84.6	86.9	78.5	90.9	86.1	1.000
Peritoneal nodules	23.0	100	100	69.6	72.2	0.052
Thickened enhancing peritoneum	15.3	100	100	67.6	69.4	0.148
Omental nodules	46.1	100	100	76.6	80.5	0.002
Thickened heterogeneous omentum	15.3	100	100	67.6	69.4	0.148
Ascites	92.3	82.6	75	95	86.1	<0.001
Enlarged lymph nodes	23.0	95.6	75	68.7	69.4	0.052

*p value calculated by Fisher's exact test

In this study, among 36 cases, serous carcinoma (n=7, 19.4%) and mature cystic teratoma/dermoid cyst (n=7, 19.4%) were the most common adnexal masses on histopathological examination as shown in table V.

Histopathological diagnosis	Frequency	Percentage	Benign/ Malignant/ Borderline
Serous carcinoma	7	19.4%	Malignant
Mature cystic teratoma/ dermoid cyst	7	19.4%	Benign
Mucinous cystadenoma	5	13.8%	Benign
Serous cystadenoma	3	8.3%	Benign
Yolk sac tumor	2	5.5%	Malignant
Endometriotic cyst	2	5.5%	Benign
Clear cell carcinoma	1	2.7%	Malignant
Mucinous carcinoma with Brenner tumor	1	2.7%	Malignant
Seromucinous carcinoma	1	2.7%	Malignant
Immature teratoma grade III	1	2.7%	Malignant
Atypical proliferative seromucinous tumor	1	2.7%	Borderline
Atypical proliferative Brenner's tumor	1	2.7%	Borderline

Mucinous borderline tumor	1	2.7%	Borderline
Benign Brenner's tumor	1	2.7%	Benign
Serous cystadenofibroma	1	2.7%	Benign
Fibroma	1	2.7%	Benign
Total	36	100	

ILLUSTRATION:

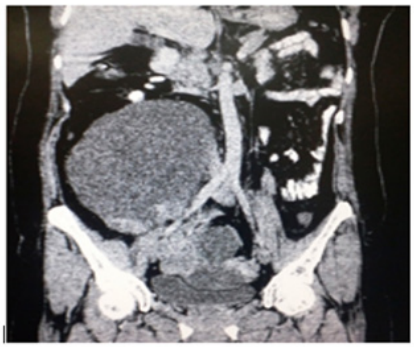

Figure 7a

Figure 7b

Figure 7c

Figure II: CECT with coronal (7a, 7b) and sagittal (7c) reconstruction images revealing a large abdominopelvic cystic lesion with thick enhancing wall at places, thick enhancing internal septations and enhancing peripheral solid components arising from right side of pelvis. Another thick-walled lobulated cystic lesion with thick and thin internal septations and enhancing peripheral solidcomponent in left adnexa adjacent to the large cyst. On histopathology, the lesions were diagnosed as bilateral high-grade serous carcinoma.

DISCUSSION

Once we come across an adnexal mass, it is imperative to decide whether the mass is benign or malignant to determine further treatment plan, and this is based largely on imaging appearances in addition to laboratory findings.[7]

There are myriad types of ovarian masses and CT appearances vary widely. Accurate histologic characterization is thus not always possible, however, some tumors have certain radiologic features which predominate and knowledge of these key findings may help in reaching a specific diagnosis.[8]

In present study, 52.8% (n=19) cases were diagnosed as benign masses and 47.2%(n=17) were diagnosed as malignant masses on CT. On histopathological examination, 55.5% (n=20) cases were benign masses, 36.1% (n=13) cases were malignant masses and 8.3%(n=3) cases were borderline masses.In a study conducted by Karki P et al in 2023 in Patan hospital, among 175 patients, 135 had benign and 40 had malignant lesions.[9] Malignancy was common in middle aged patients (41-60years). MRI features of malignancy were multilocular, solid cystic lesion with contrast enhancement, septations and diffusion restriction.

A study conducted by BS S B et alin the year 2016 revealed that the ovarian masses constituted 96% and fallopian tube masses,4% of all adnexal masses.[10] Among the ovarian masses, malignant lesions were 48%, benign lesions were 37.5% and borderline lesions were 14.5%. Greater percentage of malignant masses compared to benign masses were also noted in studies by Khattak Y J et al and Mubarak F et al. Lesser number of cases of malignant tumors in our study could be because suspected cases of malignant masses with extra ovarian spread on CT who required neoadjuvant chemotherapy were referred to higher oncological centre for further management and were not operated in our centre.[8,11]

Similar studies were obtained in a study in 2009 in Nepal Medical college teaching hospital. In that study, the incidence of ovarian tumour was 16.7% among total gynaecological admissions, out of which malignant ovarian tumour was 9.5%.6 The age range was 18 to 70 years. Benign tumour occurred in all age group 86 (90.5%) while maximum of malignant tumour occurred after 40 years (66.7%). Seventy two point six percent were surface epithelium tumour which is common in older women. Twenty seven percent were germ cell tumour which is common in younger age group. Commonest surface epithelial tumour was serous cyst adeno-

ma (40.0%) and commonest germ cell tumour was dermoid (25.3%).[6]

In this study, CT findings were compared with histopathological diagnosis to calculate the diagnostic accuracy of CT in differentiating benign from malignant adnexal masses. Similar results were obtained in prospective studies[11-16].

MDCT features that correlated with malignancy include thick wall(≥3mmm), wall enhancement, thick septa, septal enhancement, enhancing solid component, peritoneal nodules, thickened enhancing peritoneum, omental nodules, thickened heterogenous omentum, ascites and enlarged lymph nodes. Similar findings were observed in other studies.[14,16-18]

According to Kawamoto et al, clear cell tumors are frequently unilocular cysts with one or more solid tumor nodules protruding into the cavity. There was one case of clear cell carcinoma diagnosed on histopathology which was wrongly diagnosed as benign lesion on CT because of the absence of typical morphological features of malignancy.[19]

CONCLUSION:

MDCT was found to be a valuable modality of imaging in differentiating benign and malignant adnexal masses with accuracy of 93.9%. Likewise, accuracy of MDCT for detecting benign masses was 94.4% and 86.1% for detecting malignant masses. Based on our study, it can be concluded that MDCT can be helpful to differentiate various benign and malignant adnexal masses based on typical MDCT characteristics.

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