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Characterization of Adnexal Masses Using Multidetector Contrast-Enhanced CT Scan – Recognising Common Pitfalls that Masquerade as Ovarian Cancer

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ABSTRACT

Adnexal masses are growths that form near the uterus; the majority being ovarian tumours. Although there is no established population-screening tool for detecting ovarian cancer, ultrasound and contrast-enhanced computed tomography (CECT) are useful imaging tools in the management of adnexal masses. Our study aimed to determine the characteristics of malignant adnexal masses on CECT scan and to describe common pitfalls in diagnosis of ovarian cancer when interpreting images. We also determined the sensitivity and specificity of diagnosing ovarian cancer using CECT. A retrospective study was conducted in Hospital Serdang using data from all patients who underwent CECT scan and detected with adnexal masses, and had histopathological examination correlation from January 2013 until January 2015. Out of the 64 cases analysed; the majority of malignant lesions were serous carcinoma of the ovary (40%). The CECT scan characteristics, tumour consistency of mixed type, presence of wall enhancement, septations, ascites and peritoneal nodule/omental caking were significantly associated with ovarian malignancy ($p<0.05$). The sensitivity, specificity, PPV and NPV of CECT scan was 95.45%, 71.43%, 63.63% and 96.77% respectively. Contrast-enhanced computed tomography scan is a good, non-invasive method to diagnose ovarian cancer. By using a pro-forma document as a guide, good results can be achieved to help differentiate between benign and malignant lesions. Nevertheless, caution needs to be exercised in interpreting cases that mimic features of malignancy.

Keywords: Accuracy, computed tomography, diagnosis, ovarian cancer

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INTRODUCTION

Adnexal masses are growths that form on the tissue near the uterus, usually in the ovary or fallopian tube. These include a spectrum of

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conditions from gynaecologic and non-gynaecologic sources, which may be benign or malignant in nature. Benign gynaecologic masses include ovarian cysts and ectopic pregnancy, while ovarian carcinoma and fallopian tube carcinomas are examples of malignant gynaecologic masses. The non-gynaecologic masses may include appendicitis and metastatic tumours that originate from other parts of the body such as breast cancer and colon cancer (Givens et al., 2009).

In 2007, the National Central Report (NPC) recorded 658 cases of ovarian cancer, making it among the top four most common cancers affecting Malaysian women. The crude incidence rate (CR) among Malaysian females in 2007 was 6.9 per 100 000 general population and the age-standardised rate (ASR) was 7.8 per 100 000 general population (Ministry of Health Malaysia, 2011).

Ovarian masses are detected during pelvic examination and confirmed using screening tests such as blood test, imaging, and biopsy/surgery for histopathological examination that has been the gold standard in diagnosing ovarian cancer. Initial examination involves gynaecological assessment of the pelvic area to look for any signs of ovarian tumours such as enlarged ovary and ascites. Additional tests such as tumour markers assay and radiological diagnostic imaging may be necessary to aid in the diagnosis. Tumour marker levels e.g. CA125 have been used to predict the presence of malignancy in women with a pelvic mass, monitor response to chemotherapy, and detect possible relapse after initial response to treatment (Granato et al., 2012).

Unfortunately, even though CA125 is elevated (>35 U/ml) in more than 80% of patients with epithelial ovarian cancer, it is only 25% sensitive towards detection of early disease (Togashi, 2003). There are variable results of sensitivity of CA125 to detect ovarian cancer which ranges from 61-90%, and specificity ranging from 35-91% (American College of Obstetricians and Gynecologists, 2007). As a matter of fact, CA125 can be elevated in many other clinical conditions, including both malignant and benign, such as leiomyomas, endometriosis, pregnancy, and pelvic inflammatory diseases, and is even associated with the presence of excessive peritoneal fluid.

Furthermore, the sizes of adnexal lesions are frequently underestimated using abdominal and pelvic examination techniques alone (Padilla et al., 2000). Conversely, semi-invasive and invasive procedures such as peritoneal fluid aspiration and cytology, laparoscopic or computed tomography (CT) guided biopsy of ovarian cancer or explorative laparotomy, debulking surgery and biopsy are some of the definite ways to diagnose ovarian cancer.

Consequently, much effort has been put into developing non-invasive methods for detecting and characterising adnexal tumours. Thus, the advent of sophisticated imaging tools, such as CT scan, MRI and PET/CT scans, has enabled a non-invasive method for the assessment of adnexal masses. Hence, cross sectional diagnostic imaging can facilitate the diagnosis, and characterisation of tumours, as well as guide in disease staging, monitor treatment response and evaluate for suspected cancer recurrence. Ultrasound via trans-abdominal or trans-vaginal approach is the first line imaging of choice when ovarian cancer is suspected. Magnetic resonance imaging gives good soft tissue resolution and has good specificity in detecting and characterising soft tissue cancers, including breast cancers (Suppiah et al., 2013); however, it can be costly and time consuming.

Advantageously, computed tomography (CT) scan can act as a fast, reliable, reproducible and reasonably cost-effective means for characterising adnexal masses and diagnosing ovarian cancer. Contrast-enhanced CT scan is performed when ultrasound findings are equivocal or if the abnormality extends beyond the pelvis or field of view achievable with the endovaginal probe requiring further characterisation (Bennett et al., 2002).

The CT scan enables cross-sectional and three-dimensional imaging of internal organs and structures of the body that helps in the detection and staging of cancer. The advantages of CT scan is that it helps in diagnosing and guiding treatment for a wider range of conditions in an accurate manner. It also provides additional information that can be useful for preoperative evaluation and treatment planning, which includes information on surgical resectability (Santoso et al., 2013). The accuracy for characterising ovarian tumours using CT scan compared with ultrasound is 94% vs. 80% (Santoso et al., 2013) whereby the former also produces better quality images and an improved spatial resolution of the pelvic region anatomy compared with the latter.

Previous studies have assessed the sensitivity and specificity of abdominal CT scan in detecting ovarian cancer in correlation with histopathological examination (HPE) findings (Kubik-Huch et al., 2000 and Sebastian et al., 2008). Sensitivity as high as 100% and specificity of 67% have been reported (Kubik-Huch et al., 2000). Nevertheless, other studies have reported lower sensitivity of 89% and specificity of 59% (Sebastian et al., 2008).

The objective of this study was to determine the sensitivity and specificity of detecting ovarian cancer using contrast-enhanced computed tomography scan and to characterise ovarian cancer subtypes. By using a pro-forma document, we aimed to help reduce common pitfalls that lead to misdiagnosis of adnexal lesions.

METHODS

We conducted a retrospective cross-sectional study in Serdang Hospital, Selangor, a tertiary referral, government hospital institution, after receiving ethical approval from our institutional and national ethical committees (Ethical approval reference: FPSK(EXP15-medic) U035 and NMRR-15-497-25521). We retrospectively recruited all female patients who underwent contrast-enhanced CT scan (CECT) of the abdomen and pelvis between January 2013 and May 2015. Using Serdang Hospital's IT environment software called Total Hospital Information System (T-HIS), we selected Malaysian female patients with adnexal masses who had undergone both CECT of the abdomen and pelvis as well as biopsy with histopathological investigation. We excluded all patients with inconclusive histopathological findings on adnexal lesion and incomplete images of CECT scans.

The CECT scans were performed on a SOMATOM Definition Flash (Siemens Healthcare, Munich, Germany) 128-slice CT scanner. Initial topogram acquisition was followed by abdominal scan performed 60 seconds after intravenous injection of the water soluble low osmolar-iodinated contrast media, by means of an automatic power injector at a rate of 2 – 3 ml/s, 1.5 – 2.0 ml/kg body weight. This was done to acquire porto-venous phase of CECT scans. Image reconstruction of 1 and 5 mm slice thickness and multiplanar reformatting in sagittal and coronal planes were also performed.

Secondary data was accessed from Serdang Hospital using the Centricity Database at Radiology Department and Hospital Information System (HIS). A pro-forma was used to collect information on patients' age, race, parity, CECT findings, and biopsy results (please refer to Appendix A). In the Centricity application of hospital PACS system, present researchers retrieved CECT scan images that fulfilled the study inclusion criteria and removed image overlay that identified the patient. All patients were assigned a code number and the relevant scan images were saved onto a CD. Two experienced radiologists, SS and HAH, were blinded to the patients' information and reviewed the images separately.

Subsequently, SS and HAH filled up the designated pro-forma document, with information regarding the features of the CECT scan images of the study patient, by consensus. We then traced the histological examination (HPE) results and correlated it with CT scan findings. All information pertaining to patient identity was omitted from the pro-forma document as well as the final data sheet for the purpose of protecting patient privacy and for data protection.

Social Package for Social Science (SPSS) version 22 was used for data analysis. The study used p-value of less than 0.05 ($p<0.05$) and 95% confidence interval (CI 95%) as statistically significant. Chi-Square test or test was used to measure the association between the adnexal lesions with age groups and ethnic groups. We used Fisher's exact test to evaluate the relationship between tumour consistency, presence of septation, omental caking or peritoneal thickening, and presence of ascites with the diagnosis of malignancy. We also calculated the sensitivity, specificity, PPV and NPV of CECT in diagnosing ovarian cancer using histopathological findings as a gold standard.

RESULTS AND DISCUSSION

We accessed approximately 1450 CT scans of patients undergoing CT abdomen and pelvis during the study period, January 2013 - May 2015. We identified 121 cases with adnexal masses. However, only 64 cases were suitable for final data analysis because they had retrievable histopathological examination (HPE) results. Based on histopathological results, we identified 22 malignant and 42 benign lesions.

Socio-demographic and descriptive analysis

The subjects of this study were aged between 14 and 76 (mean age 46.80 ±15.19). Previous study found that the mean age of 104 patients with clinically or sonographically detected complex adnexal masses was 50 years (Sohaib et al., 2003). Based on Erikson's psychosocial stages (Rosenthal et al., 1981), we divided the patients into five broad age categories: adolescence (13-19years), adult (20 – 39years), middle aged (40 – 64years), and elderly (65 years above). The majority of the study population were middle-aged women (55%, n=35). The adolescence age group was the minority (3%, n=2). The patients with benign lesions ranged in age between 14 and 76 years (mean age 47.0 ±13.4). The age of patients with malignant lesions ranged between 15 and 74 years (mean age 50.55 ±17.85). Although there wasn't a statistically significant association between age and malignancy, there was evidence to support that risk of malignancy increases with age (Sohaib et al., 2003).

Our study population consisted of ethnic Malays, Chinese and Indians among whom Malays topped the list with 44 cases (68.8 %) followed by Chinese with 13 cases (20.3%), Indians with 5 cases (7.8%) and other ethnic minorities with 2 cases. Sixteen Malay patients (72.7%) had malignant lesions. There was no significant association between adnexal mass malignancy and age or race.

Majority of patients with adnexal tumours were nulliparous (25%). There was a balanced distribution of cases in parous patients and a marked reduction in the percentage of cases in grand multiparous women having more than 5 children. In addition, majority of the patients with malignancy were nulliparous women (27.3%). Majority of the patients were pre-menopausal women (59.4 %) whereby the latter had higher incidence of benign lesions (66.7%) compared with the post-menopausal group which had a higher incidence of malignant lesions (54.2%). Although it has been postulated that increased parity due to reduced ovulation, and thus reduced ovarian surface epithelium damage, has a protective role against ovarian cancer (Fleming et al., 2006), there was no significant association between parity, menstrual status and malignancy in this study.

Based on WHO classification, epithelial tumours account for about 75% of all ovarian tumours, and 90-95% of ovarian malignancies (Lee-Jones, 2011). Approximately 70% of epithelial tumours are high grade serous type and 5% are low grade serous carcinomas, while endometrioid and clear cell carcinomas follow with 10% each, and mucinous types account for 3% of cases (Santoso et al., 2013). Transitional or Brenner tumour, mixed and undifferentiated tumours are very rare and make up remainder of the cancer subtypes. Sex cord-stromal tumours account for about 5-10% of all ovarian neoplasms. Germ cell tumours account for about 15-20% of all ovarian neoplasms. Metastatic tumours, accounting for about 5% of ovarian malignancies, usually originate from breast, colon, endometrium, stomach and cervical cancers. There are also other types of neoplasms which develop from ovarian soft tissue or non-neoplastic processes.

This study identified 42 (66%) cases of benign lesions and 22 cases of (34%) malignant lesions. Among the benign adnexal lesion cases, 28 cases (67 %) were ovarian in origin, confirmed by HPE results. There were 14 cases (33%) of non-ovarian benign cases whereby 12 were uterine in origin (86%, n=12) while only one each originated from the fallopian tube (7%, n=1) and bowel (7%, n=1). These were mostly endometriosis lesions (79%, n=11) while the rest were enteric retention cyst, fallopian tube cyst and fibroma, each represented by one case. On the other hand, benign lesions of ovarian origin were categorised as physiological follicles, cysts, leiomyoma, mucinous cystadenoma, serous cystadenoma and teratoma based on HPE results. Cysts were the most common of all benign ovarian lesions encountered in this study (29%, n=8) while leiomyoma and serous cystadenoma accounted for only one case each.

There were 22 cases (34%) of malignancy based on HPE results and out of these 7 (32%) were non-ovarian lesions that included uterine in origin (23%, n=5) and metastatic lesions (9%, n=2). There were 15 cases (68%) of malignant lesions having ovarian origins. Malignant non-ovarian lesions were grouped into metastatic uterine adenocarcinoma (28.6%, n=2) and endometrioid adenocarcinoma (71.4%, n=5). There were 15 primary ovarian cancers (Table 1) that were mostly serous adenocarcinoma (40%, n=6). The two least common cases were malignant mixed germ cell tumours and adenocarcinoma each represented by one case.

Table 1
Distribution of Malignant Ovarian Lesions by HPE Results. (N=15)

Malignant ovarian HPE results	No of cases	Percentage (%)
Dysgerminoma	2	13
Clear cell carcinoma	3	20
Malignant mixed germ cell tumour	1	7
Serous carcinoma	6	40
Adenocarcinoma	1	7
Seromucinous carcinoma	2	13
Total	15	100

Common characteristics of adnexal masses detected on abdominal CECT scan

Certain types of adnexal mass characteristics were highlighted in the pro-forma document (please refer to Appendix). These were frequently reported findings in cases of ovarian malignancy, which included the consistency of the lesion, wall enhancement, loculation, septation, sizes of mass, presence of ascites and also presence of peritoneal nodule or omental caking (Jung et al., 2002).

Consistency of adnexal lesions

There was a significant association between the types of consistency of the adnexal lesions and benign or malignant results based on HPE ($p < 0.001$). The majority of cystic lesions (95.8%) were confirmed to be benign. These lesions were purely cystic, having no evidence of solid components, internal septations or papillary projections (Figure 1). Conversely, the mixed solid-cystic type of tumours was mostly malignant (55.9%). Majority of lesions identified by this study were mixed solid-cystic type which could be due to the centre receiving more complex cases as it is a tertiary referral centre. However, this finding differs from previous studies (Slanetz et al., 1997 and Chang et al., 2006) in which most of the CT scan findings were predominantly cystic in consistency. This is due to the higher prevalence of the epithelial type of ovarian tumours in the general population; which more often than not consistent of the cystic type. On the other hand, the mixed solid-cystic types of tumours are more commonly observed in metastatic diseases (Brown et al., 2001).

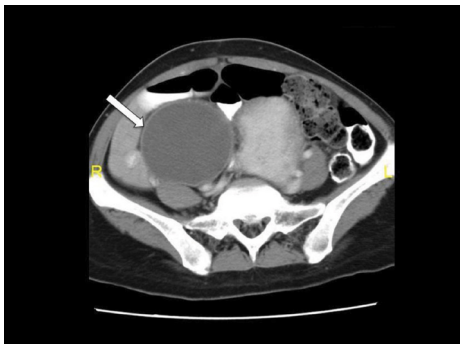

Figure 1. Simple, purely cystic, unilocular ovarian cyst, consistent with a benign cyst (white arrow). Note the absence of internal septations or solid components which are usually associated with complex lesions.

Wall enhancement of adnexal lesions

There was a significant association between lack of wall enhancement and benign lesions. Adnexal lesions that did not have wall enhancement were interpreted as benign and the researchers correctly identified 92.9% of benign cases. Only one malignant lesion lacked wall enhancement, i.e. low grade serous carcinoma of the ovary. Generally, most adnexal lesions demonstrated wall enhancement; in addition, mild wall enhancement was also seen in 49% of benign tumours. This can be attributed to physiological uptake in women of reproductive age.

Type of loculation of adnexal lesions

The study identified 30 cases of unilocular tumours in which 27 (76.7%) were benign in nature. However, there was also an almost equal distribution of benign and malignant cases that showed multiloculations. Therefore, there was no statistically significant association between types of loculation with HPE. Findings by Brown et al. (2001) are consistent with findings of the present study as they also reported an even distribution of both types of loculations.

Presence of septation in adnexal lesions

The present study found majority of the adnexal lesions had presence of septations (70.3%). This finding was supported by an earlier study by deSouza et al. (2005) where it reported majority of their cases (84%) presented with septations. They stated that septations are more prominent in invasive tumours compared with borderline tumours. The majority (93.3%) of the cases that lacked septations, were confirmed to be benign. However, in lesions that demonstrated presence of septations, 42.2% were malignant lesions and the rest were benign lesions. Fisher's exact test identified, a significant association between septation and HPE i.e. absence of septations indicated the lesion was likely to be benign.

Size of adnexal lesions

Simple, unilocular, cystic adnexal lesions that are small in size (< 5 cm), tend to run a benign course and have a low risk of undergoing malignant change (Ekerhovd et al., 2001). Therefore, the study grouped the lesions into small (less than 5cm in diameter); and large (more than 5 cm in diameter) in the pro-forma document (please refer to Appendix A). It was noted that the adnexal lesions measuring less than 5cm were mostly histopathologically confirmed benign lesions (66.7%). Contradictory to our expectations, the majority (65.3%) of the bigger lesions with sizes more than 5cm were also determined to be mostly benign by HPE. Therefore, we did not detect any significant association between sizes of adnexal masses and HPE.

Presence of peritoneal nodule or omental caking

On CT scan images, peritoneal implantation are reported when nodular, plaque-like, or infiltrative soft tissue lesions with abnormal enhancement are seen in the peritoneal fat or

on the peritoneal surface. Omental invasion is diagnosed when there is a nodular pattern; infiltrative or feathery pattern; or cake-like appearance of enhanced soft tissue in the omentum (Kitajima et al., 2008 and Coakley et al., 2002). Based on the present study, the cases that had peritoneal nodule or omental caking were mostly primary malignant (75%) and metastatic. In cases that did not demonstrate peritoneal nodule or omental caking, the majority (65.6%) of them were benign lesions. There were 3 cases (25%) of false positive findings i.e. peritoneal nodule identified in benign conditions, such as in endometriosis, as this may be caused by reactive inflammation of the peritoneum or even endometriotic deposits in the peritoneal lining (Figure 2). Nevertheless, there was a statistically significant association between presence of peritoneal nodule and malignant HPE.

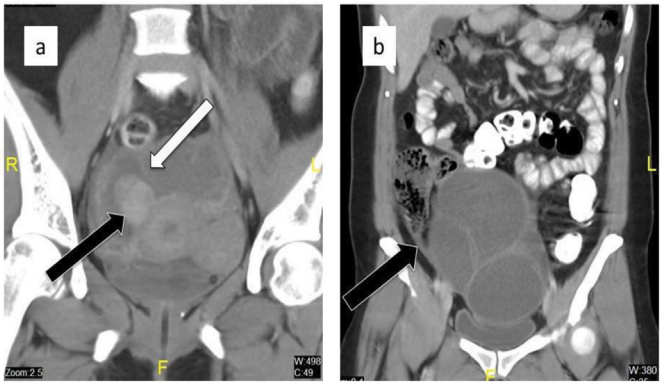

Figure 2. Commonest mimicker of ovarian cancer is ovarian endometriosis. (a) An endometrioma demonstrating mixed solid-cystic consistency (black arrow), internal septations (white arrow) and wall enhancement. (b) Presence of peritoneal nodules, which are likely due to deposits of endometriosis (black arrow).

Presence of ascites

There was an equal chance for benign and malignant lesions to have presence of ascites. Nevertheless, the majority (76.3%) of benign lesions did not have concurrent ascites whereas most malignant cases had presence of ascites. A study done Jung et al. (2002) also stated that the findings of lesion with ascites increase diagnostic confidence for malignancy. There was a significant association between ascites and HPE in the present study i.e. absence of ascites correlates with benign diagnosis.

The sensitivity, specificity, positive predictive value, negative predictive value of CT scan to detect ovarian cancer

Based on our pro-forma document, the sensitivity and specificity of contrast-enhanced CT scan in detecting ovarian cancer is 95.5% and 71.4% respectively. The positive predictive value (PPV) of CT scan is 63.6% whereas the negative predictive value (NPV) 96.8%. The slightly lower specificity was because due to a high rate of detection of false positive results

(12 cases). The commonest mimickers of malignancy were adnexal endometriosis and ovarian endometriomas (5 cases), followed by developmental follicular cysts - some having haemorrhagic component (4 cases) and the rest were mucinous cystadenoma, leiomyoma of the ovary, and infected ileum retention cyst which were represented by one case respectively (Figure 3). The high number of false positive findings was attributed to the reviewers assigning the lesions to be malignant when the lesions were indeterminate, thus having a high tendency to over diagnose malignancy. We had one false negative result that was confirmed to be an ovarian borderline seromucinous tumour with microinvasion.

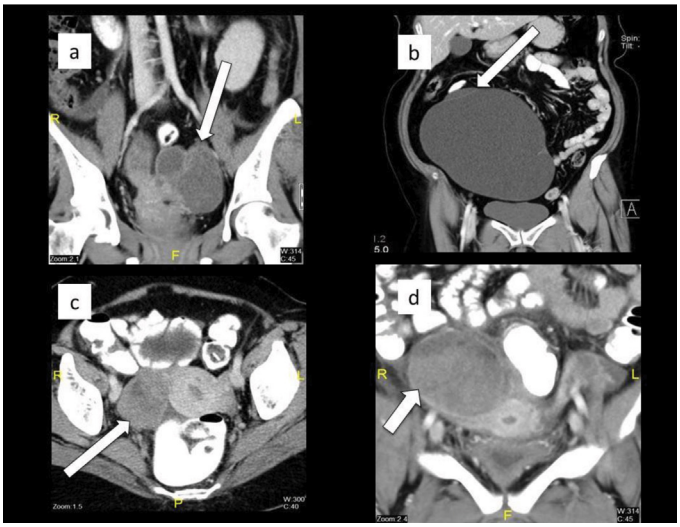

Figure 3. Adnexal lesions that masquerade as adnexal malignancy, having mixed solid-cystic consistency and internal enhancing components (white arrows). (a) Coronal view CECT Abdomen showing a haemorrhagic follicular cyst in the left adnexa. (b) Coronal view CECT Abdomen showing a large mucinous cystadenoma of the ovary. (c) Axial view CECT Abdomen showing an ovarian leiomyoma. (d)Coronal view CECT Abdomen showing an infected ileum retention cyst in the right adnexa.

Our findings on the sensitivity and specificity of CT in detecting ovarian malignancy correlated well with other studies. In general, the range for sensitivity of CT scan in detecting ovarian cancer is 73 - 85% while for specificity, it is 81 - 94% (Iyer et al., 2010). Moreover, the reported pre-operative staging accuracy of CT is 70%–90% while the reported sensitivity and specificity of CT performed before second-look surgery ranges from 59%–83% and 83%–88% respectively (Kawamoto et al., 1999). A study by Fischerova and Burgetova (2014) also stated that sensitivity of CT scan was 79% while the specificity 84%.

In the present study, the sensitivity is slightly higher compared with other studies as described earlier. This is maybe due to improved resolution in current multidetector CT scanners and the usage of pro-forma document. Classical-appearing benign and malignant adnexal lesions were successfully identified and accurately characterised using the pro-forma document as a guide (please refer to Appendix A). Nevertheless, the researchers also encountered truly negative (Figure 4), truly positive (Figure 5), falsely positive (Figure 6), falsely negative (Figure 7) as well as metastatic lesions involving bilateral ovaries (Figure 8).

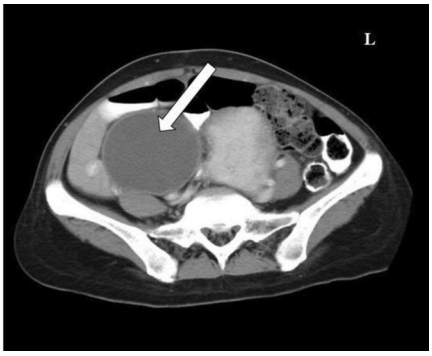

Figure 4. CECT Abdomen scan in axial view showing a benign-looking cystic lesion (white arrow) with no solid component, no septation and no concurrent ascites. HPE confirmed it to be a benign cyst in keeping with a true negative finding.

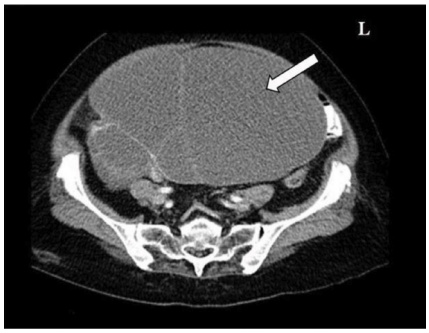

Figure 5. CECT scan showing a mixed solid cystic mass (white arrow) with septations and wall enhancement associated with peritoneal nodule that was suggestive of malignancy. HPE result confirmed that it is a malignant lesion in keeping with a true positive finding.

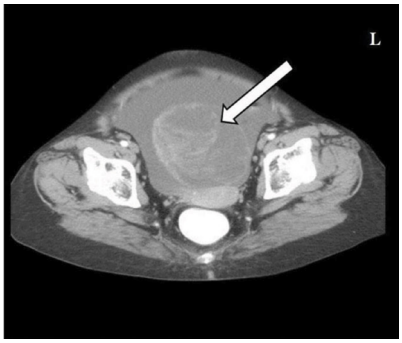

Figure 6. CECT scan showing a suspicious looking enhancing, mixed solid cystic mass (white arrow) with presence of ascites. However, HPE the result was benign endometrial cyst, in keeping with a false positive finding i.e. mimicker of malignancy.

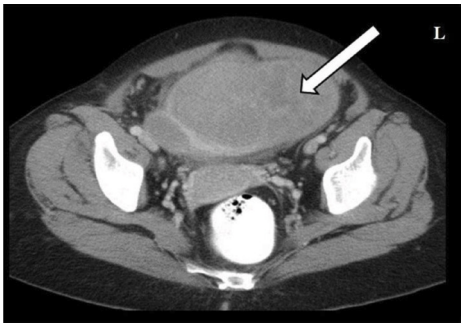

Figure 7. CECT scan showing a benign-looking cystic adnexal mass (white arrow). There was no solid component, abnormal enhancement pattern, no peritoneal nodule nor presence of ascites. However, HPE result showed it to be a borderline seromucinous tumour with microinvasion, in keeping with a false negative finding.

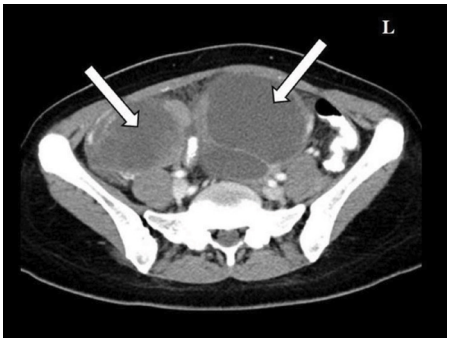

*Figure 8***.** CECT scan showing a mixed solid cystic lesion, multiloculated, septated bilateral adnexal masses (white arrows). This is an example of metastatic malignant lesions.

We noted that the commonest type of lesion masquerading as ovarian cancer is ovarian endometriomas. It is understandably a challenge to interpret these cases, as inflammatory changes occurring in endometriosis often mimic changes seen in malignancy. These changes are namely presence of solid components and septations within the cysts. Additionally, presence of concomitant peritoneal deposits of endometriosis and pelvic ascites tend to be misleading signs of potential malignancy. Therefore, we recommend correlation to be made based on clinical history, physical examination, and biochemical tests when faced with indeterminate lesions on imaging.

CONCLUSION

Contrast-enhanced computed tomography scan is a reliable, non-invasive, imaging tool which has good sensitivity but variable specificity for characterising adnexal masses and diagnosing ovarian cancer. The usage of our pro-forma document aided in the diagnosis by elucidating parameters significantly associated with ovarian cancer i.e. mixed solid-cystic consistency, presence of wall enhancement, septations, concurrent ascites and presence of peritoneal nodules.

Nevertheless, reviewers ought to be cautious of mimickers of malignancy such as ovarian endometriosis, which require further clinical correlation and may necessitate more advanced imaging for further assessment.

LIMITATION AND RECOMMENDATION

This is a retrospective, hospital-based study which may not be applicable to patients who do not come to hospital for screening of ovarian cancer although they are in the high-risk group. There may be some selection bias in terms of study population. Additionally, this research relied on secondary data and did not have control over data quality.

We recommend the use of our pro-forma document to correlate the CT scan characteristics with tumour marker levels. In this way, we can improve upon the specificity of the CT scan thus, avoiding much more invasive procedures and aid in accurate and early detection of malignancy.

Nevertheless, we note that although it has high sensitivity for detecting ovarian cancer, the interpretation of CT scan characteristics lack specificity due to similar features noted in benign conditions such as ovarian endometriosis that masquerade as malignant lesions. Thus, the utility of advanced imaging tools such as positron emission tomography / computed tomography (PET/CT) and positron emission tomography/ magnetic resonance (PET/MR) imaging may be considered in indeterminate cases.

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APPENDIX A

Pro-forma Document

Assigned ID : _____

Age : _____

Race : _____

Date of birth : _____

CA125 value : _____

Imaging date- Computed tomography (CT) : _____

Biopsy/Operation date : _____

Diagnosis of histopathological examination (HPE) : _____

Item	Imaging features	Yes	No
1.	Consistency		
	Solid component		
	Cystic		
	Mixed solid cystic		
2.	Wall enhancement		
3.	Loculation		
	Uniloculated		
	Multiloculated		
4.	Large size of mass (greater than 5cm)		
5.	Septations		
6.	Peritoneal nodule / omental caking		
7.	Ascites		

*please tick the relevant option (✓)