IOTA Risk Assessment Models
Ovarian tumor analysis with Voluson™
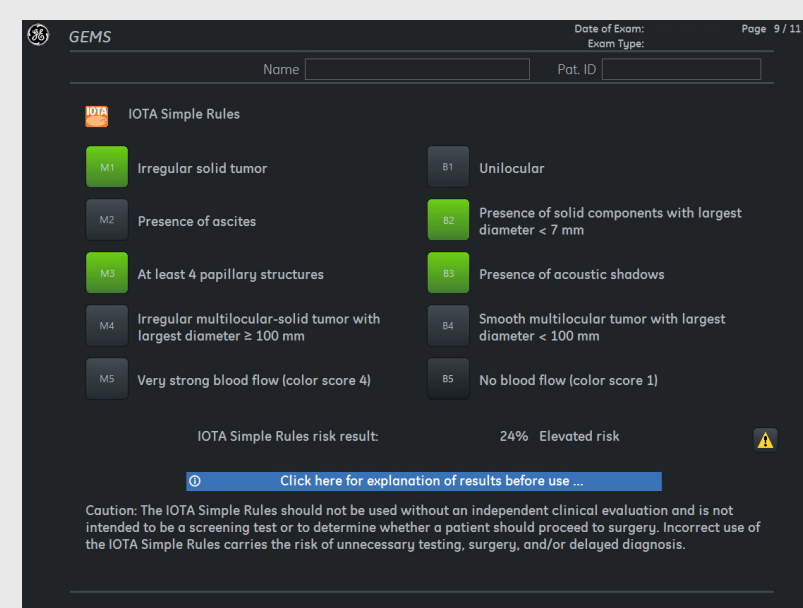
SIMPLE RULES RISK CALCULATOR

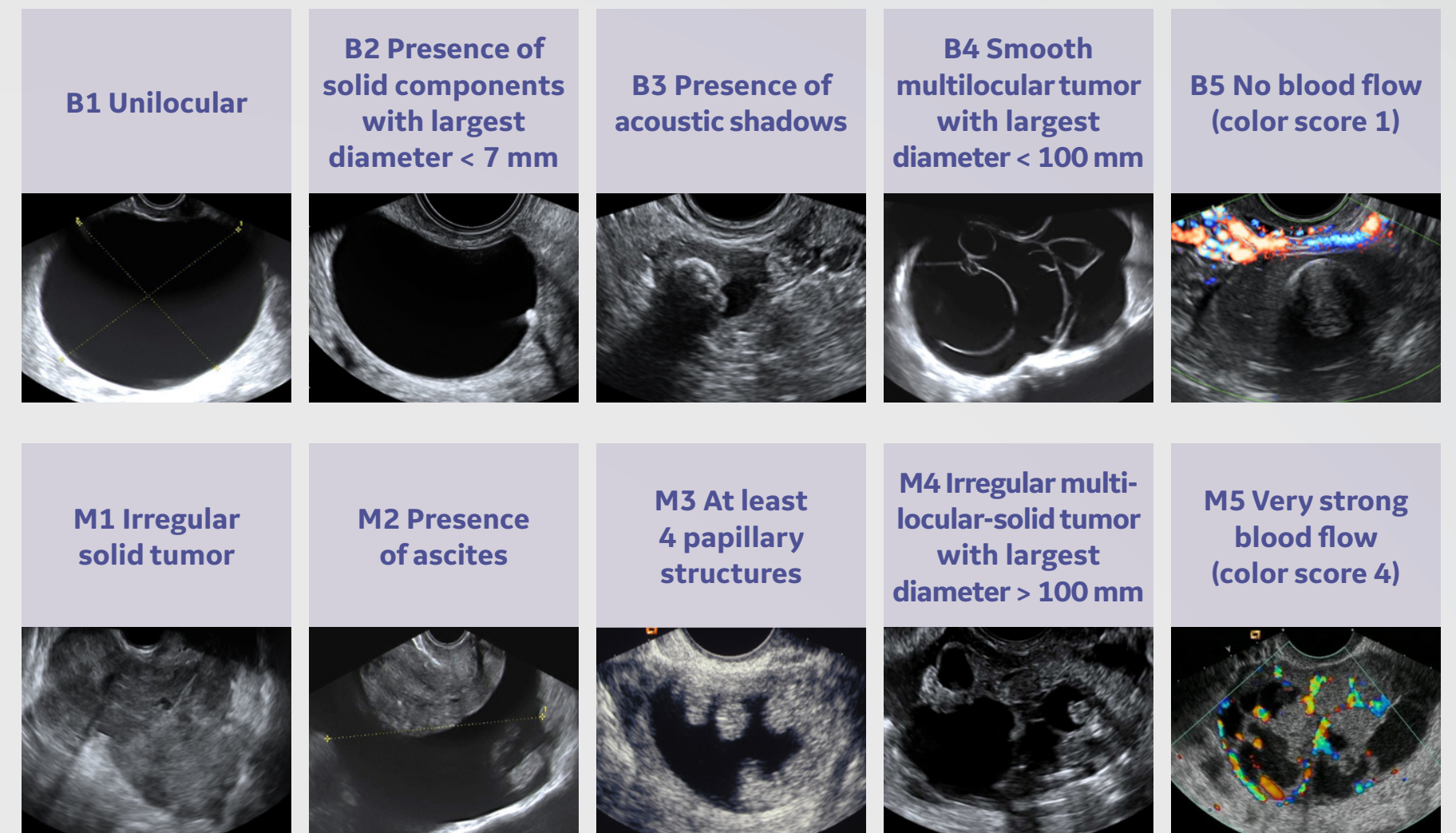### Pre-operative classification system for ovarian tumors

The Simple Rules consist of five features typical for benign tumors (B-features) and five features typical for malignant tumors (M-features).

Tumors are classified as Benign, Malignant or Inconclusive:

- Benign: Only B-features apply
- Malignant: Only M-features apply
- Inconclusive: No features apply, or both B- and M-features apply

Timmerman D, Van Calster B, et al. Am J Obstet Gynecol 2016;214:424-437.

B1 Unilocular

B2 Presence of solid components with largest diameter < 7 mm

B3 Presence of acoustic shadows

B4 Smooth multilocular tumor with largest diameter < 100 mm

B5 No blood flow (color score 1)

M1 Irregular solid tumor

M2 Presence of ascites

M3 At least 4 papillary structures

M4 Irregular multi-locular-solid tumor with largest diameter > 100 mm

M5 Very strong blood flow (color score 4)

LR2 RISK MODEL

Estimates probability of malignancy

LR2 uses six predictors (one clinical, plus five ultrasound):

- Age
- Maximal diameter of the largest solid component
- Irregular internal cyst walls
- Presence of papillary projections with detectable flow acoustic shadows
- Ascites

The algorithm produces a % of probability.

Timmerman D, et al. J Clin Oncol 2005;23:8794-801.

ADNEX RISK MODEL

Estimates probability a tumor is benign, borderline, stage 1 cancer, stage II-IV cancer or secondary metastatic cancer

The ADNEX model uses nine predictors (three clinical, six ultrasound):

- Age
- Serum CA-125 level
- Type of center
- Maximal diameter of lesion
- Proportion of solid tissue
- > 10 cyst locules

- # of papillary projections
- Acoustic shadows
- Ascites

The algorithm produces a % for various tumor types.

Van Calster B, et al. BMJ 2014;349:g5920.

TABLE OF LESIONS

Terms and definitions from the International Ovarian Tumor Analysis (IOTA) group

Unilocular cyst [1]

1 A unilocular cyst without septa and without solid parts or papillary structures.

2 If a cyst has only incomplete septa and no real septa, it is recorded as unilocular. An incomplete septum as seen in hydrosalpinges is defined as a thin strand of tissue running across the cyst cavity from one internal surface to the contralateral side, but which is not complete in some scanning planes.

3 If there is irregular internal cyst without a solid papillary projection, than the cyst is also unilocular by definition. The height of excrescences should be less than 3 mm.

4 The hyperreflective and avascular area ("white ball") in the center of dermoid cyst should not be classified as a solid papillary projection.

5 Similarly, "sludge" on the internal walls is not regarded as a papillary projection.

Unilocular-solid cyst [2]

A unilocular cyst with a measurable solid component or at least one papillary structure. This category may include pyo- or hydrosalpinges with the so-called 'beads-on-a-string' or "cogwheel" appearance if their height is greater than or equal to 3 mm. If the solid components comprise 80% or more of the tumor than the mass is called a solid tumor.

Multilocular cyst [3]

A cyst with at least one septum but no measurable solid components or papillary projections. A septum is not classified as a solid component and is defined as a thin echogenic strand of tissue running across the cyst cavity from one internal surface to the contralateral side.

Multilocular-solid cyst [4]

A multilocular cyst with a measurable solid component or at least one papillary projection.

Solid tumor [5]

A tumor where the solid components comprise 80% or more of the tumor when assessed in a two-dimensional section. A solid tumor may contain papillary projections protruding into the small cysts of the solid tumor.

Internal cyst wall [6]

The internal cyst wall is described as being "smooth" or "irregular". If there is a solid papillary projection, then the wall is irregular by definition. In cases of "sludge" (as seen in endometriotic cysts), the internal walls are also called 'irregular'.

Solid papillary projection [7]

Solid papillary projections are defined as any solid projections protruding into the cyst cavity from the cyst wall with a height greater than or equal to 3 mm. The hyperechogenic avascular area of a dermoid cyst or sludge on the internal walls are not regarded as a papillary projection. Solid papillary projections are described as being "smooth" or "irregular" (e.g. califlower-like).

Cystic contents [8]

The dominant feature of the cystic contents is described as:

1 anechoic (black)

2 low-level echogenic (i.e.homogeneous low-level echogenic as seen in mucinous tumors)

3 "ground glass" appearance (homogeneously dispersed echogenic cystic contents, as often seen in endometriotic cysts)

4 hemorrhagic (with internal thread-like structures, representing strands)

5 or mixed (as often seen in teratomas).

Subjective assessment of blood flow [9]

1 Color score of 1 is given when no blood flow within the septa, cyst walls, or solid tumor areas.

2 Color score of 2 is given when only minimal flow can be detected.

3 Color score of 3 is given when moderate flow is present.

4 Color score of 4 is given when the adnexal mass appears highly vascular with marked blood flow.

Acoustic shadows [10]

The presence of acoustic shadows, defined as loss of acoustic echo behind a sound-absorbing structure, is noted.

Ultrasound Obstet Gynecol 2000;16:500-505.