

International Ovarian Tumour Analysis (IOTA)

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Why talk about ovarian pathology?

| Benign ovarian | Functional/physiological cyst |
|----------------------------------|---|
| | Haemorrhagic cyst |
| | Endometrioma |
| | Serous cystadenoma |
| | Mucinous cystadenoma |
| | Mature teratoma/dermoid cyst |
| | |
| Benign non-ovarian | Para ovarian/para tubal cyst |
| | Hydrosalpinx |
| | Tubo-ovarian abscess |
| | Peritoneal pseudocyst |
| | |
| Pregnancy related adnexal masses | Hyper stimulated ovaries |
| | Theca lutein cysts |
| | Luteoma of pregnancy |
| | Heterotopic pregnancy |
| | |
| Borderline ovarian tumours | Serous borderline ovarian tumours |
| | Mucinous borderline ovarian tumours |
| | |
| Primary malignant | Epithelial carcinoma |
| | Sex-cord tumour |
| | Germ cell tumour |
| | |
| Secondary malignant | Predominantly breast or gastrointestinal metastases |



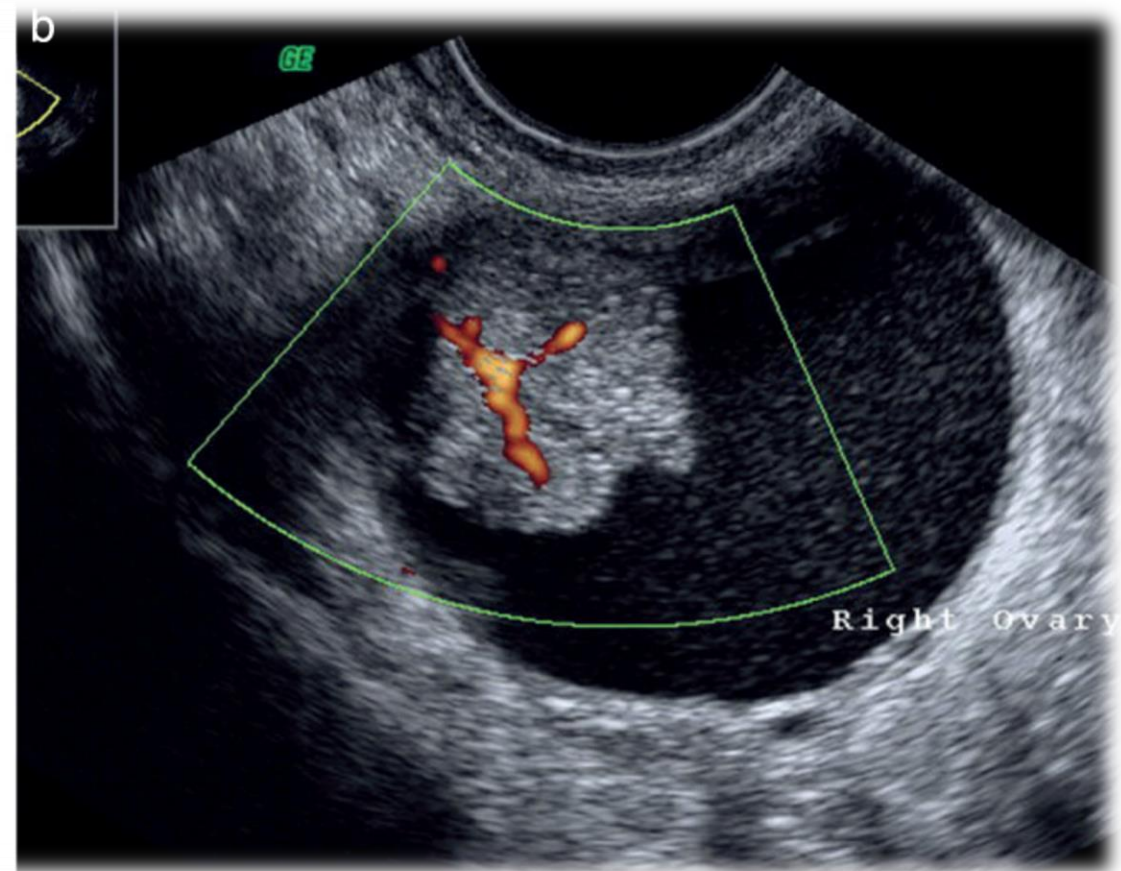
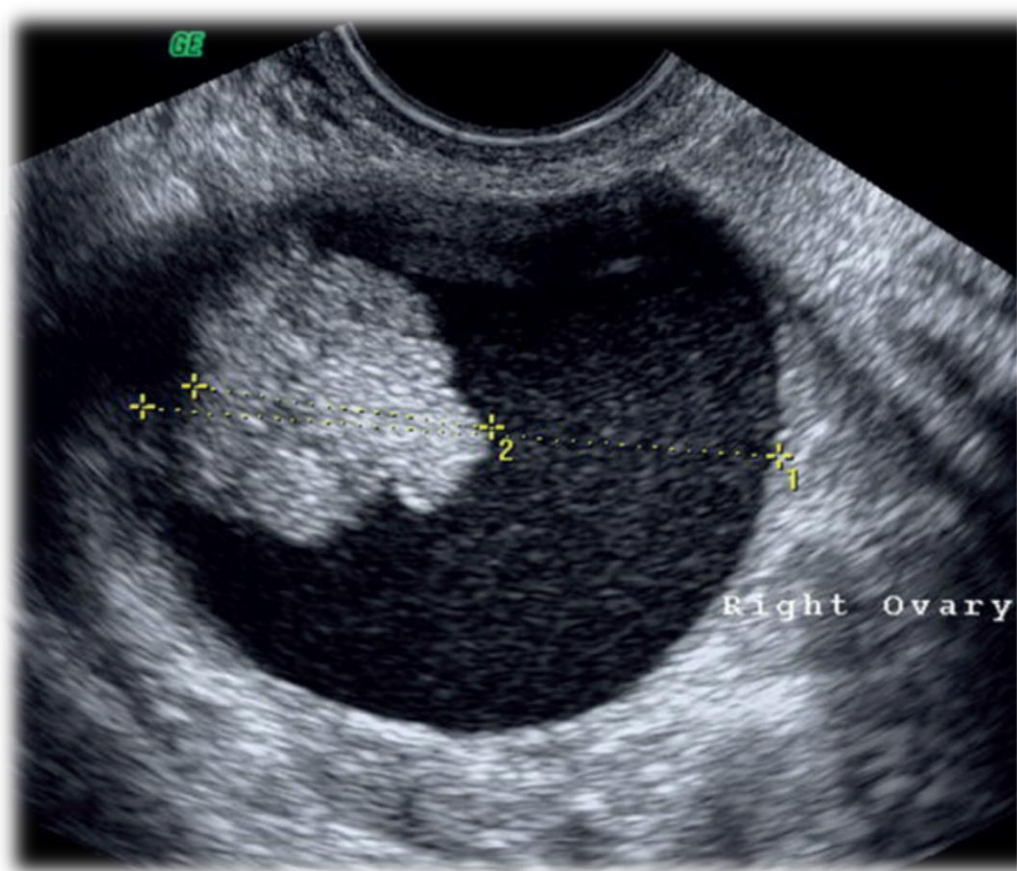
Why talk about ovarian pathology?

- Up to 10% of women will have surgery for a presumed ovarian 'cyst' (RCOG).
- 10% of these operations reveals the pathology to be arising from another adnexal structure (Canis et al., 2000).
- Differentiation between benign and malignant is imperative for:
 - Patient counselling and outcome
 - Treatment planning
 - Research & development
 - Statistics
- Ovarian cancer rates are 25% higher in Ireland – 30% survive 5 years.

Pattern Recognition

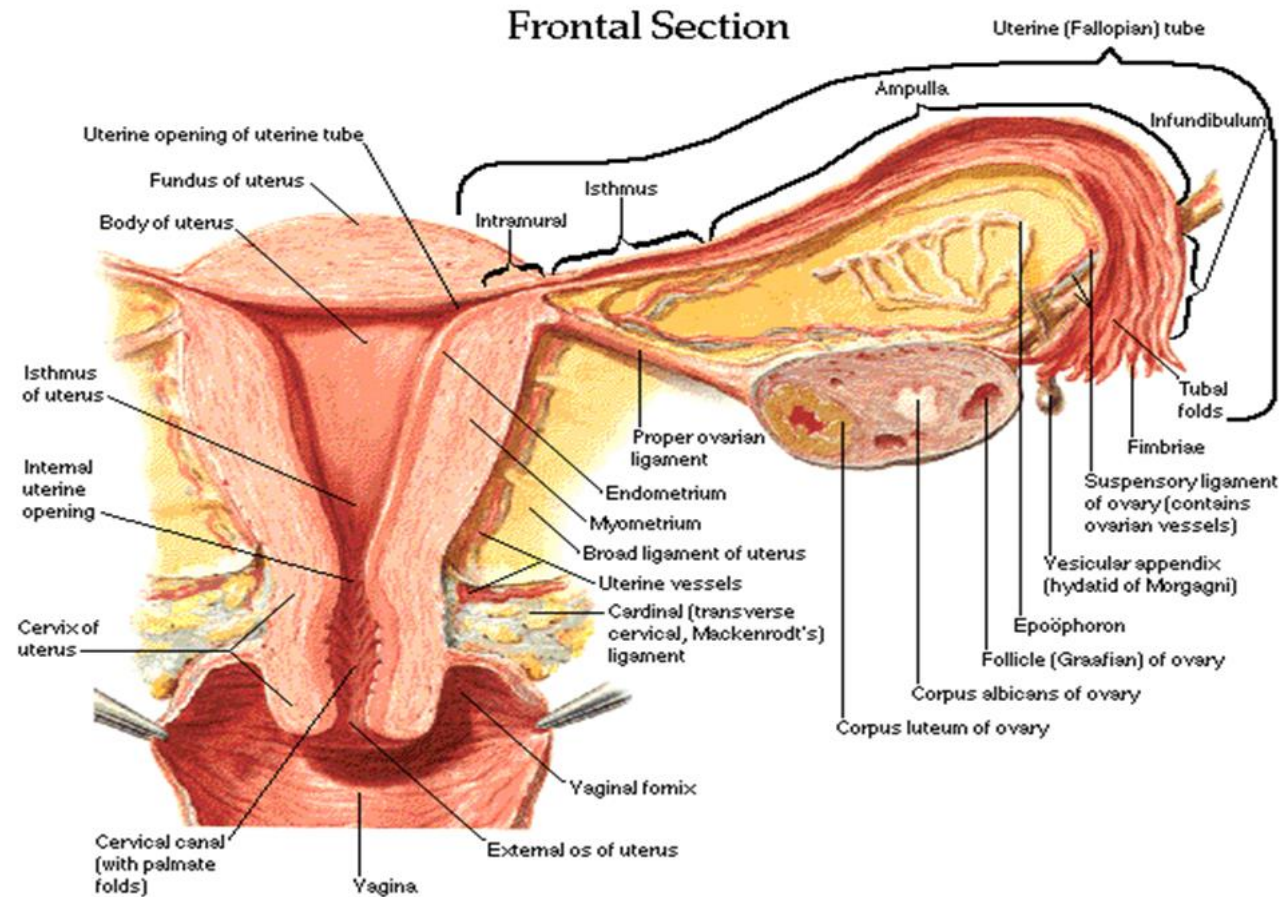


Why talk about ovarian pathology?



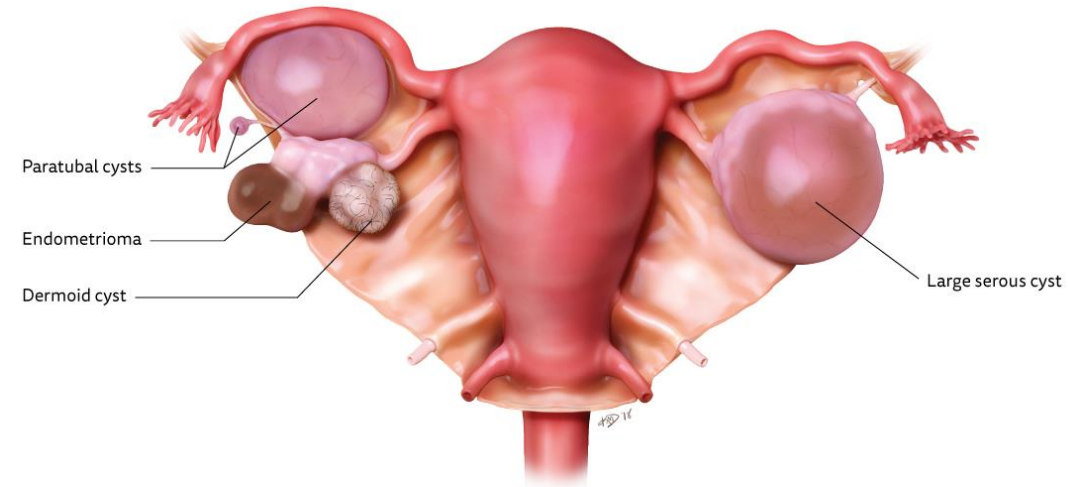
Nomenclature

Adnexa – *'The parts adjoining an organ'*



Is it a cyst, a follicle, a mass or a lesion?

- Cyst: air or fluid filled structure >30mm.
- Follicle: physiological cyst of <30mm.
- Mass: partially or fully solid.
- Lesion: part of an ovary or adnexa that is judged by ultrasound to be inconsistent with normal physiologic function' (IOTA).





What is IOTA?

'IOTA is a collaborative group including more than 40 centres from around the world that aims to develop new algorithms to detect ovarian cancer for optimal care of adnexal tumors.'

IOTA Beginnings

Ultrasound Obstet Gynecol 2000; 16: 500–505.

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

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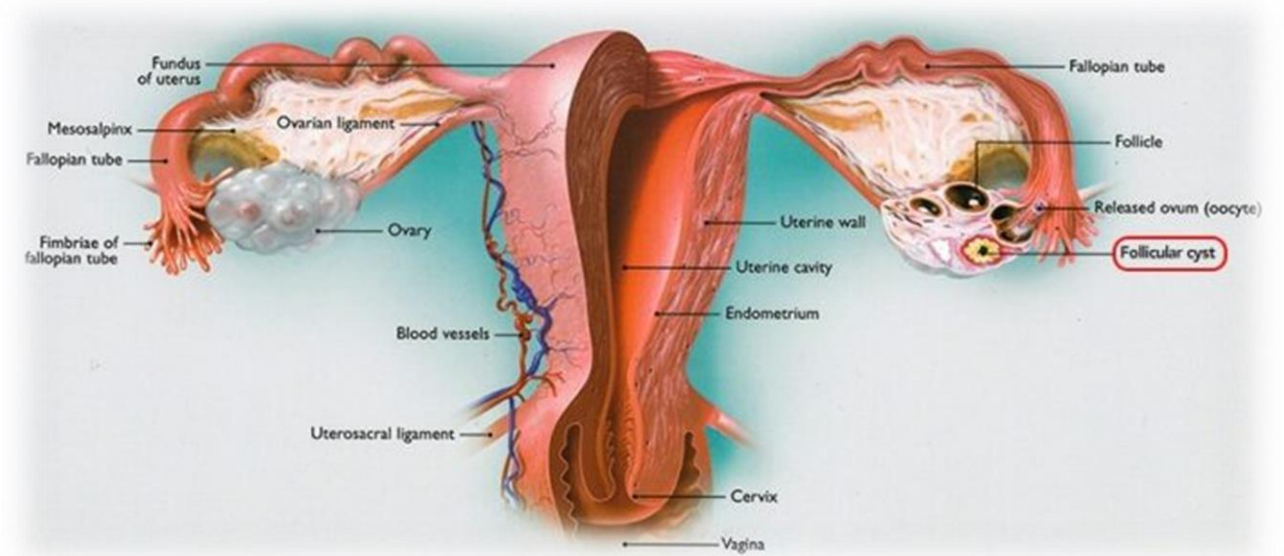
KEYWORDS: Ultrasonography, Color Doppler imaging, Ovary, Definitions, Standardization

A close-up photograph of a hand holding a small, rectangular piece of light-colored, textured paper. The paper is held between the thumb and index finger of the right hand, with the middle and ring fingers also visible. The paper has the words "COMMON LANGUAGE" printed in a bold, black, sans-serif font. The background is a soft, out-of-focus green and yellow, suggesting an outdoor setting. The lighting is bright and even, highlighting the texture of the paper and the skin of the hand.

COMMON LANGUAGE

Definition 1: 'Lesion'

'An adnexal lesion is the part of an ovary or adnexa that is judged from an assessment of ultrasound images to be inconsistent with normal physiologic function.'



Definition 2: 'Septum'

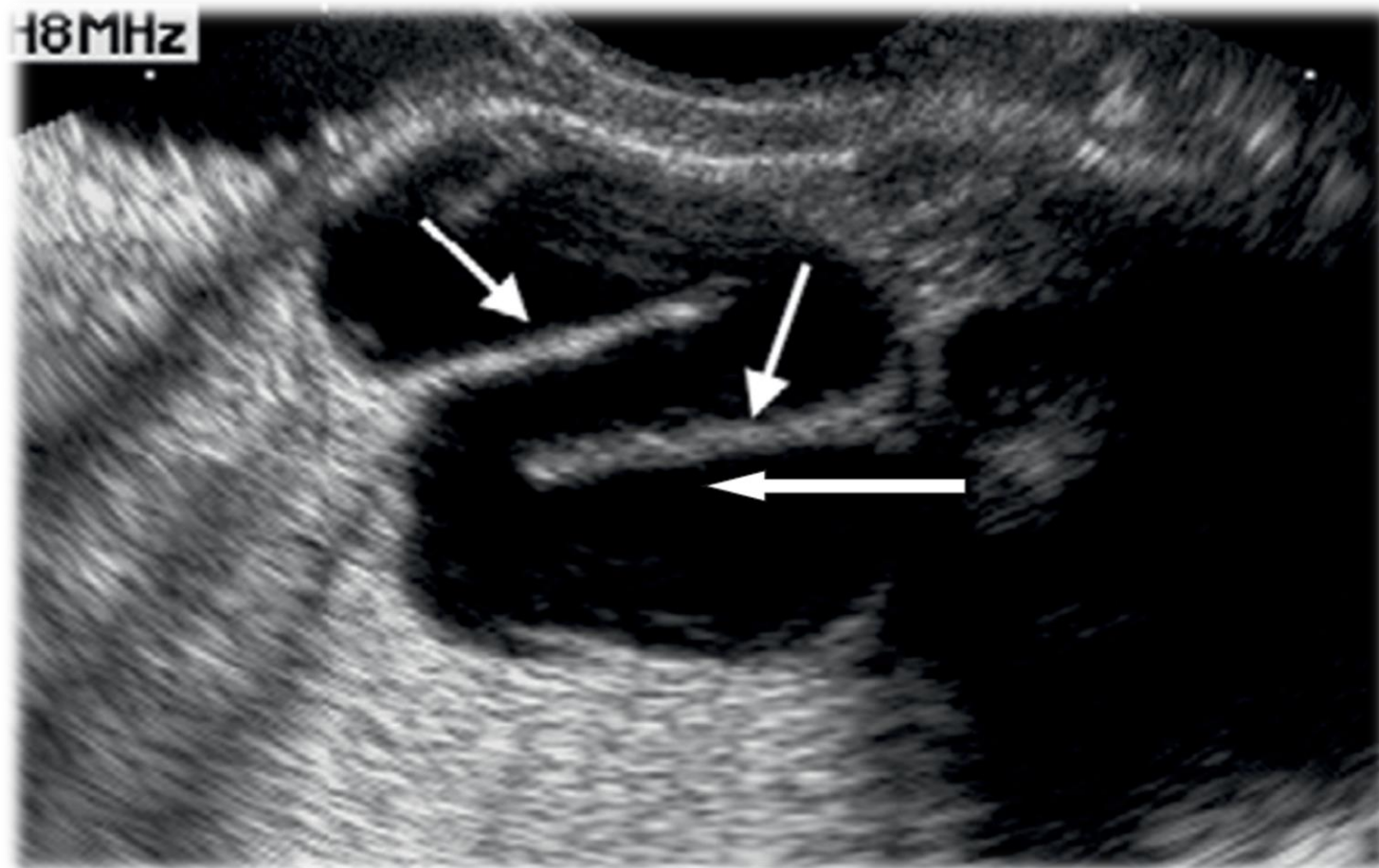
'A thin strand of tissue running across the cyst cavity from one internal surface to the contralateral side'

*An **incomplete** septum is a thin strand of tissue running across the cyst cavity from one internal surface to the contralateral side but is not complete in some scanning planes'*

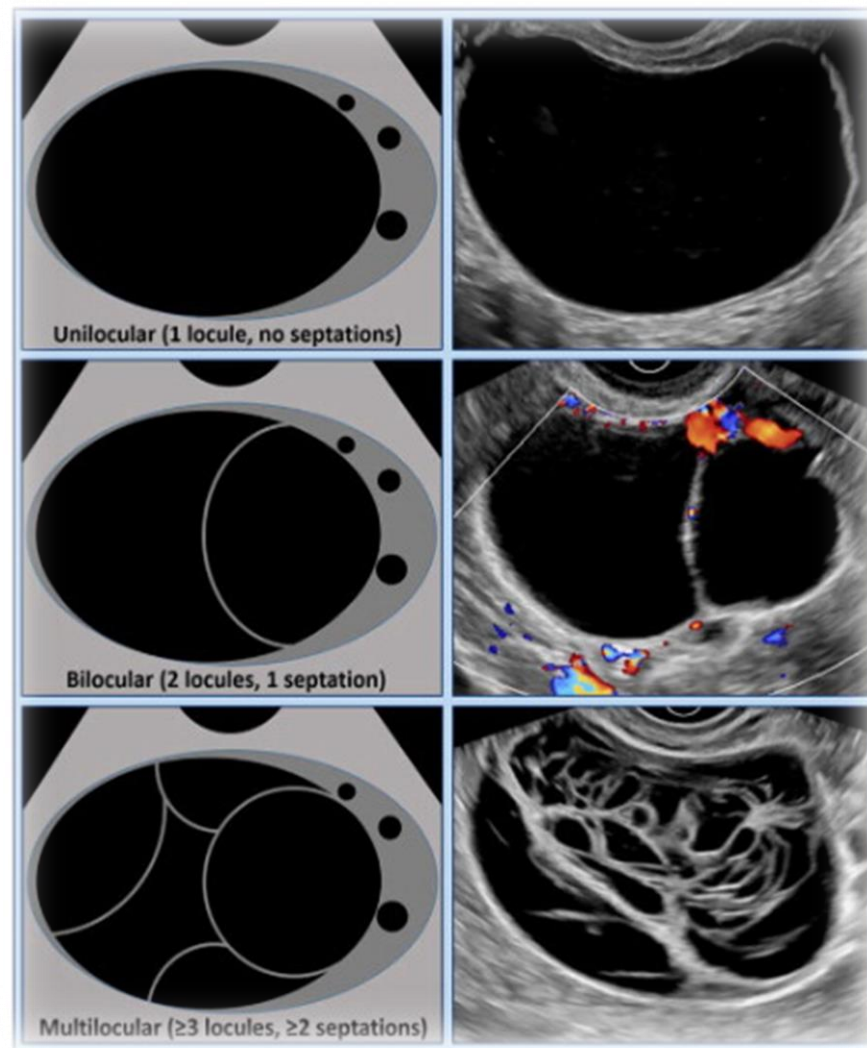
Complete septum

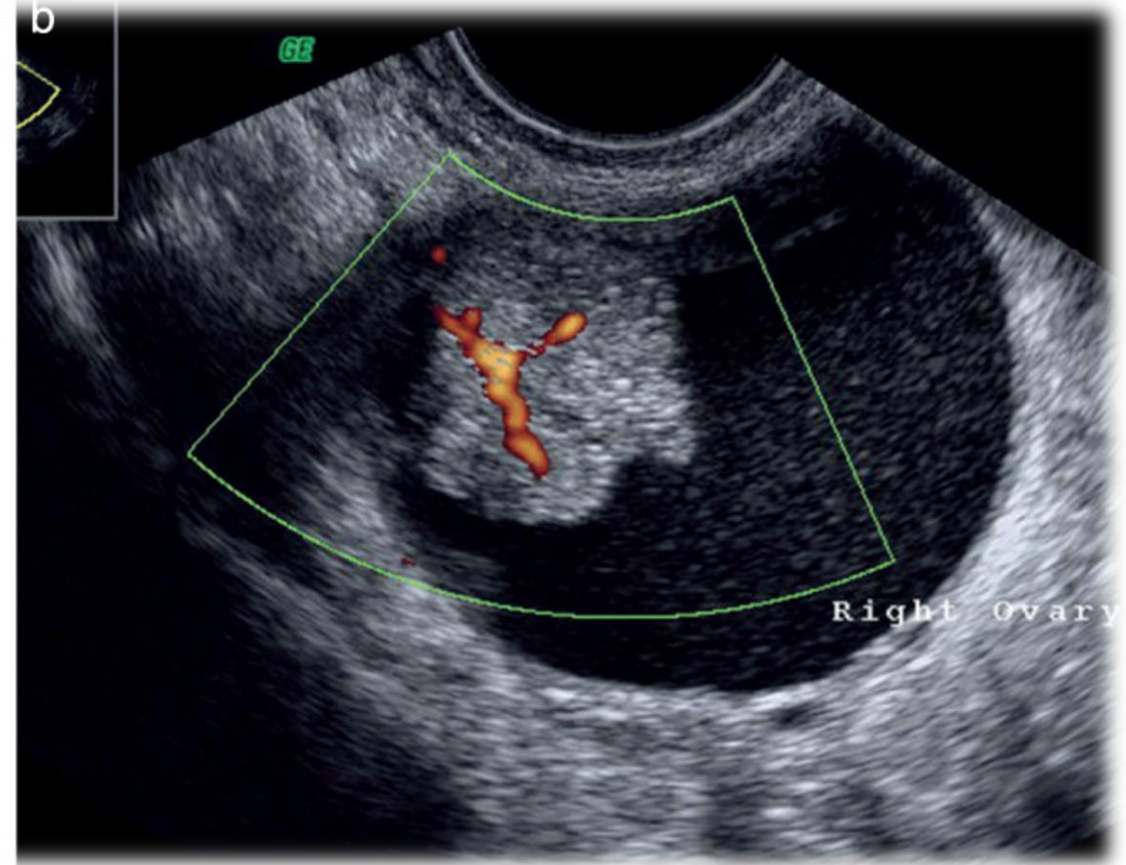
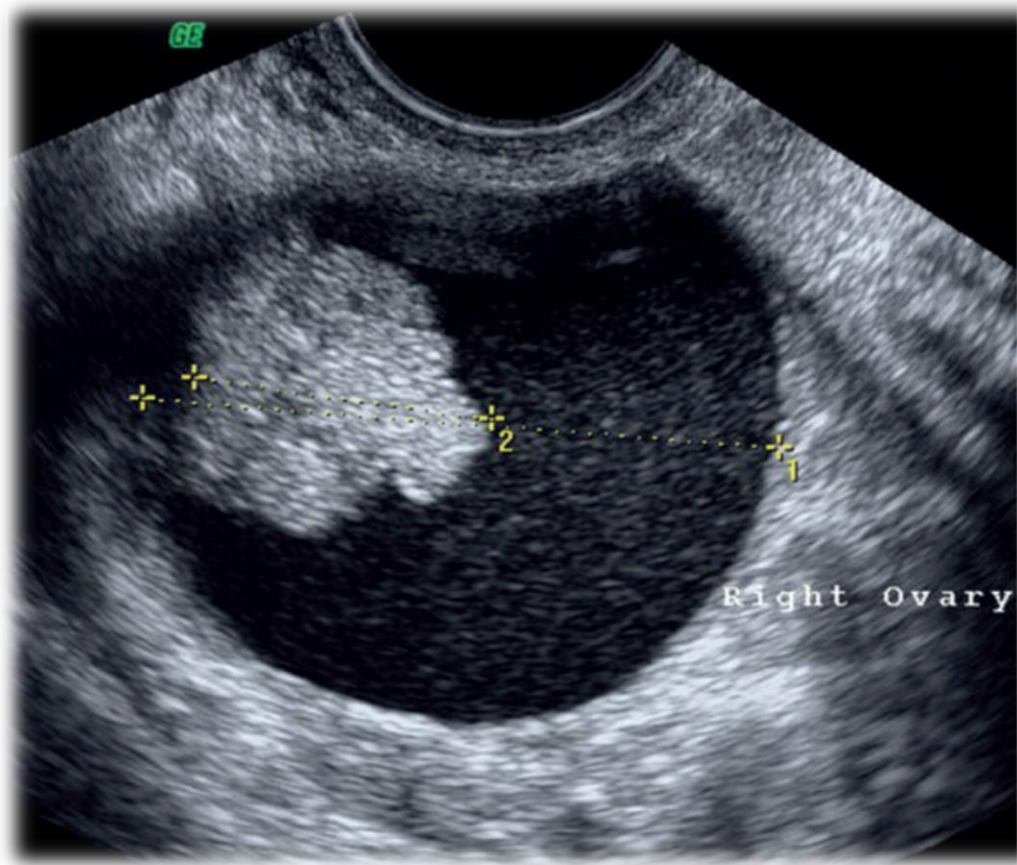


Incomplete septum

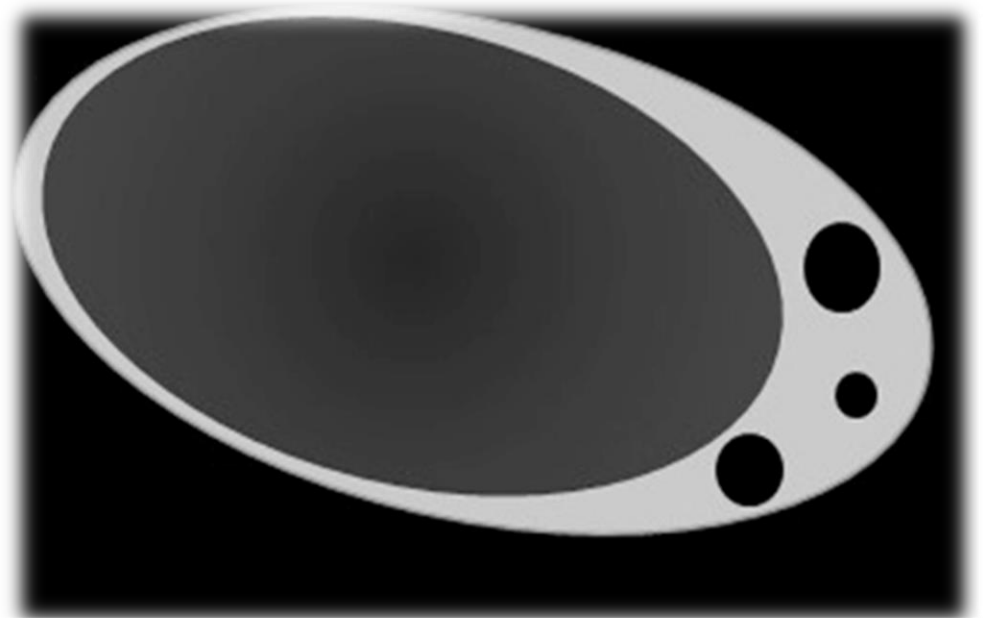


Unilocular or multilocular?

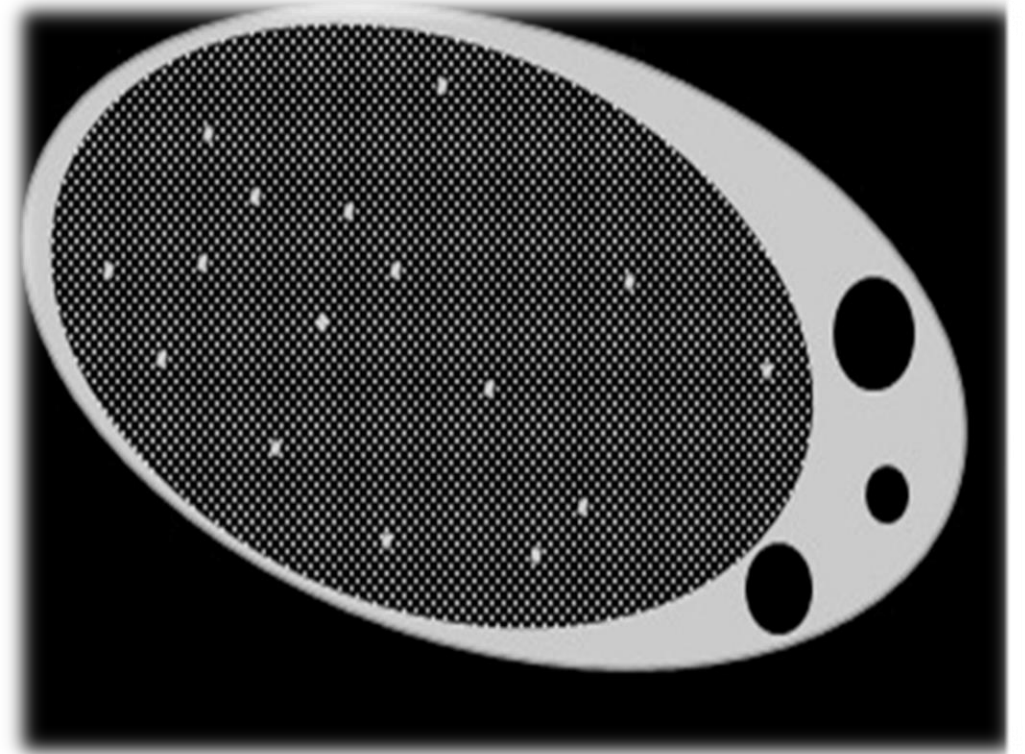
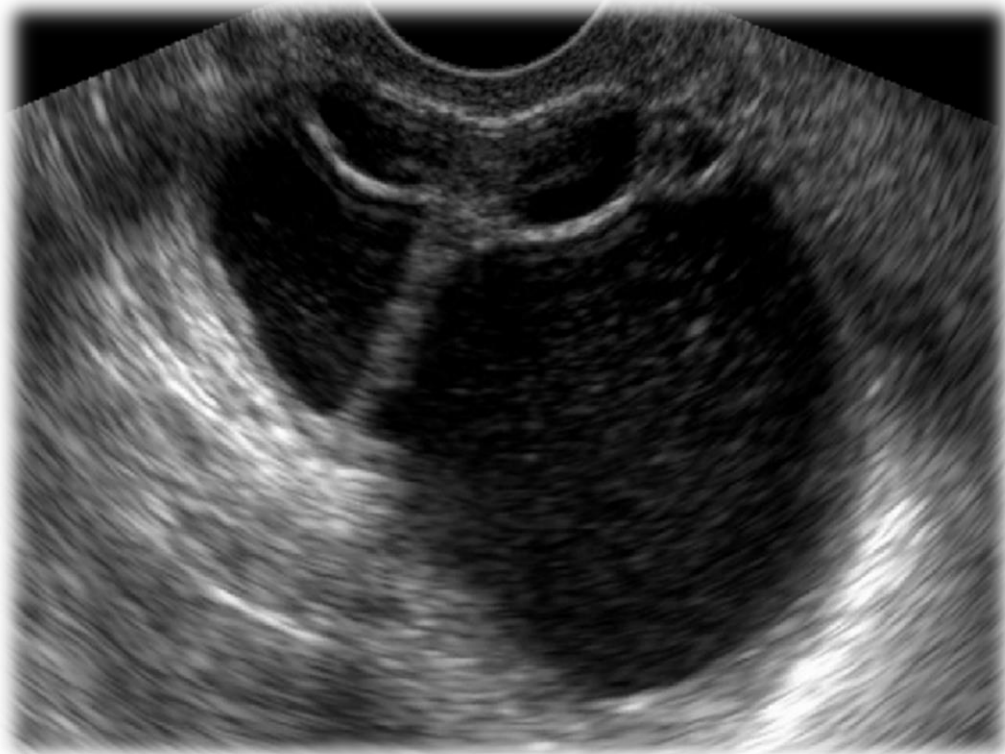




Definition 3: Cyst contents - Anechoic

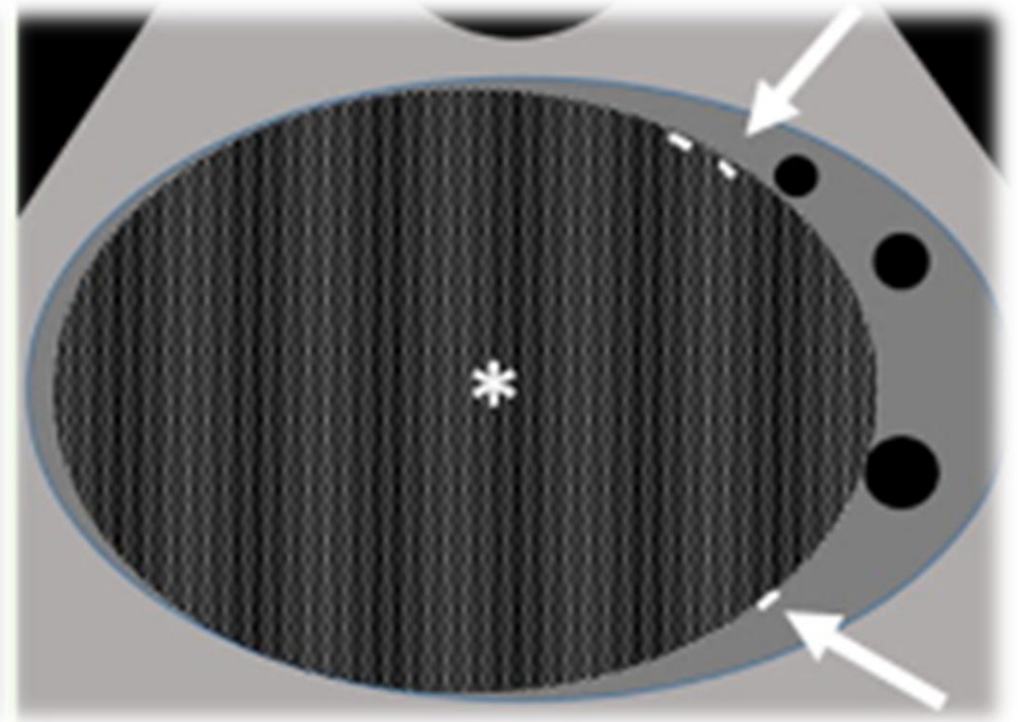
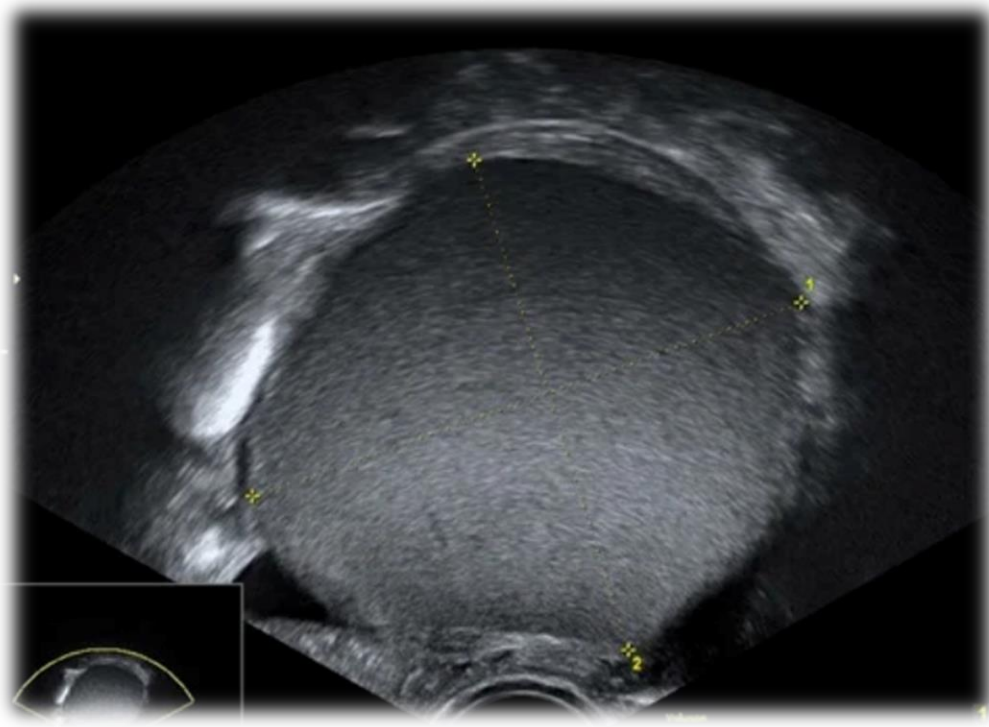


Definition 3: Cyst contents – Low level echoes

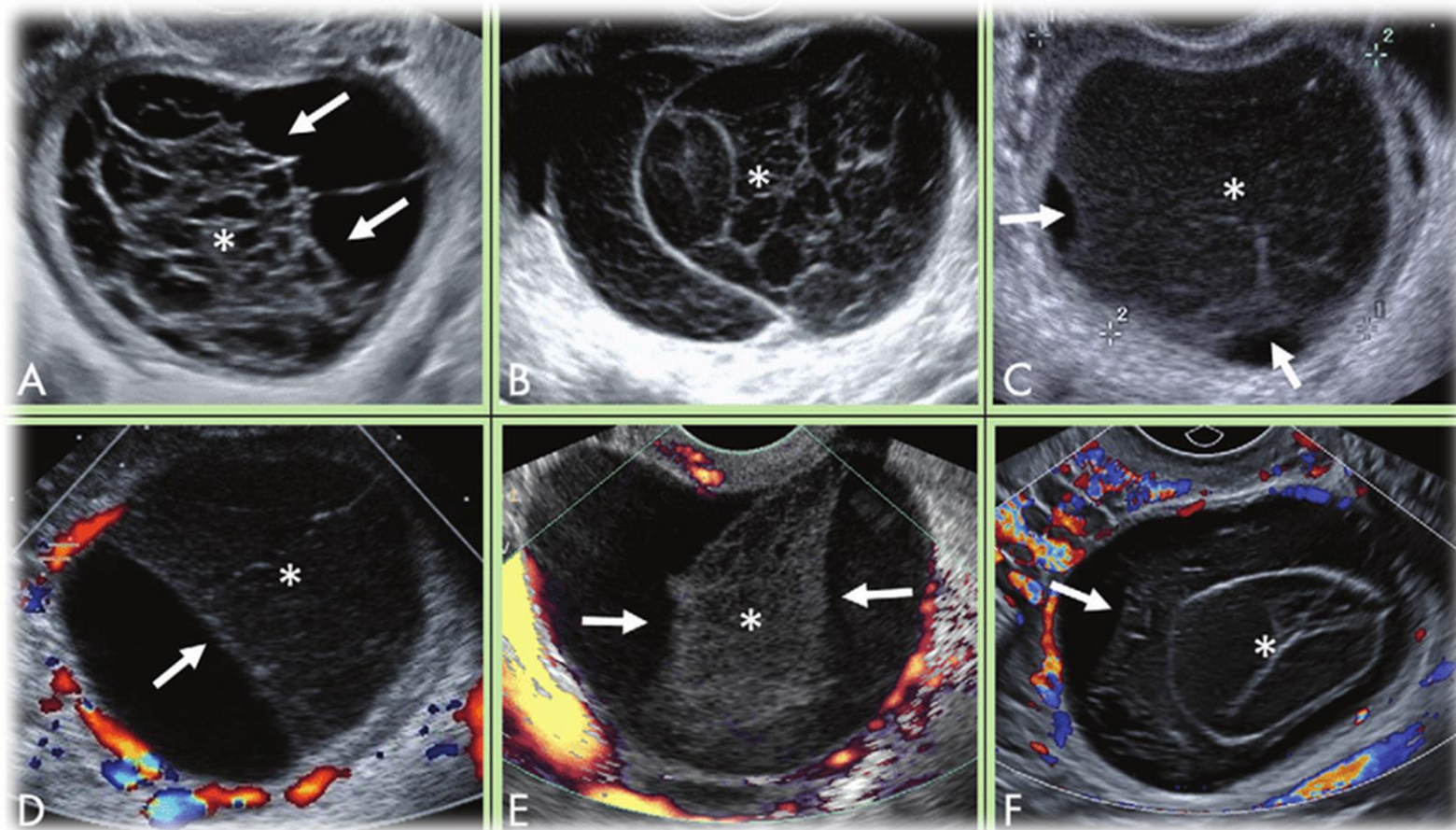


Definition 3: Cyst contents

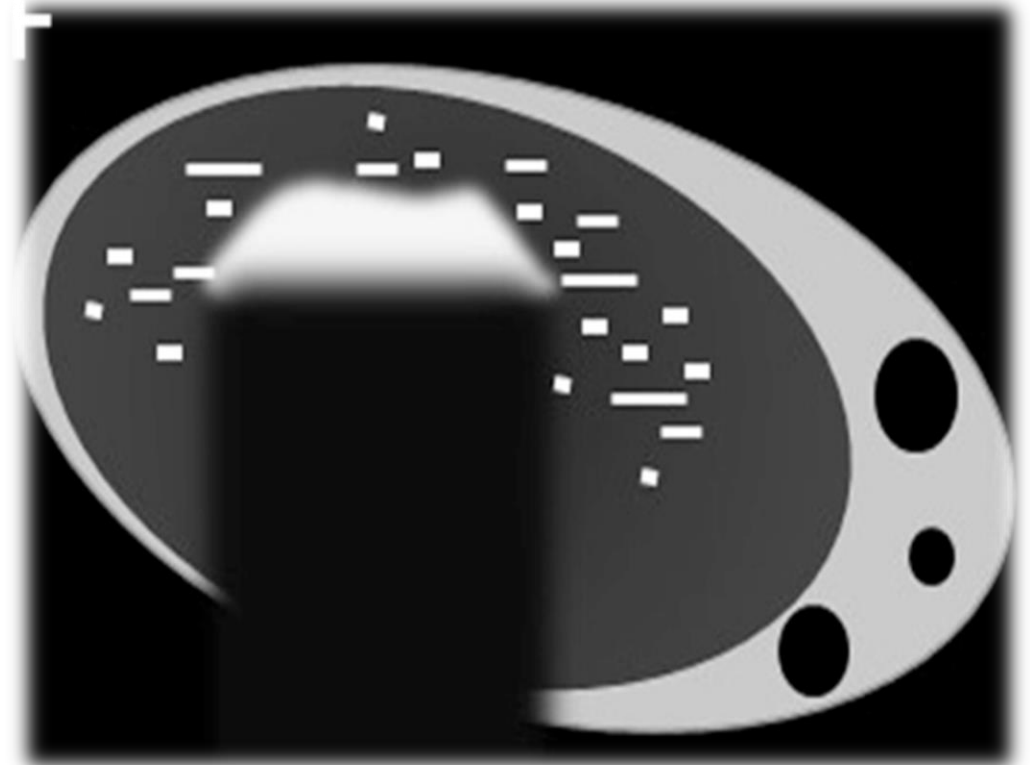
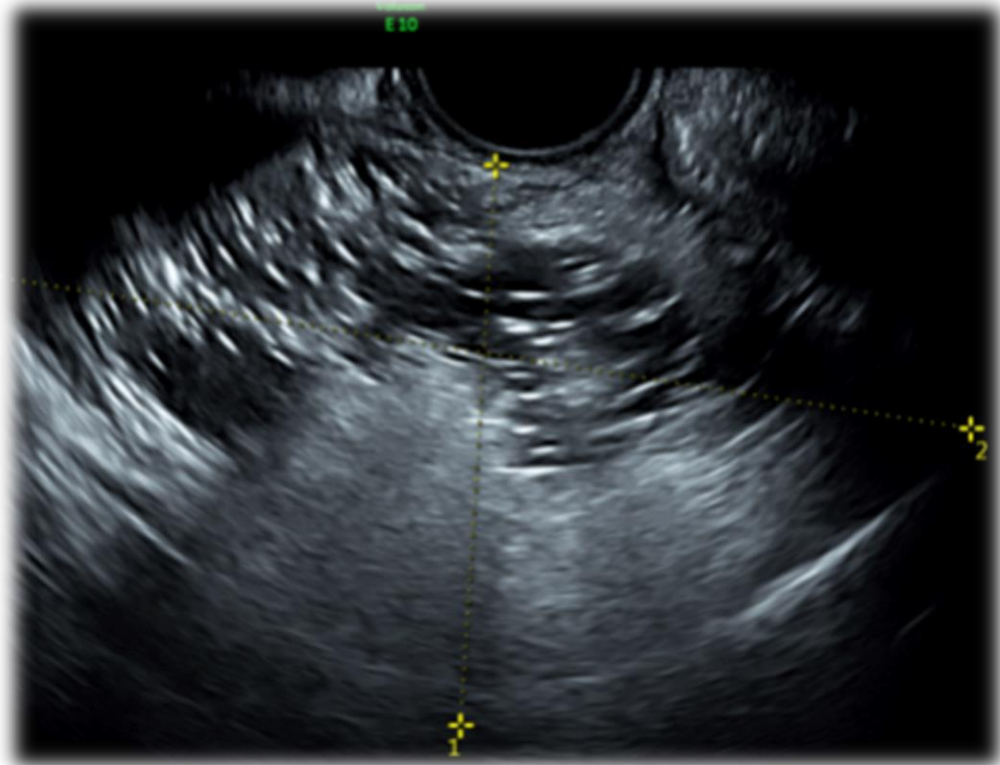
Ground glass

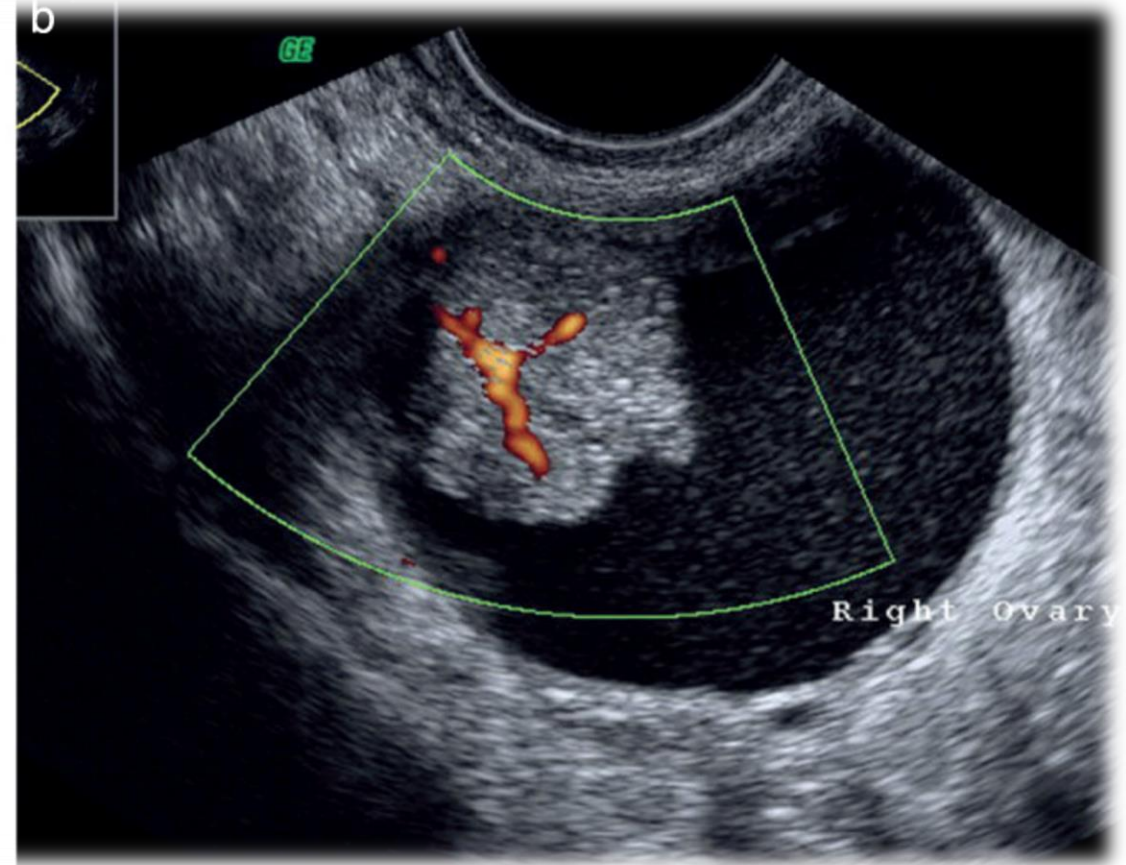
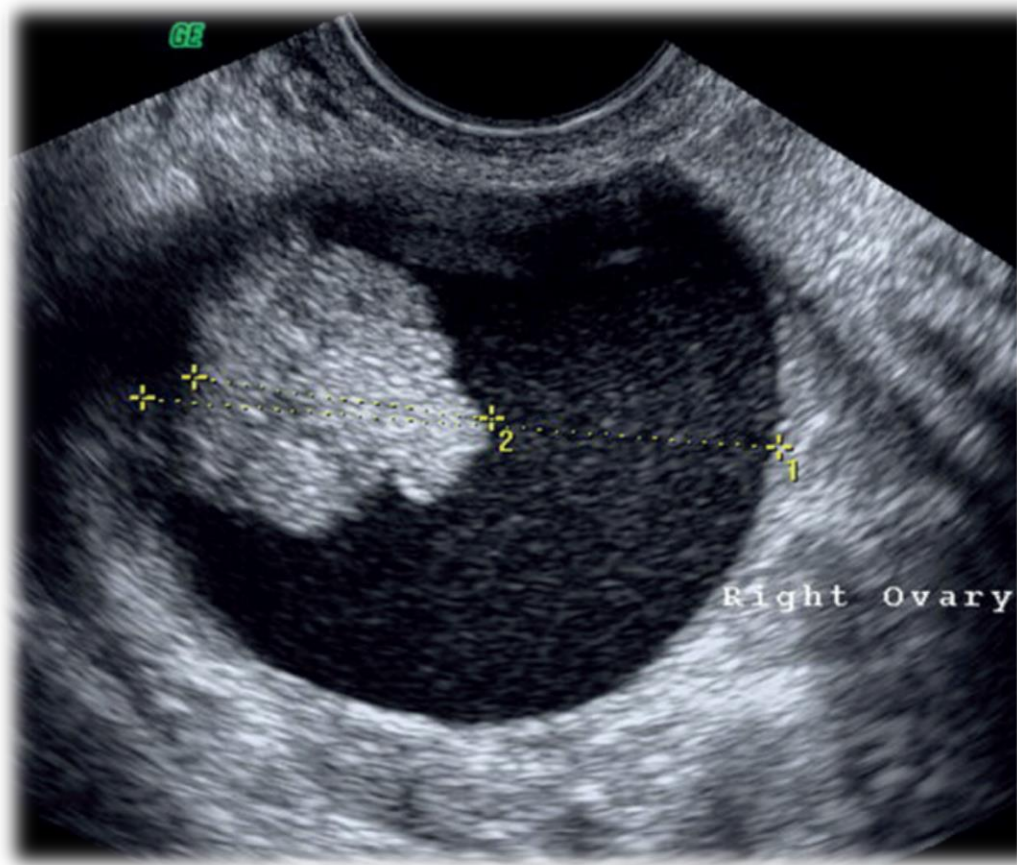


Definition 3: Cyst contents - Haemorrhagic

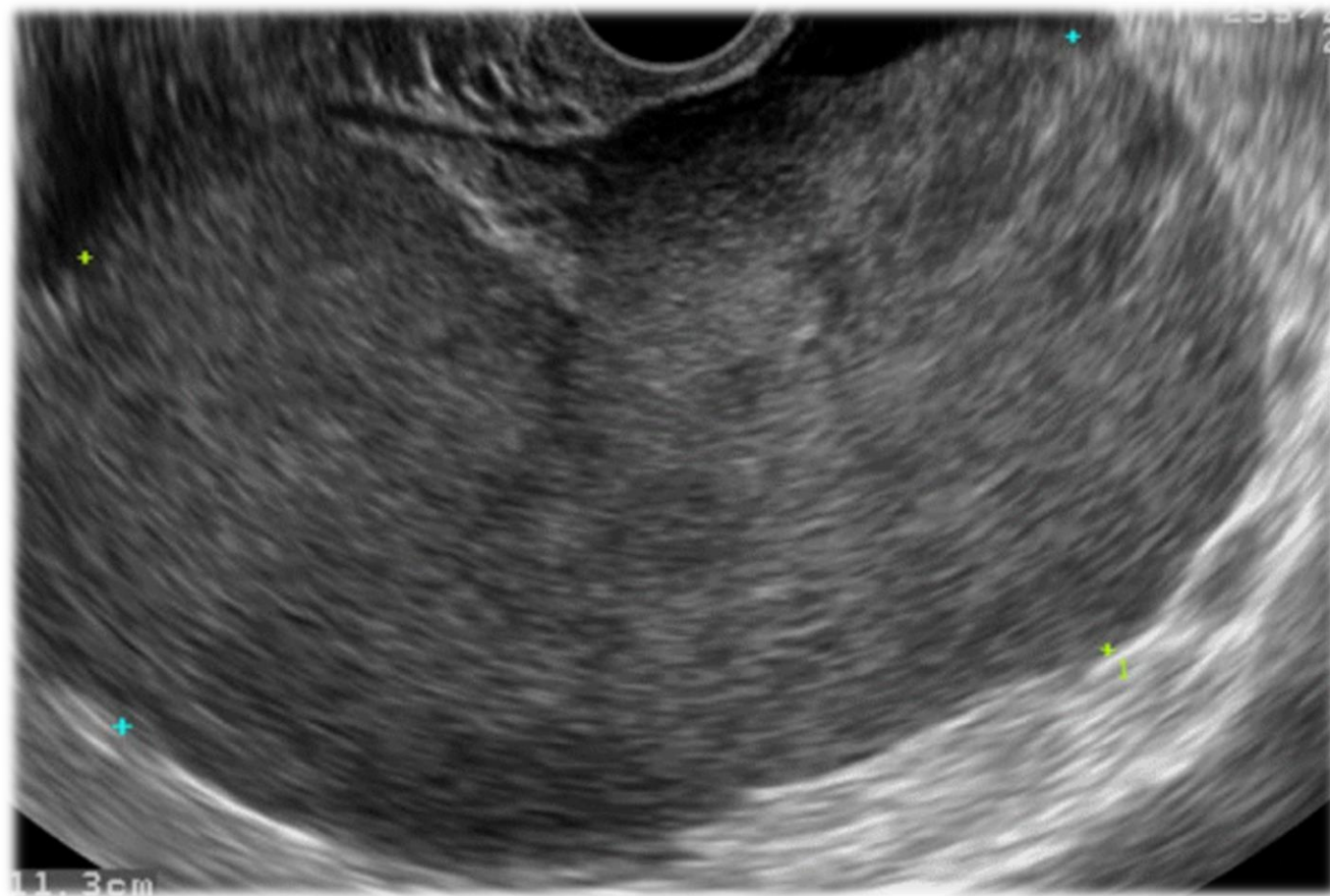


Definition 3: Cyst contents – Mixed echogenic





Definition 3: Cyst contents: Solid



Definition 4: 'Solid'

'An area within the lesion exhibiting high echogenicity in keeping with tissue'

NB: A septum does not make a lesion 'solid'

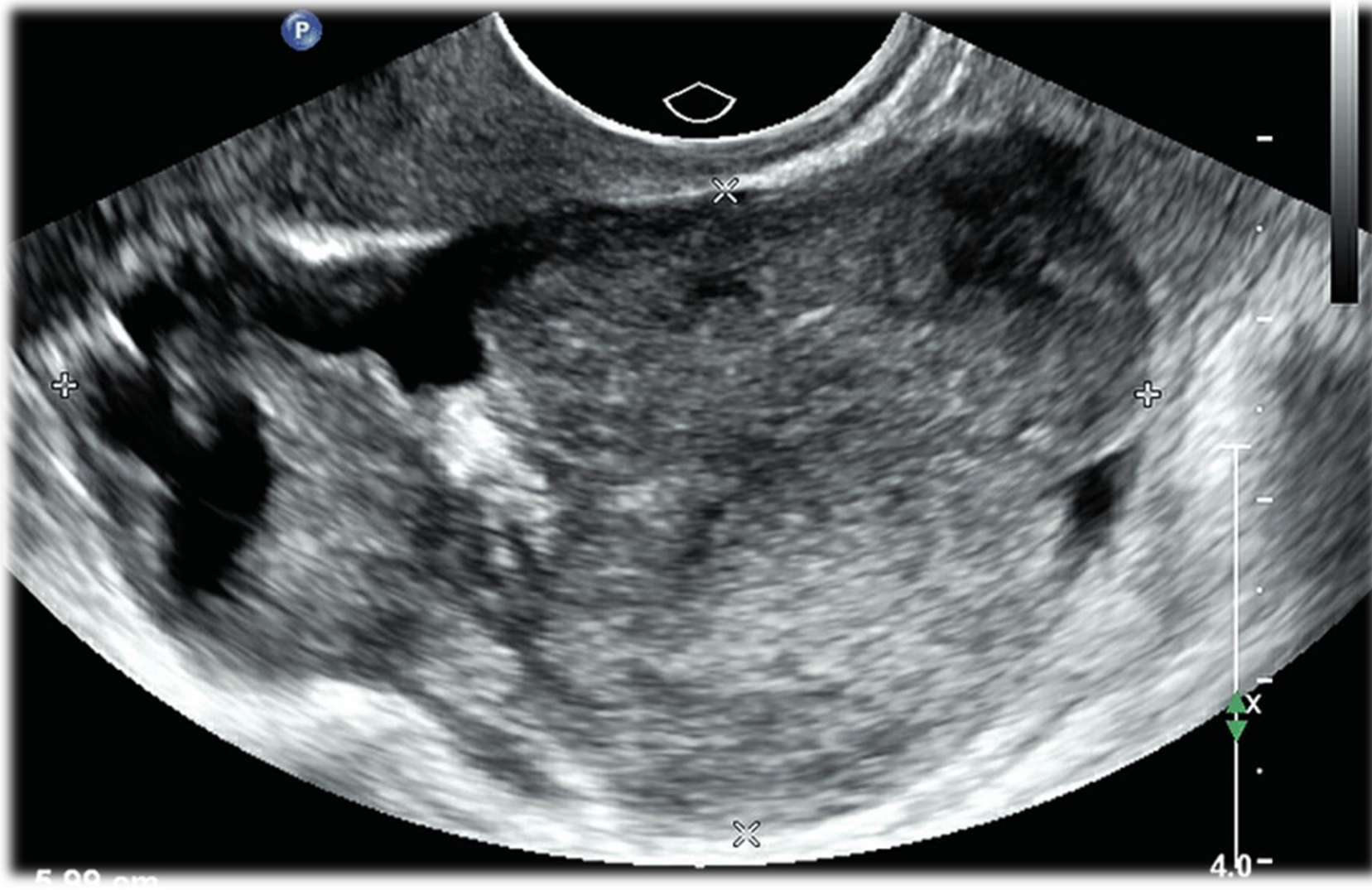
Thickened lesion walls are not 'solid'

Blood clots are not 'solid'

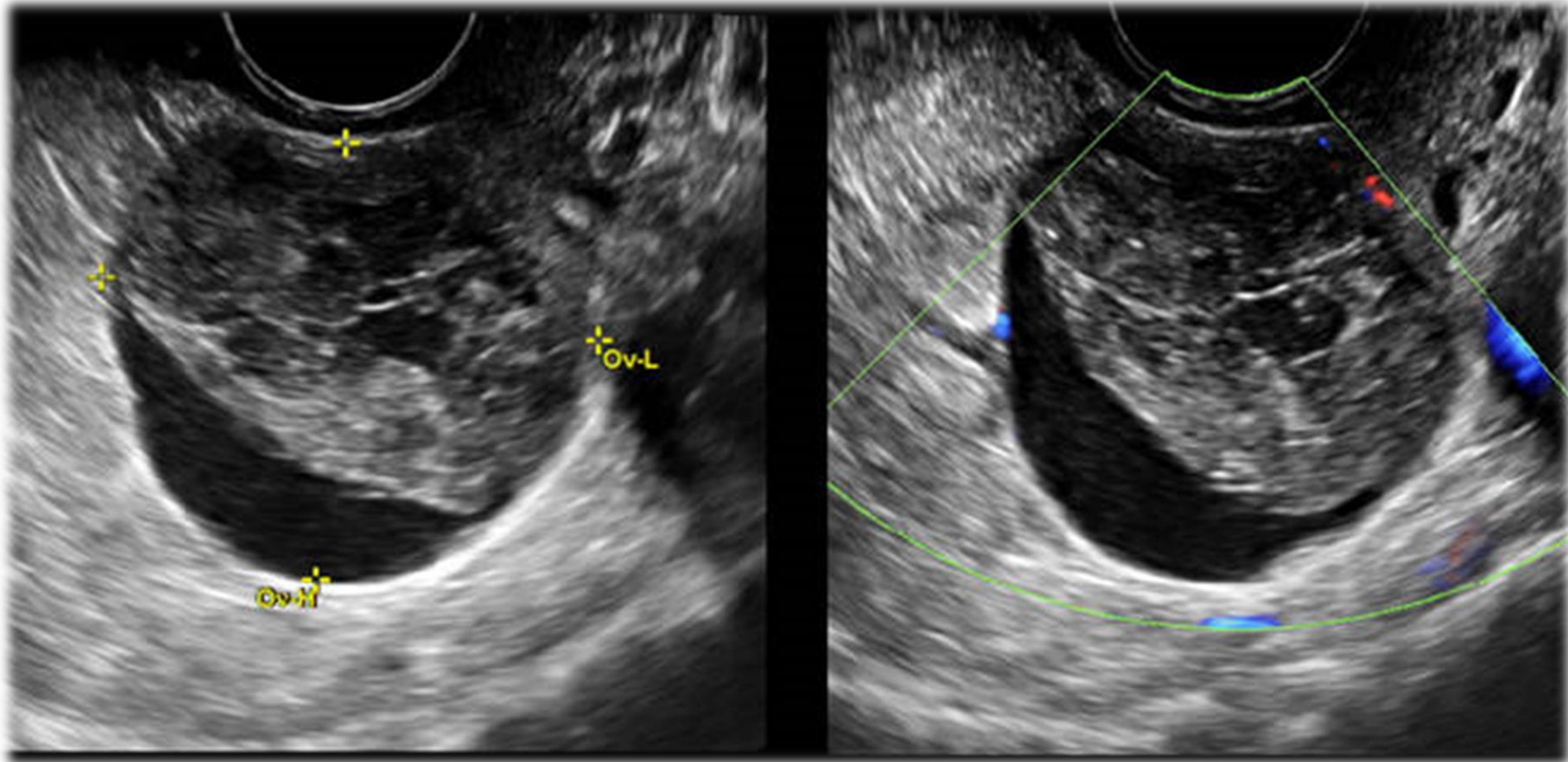
Rokitansky nodule in a dermoid is not 'solid'

Papillary projections are 'solid'

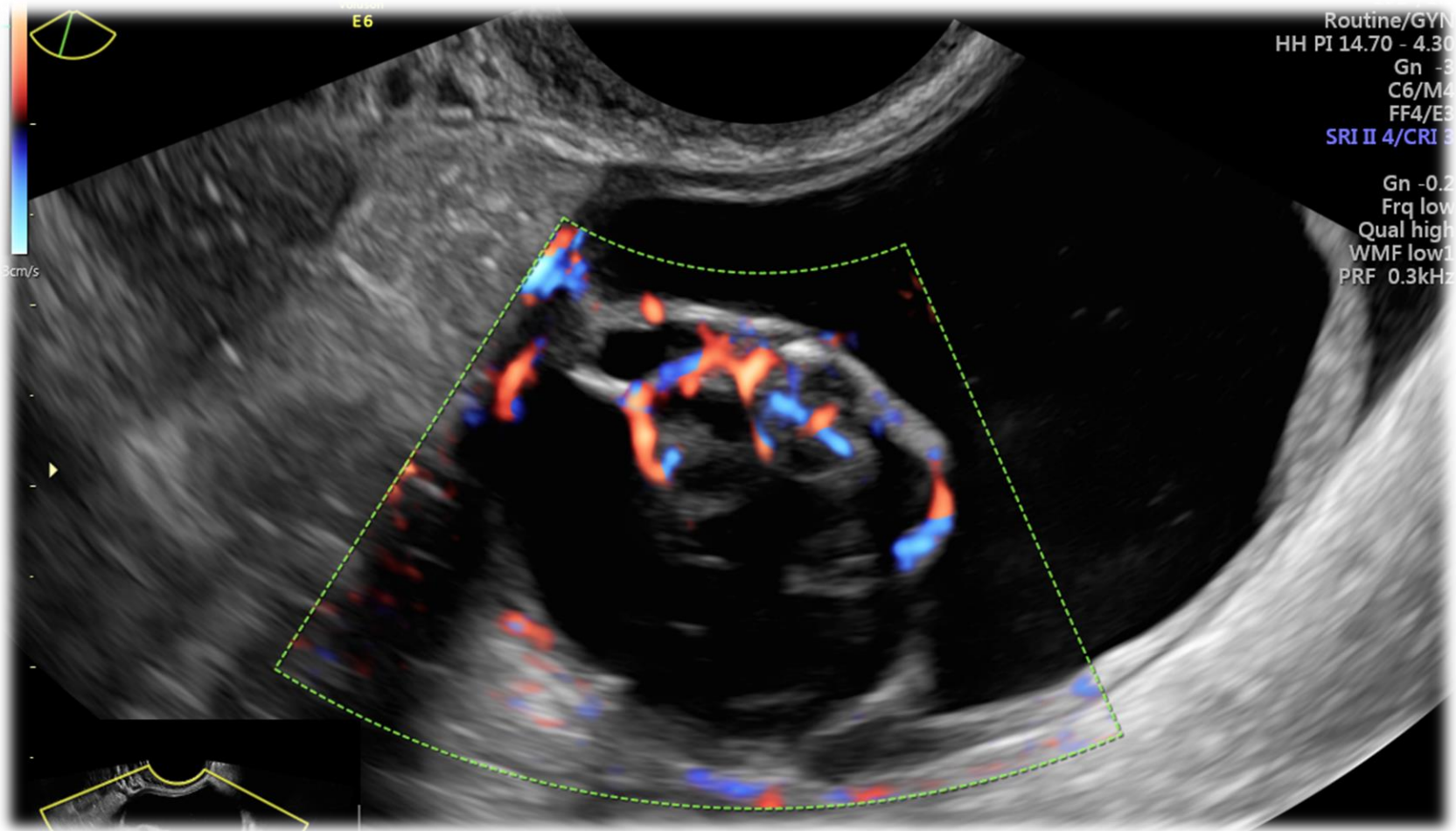
Complexities of 'Solid'



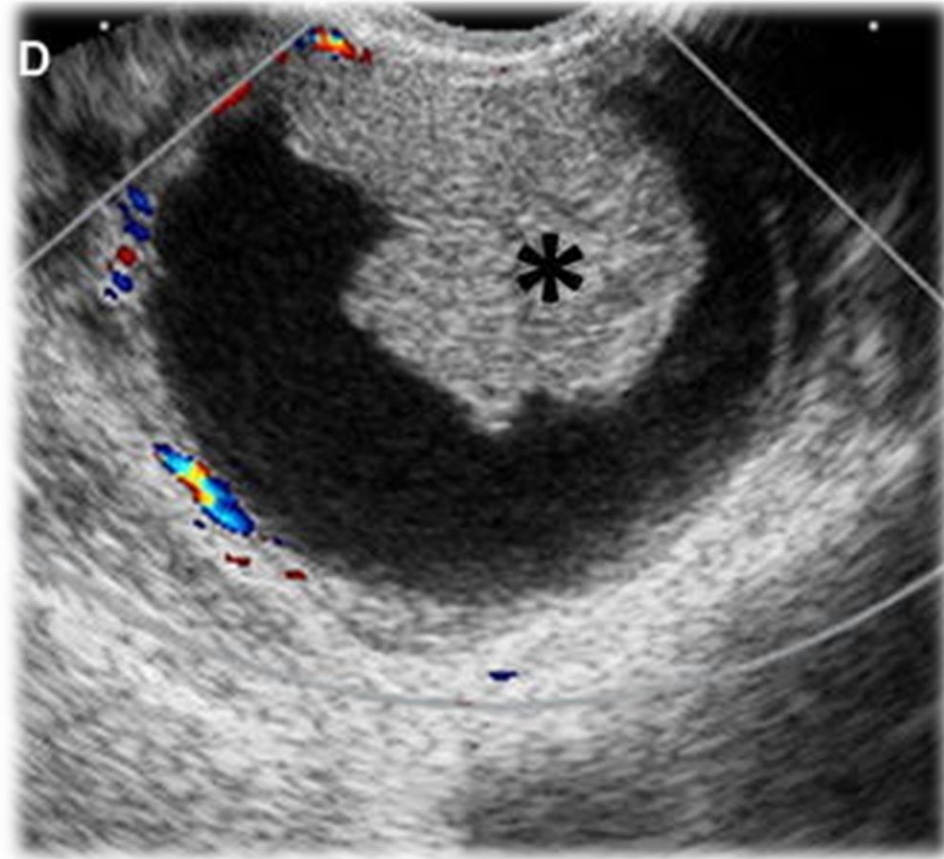
Complexities of 'Solid'



Complexities of 'Solid'

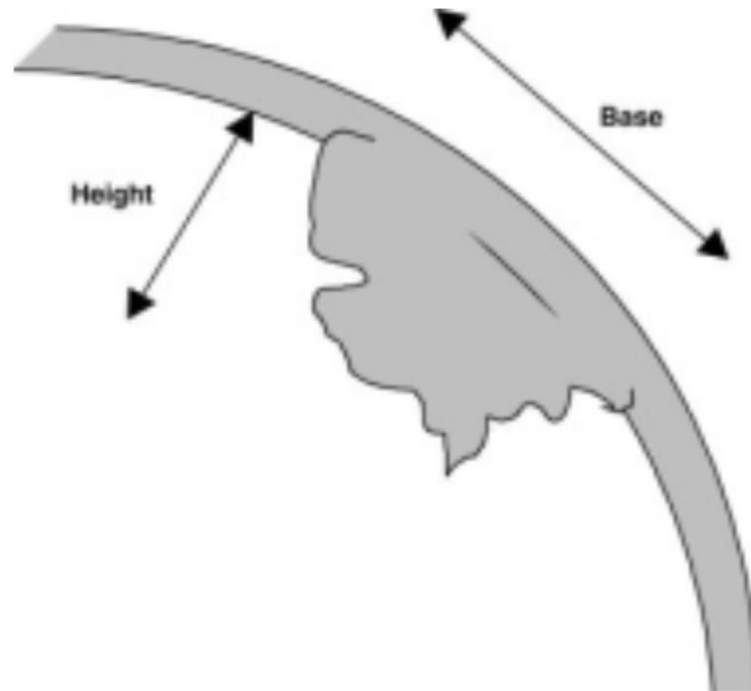


Complexities of 'Solid'

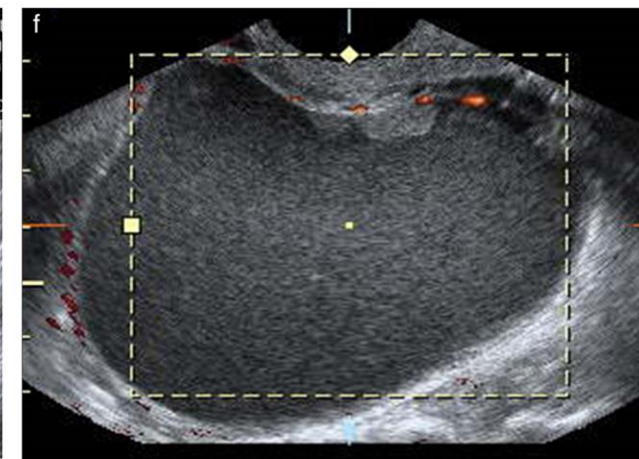
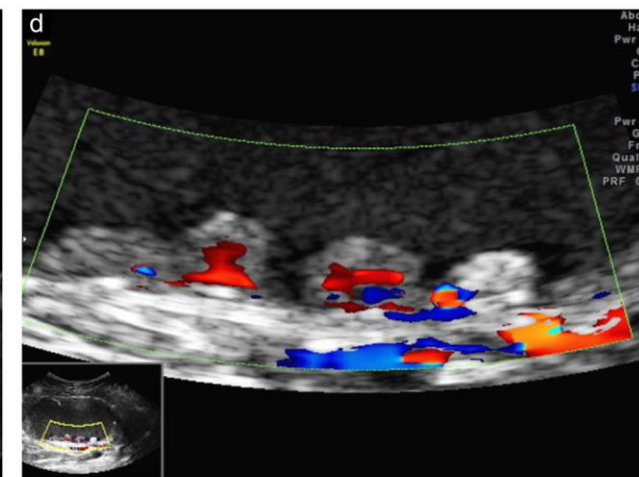
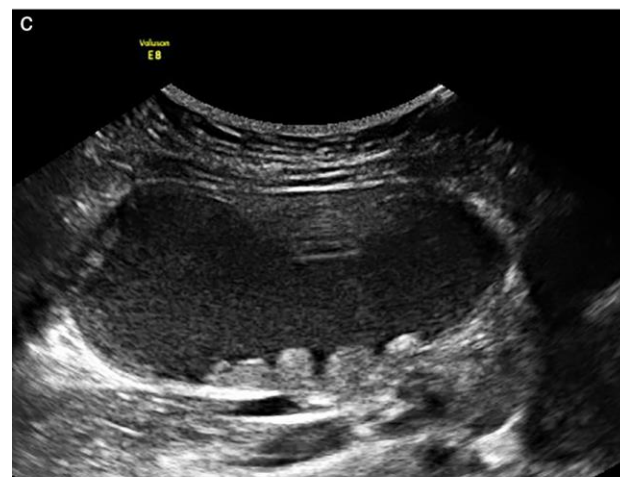
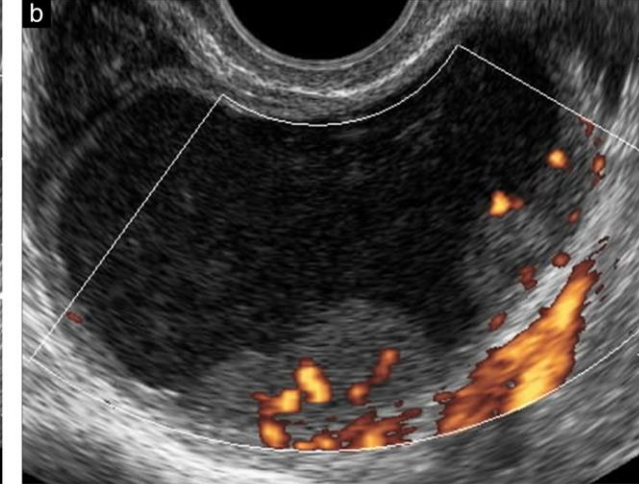
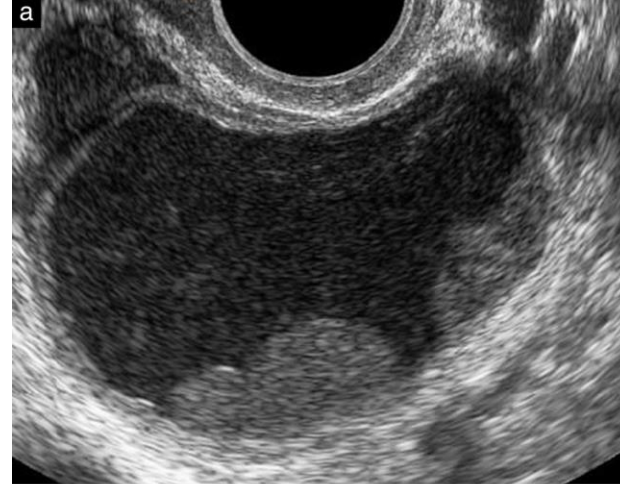


Papillary Projections

'A solid projection arising from the cyst wall and measuring >3mm in height'

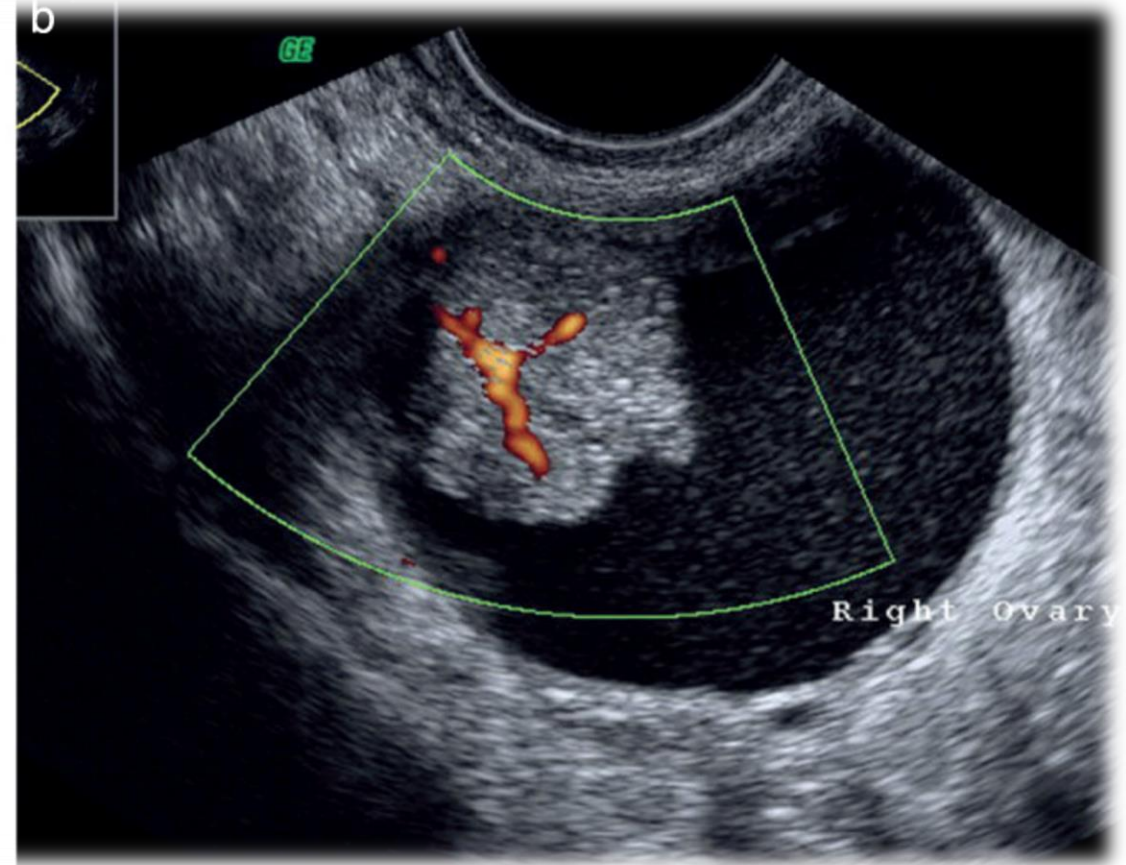
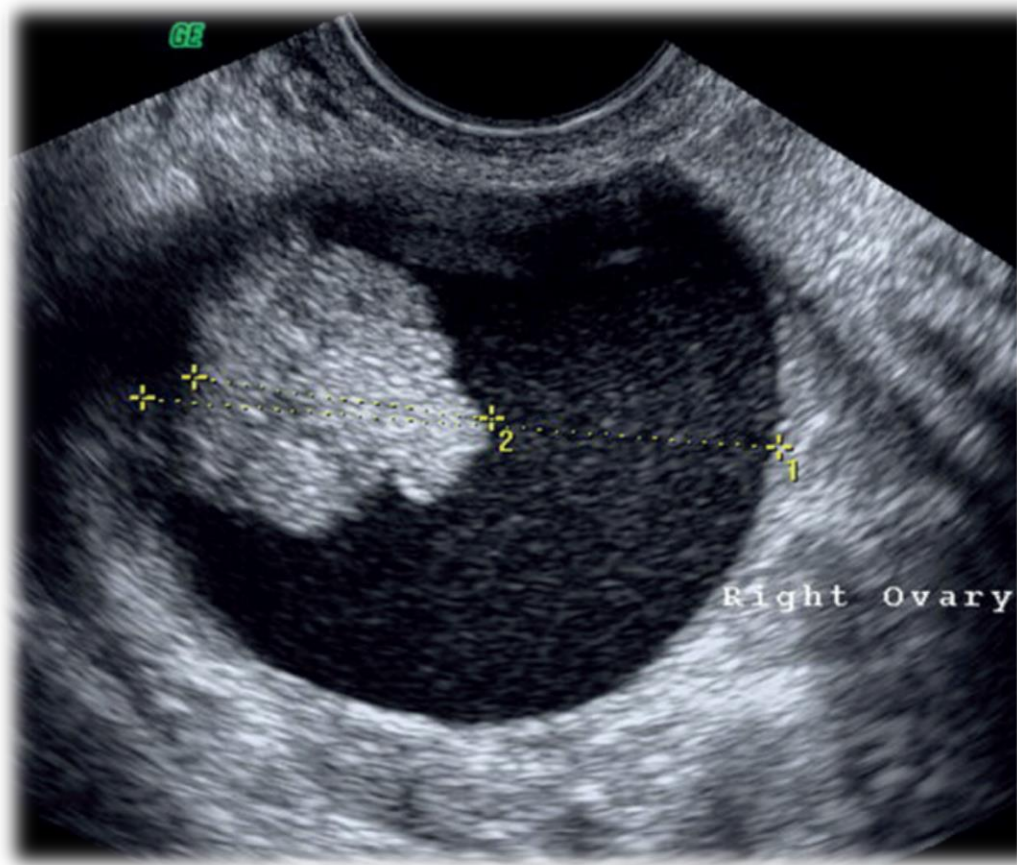


Papillary Projections



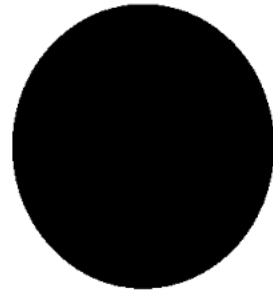
Deciphering if something is solid or not

1. Give it a poke.
2. Apply Doppler (PRF 0.3).
3. Positive Doppler signal = solid; No Doppler signal may still be solid.
4. If in doubt, call it solid!

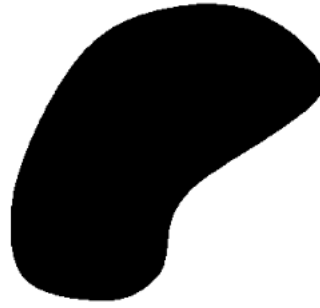


Smooth or irregular cyst wall

- Dependant on the presence or absence of solid papillary projection(s)



Smooth

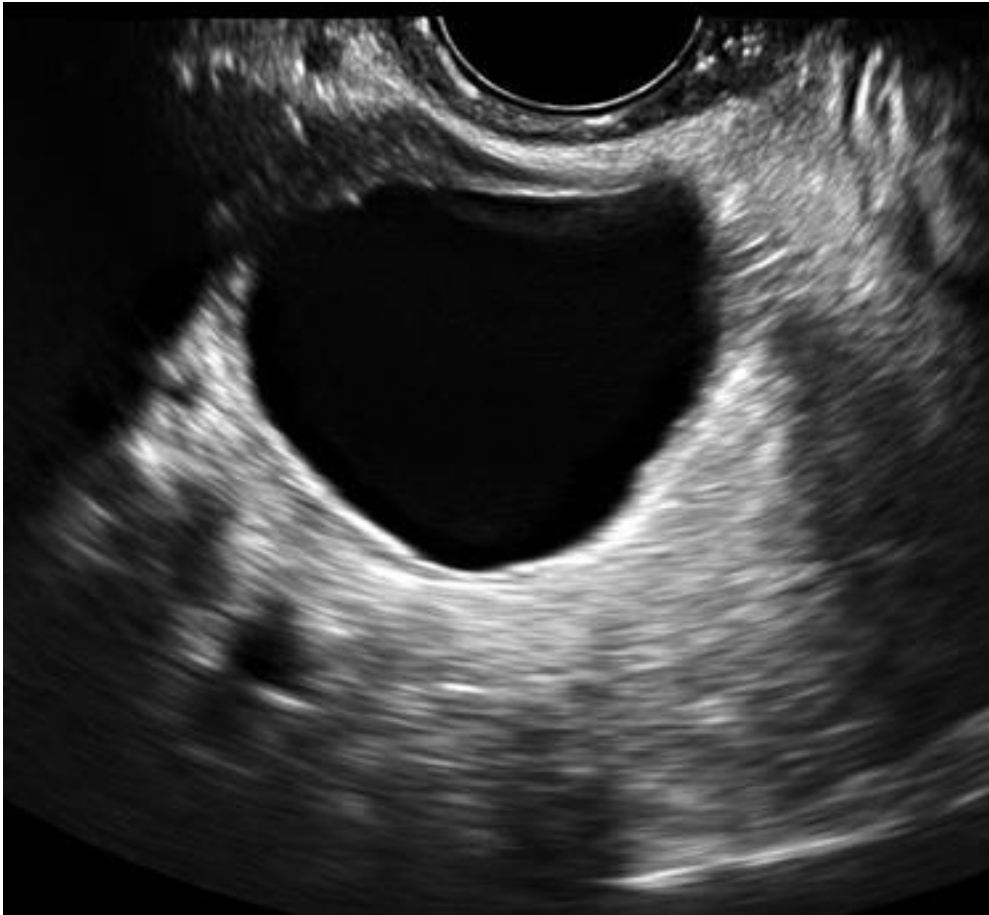


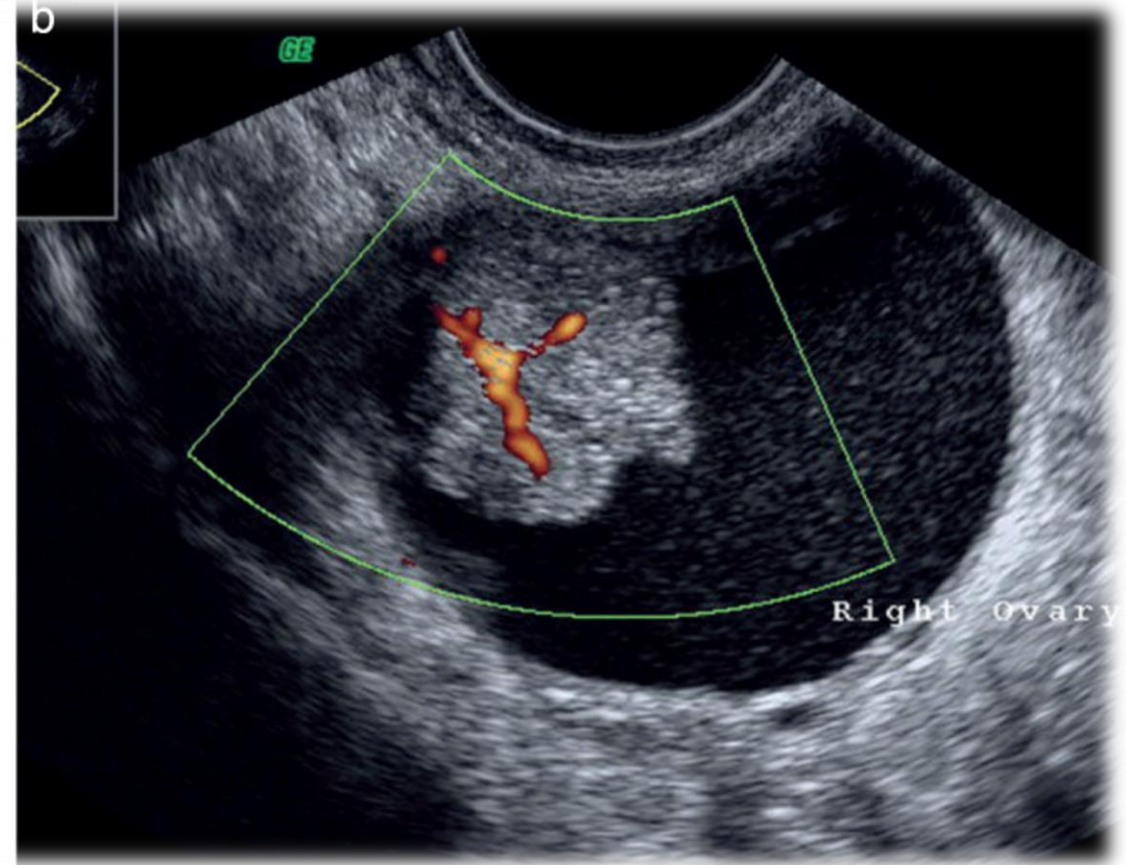
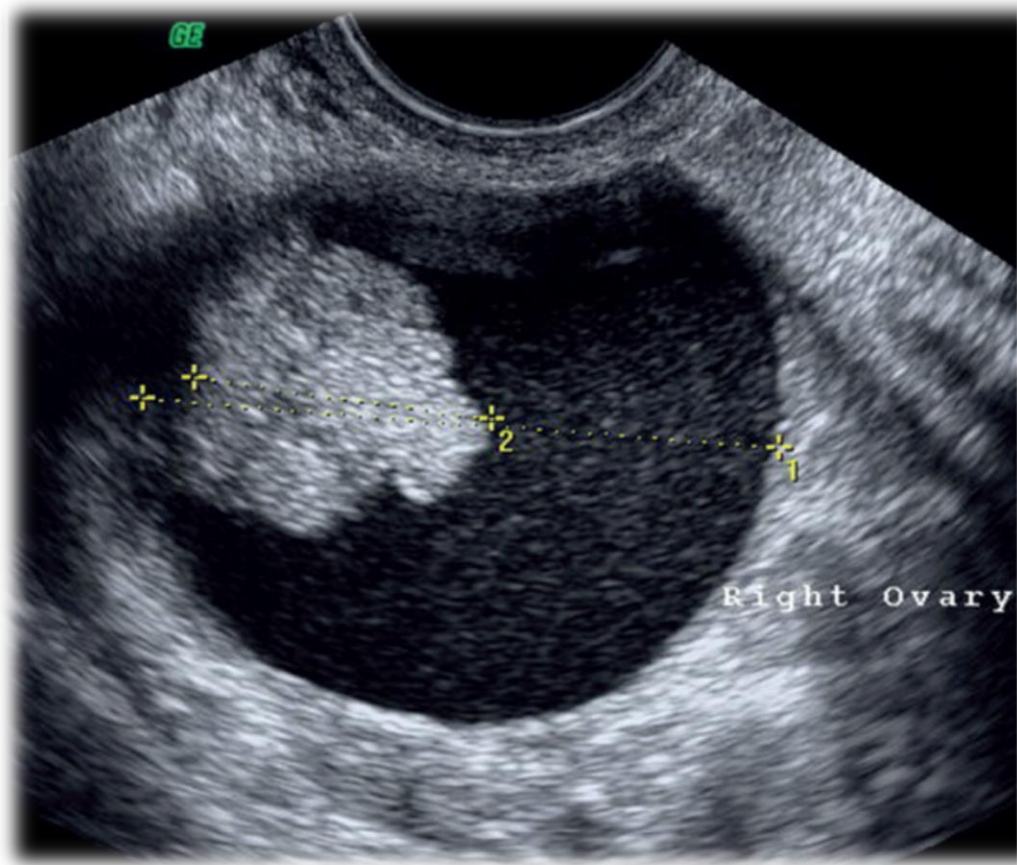
Smooth



Irregular

Smooth or irregular cyst wall

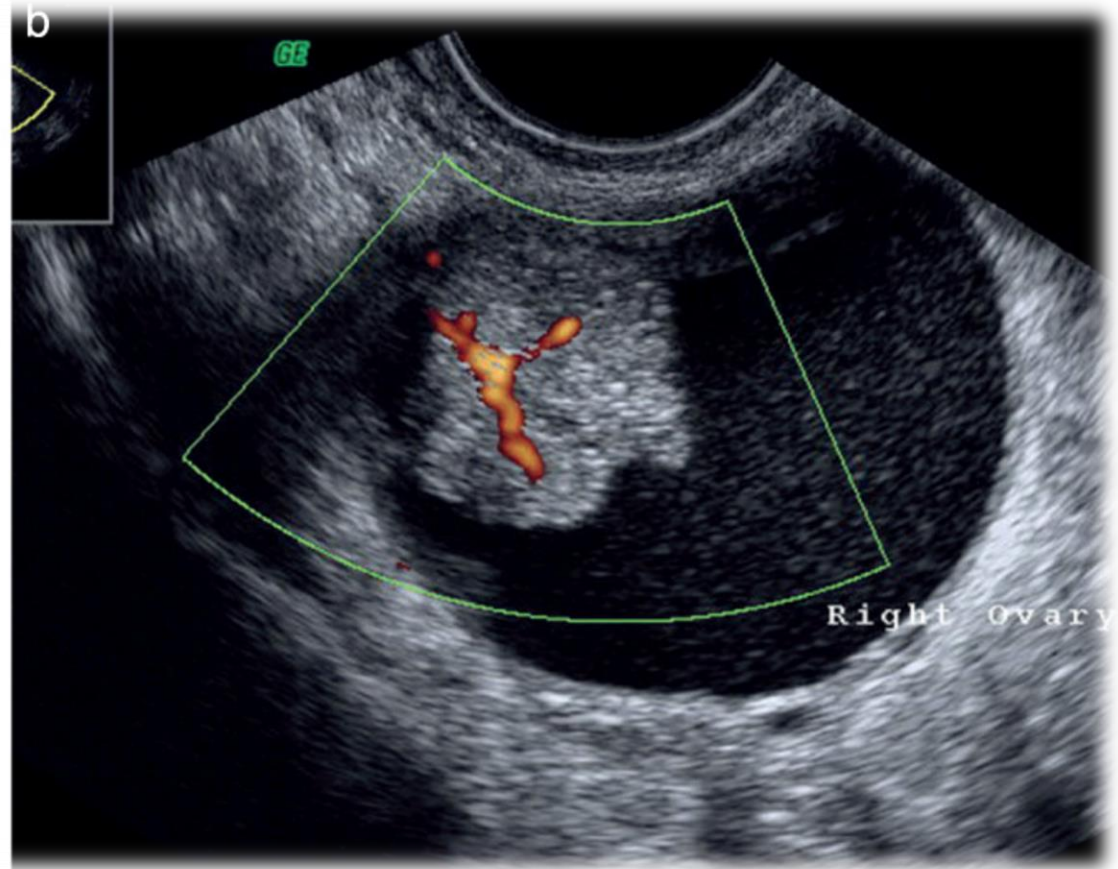
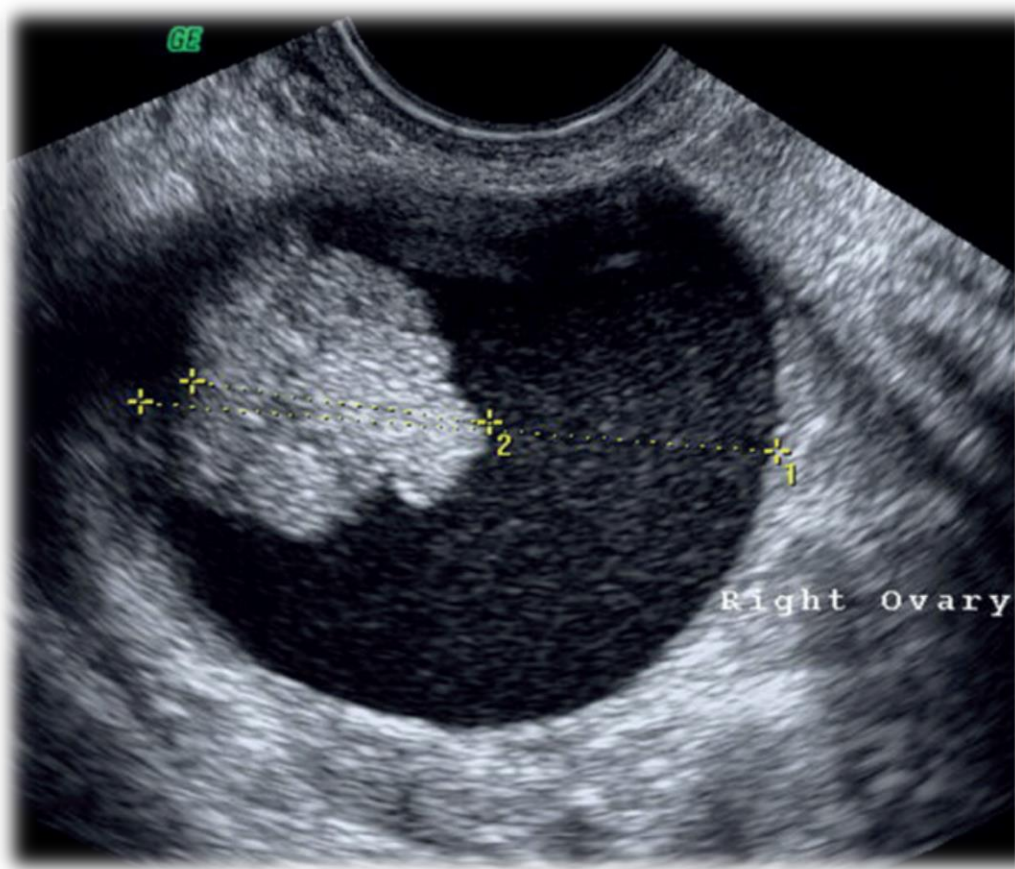




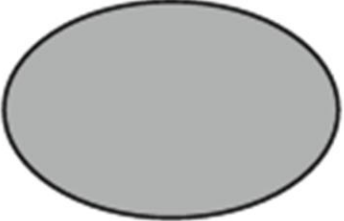
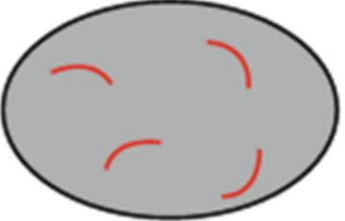
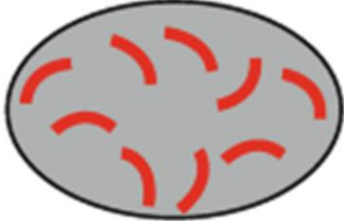
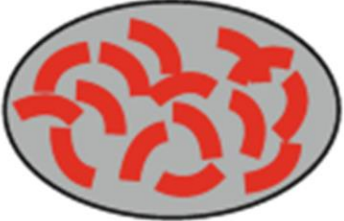
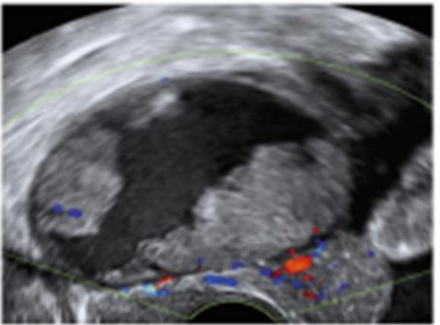
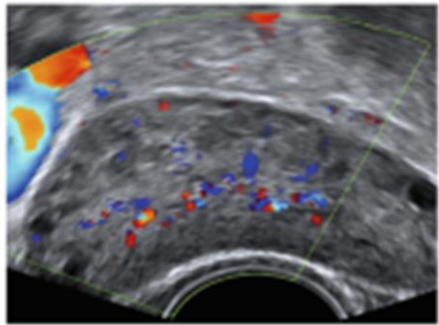
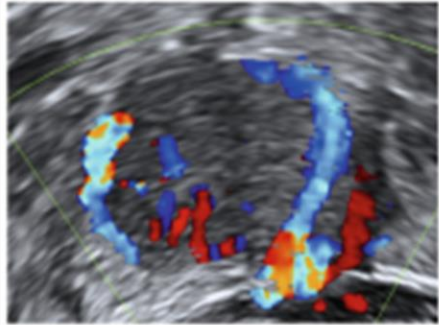
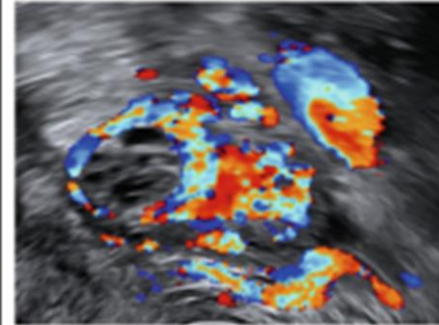
6 categories

1. Unilocular cyst
2. Unilocular – solid cyst
3. Multilocular cyst
4. Multilocular-solid mass
5. Solid tumour (Solid component >80% of lesion)
6. Not classifiable (e.g. because of poor visualisation)

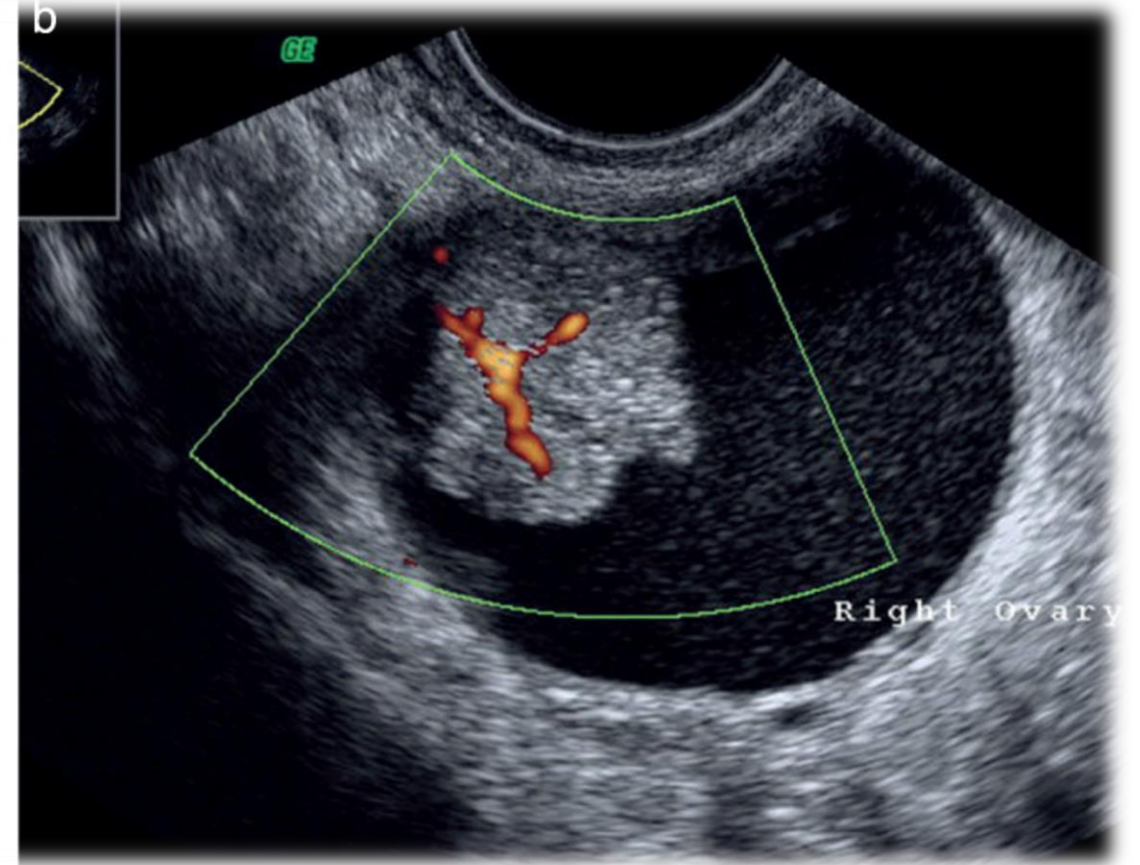
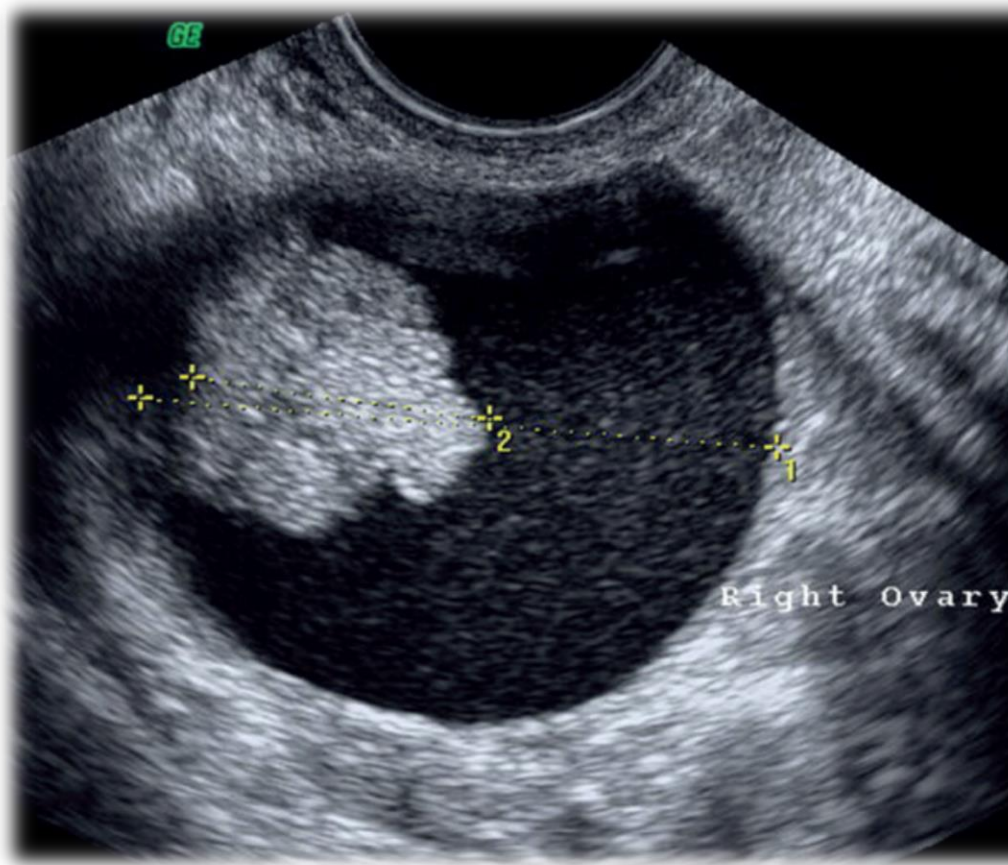
A unilocular solid cyst!



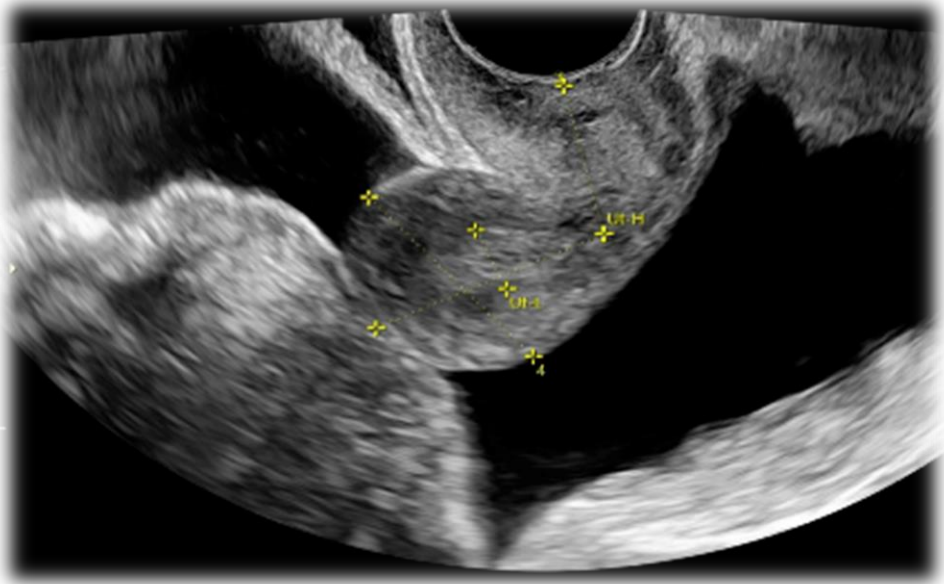
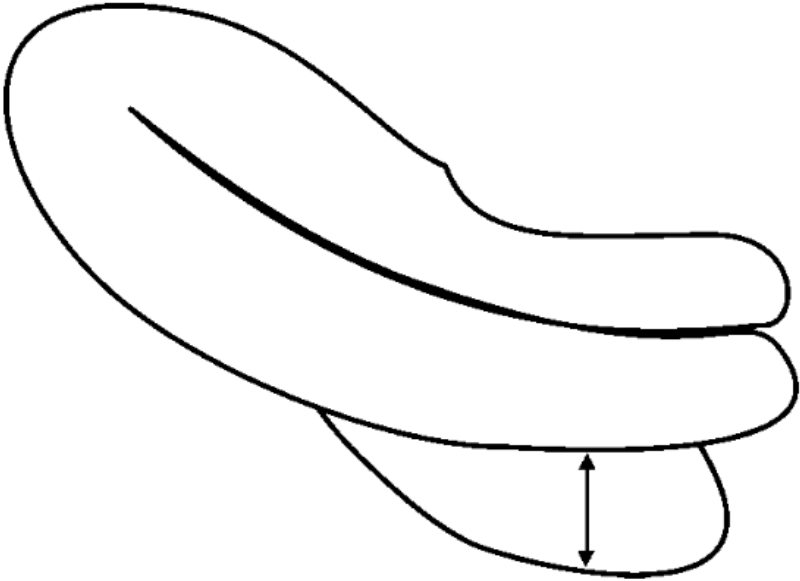
Vascular pattern

| Score 1 | Score 2 | Score 3 | Score 4 |
|--|---|--|--|
|  |  |  |  |
|  |  |  |  |

A unilocular solid cyst with a Doppler colour score of 3!

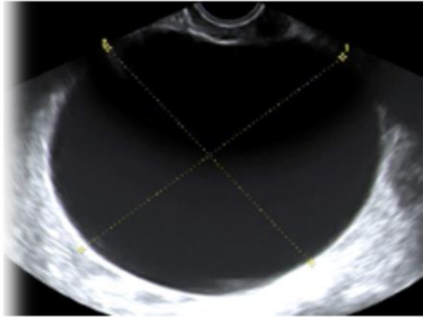


Ascites

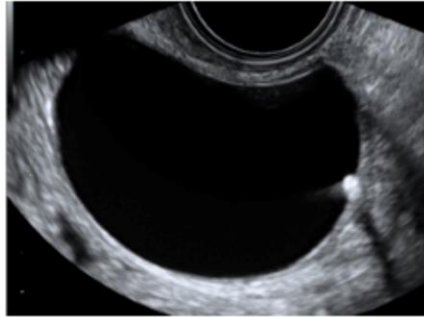


IOTA simple rules

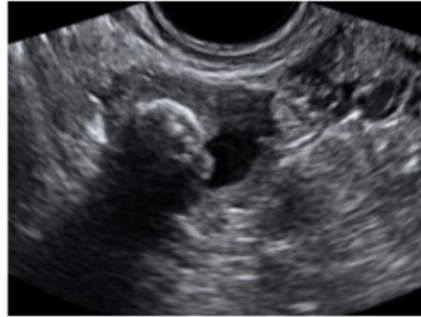
B1 Unilocular



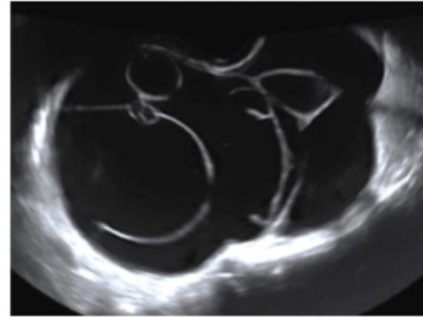
B2 Presence of solid components with largest diameter < 7 mm



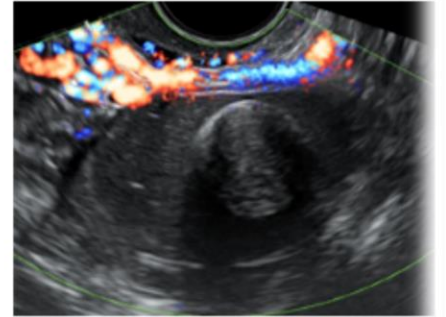
B3 Presence of acoustic shadows



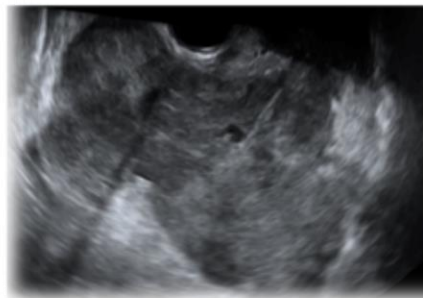
B4 Smooth multilocular tumor with largest diameter < 100 mm



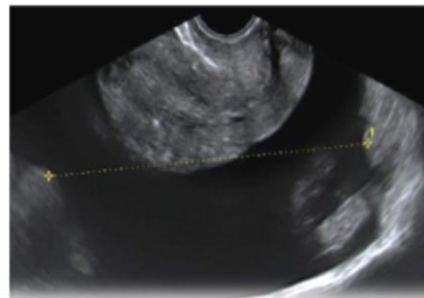
B5 No blood flow (color score 1)



M1 Irregular solid tumor



M2 Presence of ascites



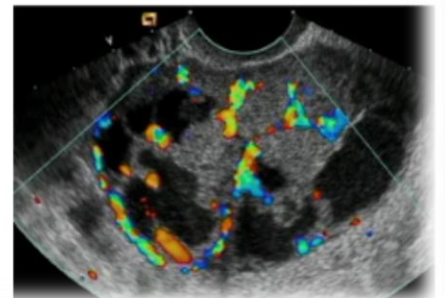
M3 At least 4 papillary structures



M4 Irregular multilocular-solid tumor with largest diameter \geq 100 mm



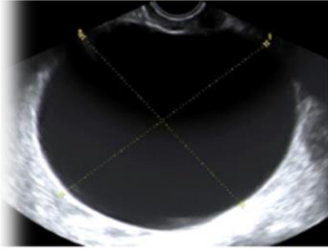
M5 Very strong blood flow (color score 4)



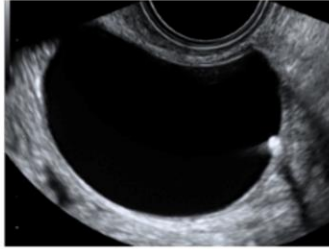
IOTA simple rules

- At least one B feature and no M features = Benign.
- At least one M feature and no B features = Malignant.
- If both M and B or neither features = Unclassifiable.

B1 Unilocular



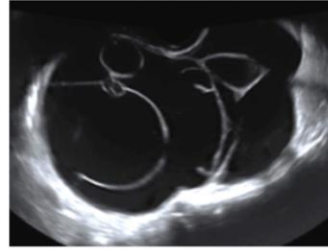
B2 Presence of solid components with largest diameter < 7 mm



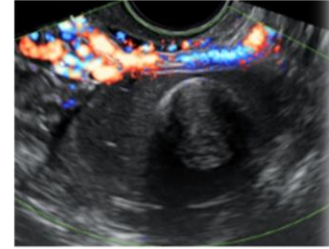
B3 Presence of acoustic shadows



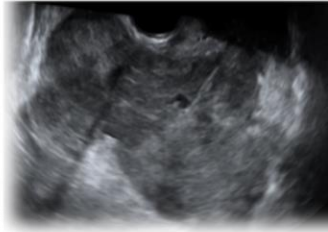
B4 Smooth multilocular tumor with largest diameter < 100 mm



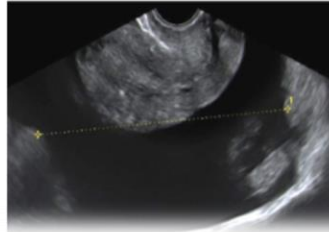
B5 No blood flow (color score 1)



M1 Irregular solid tumor



M2 Presence of ascites



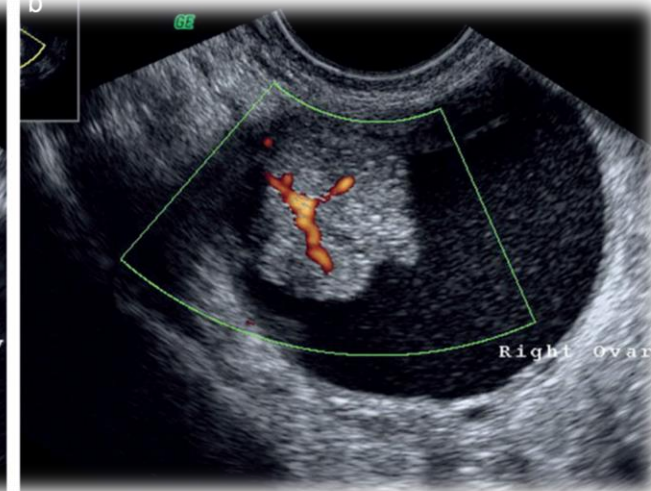
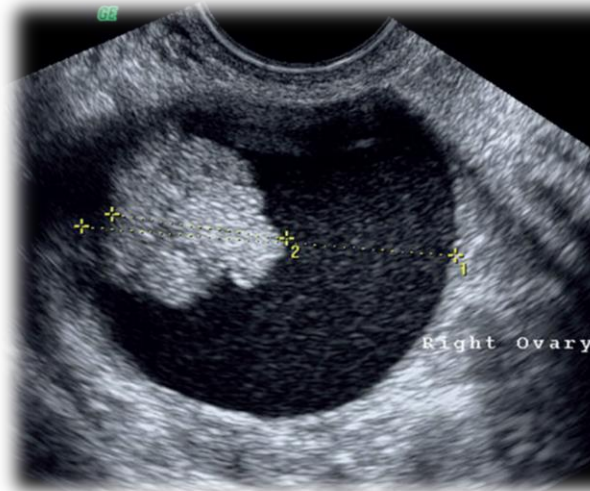
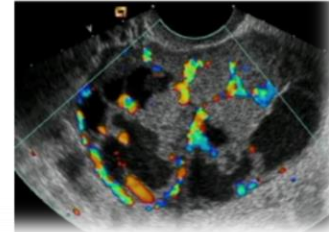
M3 At least 4 papillary structures



M4 Irregular multilocular-solid tumor with largest diameter ≥ 100 mm



M5 Very strong blood flow (color score 4)



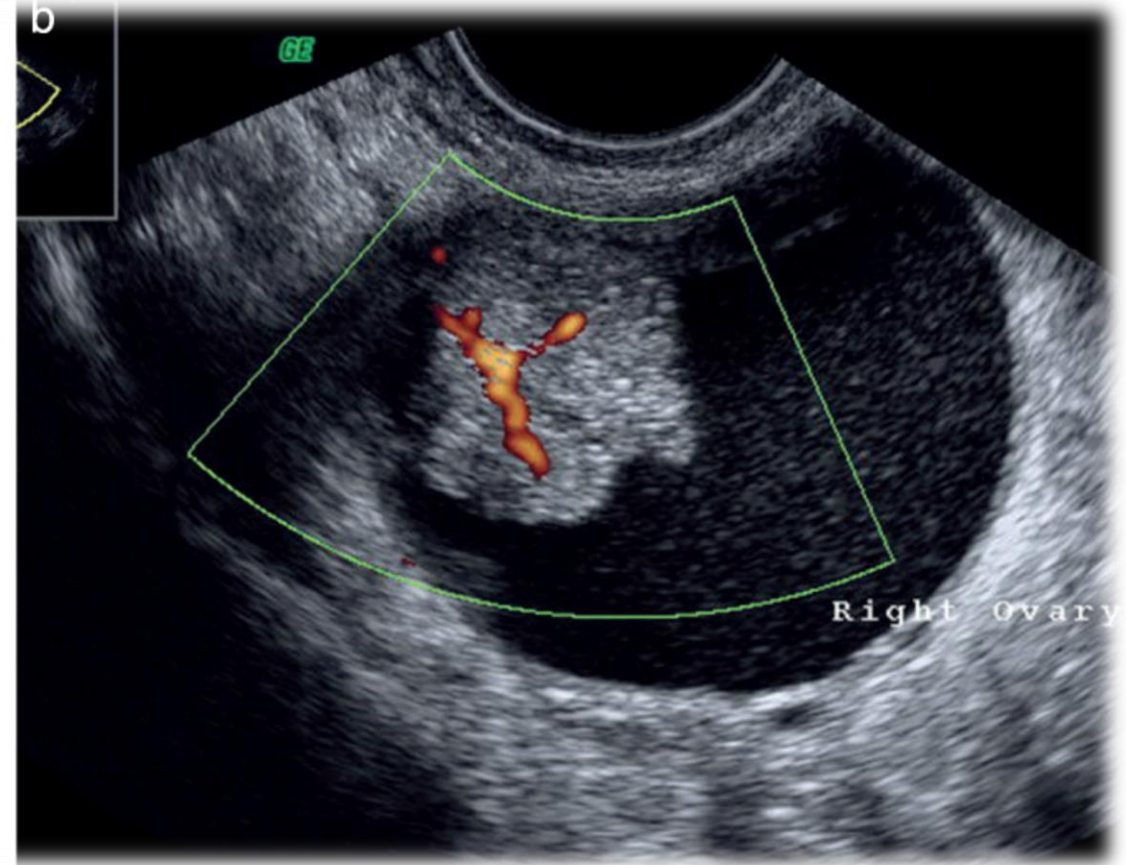
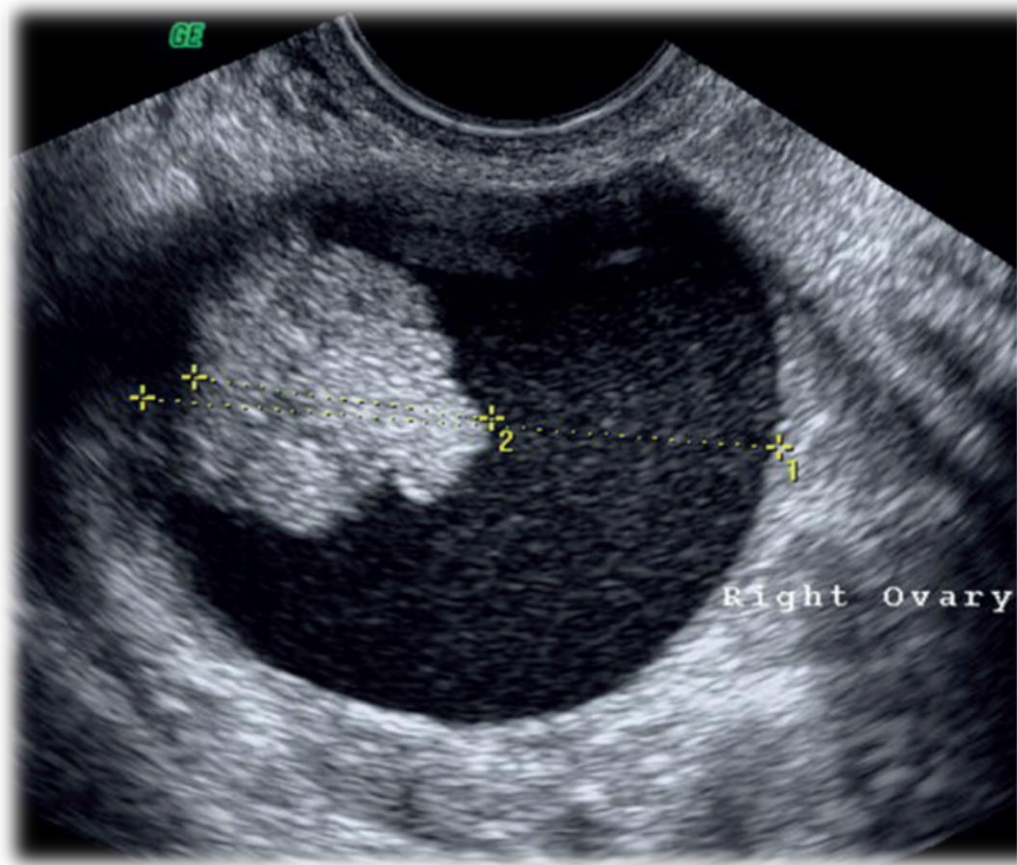


UNCLASSIFIABLE

Writing your report....

'There is a right sided complex ovarian cyst. Recommend an MRI and tumour markers'





Writing your report.....

'Within the right adnexa there is a unilocular-solid lesion measuring 51x48x39mm. It contains mixed echogenic material. There is a papillary projection that measures 11x7x6mm with positive Doppler signal (score 3). There is no ascites. As per IOTA this is unclassifiable. Referral to.....



Efficacy of IOTA

Ultrasound Obstet Gynecol 2008; 31: 681–690
Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/uog.5365

Simple ultrasound-based rules for the diagnosis of ovarian cancer

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KEYWORDS: color Doppler imaging; ovarian neoplasms; ultrasonography

ABSTRACT

Objective To derive simple and clinically useful ultrasound-based rules for discriminating between benign and malignant adnexal masses.

Methods In a multicenter study involving nine centers consecutive patients with persistent adnexal tumors underwent transvaginal gray-scale and Doppler ultrasound examination using a standardized examination technique and standardized terms and definitions. Information on 42 gray-scale ultrasound variables and six Doppler variables was collected and entered into a research protocol. When developing simple ultrasound-based rules to predict malignancy (M-rules) we chose the ultrasound variable or the combination of ultrasound variables that had the highest positive predictive value (PPV) with regard to malignancy; when developing simple rules to predict a benign tumor (B-rules) we chose the ultrasound variable or the combination of ultrasound variables that had the lowest PPV with regard to malignancy. We selected ten rules that were in agreement with our clinical experience and were applicable to at least 30 tumors and then tested them prospectively on 507 tumors examined in three of the nine centers.

content on color Doppler examination. We chose five simple rules to suggest a benign tumor (B-rules): (1) unilocular cyst; (2) presence of solid components where the largest solid component is < 7 mm in largest diameter; (3) acoustic shadows; (4) smooth multilocular tumor less than 100 mm in largest diameter; and (5) no detectable blood flow on Doppler examination. These ten rules were applicable to 76% of all tumors, where they resulted in a sensitivity of 93%, specificity of 90%, positive likelihood ratio (LR+) of 9.45 and negative likelihood ratio (LR-) of 0.08. When prospectively tested the rules were applicable in 76% (386/507) of the tumors, where they had a sensitivity of 95% (106/112), a specificity of 91% (249/274), LR+ of 10.37, and LR- of 0.06.

Conclusion Most adnexal tumors in an ordinary tumor population can be correctly classified as benign or malignant using simple ultrasound-based rules. For tumors that cannot be classified using simple rules, ultrasound examination by an expert examiner might be useful. Copyright © 2008 ISUOG. Published by John Wiley & Sons, Ltd.

Internal validation

- 76% classifiable

- Sensitivity: 95%

- Specificity: 91% (249/274)

Efficacy of IOTA

Multicenter Study > [Gynecol Oncol.](#) 2013 Jul;130(1):140-6. doi: 10.1016/j.ygyno.2013.04.003.

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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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PMID: 23578539 DOI: [10.1016/j.ygyno.2013.04.003](#)

External Validation

-89% classifiable

-Sensitivity: 93%

-Specificity: 92%

Efficacy of IOTA in cancer v- referral unit

Multicenter Study > [Am J Obstet Gynecol. 2016 Apr;214\(4\):424-437.](#)

doi: [10.1016/j.ajog.2016.01.007](#). Epub 2016 Jan 19.

Predicting the risk of malignancy in adnexal masses based on the Simple Rules from the International Ovarian Tumor Analysis group

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