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Advanced course in gynecological ultrasound

**ISUOG APPROVED
COURSE**

***January 25-29 2021
Malmö, Sweden***

Course directors:
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IOTA methods to characterize adnexal masses as benign or malignant

Lil Valentin

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Sverige



IOTA, International Ovarian Tumor Analysis

- **What is IOTA?**
- **Which are the IOTA-methods?**
- **How good are the IOTA-methods?**



The IOTA collaboration was started in 1997 by



Dirk Timmerman



Lil Valentin



Tom Bourne



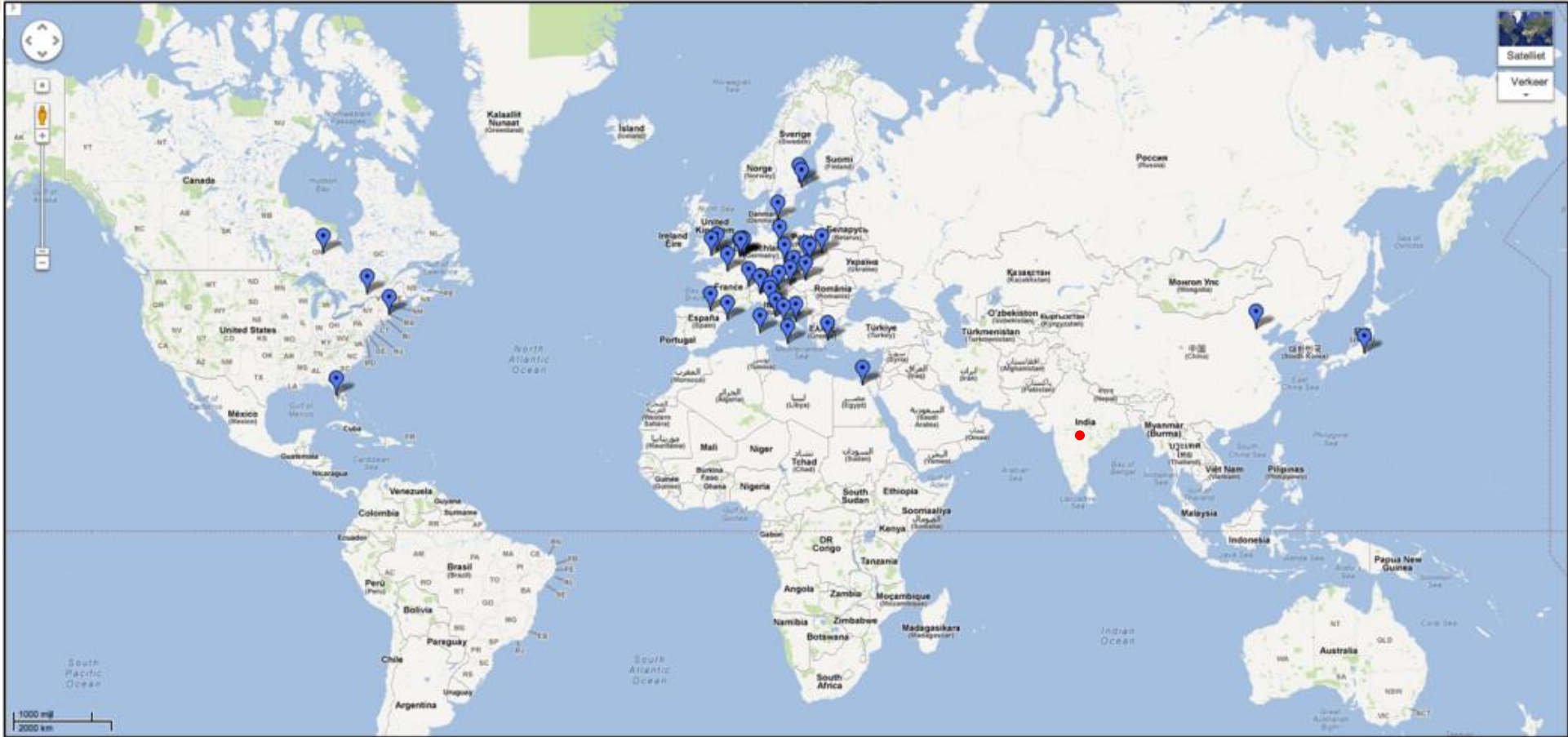
Ignace Vergote



William Collins



International Ovarian Tumor Analysis collaboration (IOTA)



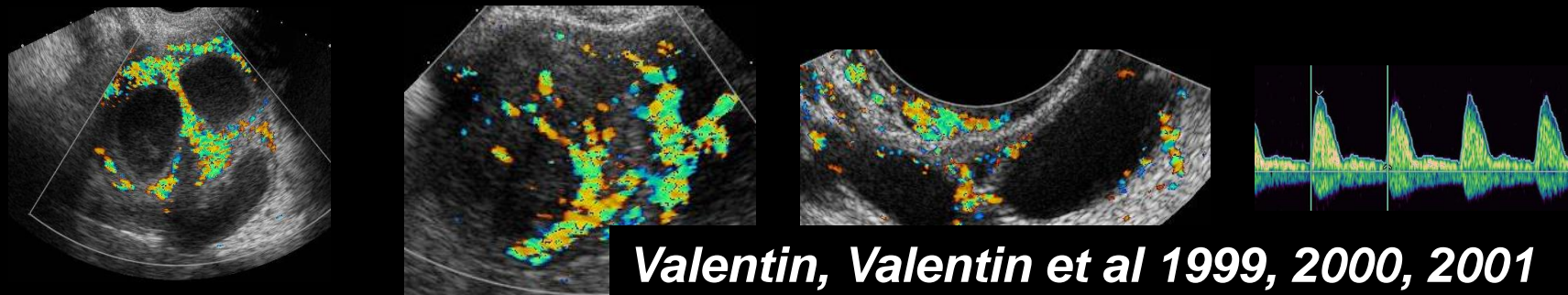
.....more than 50 centres



Aim of IOTA collaboration

- To develop methods to make a correct diagnosis in adnexal masses**
- validate these methods**

Subjective evaluation of grey scale and Doppler ultrasound findings





First step: common examination technique and terminology

Ultrasound in Obstetrics and Gynecology 2000;16:500

Terms, definitions and measurements to describe the sonographic features of adnexal tumors: a consensus opinion from the International Ovarian Tumor Analysis (IOTA) group

D. TIMMERMAN, L. VALENTIN*, T. H. BOURNE†, W. P. COLLINS‡, H. VERRELST§ and I. VERGOTE



IOTA methods for discrimination between benign and malignant adnexal masses

- **Logistic regression model 1, LR1**
- **Logistic regression model 2, LR2**
- **The ADNEX model**
- **The Simple Rules**
- **The Simple Rules Risk calculation model (SRRc)**



IOTA methods for discrimination between benign and malignant adnexal masses

ALL IOTA methods have been externally validated on **thousands** of patients and shown **excellent discriminative ability**
Clearly superior to RMI and ROMA



The ADNEX model

The ADNEX multiclass model calculates the likelihood of

- **Benign tumor**
- **Borderline tumor**
- **Stage I invasive tumor**
- **Stage II-IV invasive tumor**
- **Metastasis in the ovary from another primary**



<http://www.iotagroup.org/adnexmodel/>

IOTA - ADNEX model

1. Age of the patient at examination (years)
2. Oncology center (referral center for gyn-oncol)?
3. Maximal diameter of the lesion (mm)
4. Maximal diameter of the largest solid part (mm)
5. More than 10 locules?
6. Number of papillations (papillary projections)
7. Acoustic shadows present?
8. Ascites (fluid outside pelvis) present?
9. Serum CA-125 (U/ml)

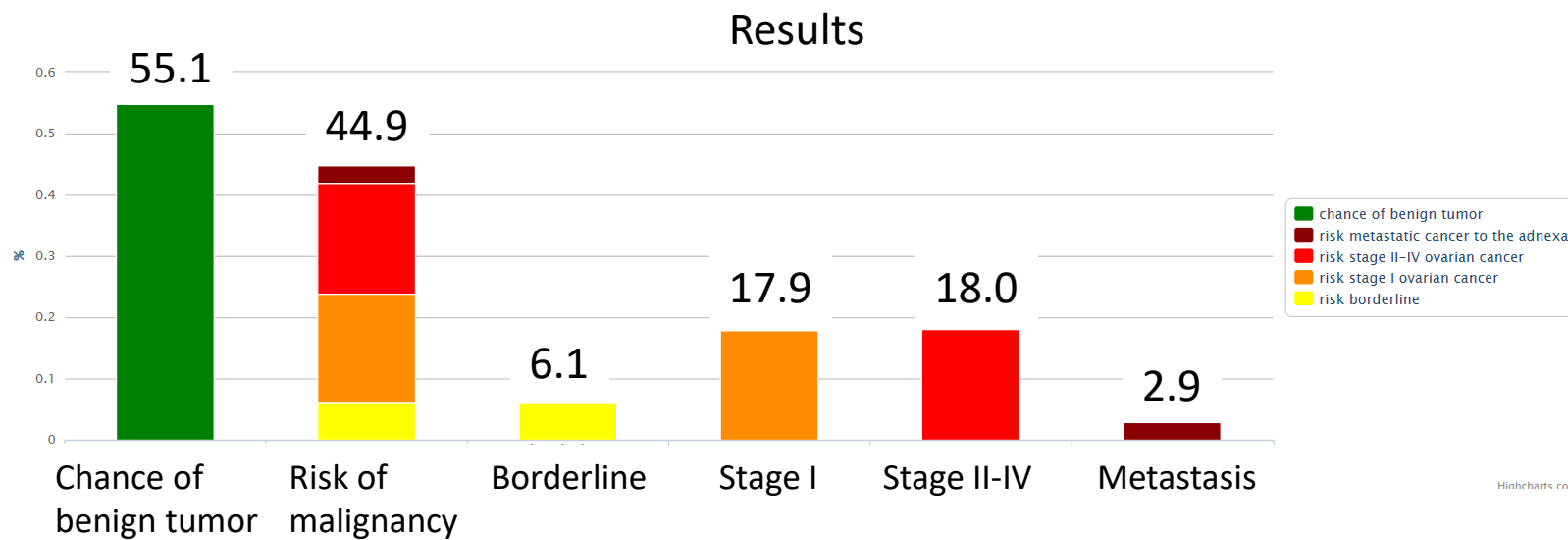
calculate

Clear

Additional information is given when moving the mouse pointer over the variable names.



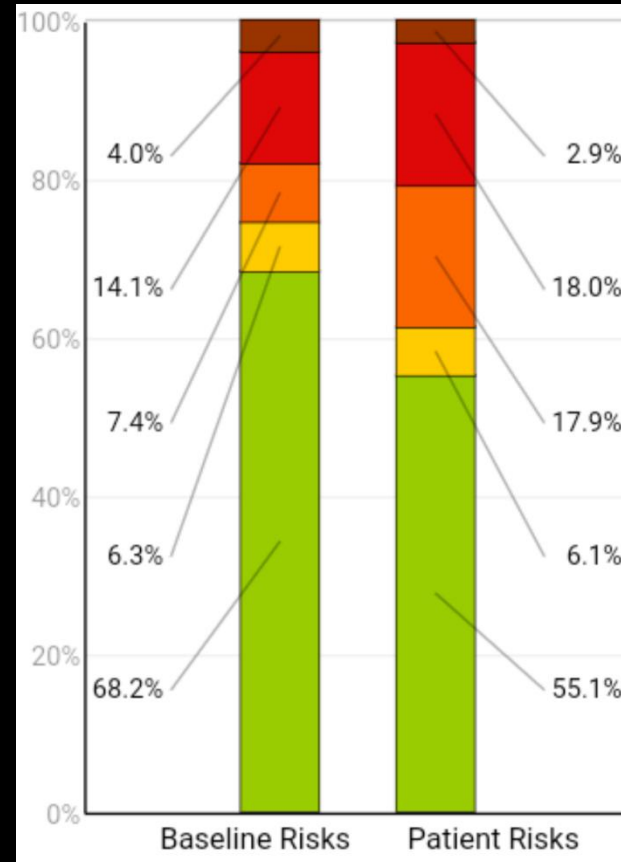
<http://www.iotagroup.org/adnexmodel/>





ADNEX model

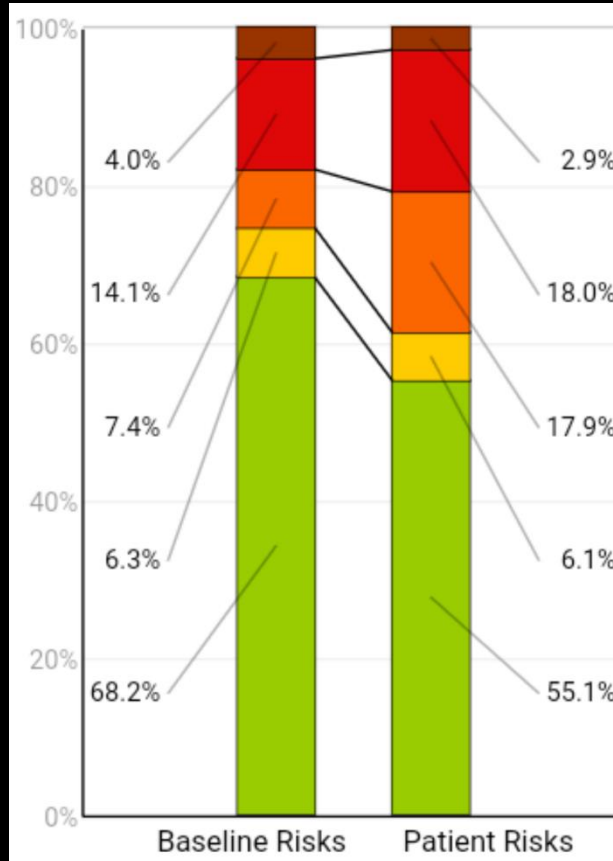
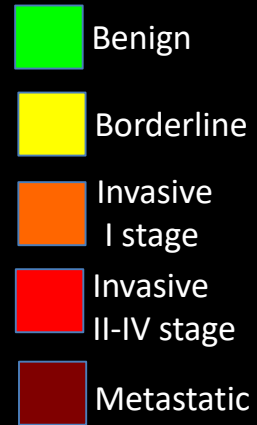
- Benign
- Borderline
- Invasive I stage
- Invasive II-IV stage
- Metastatic



Risk of malignancy
44.9%



ADNEX model



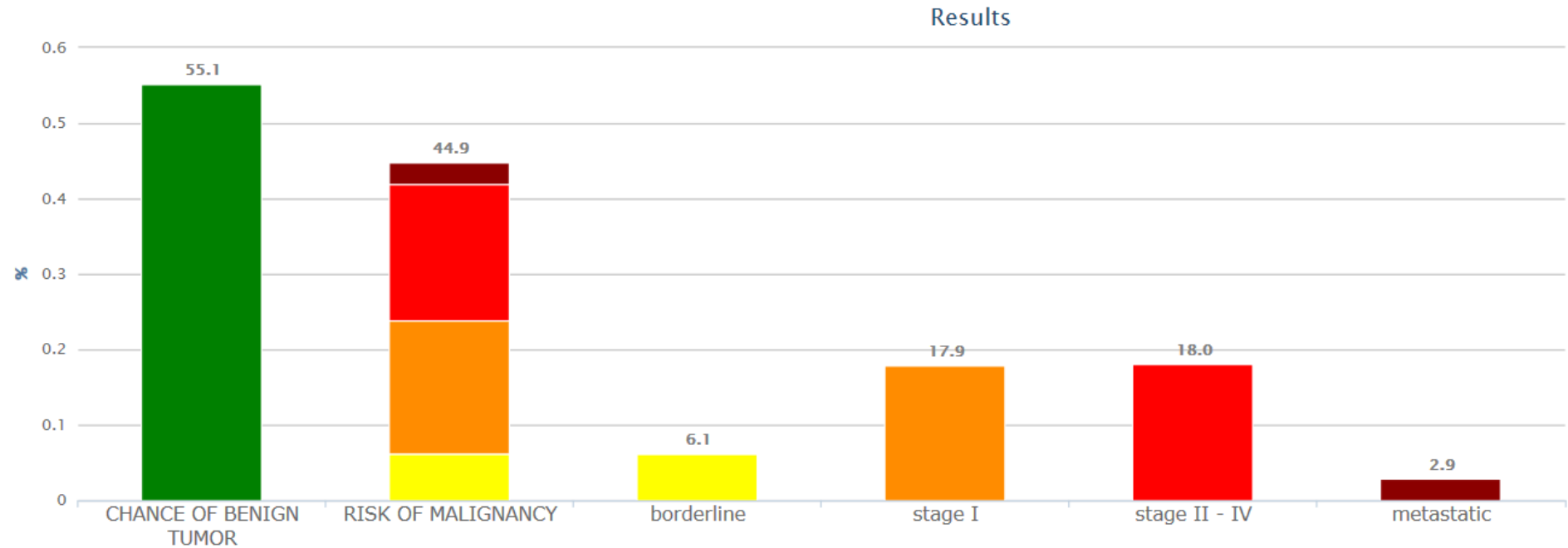
The most likely diagnosis is the one associated with highest risk increase

Risk increase (relative risk)

Stage 1	2.4
Stage 2-4	1.3



<http://www.iotagroup.org/adnexmodel/>

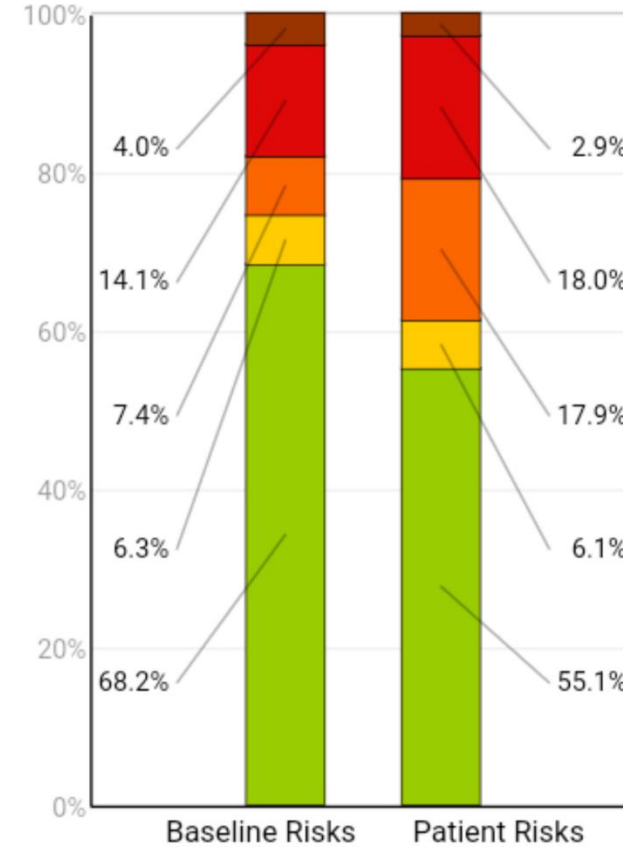
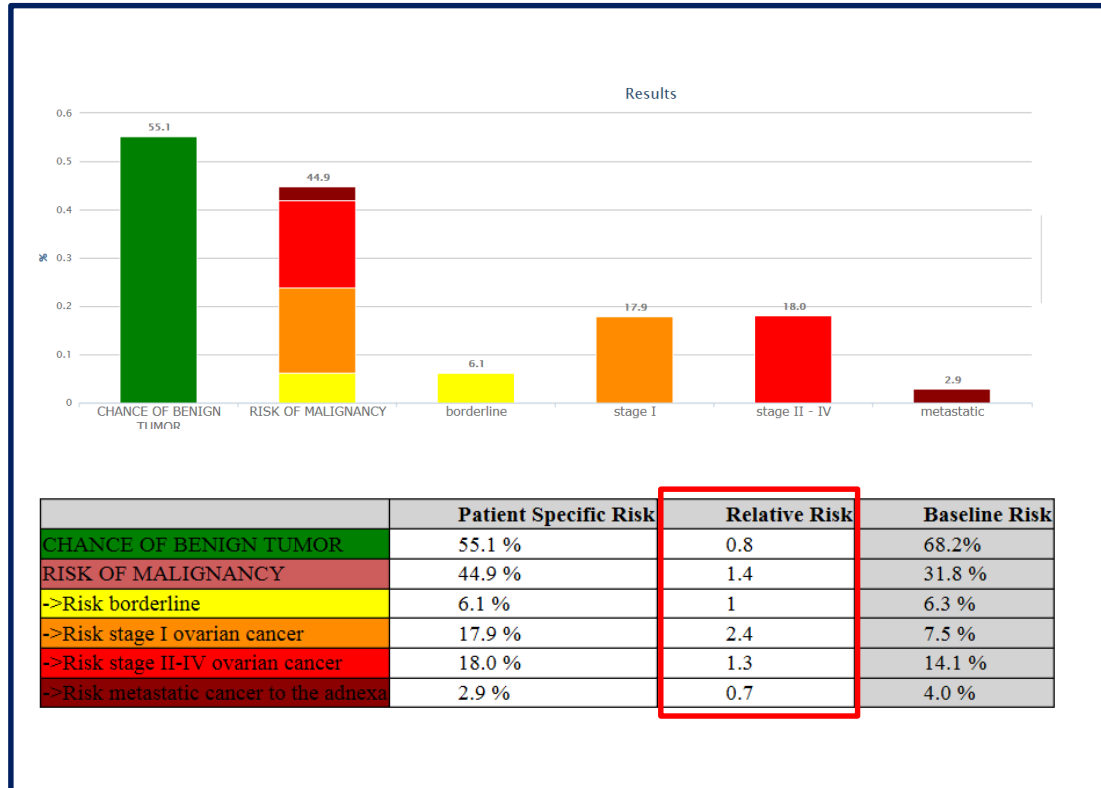


	Patient Specific Risk	Relative Risk	Baseline Risk
CHANCE OF BENIGN TUMOR	55.1 %	0.8	68.2%
RISK OF MALIGNANCY	44.9 %	1.4	31.8 %
->Risk borderline	6.1 %	1	6.3 %
->Risk stage I ovarian cancer	17.9 %	2.4	7.5 %
->Risk stage II-IV ovarian cancer	18.0 %	1.3	14.1 %
->Risk metastatic cancer to the adnexa	2.9 %	0.7	4.0 %

Relative risks (change in risk) displayed



Two ways of presenting results of ADNEX



Website: free, relative risks (change in risk) displayed

App: 20 Euros, easy to interpret



<http://www.iotagroup.org/adnexmodel/>

Variables in the IOTA - ADNEX model

1. Age of the patient at examination (years)
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3. Maximal diameter of the lesion (mm)
4. Maximal diameter of the largest solid part (mm)
5. More than 10 locules?
6. Number of papillations (papillary projections)
7. Acoustic shadows present?
8. Ascites (fluid outside pelvis) present?
9. Serum CA-125 (U/ml)

Solid
Papillary
Shadow
Ascites

Additional information is given when moving the mouse pointer over the variable names.



The IOTA simple rules - tick box

Malignant feature (M)		Benign feature (B)	
M1	Irregular solid tumor <input type="checkbox"/>	B1	Unilocular cyst <input type="checkbox"/>
M2	Ascites <input checked="" type="checkbox"/>	B2	Largest solid component < 7 mm <input type="checkbox"/>
M3	4 or more papillations <input checked="" type="checkbox"/>	B3	Acoustic shadows <input type="checkbox"/>
M4	Irregular multilocular solid tumor ≥ 100 mm <input type="checkbox"/>	B4	Smooth multilocular tumor < 100 mm <input type="checkbox"/>
M5	High color content at color Doppler <input type="checkbox"/>	B5	No blood flow at color Doppler <input type="checkbox"/>



The simple rules

Only M-features = malignant

Only B-features = benign

**Both M and B, or no feature = unclassifiable
(not applicable)**

Timmerman et al UOG 2008



The IOTA simple rules

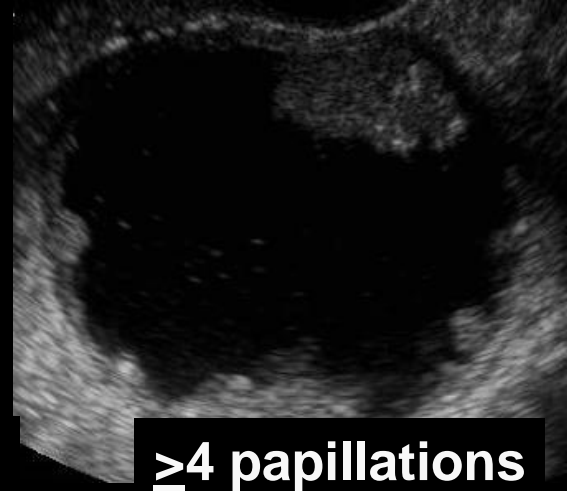
Malignant features



Irregular solid



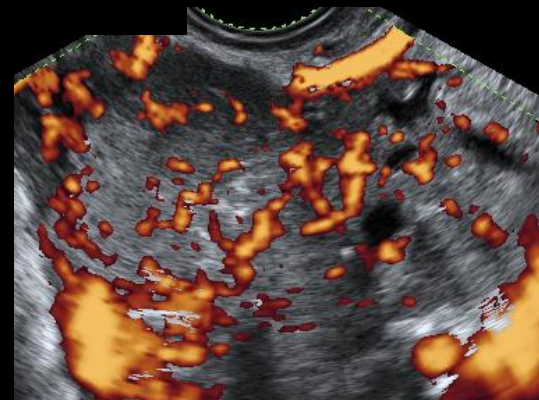
**Irregular multilocular solid
 ≥ 100 mm**



≥ 4 papillations



Ascites

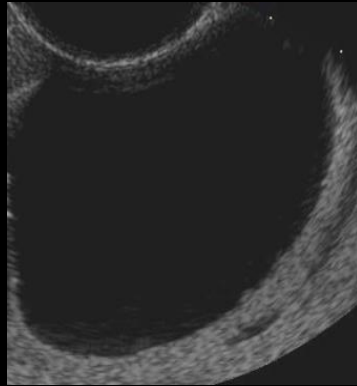


**Very rich vascularization
Color score =4**

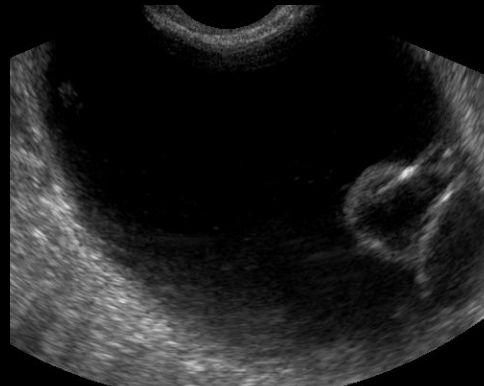


The IOTA simple rules

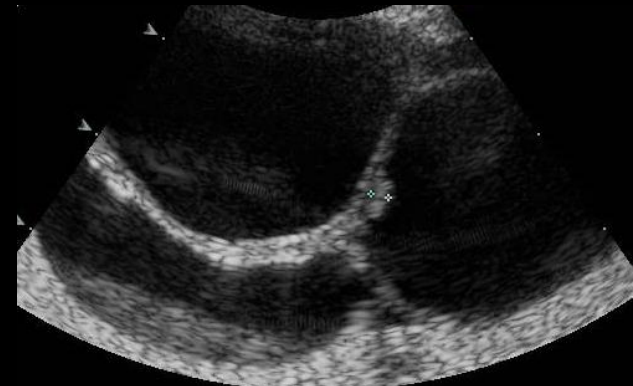
Benign features



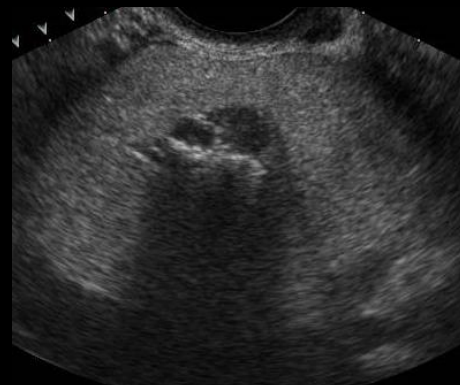
Unilocular cyst



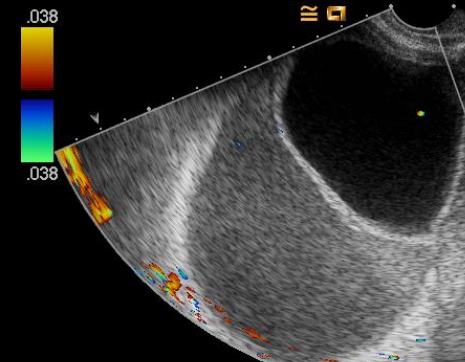
Smooth multilocular tumor <100 mm



Largest solid component <7 mm



Shadows



**No detectable flow
(Color score = 1)**



Simple Rules

- **Simple Rules** classifies 75% (77% to 96%) of masses
- **How to manage unclassifiable masses**
 - Refer for pattern recognition
 - Classify all unclassifiable masses as malignant
 - ADNEX



Which IOTA method to use?

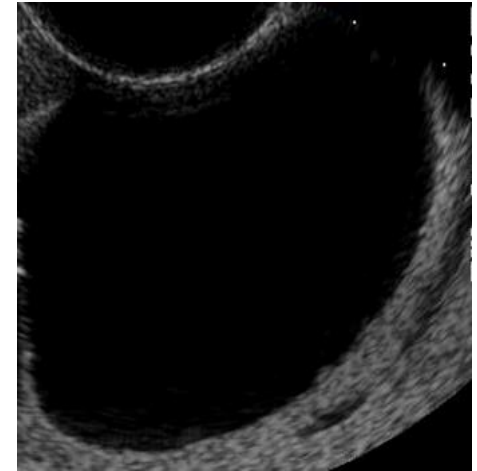
1/Simple Rules

- Inconclusive = malignant
- Inconclusive = refer to expert
- Inconclusive = LR1, LR2, ADNEX or SRRc

2/ADNEX (LR1, LR2, or SRRc) for all

Unilocular cyst

- **ONE** cyst locule
- **No septae**
- **No solid components**
- **Any type of cyst fluid**



3/All unilocular cysts with smooth walls < 10 cm (= "benign benign easy descriptors")



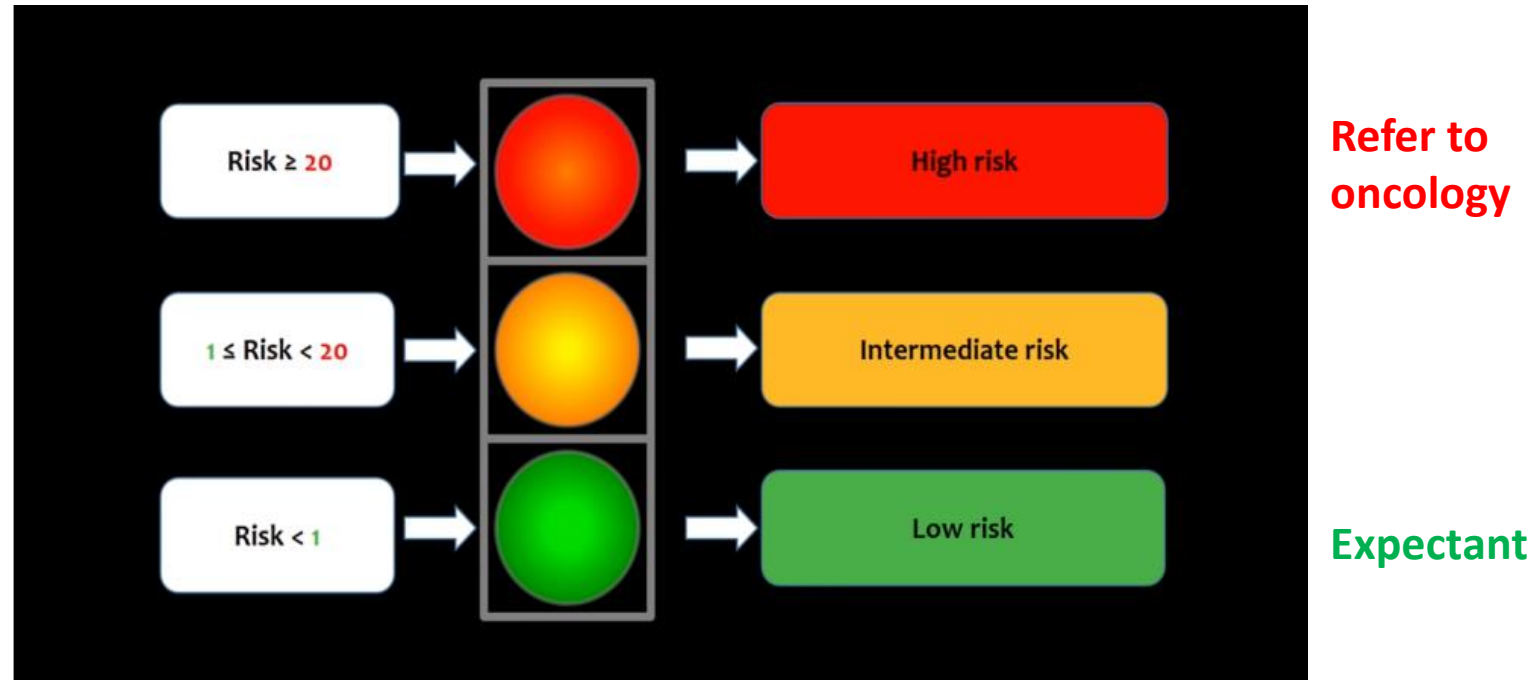
ADNEX for the others

Benign or malignant

Adnex for magnitude of malignancy risk

Adnex for type of malignancy

How do I interpret the risk of malignancy calculated by ADNEX?





NOTA BENE

IOTA methods work only
if the IOTA definitions are used
if the IOTA measurement technique is used

You need to be IOTA certified



The IOTA simple rules - tick box

Malignant feature (M)		Benign feature (B)	
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M2	<u>Ascites</u> <input type="checkbox"/>	B2	Largest <u>solid component</u> <u>< 7 mm</u> <input type="checkbox"/>
M3	4 or more <u>papillations</u> <input type="checkbox"/>	B3	Acoustic <u>shadows</u> <input type="checkbox"/>
M4	Irregular <u>multilocular solid tumor</u> <u>≥100mm</u> <input type="checkbox"/>	B4	Smooth <u>multilocular cyst</u> <u><100 mm</u> <input type="checkbox"/>
M5	High color content at <u>color Doppler</u> <input type="checkbox"/>	B5	No blood flow at <u>color Doppler</u> <input type="checkbox"/>



<http://www.iotagroup.org/adnexmodel/>

Variables in the IOTA - ADNEX model

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Solid
Papillary
Shadow
Ascites

Additional information is given when moving the mouse pointer over the variable names.

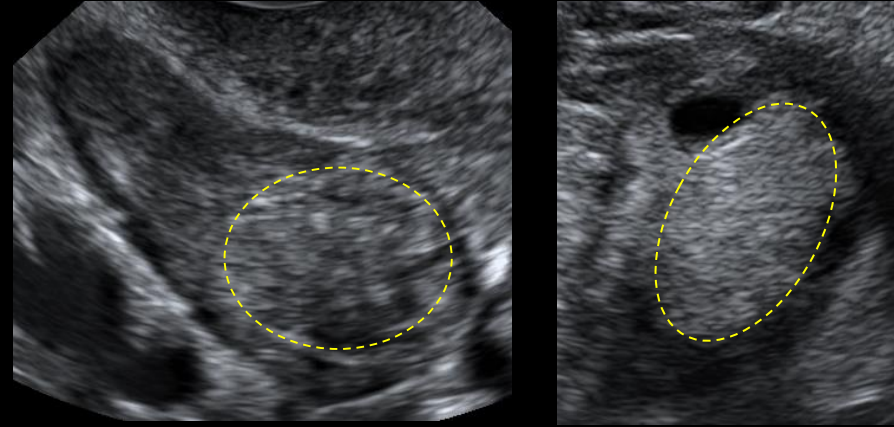
IOTA terminology

Why do we need standardized terms, definitions and measurements?

- **To use IOTA methods**
- **To understand each other**
- **To compare scientific studies**
- **To perform meta-analyses**
- **To conduct multicenter studies**

IOTA definition of lesion

- Part of an ovary inconsistent with normal physiology

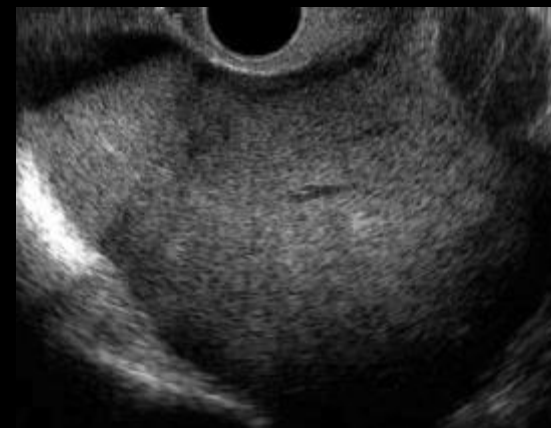
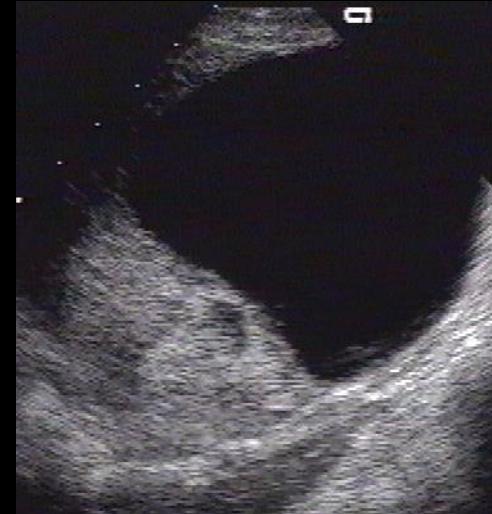


- **NOT A LESION**
Adnexal mass consistent with normal physiology



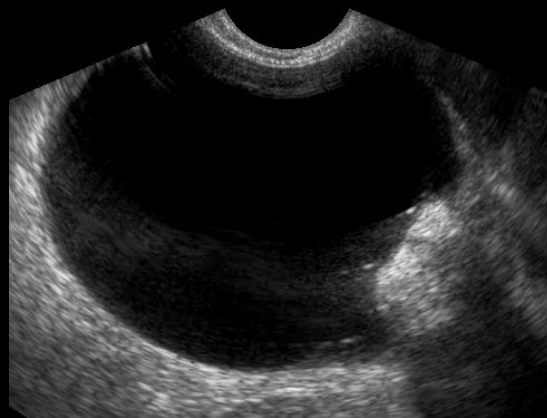
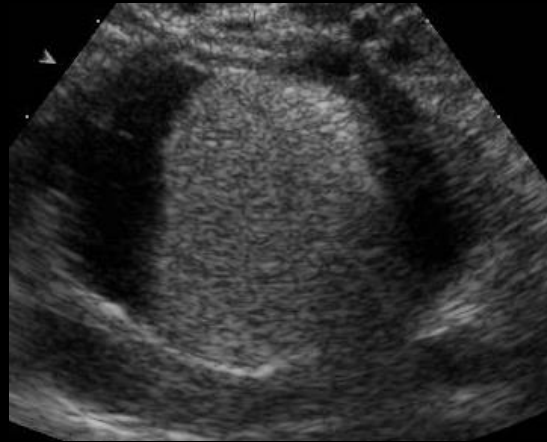
IOTA definition of solid component

- A structure that has echogenicity suggestive of tissue (myometrium, ovarian stroma)



IOTA definition of solid component

- The "white ball" in a dermoid cyst is NOT solid tissue



IOTA definition of solid component

- Blood clot, amorphous material or solid tissue?
 - push on the lesion

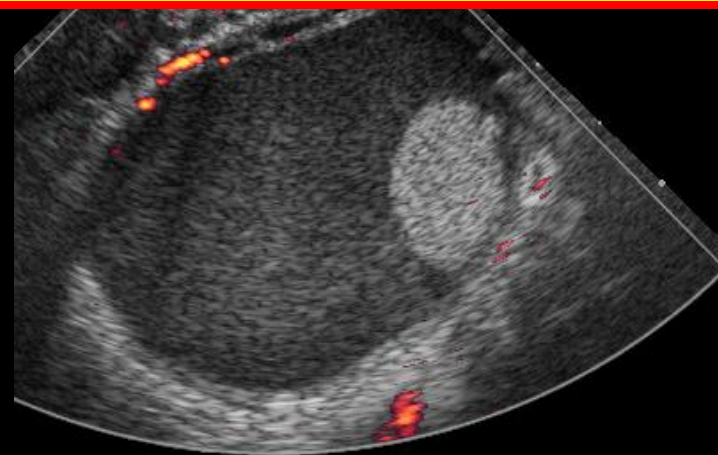


IOTA definition of solid component

- Blood clot, amorphous material or solid tissue?
 - color Doppler

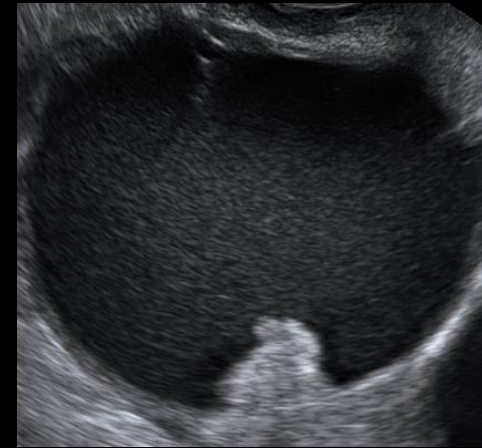
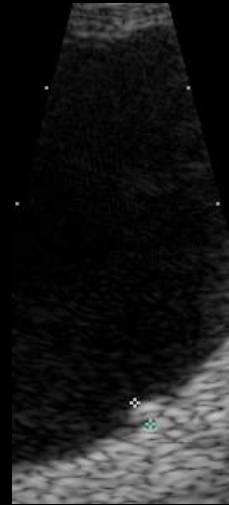


If in doubt – classify as solid tissue



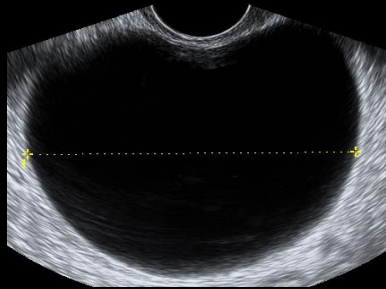
IOTA definition of papillary projection

- Protrusion of solid tissue into a cyst cavity ≥ 3 mm (height)
- Protrusions < 3 mm (height) = irregularities
- Papillary projections = solid component

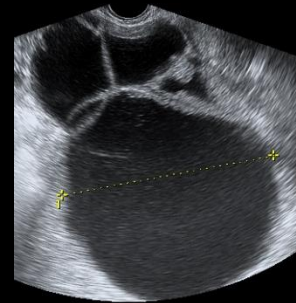


Not a papillary projection

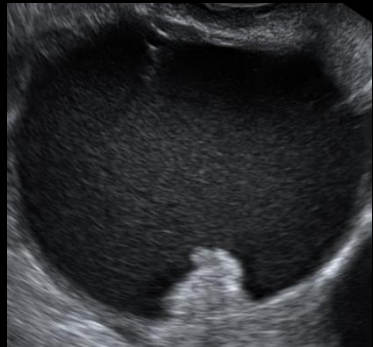
Five types of lesion/tumor (IOTA)



Unilocular



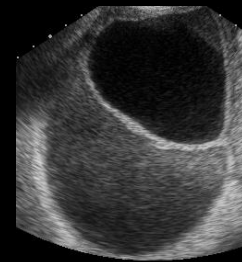
Multilocular solid



Unilocular solid

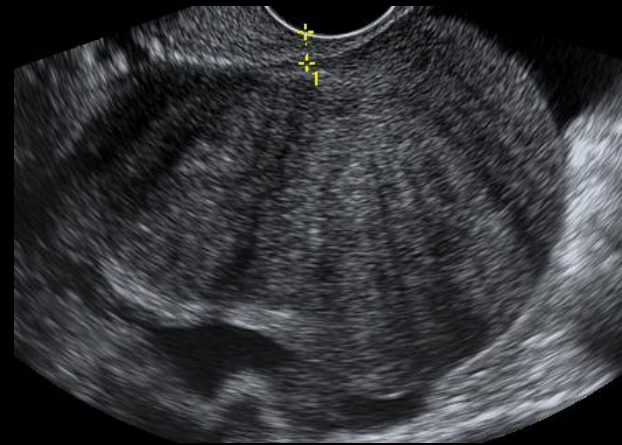


Solid



Multilocular

Shadowing (IOTA)

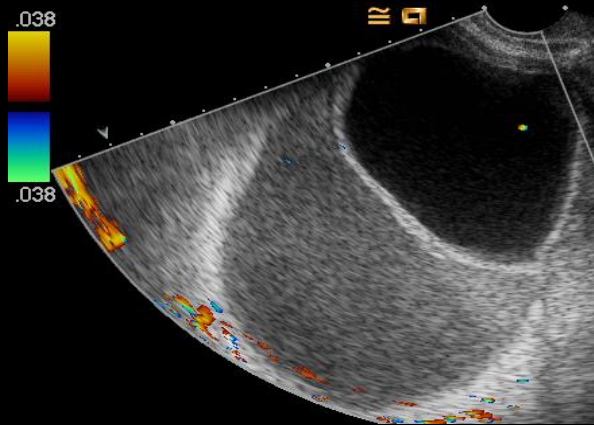


ASCITES (IOTA)

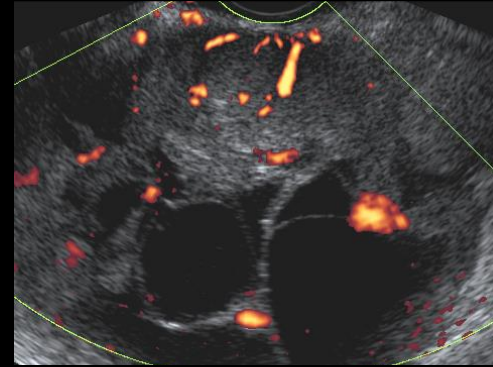


Fluid outside the pouch of Douglas

The IOTA color score

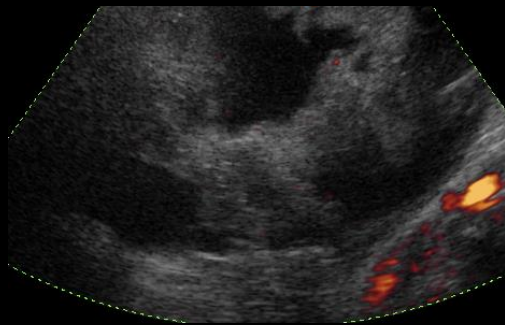


Score 1

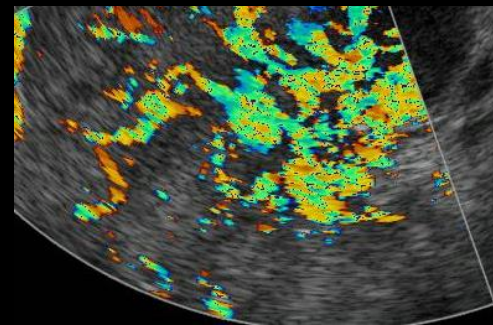


Score 3

**Adjust settings: maximize detection of flow without artifacts
(Pulse Repetition Frequency, PRF, 0.3 – 0.6 KHz)**



Score 2



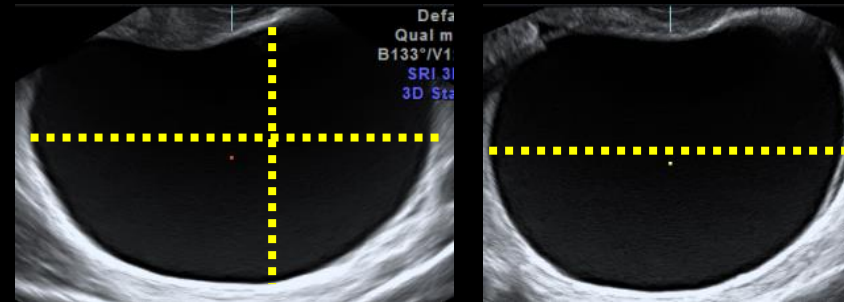
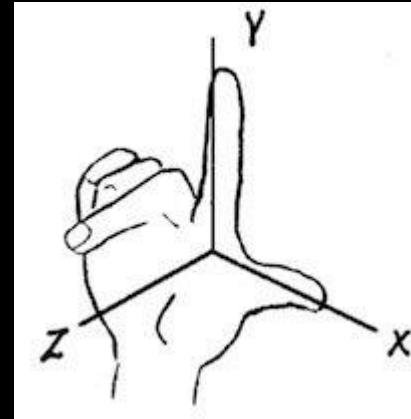
Score 4



Measurements

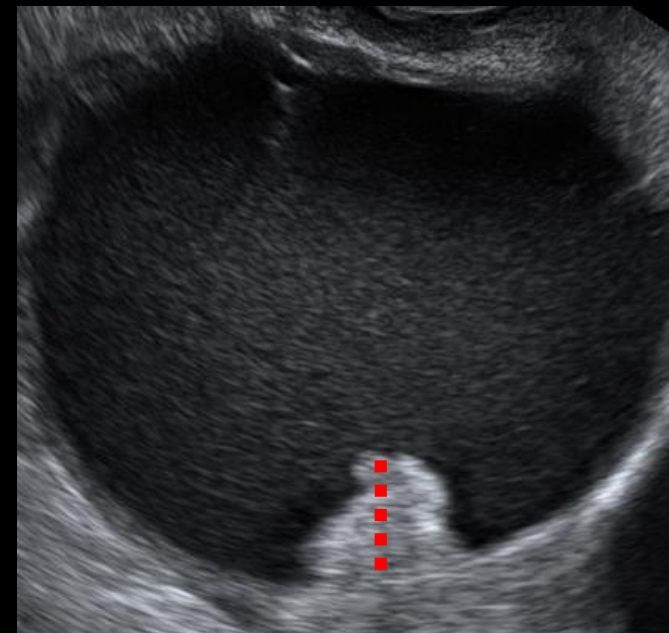
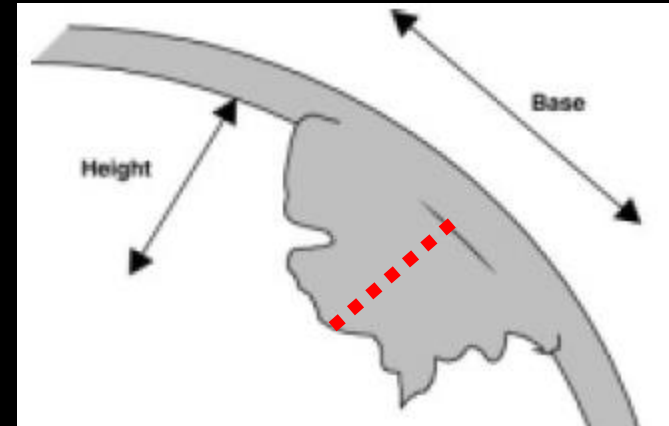
How to measure a lesion, an ovary or a solid component of a lesion

- Three orthogonal diameters
- Where the lesion/ovary/solid component appears to be at its largest
 - maximum diameter
 - mean diameter
 - volume
 - $(L * D * W * 0.5)$



How to measure a papillary projection

- Measure **the largest papillary projection**
- Three orthogonal diameters
- Height: do not include cyst wall or septum





How can I become IOTA certified?

- **Tailored workshops**
- **Certain courses offer IOTA certification**
 - E.g. "Advanced course on gynecological ultrasound", Malmö, Sweden, 20-24 January 2020
- **IOTA Congress** (April 2019, April 2021)
- Online test in the future?

How to learn and practise?

www.iota.education

FREE

www.iotagroup.org



Welcome

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Certified members

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FREE

IOTA Group in numbers

8800 Members

25 countries



Let's try to use the IOTA methods