Ruben Heremans

Department of Obstetrics & Gynecology – Department of Development and Regeneration, University
Hospitals KU Leuven – KU Leuven, Leuven, Belgium

Diagnosis of Adnexal Masses—Do we Really Need Computed Tomography?

Over the past decades ultrasound has become an indispensable extension of the gynecologist's hands and eyes. It provides the examiner with all the necessary proxies to assess tissue texture, vascularization, mobility and tenderness. The complementary information generated from this low-cost, dynamic examination in addition to static imaging modalities is undisputed. Moreover it may serve on multiple tiers, ranging from a diagnostic triaging tool, over a stereotactic guide for representative tru-cut biopsies, to a guidance for therapeutic punctures.

Adequately discriminating benign adnexal lesions from their malignant counterparts is of paramount importance, as this allows to select the most appropriate treatment effectuated by the most appropriate physician, guided by the most appropriate second-stage examinations. Making an optimal pre-operative risk estimation has always been the main pursuit of the *International Ovarian Tumor Analysis* (*IOTA*) consortium, propelling multicentric prospective observational research, by use of standardized terms and definitions [1]. Through this uniformly gathered data, risk prediction models have been constructed. Initially these models—such as the *Logistic Regression 1* (*LR1*), *LR2*, and *IOTA Simple Rules* (*SR*) and *Simple Rules Risk* (*SRR*)

model—only allowed for dichotomous (benign vs malignant) risk estimation or calculation [2–4]. After appropriate training these models already enhanced the assessment by less-experienced examiners to a similar diagnostic performance as expert sonographers. The main prerequisite for a reliable result is that of correct adherence to the predefined *IOTA* terminology.

It wasn't however until the advent of the *Assessment of Different NEoplasias in the AdneXa* (*ADNEX*) model that the deepest insight could be obtained from a thorough pelvic scan [5]. The *ADNEX* model is a multiclass or polytomous risk prediction model developed on *IOTA* phases 1, 1b and 2, temporally validated on phase 3 and ultimately retrained using the total dataset of 5909 patients. This polytomous modelling in masses was novel in that it allowed not only to distinguish between benign and malignant masses, but also allowed subdividing perceived malignancies in borderline tumors, primary *International Federation of Gynecology and Obstetrics* (*FIGO*) stage I ovarian cancer, primary *FIGO* stage II–IV ovarian cancer or secondary metastases to the ovary, respectively. The model requires only basic variables as input. Calculations are based on three clinical factors, consisting of age, whether you are scanning in an oncology center or not and the serum level of biomarker CA-125. Six highly reproducible, low-cost ultrasound variables will complete the assessment and these consist of the maximal lesion diameter, maximal diameter of the largest solid part, the number of papillary projections,

presence of more or less than ten cyst locules, presence of acoustic shadows and presence of ascites. This model has shown to uphold high sensitivity and specificity values and an *area under the curve* (*AUC*) of 0.954 of the *Receiver Operating Characteristic* (*ROC*) plot, thereby outperforming previous *IOTA* models and paralleling expert sonography. It has subsequently been validated in repetitive external validation rounds, also providing insight in its calibration, and has been subjected to several meta-analyses containing cost-effectiveness calculations [6].

Not only have the aforementioned prediction models and consensuses aided in attaining a broader consensus and unified reporting among gynecologists globally, they have also intertwined with radiologists' practice. Efforts have been made to move towards a global consensus on reporting risks associated with ovarian cysts together with the *American College of Radiology* (*ACR*) in a classification known as the *Ovarian-Adnexal Reporting and Data System* (*O-RADS*) [7]. These guidelines specify all risk categories, based on arbitrarily selected risks of malignancy as indicated by the *ADNEX* model, with their appropriate management strategies. This *O-RADS* classification model however still requires extensive internal and external validation in the years to come. From gradually merging insights with radiologists, sprouted also add-on approaches such as magnetic resonance imaging(MRI)-based stratification charts, such as *O-RADS MRI* as second stage mass characterization [8].

With respect to staging as opposed to characterization, despite reports having been published in which diffuse intra-abdominal spread and distant metastases were appreciable on ultrasound, evidence is in favor of static imaging modalities [9]. When comparing computed tomography (CT) to MRI, notwithstanding the good spatial resolution of the former, it has repetitively shown inferior to the latter in contrast resolution, thereby being inferior in site-based lesion detection and not allowing for as adequate an estimation of intestinal disease and distant (nodal) metastasis [10–12].

It is therefore audacious yet not inconceivable to say that the decades to come might surprise us with a paradigm shift away from CT and towards ultrasound supplemented with MRI in second stage, be it for further characterization or defining disease extent.

Corresponding address

Ruben Heremans
Department of Obstetrics & Gynecology – Department of Development and Regeneration, University Hospitals KU Leuven – KU Leuven
Herestraat 49, 3000 Leuven, Belgium
Ruben.Heremans@uzleuven.be

Compliance with ethical guidelines

References

1. Timmerman D, Valentin L, Bourne TH, Collins WP, Verrelst H, Vergote I (2000) Terms definitions and measurements to describe the sonographic features of adnexal tumors a consensus opinion from the International Ovarian Tumor Analysis (IOTA) Group. Ultrasound Obstet Gynecol 16:500–505
2. Timmerman D, Testa AC, Bourne T, Ferrazzi E, Ameye L, Konstantinovic ML et al (2005) Logistic regression model to distinguish between the benign and malignant adnexal mass before surgery: a multicenter study by the International Ovarian Tumor Analysis Group. J Clin Oncol 23:8794–8801
3. Timmerman D, Ameye L, Fischerova D, Epstein E, Melis GB, Guerriero S et al (2010) Simple ultrasound rules to distinguish between benign and malignant adnexal masses before surgery: prospective validation by IOTA group. BMJ 341:c6839
4. Timmerman D, Van Calster B, Testa A, Savelli L, Fischerova D, Froyman W et al (2016) Predicting the risk of malignancy in adnexal masses based on the Simple Rules from the International Ovarian Tumor Analysis group. Am J Obstet Gynecol 214:424–437
5. Van Calster B, Van Hoorde K, Valentin L, Testa AC, Fischerova D, Van Holsbeke C et al (2014) Evaluating the risk of ovarian cancer before surgery using the ADNEX model to differentiate between benign, borderline, early and advanced stage invasive, and secondary metastatic tumours: prospective multicentre diagnostic study. BMJ 349:g5920
6. Westwood M, Ramaekers B, Lang S, Grimm S, Deshpande S, de Kock S et al (2018) Risk scores to guide referral decisions for people with suspected ovarian cancer in secondary care: a systematic review and cost-effectiveness analysis. Health Technol Assess 22:1–264
7. Andreotti RF, Timmerman D, Strachowski LM, Froyman W, Benacerraf BR, Bennett GL et al (2020) O-RADS US Risk Stratification and Management System: a consensus guideline from the ACR Ovarian-Adnexal Reporting and Data System Committee. Radiology 294:168–185
8. Thomassin-Naggara I, Poncelet E, Jalaguier-Coudray A, Guerra A, Fournier LS, Stojanovic S et al (2020) Ovarian-Adnexal Reporting Data System Magnetic Resonance Imaging (O-RADS MRI) score for risk stratification of sonographically indeterminate adnexal masses. JAMA Netw Open 3:e1919896
9. Fischerova D, Burgetova A (2014) Imaging techniques for the evaluation of ovarian cancer. Best Pract Res Clin Obstet Gynaecol 28:697–720
10. Soussan M, Des Guetz G, Barrau V, Aflalo-Hazan V, Pop G, Mehanna Z et al (2012) Comparison of FDG-PET/CT and MR with diffusion-weighted imaging for assessing peritoneal carcinomatosis from gastrointestinal malignancy. Eur Radiol 22:1479–1487
11. Michielsen K, Vergote I, Op de Beeck K, Amant F, Leunen K, Moerman P et al (2014) Whole-body MRI with diffusion-weighted sequence for staging of patients with suspected ovarian cancer: a clinical feasibility study in comparison to CT and FDG-PET/CT. Eur Radiol 24:889–901
12. Gadelhak B, Tawfik AM, Saleh GA, Batouty NM, Sobh DM, Hamdy O et al (2019) Extended abdominopelvic MRI versus CT at the time of adnexal mass characterization for assessing radiologic peritoneal cancer index (PCI) prior to cytoreductive surgery. Abdom Radiol (NY) 44:2254–2261

Vitamin D zählt neben Parathormon und Fibroblast Growth Factor 23 zu den wichtigsten Regulatoren des Kalzium- und Phosphathaushalts. Darüber hinaus hat Vitamin D eine Vielzahl von extraskelettalen Wirkungen. In der zweiten Auflage des Buches „Vitamin D-Mangel – Aktuelle Diagnostik und Prophylaxe in Fallbeispielen" haben sich Frau Dozent Karin Amrein und Koautoren die Aufgabe gestellt, einen aktuellen Überblick über Vitamin D und seine Anwendungsmöglichkeiten darzustellen. Den Autoren ist es hervorragend gelungen, einen kritischen und wissenschaflich sehr fundierten Zugang zu vielen relevanten Aspekten der klassischen und nicht klassischen Vitamin D Effekte herzustellen. Das Buch zeichnet sich durch einen sehr gut lesbaren Stil, ansprechendes Design und eine Vielzahl an Abbildungen, Tabellen und Beispielen aus. Es kann allen an den vielfältigen Vitamin D Wirkungen interessierten Ärzten und Personen in Gesundheitsberufen wärmstens empfohlen werden.

Univ.Prof.Dr. Peter Pietschmann
Medizinische Universität Wien, Zentrum für Pathophysiologie, Infektiologie und Immunologie, Institut für Pathophysiologie und Allergieforschung