

Variations in Ultrasound Reporting on Patients Referred for Investigation of Ovarian Masses

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Abstract

Objective: Ultrasound characteristics play an important role in the evaluation and management of patients with an ovarian mass. We sought to quantify the variability in the reporting practices of radiologists in different practice environments

Method: We carried out a prospective audit of all patients referred to a tertiary care gynaecologic oncology clinic over a three-month period for management of an ovarian mass. Each patient's presenting symptoms, level of CA125 in serum, and previous ultrasound report were reviewed in detail, and both the environment where the ultrasound examination had been performed and the description of important predictive ultrasound characteristics for underlying risk of malignancy were noted. Descriptive statistics were used to summarize demographic variables. Cross-tabulations and chi-square tests were used to detect significant associations between categorical variables.

Results: In the three-month period, 42 patients were referred to our clinic. The most common presenting symptom was abdominal or pelvic pain (65% of patients). Ultrasound examinations had been conducted in private clinics, community hospitals, and teaching hospitals. Significant variations in the reporting were noted. The important ultrasound characteristic most often not reported (approximately 80% of reports) was Doppler flow assessment of the mass. Five reports (12%) did not include information that would be needed to make a recommendation resulting in repeat ultrasound examination. We found no significant variation in reporting practices between private clinics and community hospitals.

Conclusion: Current reporting practices for ultrasound assessments in women with an ovarian mass vary considerably. They could be improved by use of a standardized synoptic reporting template.

Résumé

Objectif : Les caractéristiques échographiques jouent un rôle important dans l'évaluation et la prise en charge des patientes présentant une masse ovarienne. Nous avons cherché à quantifier la variabilité inhérente aux pratiques de signalement des radiologistes au sein de divers milieux de pratique.

Méthode : Nous avons mené une analyse prospective de toutes les patientes orientées, sur une période de trois mois, vers une

clinique de soins tertiaires en oncologie gynécologique pour la prise en charge d'une masse ovarienne. Les symptômes, le taux sérique de CA125 et le rapport échographique précédent de chacune des patientes ont été analysés en détail; de plus, tant le milieu où l'examen échographique a été mené que la description des caractéristiques échographiques prédictives importantes en ce qui concerne le risque sous-jacent de malignité ont été notés. Nous avons fait appel aux concepts de la statistique descriptive pour résumer les variables démographiques. Des tableaux croisés et des tests de chi carré ont été utilisés pour détecter des associations significatives entre les variables nominales.

Résultats : Au cours de cette période de trois mois, 42 patientes ont été orientées vers les services de notre clinique. La douleur abdominale ou pelvienne (65 % des patientes) constituait le symptôme le plus courant. Les examens échographiques avaient été menés au sein de cliniques privées, d'hôpitaux communautaires et d'hôpitaux universitaires. Des variations significatives ont été constatées en matière de signalement. L'évaluation Doppler de la masse constituait la caractéristique échographique importante ayant le plus souvent été omise dans les rapports (environ 80 % des rapports). Cinq rapports (12 %) ne contenaient pas les renseignements requis pour formuler une recommandation, ce qui a entraîné la tenue d'un nouvel examen échographique. Nous n'avons constaté aucune variation significative en matière de pratiques de signalement entre les cliniques privées et les hôpitaux communautaires.

Conclusion : Les pratiques actuelles en matière de signalement pour les évaluations échographiques chez les femmes présentant une masse ovarienne varient considérablement. Elles pourraient être améliorées par l'utilisation d'un modèle de rapport synoptique standardisé.

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INTRODUCTION

Ovarian cysts are commonly encountered in women in both the reproductive^{1,2} and postmenopausal age groups.³ Management of these ovarian lesions depends largely on the severity of clinical symptoms and the probability of underlying malignancy. Most ovarian cysts are benign; these will either remain the same size or resolve during follow-up without requiring surgical intervention. However, a small proportion of these lesions represent an evolving neoplastic process. It is important to differentiate between commonly encountered functional ovarian cysts

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with little clinical significance and potentially malignant cysts that require urgent surgical evaluation. The difficulty in management results from the wide overlapping radiographic appearance of benign and malignant pathologic conditions that can involve the ovaries. Furthermore, invasive abdominal surgery is often required to rule out completely the possibility of underlying cancer. With advances in imaging techniques and equipment, both transabdominal and transvaginal ultrasound offer clinicians the ability to examine the morphology of ovarian lesions in an efficient, accurate, and detailed manner.^{4,5} A number of scoring systems of have been developed and prospectively validated to provide clinicians with an estimate of the risk of malignancy associated with an ovarian lesion.^{6,7} Ultrasound findings are an integral component in the derivation of these risk scores. A recent mathematical modelling study established ultrasound characteristics of ovarian lesions that are important to differentiate between benign and malignant masses.⁸ The challenge for diagnostic imaging is that a significant number of these characteristics are not routinely reported, and some measurements may be subjective and operator-dependent.⁹ Clearly, to use all the discriminatory value that diagnostic ultrasound has to offer, a standardized examination approach allowing for consistent and reproducible reporting of findings is needed, as proposed by the International Ovarian Tumor Analysis Group.¹⁰

We prospectively studied the practice of diagnostic imaging reporting with respect to ovarian masses in order to quantify variations and to develop strategies to improve ultrasound reporting.

MATERIALS AND METHODS

We reviewed the Medline and PubMed databases to identify (1) characteristics reported on ultrasound assessment that have been established to be of value in identifying a malignant ovarian mass and (2) the ultrasound components commonly used in the derivation of risk of malignancy scoring systems, as validated in prospective studies. Our literature review identified eight characteristics of ultrasound assessment that were significantly associated with an elevated underlying risk of malignancy in women with an ovarian mass^{11–13}:

1. Increased diameter of the mass of more than 10 cm¹⁴
2. Complexity of the mass consisting of multiple thick septations
3. Bilaterality of the ovarian abnormalities
4. Presence of internal solid component or growths
5. Doppler flow patterns indicating increased central vascular flow

Table 1. Distribution of patients' presenting symptoms (N = 42)

Presenting symptoms	Present (%)	Absent (%)
Family history of cancer	45.7	54.3
Abdominal pain	65	35
Bloating	18	82
Increase in abdominal girth	16	84
Vaginal bleeding	21	79
Urinary symptoms	9	91

6. Presence of ascites
7. Presence of pelvic nodularities (nodules in the cul de sac or pelvic peritoneum, identifiable on ultrasound)
8. Other associated pelvic abnormalities, such as presence of pelvic fluids or solid masses involving surrounding pelvic organs

From March 1 to June 1, 2006, all new patients referred to a tertiary outpatient gynaecologic oncology clinic for investigation and management of an ovarian lesion were included in the study. Patients' demographics, including age, presenting symptoms, and serum CA125 were recorded. From the ultrasound report that accompanied each patient's referral letter, we recorded whether each ultrasound characteristic identified from our literature review was mentioned in the report and, if so, how it was described. We also recorded in what location the ultrasound examination was performed. In our referral area, ultrasound examinations are commonly performed in private physician clinics, in community hospitals (which do not provide a full range of specialized medical services), and in tertiary referral centres with postgraduate specialty training programs. We also recorded the disposition of the case after the initial consultation.

Descriptive statistics were used to summarize the distribution of patients' demographics and the reporting variation for each targeted ultrasound characteristic. Chi square and Fisher exact tests were used to identify statistically significant associations between categorical variables. All *P* values of less than 0.05 were considered to be statistically significant. SPSS for Windows (Version 15, Chicago IL) was used for all data analysis.

RESULTS

Forty-two new patients were assessed in our clinic over the three-month period, and each had referral ultrasound reports and serum CA125 measurements. The median age was 58.4 years (range 23.7–84.6). Approximately one half of the patients had a family history of cancer. The most common significant initial presentation was abdominal and pelvic discomfort (65%), followed by vaginal bleeding (21%).

Table 2. Distribution of non-reported ultrasound characteristics (% of all reports) stratified by location of ultrasound examination (N = 42)

Location of US examination	Size	Complexity	Bilaterality	Presence of solid components	Doppler patterns	Presence of ascites	Pelvic nodularities	Other associated abnormalities
Private clinic	2	14.3	14.3	33.3	76.2	47.6	90.5	14.3
Community hospital	2	16.7	11.1	50	94.4	50	88.9	16.7
Teaching hospital	0	0	0	0	0	66.7	100	0

The median serum CA125 level was 44.5 kU/L (range 1–3684). The distribution of patients' demographics and presenting symptoms is summarized in Table 1.

Referral ultrasound examinations were performed predominantly in private clinics (50%) and community hospitals (43%). Teaching hospital units performed 7% of all initial referral ultrasound evaluations. The most consistently reported characteristic of an ovarian mass was its size, with only two reports not commenting on this variable. The presence of pelvic nodularity was not reported in 90.5% of patients; the presence of ascites was not reported in 50%, Doppler flow measurements were not reported in 79%, and the presence of internal solid components was not reported in 38%. No specific comment was made on the complexity of the mass in 14.3%, on the bilaterality of the lesion in 2%, or on the presence or absence of any other associated abnormalities in 14.3% of reports. There was no significant difference between private clinics, community hospitals, and teaching hospitals in the frequency of non-reporting for most identified characteristics. The only characteristic that was significantly more likely to be commented on in the final ultrasound report was the assessment of Doppler flow patterns. This was mentioned in the reports from all ultrasound examinations performed in a teaching hospital environment, whereas Doppler measurements were reported in only 76.2% and 94% of reports of ultrasound examinations performed in private clinics and community hospitals respectively ($P = 0.001$). In teaching hospitals the gynaecologic oncology service communicated directly with the ultrasound unit located in the same hospital.

Reports originating from private clinics and from community hospitals had equivalent levels of reporting completeness with regard to any ultrasound characteristic. The distribution of missing information in ultrasound reports, stratified by the location of examination, is summarized in Table 2. Of note, five reports (12%) did not include adequate information, leading to the recommendation for an immediate repeat ultrasound examination before management decisions could be made. Thirty-five patients (83%)

proceeded to surgical evaluation of the ovarian lesion. The final pathology was benign in 52% of surgically evaluated patients, borderline tumour in 14%, and ovarian cancer in 34%.

DISCUSSION

Our prospective audit confirmed wide variation in ultrasound reporting practice regarding the characteristics of an ovarian mass. No ultrasound report in our study mentioned all of the ultrasound features that have been linked with an elevated risk of underlying malignancy. This is of concern, because our study population can be regarded as being at relatively high risk for ovarian cancer. Most of our patients were in the perimenopausal or postmenopausal age groups and had significant gynaecologic symptoms such as pelvic pain, vaginal bleeding, and abdominal bloating. Symptoms such as unusual bloating, fullness, increased abdominal pressure, abdominal or back pain, and lack of energy are common in women with ovarian cancer, as suggested in a number of recent reports.^{15–18}

It is well established that the prognosis in women with ovarian cancer improves with diagnosis at an earlier stage.^{19,20} Screening protocols for early ovarian cancer have mainly utilized a combination of CA125 tumour markers and ultrasound characteristics of the ovaries.^{21,22} Due to a wide overlap between benign and malignant ovarian lesions, and the relatively low prevalence of ovarian cancer in the general population, the positive predictive value of an abnormal ultrasound screen is not high enough to be used in asymptomatic women.²³ However, in symptomatic women with a clinically detectable pelvic mass, gynaecologic ultrasound examination performed by a skilled examiner using a high definition ultrasound system can accurately differentiate between benign and malignant masses. Subjective evaluation of grey scale ultrasound images for the diagnosis of malignancy has a sensitivity ranging from 82% to 100%, with a false positive rate of 3% to 40%.^{24–26} Ultrasound has also been proven to be as good as, or better than, CT scanning or MRI in differentiating between pelvic tumours,

making ultrasound the preferred initial test in patients with an ovarian mass.^{27, 28} As the quality of ultrasound equipment continues to improve, a number of diagnostic algorithms have been investigated to further improve its sensitivity and specificity. A recent meta-analysis reviewed 89 data sets from 46 studies involving 5159 patients: 35 sets used morphologic information, 36 measured Doppler ultrasound indexes, 10 assessed tumour vascularity with colour Doppler flow imaging, and eight used combined techniques.²⁹ Summary receiver operating characteristic curves showed significantly higher performance for combined techniques than for morphologic information ($P = 0.003$), Doppler ultrasound indexes ($P = 0.003$), or colour Doppler flow imaging alone ($P = 0.001$). The Q* point for combined techniques was 0.92 (95% confidence interval [CI], 0.87–0.96) versus 0.85 (95% CI 0.83–0.88) for morphology, 0.82 (95% CI 0.78–0.86) for Doppler ultrasound, and 0.73 (95% CI 0.58–0.87) for colour Doppler flow imaging. Morphologic assessment showed a trend towards better performance than colour Doppler flow imaging ($P = 0.09$) or Doppler ultrasound indexes ($P = 0.07$). Doppler US index results were better in earlier studies ($P = 0.005$). The authors of this meta-analysis concluded that the combined US techniques perform significantly better than morphologic assessment, colour Doppler flow imaging, or Doppler US indexes alone in characterizing ovarian masses. Attempts at combining multiple ultrasound characteristics to determine the underlying risk of malignancy resulted in the development of a number of risk of malignancy index scores to assist clinicians in the management of these ovarian lesions.^{30–32}

It follows from the discussion above that a comprehensive ultrasound report is urgently needed to use the diagnostic potential of pelvic ultrasound fully. At present, there are no practice guidelines defining which ultrasound characteristics of an ovarian lesion should be included in the report, which makes the application of the risk of malignancy index scores difficult. Variation in reporting practices among physicians was observed in our study across all practice environments. The presence or absence of pelvic nodularity, ascites, and solid components were the characteristics most frequently not mentioned on the final report. Furthermore, there was a significantly higher prevalence of non-reporting of Doppler flow patterns in ultrasounds performed in private clinics and community hospitals. This is significant because the presence of central flow seen on Doppler studies in an ovarian mass significantly increases its potential for being malignant.^{33,34} From a cost effectiveness perspective, we documented that 12% of referral ultrasound reports did not include enough information to make a final management decision, thereby necessitating a repeat examination and increasing costs to the health care system.

One limitation of our study is the fact that it involved a relatively small number of patients followed over a short time. However, due to the focused nature of our clinical practice and the stable referral base, we feel that this is a fairly accurate representation of referral ultrasound reports coming through our clinic. A second limitation was our inability to determine whether key ultrasound characteristics went unreported because of failure to observe them during the examination or because the findings were normal. Only a synoptic report requiring a description of both positive and negative findings will clarify this issue. Our study design did not allow for controlling the quality of the ultrasound examinations, which would depend on the available equipment and on the skills of the ultrasonographers. We also did not have control over whether or not a transvaginal examination was performed during the assessment of the ovarian mass, because this was individually determined by the local ultrasound unit's examination protocol. A universal requirement for transvaginal ultrasound to be performed in the evaluation of a complex ovarian mass could have facilitated the assessment of the described characteristics because the ovaries are better visualized transvaginally than they are transabdominally.

We propose to establish a standardized synoptic ultrasound reporting system to facilitate the comprehensive ultrasound examination of ovarian lesions and to improve the completeness of ultrasound reports. The synoptic report template should include relevant symptoms as well as a minimum dataset of ultrasound characteristics that have been identified as important in evaluating malignant potential in risk scoring algorithms.^{11,35} A similar strategy has proven to be successful in improving the completeness of operative reports and their quality in surgical oncology and pathology.^{36,37} We believe that this standardized reporting template will further improve the usefulness of ultrasound in the evaluation of ovarian masses and thereby improve patient care. A strong collaborative effort will be required between gynaecologists and radiologists to implement this proposal.

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