Significance of the "ovarian crescent sign" in the evaluation of adnexal masses

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ABSTRACT

Introduction: This paper aimed to study the ability of the "ovarian crescent sign" to predict the nature of adnexal masses and to validate the "ovarian crescent" as an ultrasonographical marker for malignancy.

Methods: A prospective study was carried out in 60 consenting women with an undiagnosed adnexal mass, attending the gynaecology service and requiring operative intervention. An ovarian crescent sign at pelvic ultrasonography was considered to be present if normal ovarian tissue was seen adjacent to the tumour area. The ultrasonographer was blinded to the reports of CA 125, and if applicable, the ascitic fluid cytology and needle aspiration biopsy. Histopathological examination report of the tumour obtained at surgery (laparotomy/laparoscopy) was considered as the gold standard.

Results: 11 of 60 biopsy specimens were positive for malignancy. Normal ovarian tissue could be identified (positive crescent sign) in nearly two-thirds of cases (65 percent) scanned. Presence of normal ovarian tissue was identified in 97 percent of the benign masses. The sign was not seen in ten of the 11 cases with malignancy.

Conclusion: The ovarian crescent sign as a method in prejudging the adnexal masses was found to have high sensitivity (90.9 percent) and high negative predictive value (97.4 percent).

Keywords: adnexal mass, ovarian cancer, ovarian crescent sign, ultrasonography

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INTRODUCTION

Ovarian cancer continues to have the highest mortality of all gynaecological malignancies and is the least able to be diagnosed at an early stage. It is the fourth most common cause of cancer death in women, and the leading cause of gynaecological cancer death in the developed world,[1] with nearly 75% spread beyond the ovaries at the time of diagnosis. In the early stages, as in stage I, the reported survival is as high as 90%.[2] Over the past decades, various methods to preoperatively identify the probability of adnexal mass as malignant have been tried. There are no universally-accepted criteria for distinguishing between benign and malignant conditions on the basis of ultrasonographical findings. Several systems for classifying and scoring the abnormalities in the form of a morphological index have been described,[3-8] including a combination of factors calculated and scored as risk of malignancy index (RMI).[9-11]

Studies have shown that Doppler ultrasonogaphy (US) does not provide more useful diagnostic information than transvaginal US or estimation of CA 125.[12] Besides, the facility is not available at every healthcare delivery centre. The quest for a less cumbersome, more accurate and ubiquitously available method continues. Presence of normal ovarian tissue adjacent to the tumour tissue (ovarian crescent sign) on US is claimed to predict the nature of the tumour preoperatively.[13] It was found to be a sensitive marker, less cumbersome, non-calculative, inexpensive, and one with a dependable specificity. The present study aimed to evaluate the ability of the ovarian crescent sign to predict the nature of the adnexal mass and to validate the ovarian crescent as an ultrasonographical marker for malignancy.

METHODS

The study was carried out prospectively in accordance with the declaration of Helsinki and its subsequent revisions, and was approved by the hospital ethics committee. 60 consecutive consenting women attending the gynaecology service with an adnexal mass and requiring operative intervention were included in the study. Excluded were the cases reporting with a proven diagnosis of malignancy. The ultrasonographer carrying out the scanning was blinded to the report(s) of serum

CA 125 estimation, ascitic fluid cytology and needle aspiration biopsy of tumour. Transvaginal (5 MHz frequency) and/or transabdominal (3.5 MHz frequency) ultrasonographical evaluation was carried out using the available machines (Ultramark 4, Toshiba Nemio 20, General Electric Logic 200). Ovarian crescent sign was considered to be present if normal ovarian tissue was present adjacent to the tumour. Criteria used to identify the normal ovarian tissue were: (1) hypoechogenic tissue with or without ovarian follicles located adjacent to the cyst wall; (2) not separated from the cyst by applying a moderate amount of pressure; and (3) enclosed within the ovarian capsule encircling the tumour.[13]

Serum samples were collected preoperatively and serum CA 125 levels were measured using electroimmunoluminescence assay (ELECSYS 2010, Roshe Diagnostics, Germany) in accordance with the manufacturer's instructions. A serum CA 125 level of 35 U/ml was considered as the upper limit of normal and a score of ≥ 200 was indicative of a malignant lesion. RMI was calculated using an ultrasound score (U), menopausal status score (M) and serum CA 125 levels to calculate three different RMIs.

$$RMI = U \times M \times CA\ 125$$

Presence of multilocular cystic lesion, solid areas, bilateral lesions, ascites and intraabdominal metastasis were noted at US. Each finding was scored 1 point and total U was calculated. Postmenopausal status was defined as more than one year of amenorrhoea with intact uterus or age older than 50 years in women who had a hysterectomy. Women who did not meet these criteria were classified as premenopausal. Different weightage was given to the variables in three different RMI systems. RMI 1: Ultrasound values from 0 to 3 (3 for scores ≥ 2); 1 it premenopausal, and 3 if postmenopausal.[9] RMI 2: Ultrasound values of 1 and 4 (1 for scores up to 2, and 4 for ≥ 2); 1 for premenopausal status, and 4 for postmenopausal status.[10] RMI 3: Ultrasound values of 1 for scores up to 2, and 3 for beyond that; 1 and 3 for pre- and postmenopausal status, respectively.[11]

Histopathological examination report of the tumour obtained at surgery (laparotomy/laparoscopy) was considered as the reference of gold standard. All statistical analyses were performed using the Statistical Package for Social Sciences version 11.0 (SPSS Inc, Chicago, IL, USA). Sensitivity, specificity, positive predictive value and negative predictive value (NPV) were calculated. The chi-square test was applied to test the significance of differences between proportions. A probability (p) value of < 0.05 was considered as significant.

Table I. Histopathological diagnosis of adnexal tumours.

Diagnosis	No. of cases
Malignant disease	
Serous cystadenocarcinoma	4
Endometroid adenocarcinoma	4
Serous cystadenocarcinoma of low malignant potential	2
Malignant carcinoid of ovary	1
Total	11
Benign disease	
Mucinous cystadenoma	13
Endometriosis	10
Serous cystadenoma	8
Dermoid cyst	6
Follicular cyst	5
Fibroid uterus	2
Ovarian abscess	1
Paratubal cyst	1
Paramesonephric cyst	1
Hydrosalphinx	1
Fibrothecoma	1
Total	49

RESULTS

11 of 60 specimens (18.3%) were reported as having a malignant nature of the disease. Except for one case of carcinoid, all the malignant tumours were epithelial in origin, more than half being serous cystadenocarcinoma (six of 11, 54.5%). There was one case at stage 2 and all others were of stage 3 level (four of 3B and six of 3C). The stage 2 and stage 3B cases, all serous cystadenocarcinomas, were borderline tumours. Among the cases with benign nature of the disease group, epithelial ovarian cystic tumours comprised 42.9% (21 of 49). Endometriotic lesions were the next common entity, comprising a fifth of all the benign tumours (ten of 49, 20.4%). There was a case of ovarian abscess and hydrosalphinx, apart from two cases of subserous fibroid, that were preoperatively considered as adnexal masses (Table I). The mean age of cases studied was 41.4 ± 14.45 years, with the youngest aged 19 years and the eldest 78 years. Eight of 11 malignant masses were from women older than 30 years. The proportion of cases with malignancy was higher in women beyond 50 years ($p = 0.366$). Menopausal state did not appear to influence the occurrence of malignant change ($p = 0.277$).

At US, normal ovarian tissue could be identified in nearly two-thirds of cases (39 of 60, 65%) scanned. But the visualisation rate was significantly lesser in postmenopausal women ($p = 0.023$). The benign lesions with an absent ovarian crescent sign had a significantly higher mean ovarian volume than those with a positive sign (1,272.5 and 454.3 ml, respectively; $p = 0.037$). Among the 49 benign lesions, it was not possible to delineate normal ovarian tissue in the vicinity of the

Table II. Ovarian crescent sign and the nature of the adnexal mass (n = 60).

Ovarian crescent sign	No. (%) malignant cases	No. (%) benign cases	p-value*
Absent (n = 21)	10 (47.6)	11 (52.4)	0.00
Present (n = 39)	1 (2.6)	38 (97.4)	

Sensitivity 90.9%; specificity 77.6%; positive predictive value 47.6%; negative predictive value 97.4%
* Statisically significant by chi-square test.

Table III. The ability of the ovarian crescent sign and risk of malignancy indices in identifying malignancy (n = 60).

Test	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
RMI 1	72.7	89.8	61.5	93.6
RMI 2	81.8	83.7	52.9	95.3
RMI 3	72.7	85.7	53.3	93.3
Ovarian crescent sign	90.9	77.6	47.6	97.4
Crescent sign + RMI 2	90.9	69.4	40.0	97.3

RMI: risk of malignancy index; PPV: positive predictive value; NPV: negative predictive value

mass in 11 cases (four cases of mucinous cystadenomas, one case each of endometrioma, ovarian abscess, fibroid, ovarian fibrothecoma, cystic teratoma, and serous cystadenoma).

The sign was not seen in ten of the 11 cases with malignancy. The only case in which ovarian crescent sign was noted was the one with borderline malignancy, a stage 2 disease. Analysis of the cases with the presence of the ovarian crescent sign showed that 97% of the times, normal ovarian tissue could be identified in benign masses. Thus, the ovarian crescent sign was found to have a high sensitivity (90.9%) and high NPV (97.4%) in prejudging the adnexal masses (Table II). Application of the three available RMI calculations to predict the nature of the mass showed that among them, the RMI 2 system was more balanced with better figures for sensitivity, specificity, and NPV. In comparison, the ovarian crescent sign seemed highly sensitive with good NPV, but less specific than any of the RMI systems. Compared to RMI 2 in its ability to identify malignant adnexal masses, the ovarian crescent sign was found to be highly sensitive with good NPV, but less specific than the RMI 2 system. Combining the ovarian crescent sign and RMI 2 improved the sensitivity of the latter, but at the expense of specificity (Table III).

DISCUSSION

The study was based on the hypothesis that the presence of normal ovarian tissue adjacent to an adnexal mass (ovarian crescent sign) excludes the likelihood of a malignant lesion. In the present study, the incidence of malignant lesions in cases admitted with adnexal mass lesion was 18.3% (11 of 60 cases), which included two borderline tumours. Proportions of malignant adnexal masses have been reported to be varying from 20%[14] to 33%.[13] The latter study had only 9% of malignant tumours as borderline, whereas in the present study, it was 18%.

The mean age of the cases admitted with adnexal mass in the present study was 41.4 ± 14.5 (range 19–78) years, comparable to the group studied by Alcazar et al.[14] However, it was interesting to note that women with a malignant adnexal mass were younger by a decade when compared to the report by Hillaby et al.[13] Application of the three available RMI calculations[9-11] to predict the nature of the mass showed that, among them, RMI 2 system was more balanced with better figures for sensitivity, specificity and NPV. In comparison, the ovarian crescent sign seemed highly sensitive with good NPV, but less specific than any of the RMI systems. Combining the ovarian crescent sign and RMI 2 improved the sensitivity of the latter, but at the expense of specificity. The values for the RMI 2 in the present study were comparable to the ones obtained by Tingulstad et al.[10] Yazbek et al compared the ovarian crescent sign with the RMI and found that both were useful tests for discriminating invasive and non-invasive ovarian tumours. According to them, application of these tests in a sequential manner might improve the overall accuracy of ovarian cancer diagnosis.[15] But the present study did not find any added benefit on combining ovarian crescent sign and RMI 2.

In the group where normal ovarian tissue (ovarian crescent sign) was detected, 97.4% (38 of 39) of them were benign lesions. In the absence of the ovarian crescent sign, there was nearly a 50% chance of an adnexal mass

being malignant, thus giving the clinician a tool with high sensitivity (90.9%) and a respectable specificity (77.6%), similar to the study by Hillaby et al with a sensitivity and specificity for the ovarian crescent sign of 96% and 76%, respectively.[13] The detectability of the ovarian crescent was difficult in menopausal women, probably attributable to the lesser ovarian volume in them. Where there are masses with multiple cysts or heavily echogenic shadows, as in fibromas, dermoid cysts, endometriomas and abscesses, the identification of crescent sign may have been masked. In such cases, reliance on the crescent sign should be viewed in the backdrop of other clinical characteristics. In addition, the probability of failure to identify normal ovarian tissue in large ovarian lesions should be kept in mind. Benign lesions with the absent ovarian crescent sign had a significantly higher ovarian volume in the present study. Absence of identifiable ovarian echoes adjacent to the mass (ovarian crescent) should be taken into consideration with other ultrasonographic features and tumour markers.

In conclusion, the absence of the ovarian crescent sign in a case with adnexal mass is a sensitive marker for malignancy with a dependable specificity. When combined with other predictors of malignancy like RMI2, the ovarian crescent sign improved their performance. But the crescent sign alone has shown higher sensitivity, specificity and predictive values, making it an independent superior predictor of the nature of adnexal/ovarian mass preoperatively.

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