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A multicenter prospective external validation of the diagnostic performance of IOTA simple descriptors and rules to characterize ovarian masses

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HIGHLIGHTS

- We externally validated IOTA clinically oriented strategy to characterize adnexal masses in three hospitals.
- 1165 ultrasound scans performed over more than two years by 36 level II ultrasonography examiners.
- The three-step clinical oriented strategy performs as well in the main IOTA study and better than the conventional RMI.

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ABSTRACT

Objectives. To evaluate the diagnostic performance of the IOTA (International Ovarian Tumor Analysis group) (clinically oriented three-step strategy for preoperative characterization of ovarian masses when ultrasonography is performed by examiners with different background training and experience.

Methods. A 27-month prospective multicenter cross-sectional study was performed. 36 level II ultrasound examiners contributed in three UK hospitals. Transvaginal ultrasonography was performed using a standardized approach. Step one uses simple descriptors (SD), step two ultrasound simple rules (SR) and step three subjective assessment of ultrasound images (SA) by examiners. The final outcome was findings at surgery and the histological diagnosis of surgically removed masses.

Results. 1165 women with adnexal masses underwent transvaginal ultrasonography, 301 had surgery. Prevalence of malignancy was 31% (n = 92). SD were able to classify 46% of the masses into benign or malignant (step one), with a sensitivity of 93% and specificity of 97%. Applying SD followed by SR to residual unclassified masses by SD enabled 89% of all masses (n = 268) to be classified with a sensitivity 95% of and specificity of 95%. SA was then used to evaluate the rest of the masses. Compared to the risk of malignancy index (RMI), the sensitivity and specificity for the three-step (SD + SR + SA) strategy were 93% (95% CI: 86–97%) and 92% (95% CI: 87–95%) vs. 72% (95% CI: 62–80%) and 95% (95% CI: 91–97%) for RMI, respectively.

Conclusion. The IOTA three-step strategy shows good test performance on external validation in the hands of ultrasonography examiners with different background training and experience. This performance is considerably better than the RMI.

Introduction

Correctly characterizing ovarian tumors prior to surgery is critical to optimize patient care, surgical setting and hence survival [1–4]. Many prediction models have been developed to help characterize ovarian masses [5–8]. For example the International Ovarian Tumor

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Analysis (IOTA) group has developed and validated ultrasound-based logistic regression models (for example LR1 and LR2) that estimate the risk of malignancy, as well as a set of ultrasound-based simple rules (SR) that characterize masses as benign, malignant, or inconclusive [6,7,9–11]. Although the performance of the IOTA models approaches the level of subjective assessment, the optimal approach to the classification of adnexal pathology remains subjective assessment of ultrasound findings by experienced examiners [12–14]. Unfortunately, such level III ultrasonography is not always available and the training and experience of clinicians performing transvaginal ultrasonography vary. We also know that a significant proportion of ovarian masses are relatively straightforward to diagnose correctly. For example the positive predictive value of ultrasonography for the diagnosis of benign simple cysts, benign teratomas and endometriomas is very high and can be identified easily using subjective impression of ultrasound images [14–17]. In such cases there is a limited requirement to use ultrasound-based prediction models or the risk of malignancy index (RMI) which often gives false positive results with endometriosis [18].

To reflect this, the IOTA group recently published a diagnostic strategy to characterize adnexal pathology using simple descriptors as a first stage test to identify "easy to classify" masses (Fig. 1) [15] These descriptors were based on the clinical experience of senior examiners. If these descriptors did not apply, the IOTA ultrasound-based SR were used. Finally in the 19% of residual masses where neither rules nor descriptors were applicable, subjective assessment by experienced examiners was used as the final test. When validated on the data from phase 2 of the IOTA study, this three-step strategy performed as well as if the entire tumor population had been assessed by an experienced examiner with a sensitivity and specificity of 92% [7,10,15]. This diagnostic approach showed a significantly better diagnostic performance than the commonly used RMI, for which sensitivity and specificity on the same data were 68% and 93% [15]. Importantly, the use of subjective impression on all masses did not perform better, with a sensitivity of 90% and specificity of 93%. However this novel approach has not been subjected to external validation and has not been shown to work as well in the hands of less experienced examiners or examiners with different background training (e.g. sonographers) [15].

The primary aim of this study was to externally validate the performance of the IOTA three-step strategy and to compare this strategy to the RMI for the preoperative characterization of ovarian masses. The secondary aim was to determine whether this diagnostic approach retained its test performance when performed by examiners with a range of training backgrounds and experience. In this way we set out to show the performance of these diagnostic approaches in the "real-world" clinical setting.

Methods

Study design and setting

This was a prospective multicenter cross-sectional cohort study. Consecutive patients were recruited in three hospitals in the UK: two tertiary referral centers for gynecological oncology (Queen Charlotte's and Chelsea Hospital London QCCH, Princess Anne Hospital Southampton PAH) and an urban acute hospital partnered to Imperial College (West Middlesex University hospital London WMUH). Approval of the study as an assessment of "service improvement" was given by the local Joint Research Office (JRO) at Imperial College Academic Health Science Center (AHSC), and by the Research and Development department at

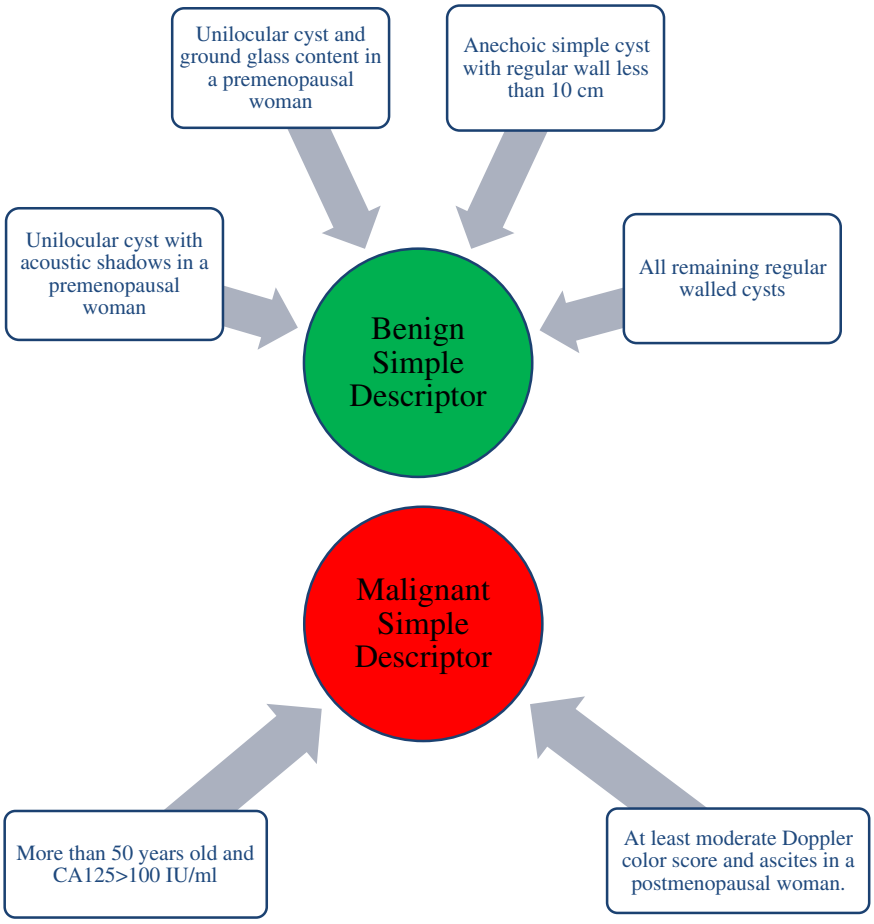

Fig. 1. The simple descriptors.