A SYSTEMATIC REVIEW OF PREOPERATIVE RISK ASSESSMENT OF ADNEXAL MASSES USING SIMPLE RULES FROM THE INTERNATIONAL OVARIAN TUMOR ANALYSIS GROUP.

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ABSTRACT

The most common investigation done in gynaecological practice for complaints such as pain in the abdomen, abdominal mass is ultrasonography. It is an easily available, affordable and congruous method for detecting adnexal/ pelvic masses. Adnexal masses are common in all age groups. Early detection and treatment of malignant ovarian tumors results in better prognosis. The International Ovarian Tumor Analysis group (IOTA) has given simple rules in order to distinguish the adnexal pathology to benign or malignant irrespective of level of expertise. The terms, definitions and measurements used to describe the sonographic features of the adnexal masses were also described by the IOTA group. Establishment of these rules has provided some consistency while evaluating the adnexal masses.

Keywords: IOTA, Ultrasonography, Adnexal masses, Unilocular cyst, Multilocular cyst, Papillary projections

I. INTRODUCTION

One of the most common gynecological problems in the reproductive age group is the presence of an adnexal mass which can be either a mass of the ovary or fallopian tube or any other surrounding connective tissues. According to studies, the incidence of adnexal masses that required surgical intervention is 5.26%, with 93 percent of them being of ovarian origin. The incidence of neoplastic lesions amongst the ovarian masses is 68% and that of non-neoplastic lesions is 32%. The adnexal masses are mostly diagnosed accidentally and they can be either gynecological or non-gynecological masses and can be benign, borderline, or malignant or represent metastasis from any distant site or sometimes any non-neoplastic process as well. Hence the management of adnexal mass remains controversial as it can be any of the above mentioned lesions. Due to a large degree of uncertainty regarding these adnexal masses whether to go for surgery or not is still a matter of debate. An adnexal mass has a wide variety of potential diagnoses. Any benign or malignant ovarian tumour, para ovarian cysts, functional cysts, tubo-ovarian abscesses, ectopic pregnancy, pregnancy in the bicornuate uterus, tubal malignancy, hydrosalpinx, fimbrial cyst, broad ligament fibroid, sigmoid colon distended with gases or faeces, or a pelvic kidney may trigger it.

II. SONOGRAPHIC EVALUATION OF ADNEXAL MASSES

In order to discriminate benign from malignant adnexal masses transvaginal ultrasonography can serve as an excellent tool. Various studies have discovered that the risk of malignancy in unilocular ovarian cysts is very low. However the presence of certain characteristics such as papillary structures, solid areas and an increase in vascularity as determined by the use of Doppler ultrasonography is associated with an increased risk of malignancy.

In 1989, Granberg et al reported that with the use of transvaginal sonographic images of the ovarian mass we can predict the chances of malignancy. It was also found out in the same year that the ultrasound-derived index of
tumoral blood flow might serve as an important risk factor to predict the likelihood of malignancy.\textsuperscript{5} But some workers used the serum CA-125 levels and menopausal status of the women to produce the risk-of-malignancy index.\textsuperscript{6} This method was then incorporated in coming years into the scoring systems for improving the test performance.\textsuperscript{7,8}

Sassone et al devised a scoring system using two-dimensional gray scale ultrasonography features to describe an ovarian lesion which on several studies showed high diagnostic value.\textsuperscript{9} This scoring system, together with other popular scoring systems like Lerner and DePriest Scoring System has been used in the practice of gynecologic sonography since the 1990’s. In the early 2000s, an in-depth analysis of the literature revealed many differences in the diagnostic accuracy of these procedures.\textsuperscript{10} When scoring systems derived from retrospective data analysis in one centre were used prospectively in another centre, it was discovered that they did not yield the same good results.\textsuperscript{11–13} Such differences in the results might be due to variations in the interpretation or the usage of phrases and definitions of the diagnostic end-points.\textsuperscript{14} Hence, the International Ovarian Tumor Analysis (IOTA) group was instigated in the early 2000’s and is currently the largest diagnostic accuracy study of its kind.\textsuperscript{15} The aim of the consensus group was to form a proper “evidence-based” algorithm for the classification and management of the different types of adnexal masses.\textsuperscript{15} There are different algorithms, mathematical models with logistic regressions which were formulated and verified over the span of 15 years with the purpose of enabling the clinicians to direct patients to a subspecialist in oncology once with suspicion of ovarian malignancy and in some cases, guide them in managing benign conditions either for follow-up or immediate access to surgery.

The IOTA group first of all published a consensus paper to standardize the terms, definitions, and measurements required for assessment of ovarian pathology. Simple Rules (SRs) based on five ultrasonography features suggestive of a benign lesion (B-features) and five ultrasonography features suggestive of a malignant lesion (M-features) were established through prospective study of patients who present with an adnexal mass.\textsuperscript{16} IOTA simple rules have now grown to be very famous as they are pretty easy to apply and don't want any calculation. As a result, they have been thoroughly tested and are now included in international guidelines.\textsuperscript{17,18}
In Ultrasound in Obstetrics and Gynecology, a manuscript detailing the various basic rules was published (Timmerman et al, 2008).

About 1066 women who presented with a recurrent adnexal mass, who underwent a transvaginal and colour Doppler ultrasound test by a skilled examiner within 120 days of surgical procedure in a prospective multicentric study by the International Ovarian Tumor Analysis. A mass was classified as benign or malignant using pattern recognition. Blood samples from 809 of the 1066 women were taken prior to surgery to test serum CA-125 levels. Different amounts of CA-125 were used as cutoffs for adnexal mass classification. Following that, the results of both assays were compared to the histological findings following surgery. They came to the conclusion that pattern recognition outperformed serum CA-125 in determining whether the masses were benign or malignant.

According to two systematic studies and meta-analyses, the IOTA SRs are one of the best available diagnostic techniques for classifying various benign and malignant adnexal masses. However, the SRs have the drawback of having unpredictable results in some circumstances, such as when both B and M features apply or when no features apply and there is no estimated chance of malignancy. As a result, the ultrasonography parameters used in SRs are now being used to assess a malignancy risk, leading to the development of the Simple Rules Risk (SRR) model. The IOTA group has also developed a new logistic regression model known as the Assessment of different neoplasias in the adnexa (ADNEX) model. The ADNEX prediction model can be used to measure the risk of malignancy in adnexal masses, the likelihood that the lesion is borderline malignant, stage I primary invasive ovarian cancer, stage II–IV primary invasive ovarian cancer, or any metastasis in the ovary from any

<table>
<thead>
<tr>
<th>Rules for predicting a malignant tumor (M-rules)</th>
<th>Rules for predicting a benign tumor (B-rules)</th>
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<tbody>
<tr>
<td>M1 Irregular solid tumor</td>
<td>B1 Unilocular</td>
</tr>
<tr>
<td>M2 Presence of ascites</td>
<td>B2 Presence of solid components where the largest</td>
</tr>
<tr>
<td>M3 At least four papillary structures</td>
<td>B3 Presence of acoustic shadows</td>
</tr>
<tr>
<td>M4 Irregular multilocular solid tumor with largest diameter ≥ 100 mm</td>
<td>B4 Smooth multilocular tumor with largest diameter &lt; 100 mm</td>
</tr>
<tr>
<td>M5 Very strong blood flow (color score 4)</td>
<td>B5 No blood flow (color score 1)</td>
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If one or more M-rules apply in the absence of a B-rule, the mass is classified as malignant. If one or more B-rules apply in the absence of an M-rule, the mass is classified as benign. If both M-rules and B-rules apply, the mass cannot be classified. If no rule applies, the mass cannot be classified.

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other primary tumour. Various external validation studies have confirmed that the performance of ADNEX is almost as good as the performance of previous IOTA methods.

Despite the fact that reviews are numerous which prove the efficacy of the IOTA simple rules, a prospective study applying these diagnostic rules directly to the subjects was not present.

III. DESCRIBING THE SONOGRAPHIC CHARACTERISTICS OF ADNEXAL TUMORS: TERMINOLOGY, DESCRIPTIONS, AND MEASUREMENTS

An adnexal lesion is a part of the ovary or an adnexal mass that is found to be incompatible with normal physiological function in an ultrasound evaluation.

A septum is a thin strand of tissue or membrane that extends from one inner surface to the opposite side of the cyst cavity.

In situations like hydrosalpinx, an incomplete septum is a flimsy band of tissue stretching from the cavity of the cyst from one inner surface to the contralateral side, but it isn't complete in those examining planes. The cyst with incomplete septa are reported as unilocular, but the growth appears to be multilocular in some parts.

Solid masses are classified as masses with a high echogenicity that show the presence of tissue (for example, myometrium, ovarian stroma, myomas, and fibromas). In adnexal tumours, diffuse thickening of the wall, standard ovarian stroma, and normal septa are not considered "solid" tissue.

Solid papillary projections are solid projections that extend from the cyst wall in to the cavity of the cyst and have a height which is greater than or equal to 3mm.

If there is a strong papillary projection on the wall, it is known as irregular. The exterior wall of a cyst isn't taken into account in these situations. In cases of solid tumours, the depiction of the inner wall as smooth or irregular is meaningless, but the outline of the tumour is depicted as smooth or irregular. The lesion is considered as "irregular" if there is irregularity on the surface of a solid component.

![Smooth](image1.png) ![Smooth](image2.png) ![Irregular](image3.png)

Figure 3 The internal wall of the cyst is described as being either smooth or irregular.

The cystic contents may be anechoic (black in colour), low-level echogenic (for example, in cases of mucinous tumours or an appearance similar to amniotic fluid), ground glass (homogeneously distributed echogenic cystic contents commonly seen in endometriotic cysts), or hemorrhagic (with inner string like structures reminiscent of the fibrin strands). The echogenicity of hemorrhagic cysts may be classified as star-shaped, cobweb-like, or jelly-like, or mixed echogenic (as seen in teratomas) (see Figure 2). In the case of solid tumours, however, the dominant feature of any cystic component is only defined if it can be evaluated.
The lesions are categorised subjectively into one of the following six classifications:

**Unilocular cyst** (A unilocular cyst is characterised as one with no septa and on the other hand at least a solitary papillary projection). The stroma of the normal ovary is not considered a "solid" part of the tumour (e.g., A peritoneal cyst containing a normal ovary is included as unilocular and not unilocular-solid).

**Unilocular-solid cyst** (A unilocular cyst with a measurable solid portion or at least a single papillary structure is shown in figure 5). If the height of the pyo-or hydrosalpinx is greater than or equal to 3 mm, it is included in this class. The mass can be classified as unilocular-solid if a unilocular cyst is present with a solid portion containing very small cysts.

**Multilocular cyst** (Figure 6 shows a cyst with at least one septum but no discernible solid part or papillary projection.)

**Multilocular-solid cyst** (Figure 7: a multilocular cyst with a discernible solid portion or at least a single papillary projection)

**Solid tumor** (A tumour in which the solid components account for at least 80% or more of the tumour in a two-dimensional section, as shown in Figure 8) Papillary projections that protrude into the tiny cysts of a solid tumour are also seen.

**Unclassifiable due to poor visualization** (For example, strong acoustic shadowing caused by the presence of calcifications in certain dermoids.)

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**Figure 4** Dominant features of the components of the cyst in complete septum

**Figure 5** Various types of unilocular cysts. A cyst with no septa and no solid part or papillary projections is known as a unilocular cyst.
A measurable solid component or at least one papillary projection is required for a unilocular-solid cyst to be described. The mass may be classified as unilocular-solid if the solid component contains extremely small cysts.

A multilocular cyst is one that has no solid components or papillary projections and has at least one septum that can be seen. The arrows indicate the planes where the 'lesion' is measured.

A multilocular-solid cyst is one in which there is solid component that is measurable or at least one papillary structure (solid tumour with an irregular cyst wall).
When examined in a two-dimensional section, a solid tumour is characterised as one in which the solid components account for at least 80% of the tumour. Papillary projections protruding into an internal small cyst can be present in a solid tumour.

The vascularity of ovarian tumors is divided into four scores in the IOTA consensus paper: score of 1 given for tumors without any blood flow, score of 2 for tumors with minimal flow, score of 3 is given for tumors with moderate flow and score of 4 for tumors having high vascularity. In an investigation with 100 tumors and seven US analysts with various levels of expertise, the 'intraobserver and interobserver' agreement of the assessment of the 'colour content' of adnexal masses was, individually, discovered to be good to very good and moderate to good.

IV. MEASUREMENTS AND QUANTITATIVE ASSESSMENT OF MORPHOLOGY

Lesion: The largest three diameters (in mm) in two opposite planes are used to determine the scale of both the ovaries and the lesions.

Septum: The thickest septum's thickness is determined at the points where it has the largest diameter (however not estimated at its interface at the inner surface of the cyst wall). Since most ultrasound equipment has a higher axial resolution than lateral resolution, it is preferable to measure a septum that is perpendicular to the ultrasound beam.(see figure 10)

Papillary projection: As shown in Figure 12, the largest projection is estimated in two opposing planes i.e., height and base. The number of distinct papillary projections (1,2,3/more) and whether or not blood flow can be discerned in each of them are registered. It may be difficult to determine if a papillary projection is present and, if so, from what base the projection should be measured. In these instances, one can utilize an imaginary line as represented in Fig 13.

In a sagittal plane, the volume of fluid present in the Douglas pouch is estimated, and the largest anteroposterior distance across is measured in millimetres. (Fig14).
Papillary projections are solid projections from the cyst wall into the cyst cavity that are greater than or equal to 3mm in height. The height, base, and width of the largest papillary projection are measured.

Figure 11

Figure 12: The imaginary line from which a papillary projection is measured is depicted in the schematic diagram.

REFERENCES