3D Ultrasound in Gynaecology

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3D is a volume scanning

- 3D scanning is a volume acquisition which permits an infinite number and types of dysplays for the information - the display of images previously only in the mind's eye of the sonographer.

- 3D enables the ultrasound practitioner to be far less dependent on the method of initial acqustion of the volume, since any view can be reconstructed easily from the stored volume information.
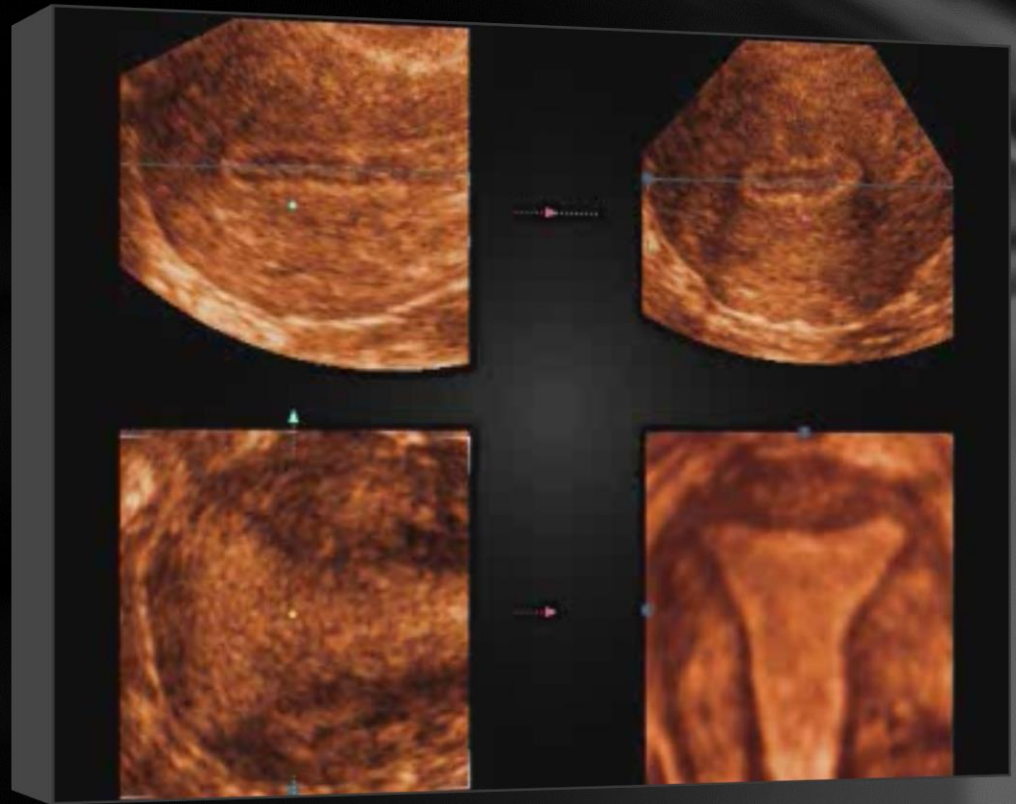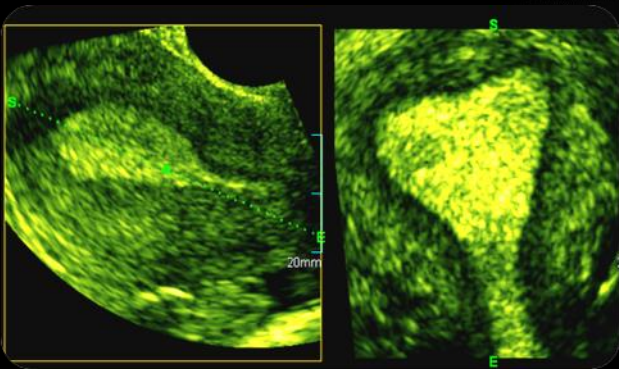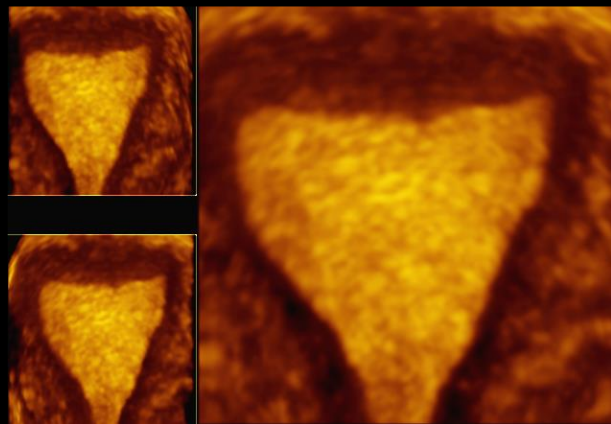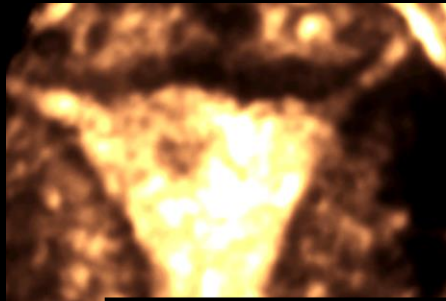
3D multiplanar view
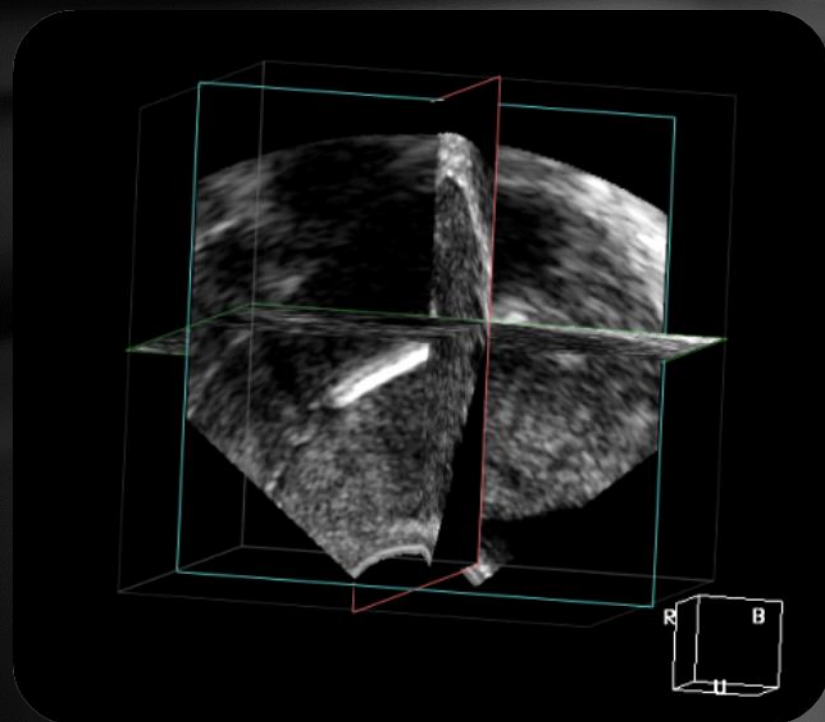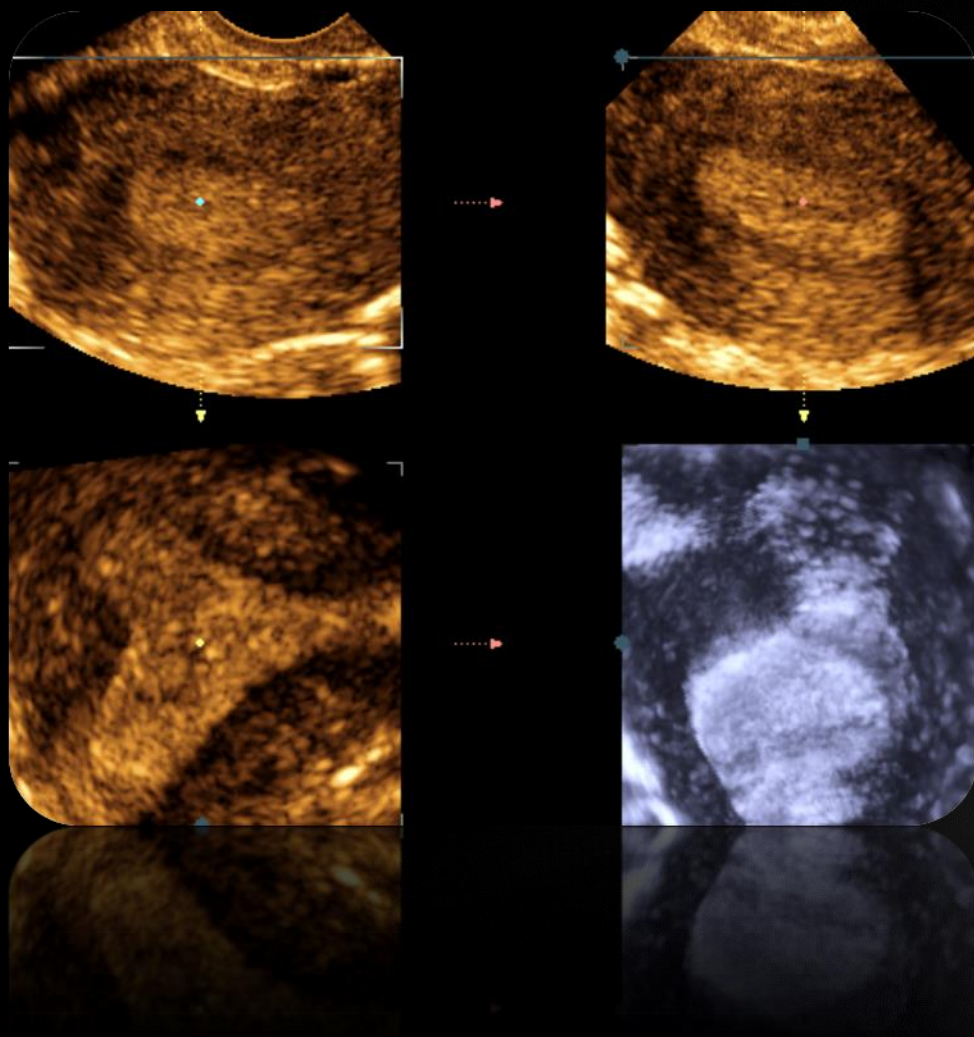
Normal uterus

The logistic of 3D: Advantages

- The acqusition of data requires only one sweep in 2D. Transvaginally one can examine a uterus & 2 ovaries taking only 3 sweeps to acquire all data for the pelvis.

- These volume acqusition contain the entire pelvis, with the ability to rescan it electronically in any plane.

The most important benefit of 3D in gynaecology

- The 3 orthogonal planes are necessary to evalute the shape of the uterine cavity. Short of an MRI, the coronal plane shows cervix and 2 cornua (same plane)

- Distinguish a septate from a bicornuate uterus

- One could sent these packets of information via telemedicine (or internet) to someone else, who could then evaluate the entire pelvis by essentially "rescanning it", using the raw data from the original acqusition.
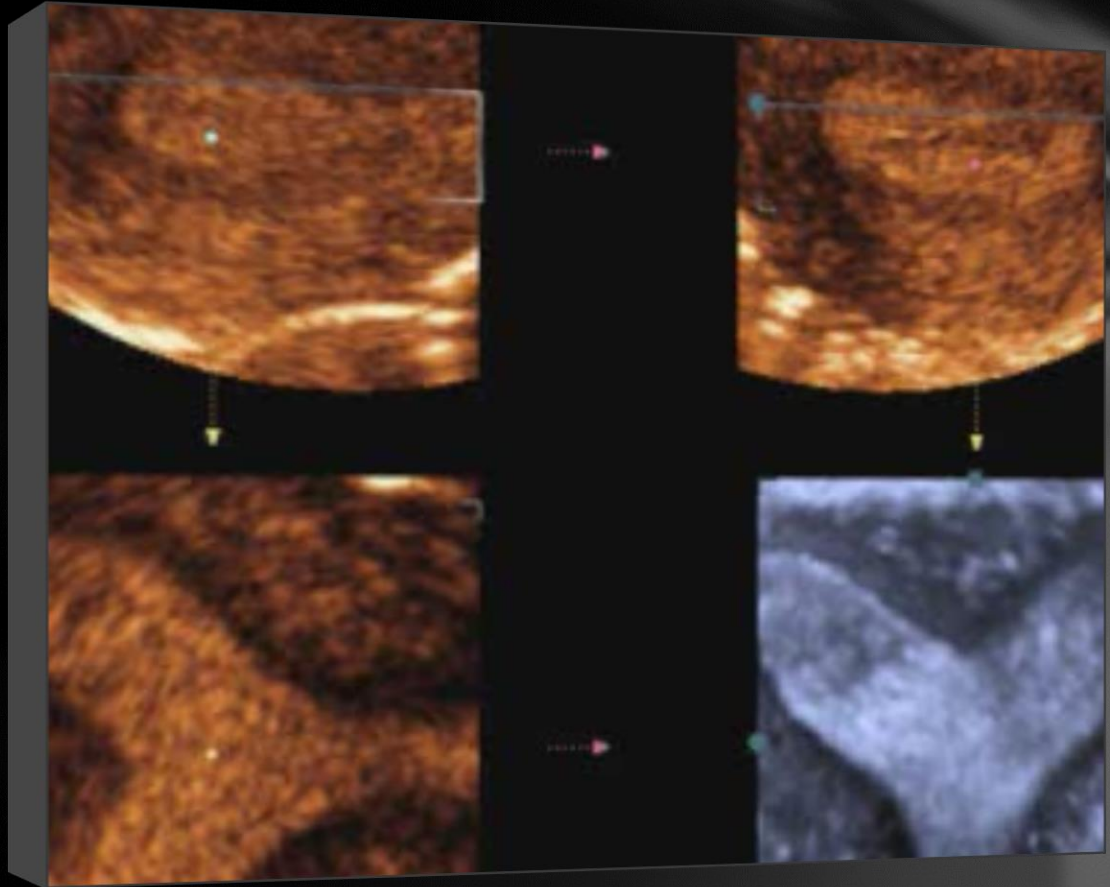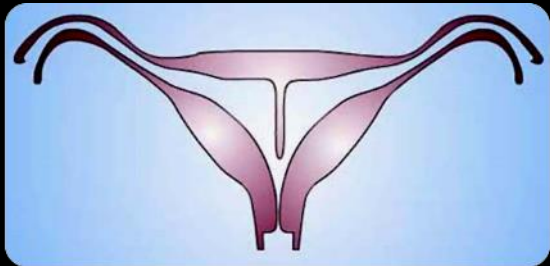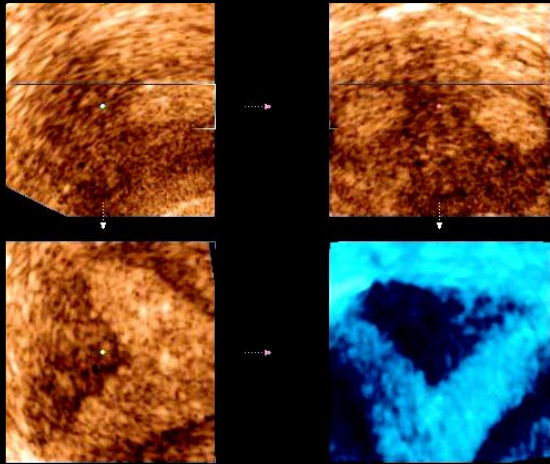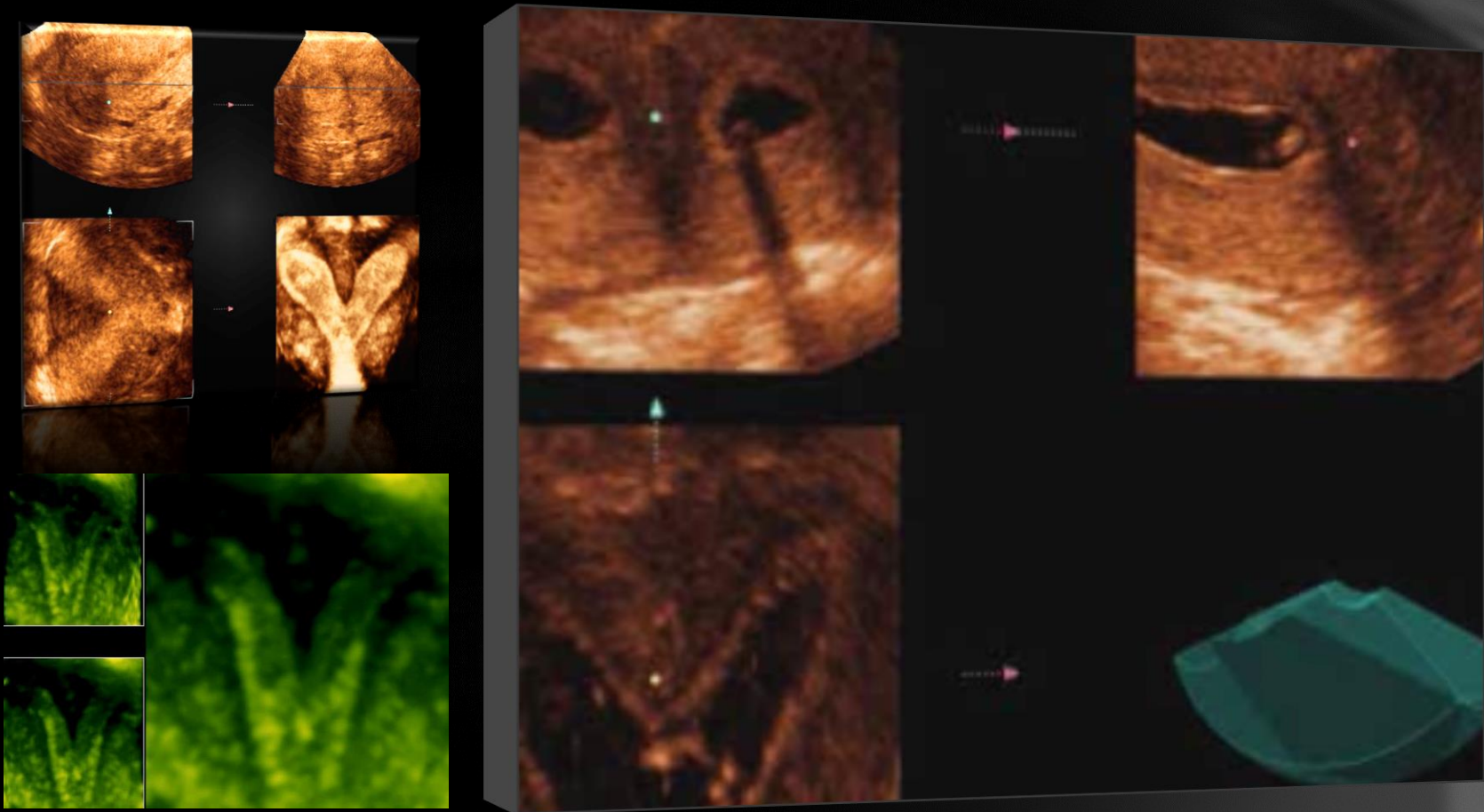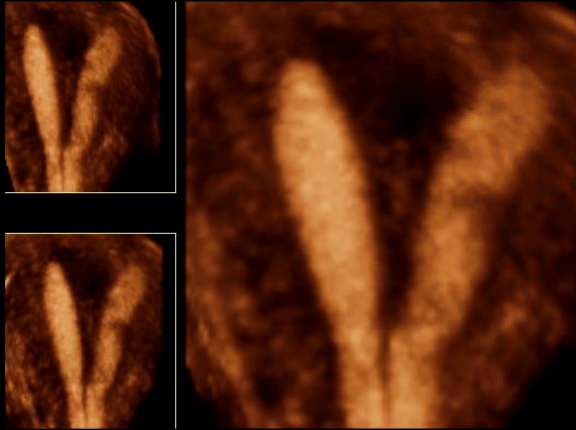
Arcuate uterus
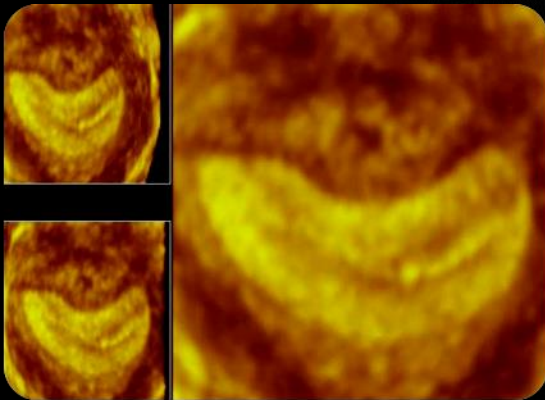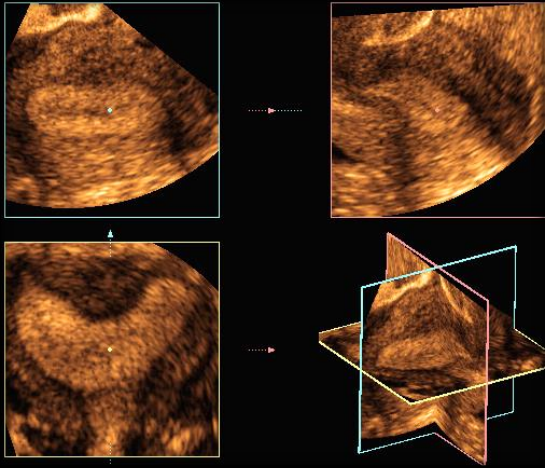
Subseptate uterus

Subseptate uterus

Septate uterus

Bicornuate uterus

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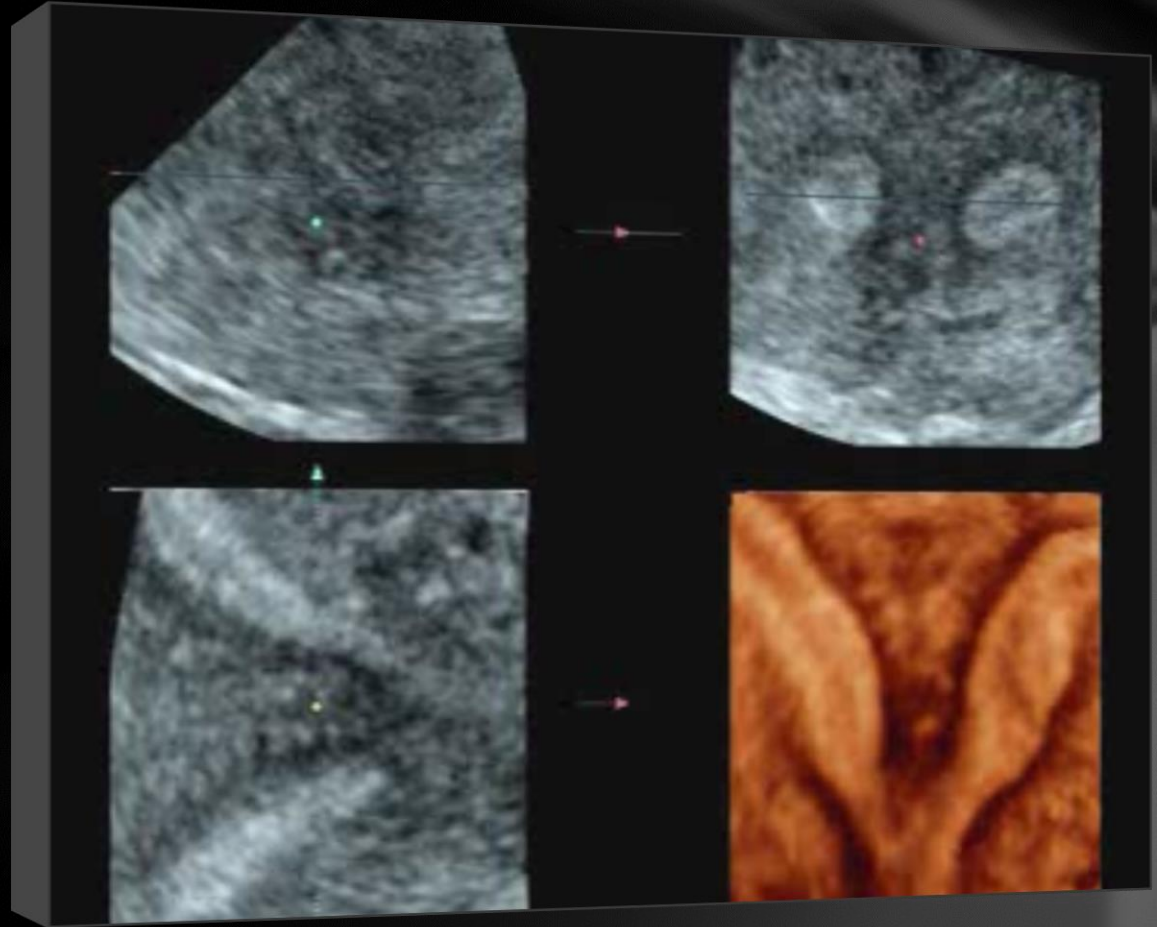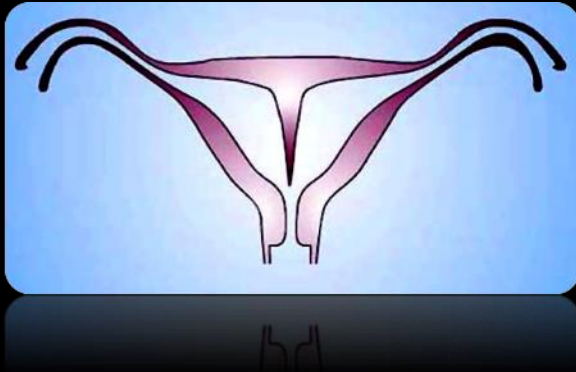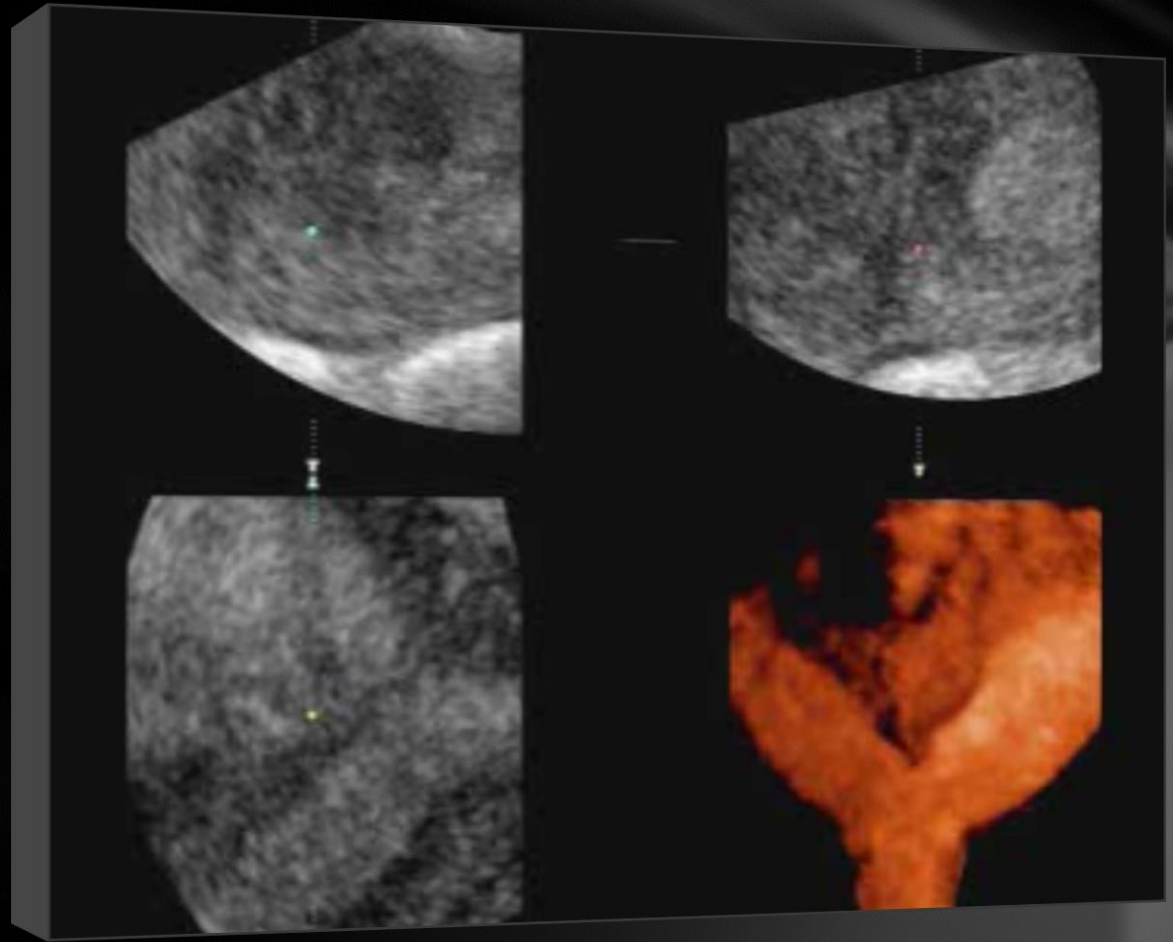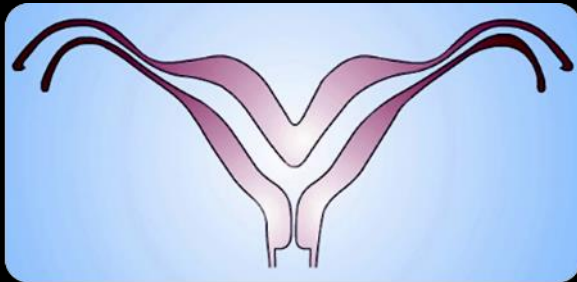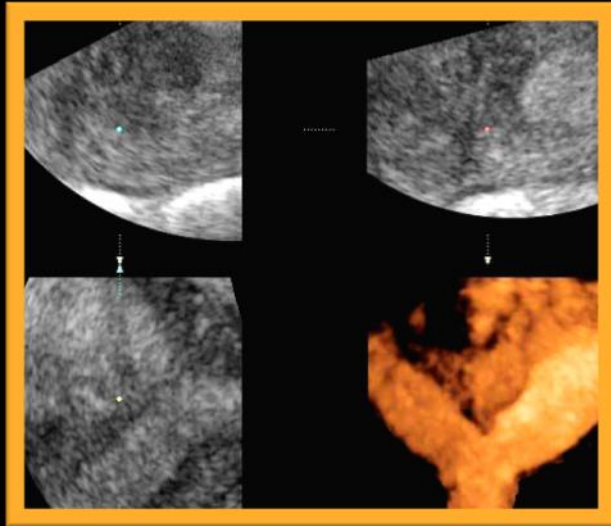
Uterus didelphys
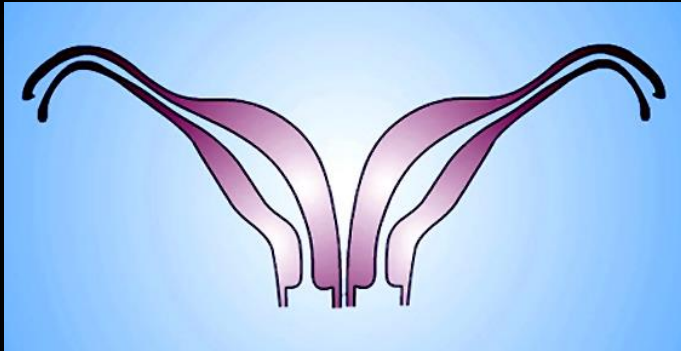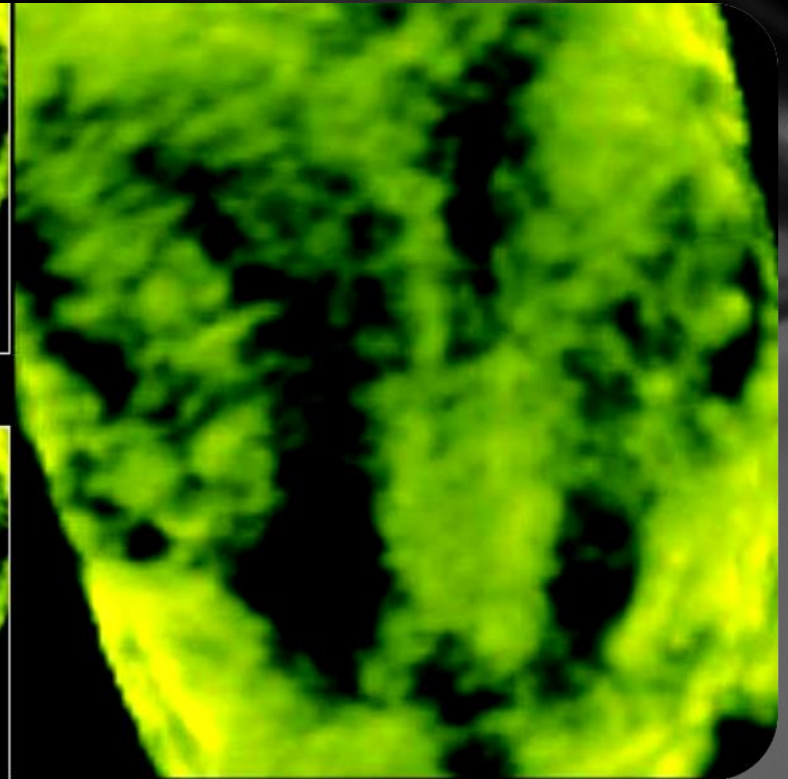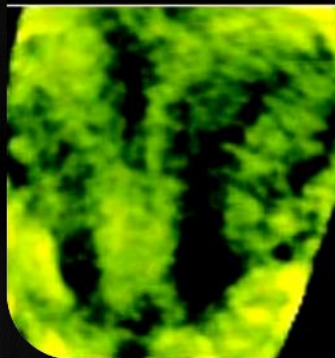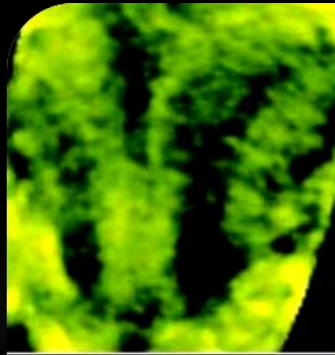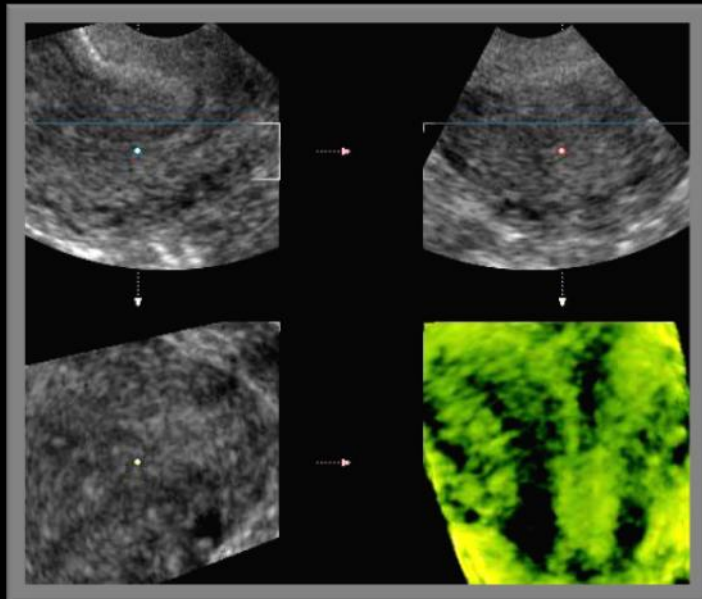
Uterus unicornis unicollis
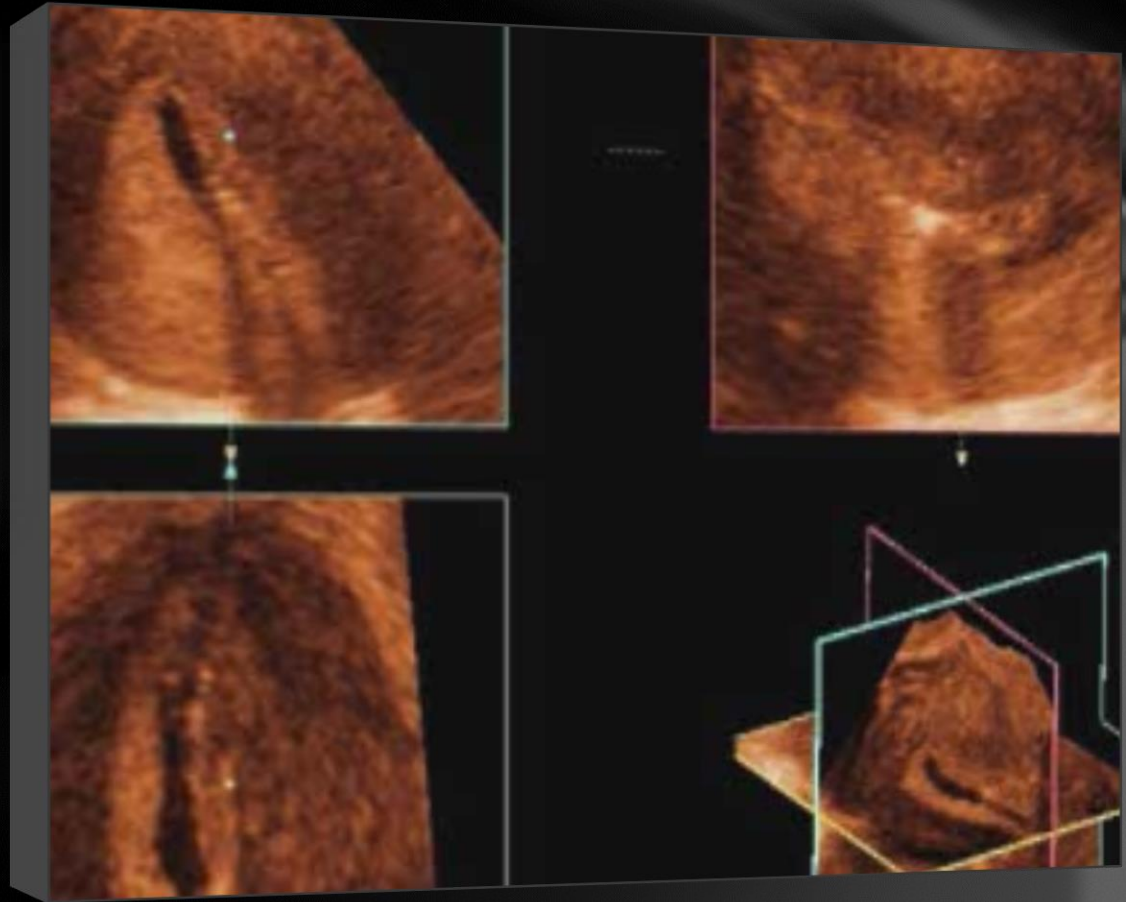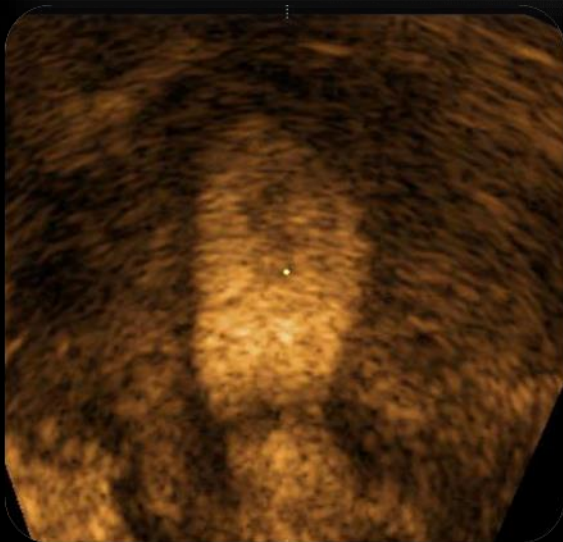
IUD / LNG-IUD

Endometrial hyperplasia
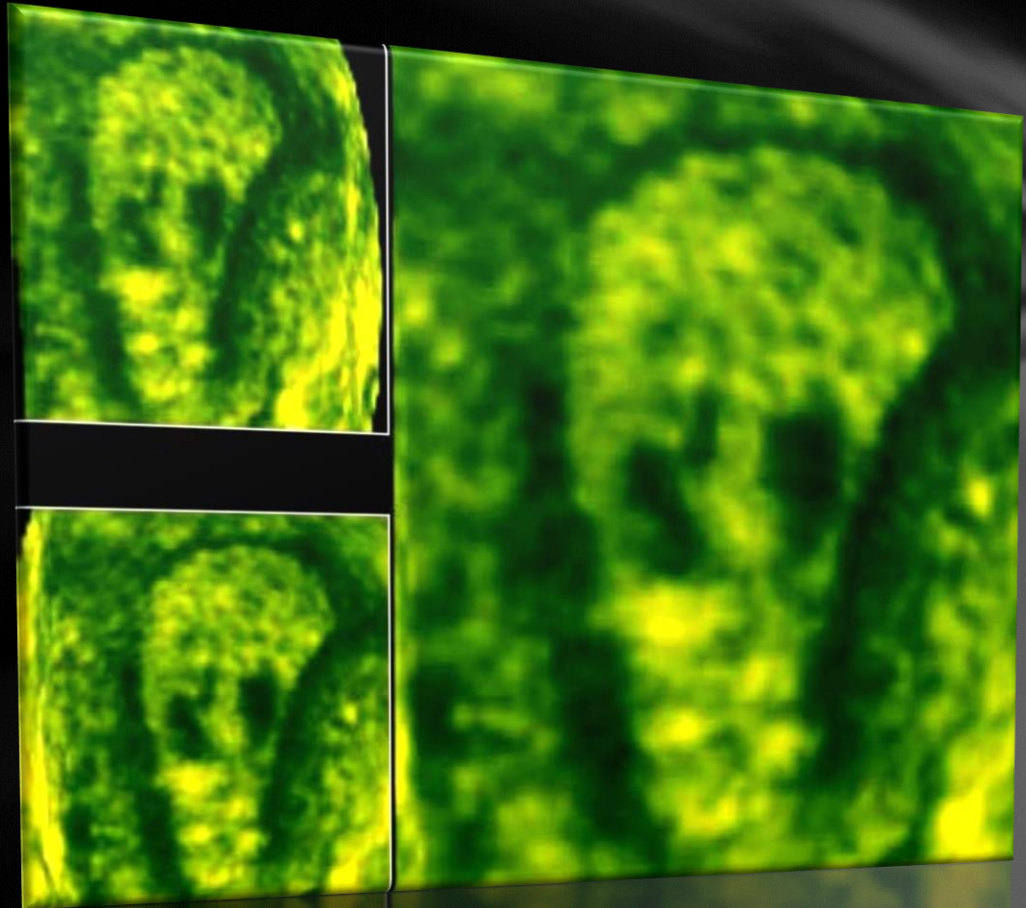
Endometrial polyp
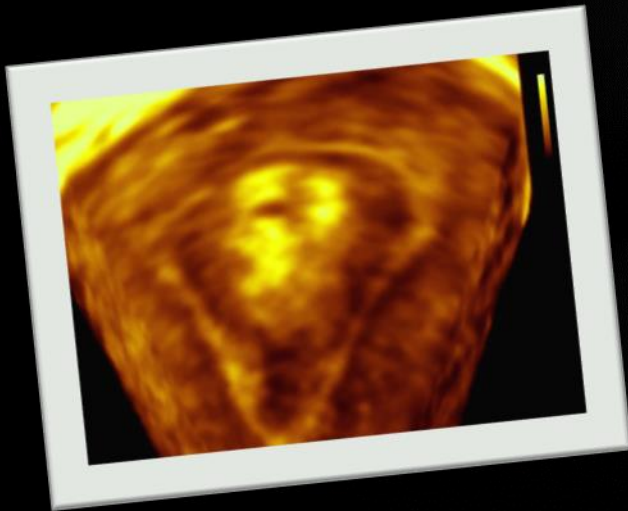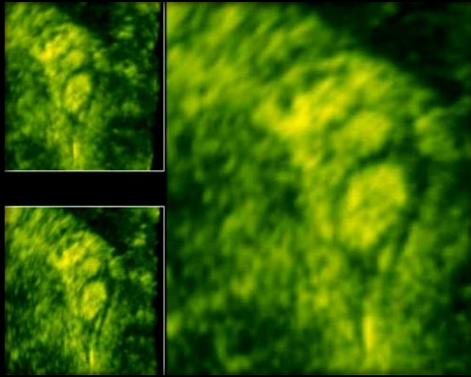
Sonohysterography

Hysterosonography or
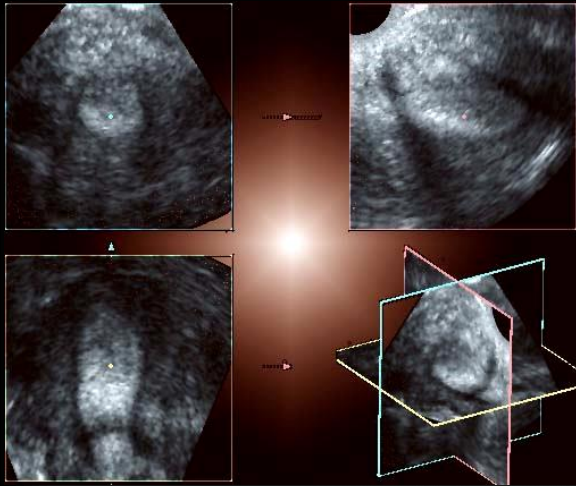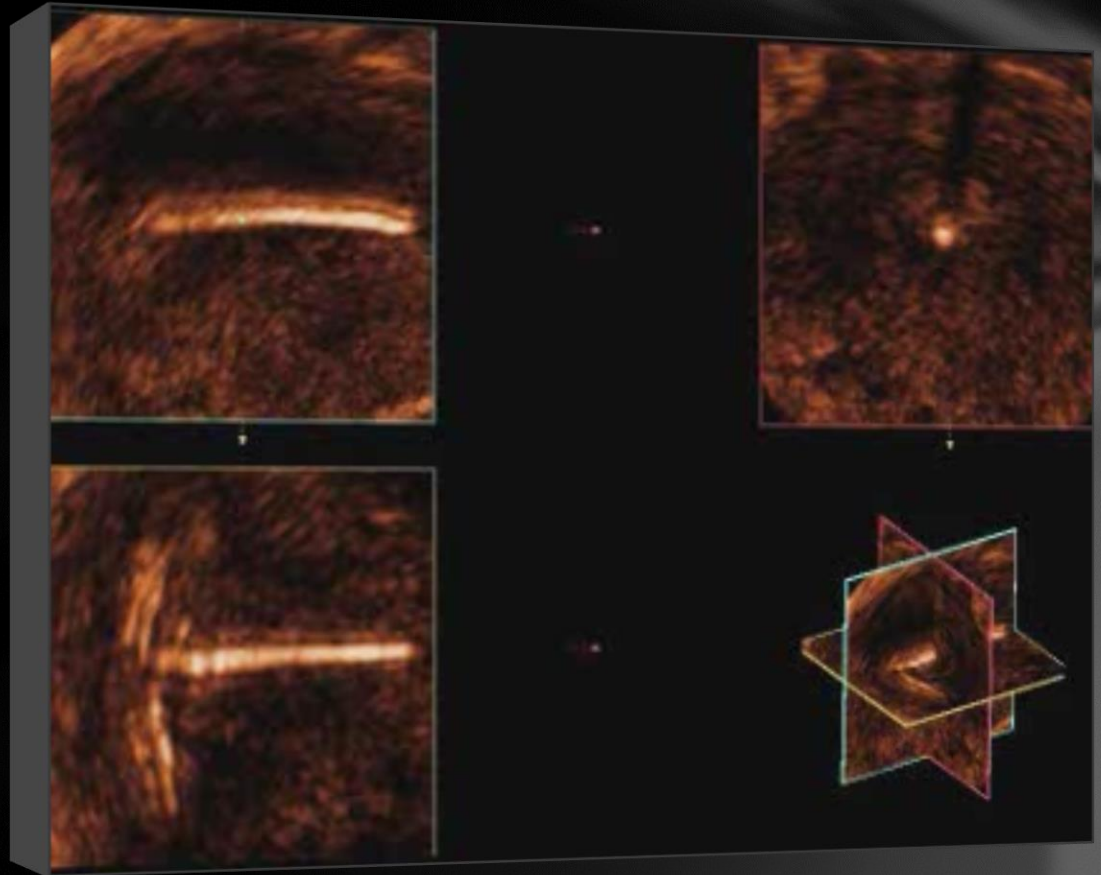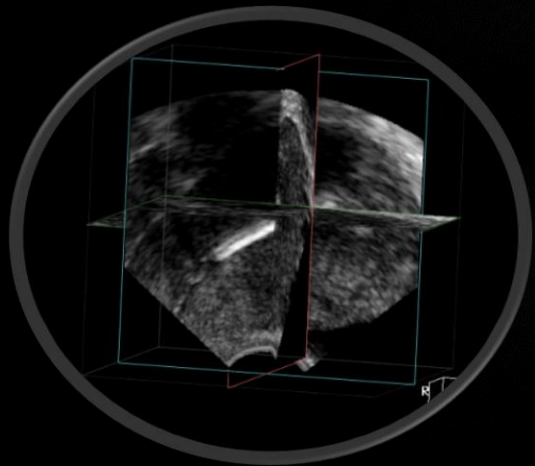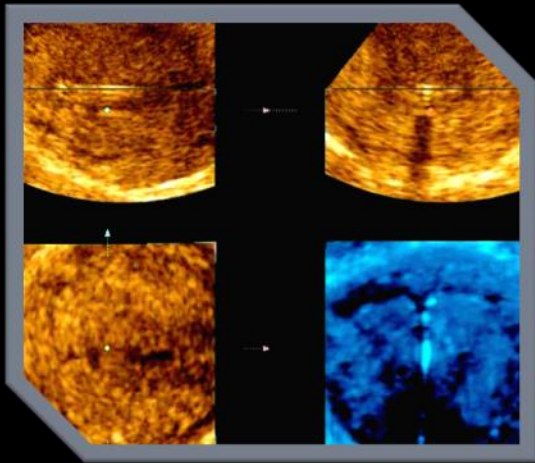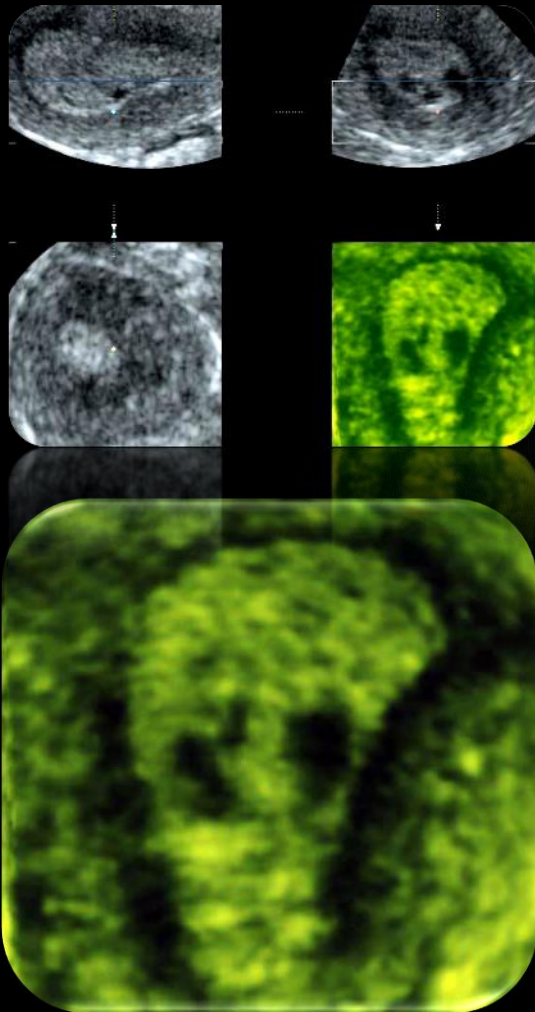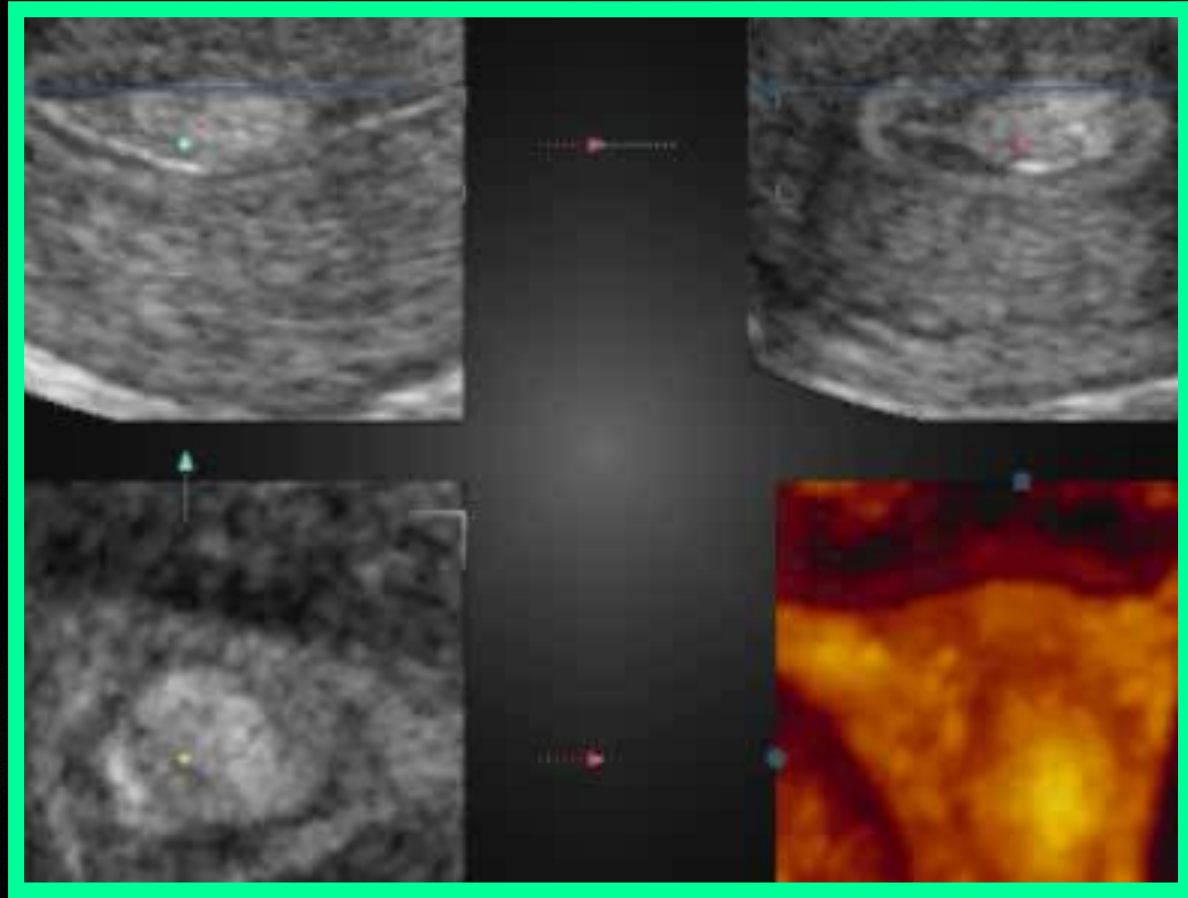
Saline Infusion Sonohysterography (SIS)

Why SIS?

- Vaginal sonography: limited ability distinguish endometrial from myometrial lesions, e.g. fibroid adjacent to cavity

- Endometrium difficult to see with fibroids; e.g. exact location

- Endometrial & myometrial lesions common, often coexist; distinction clinically significant

- Abnormal bleeding in presence of fibroids may be due to polyps

Endometrial polyp: 3D SIS

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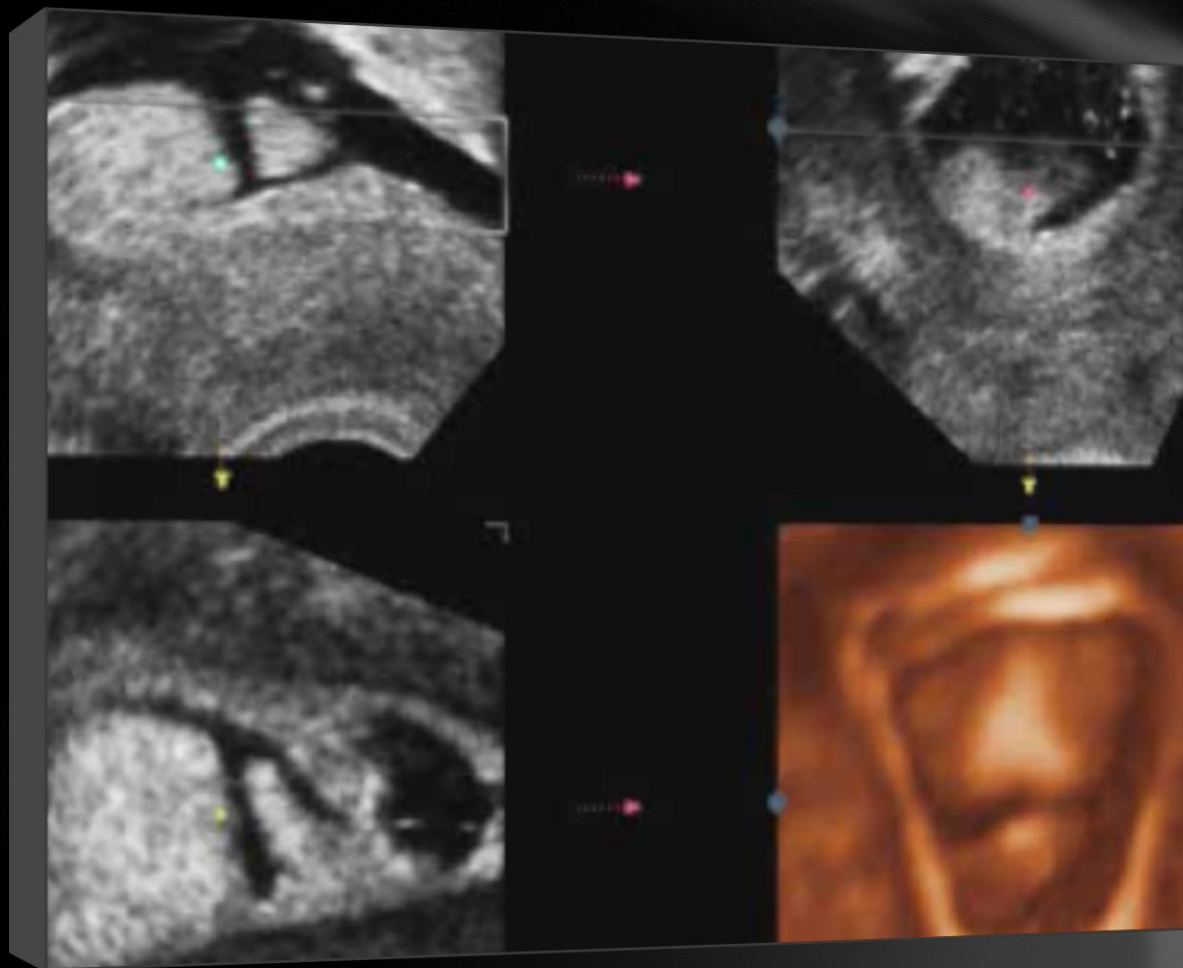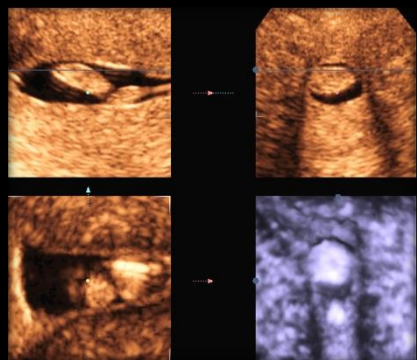
SIS – Indications:

- Abnormal bleeding
- Infertility & Habitual abortion
- Fibroids, pre-/ and post-/ operation
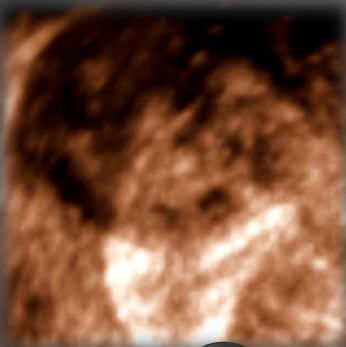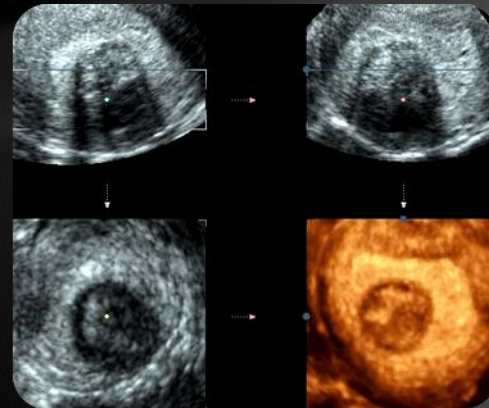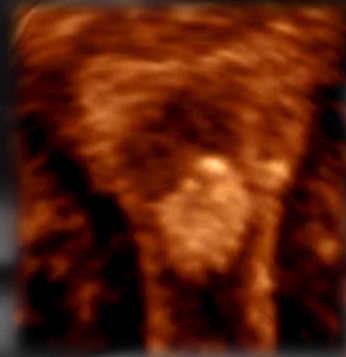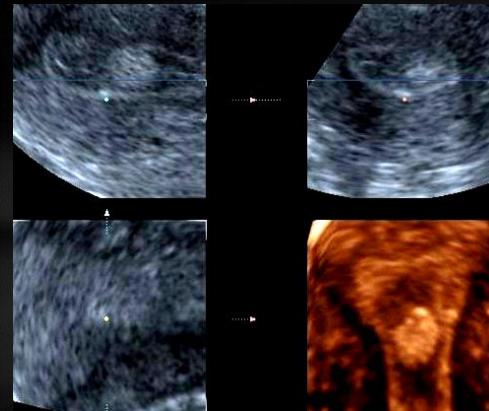- Uterine malformations
- Postpartum (retained placenta, placentar polyp, Asherman's sy)
- Abnormal TVS
- Pre-/ endometrial ablation or UAE

Diagnostic Criteria

- Polyps and other endometrial lesions – echogenic

- Fibroids – hypoechoic, heterogeneous, sound attenuation

- Adhaesions – echogenic bands
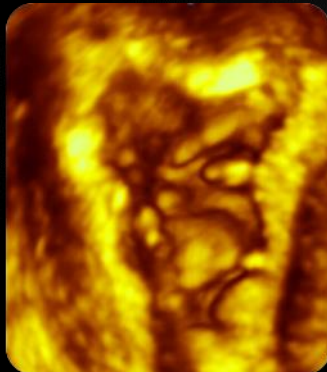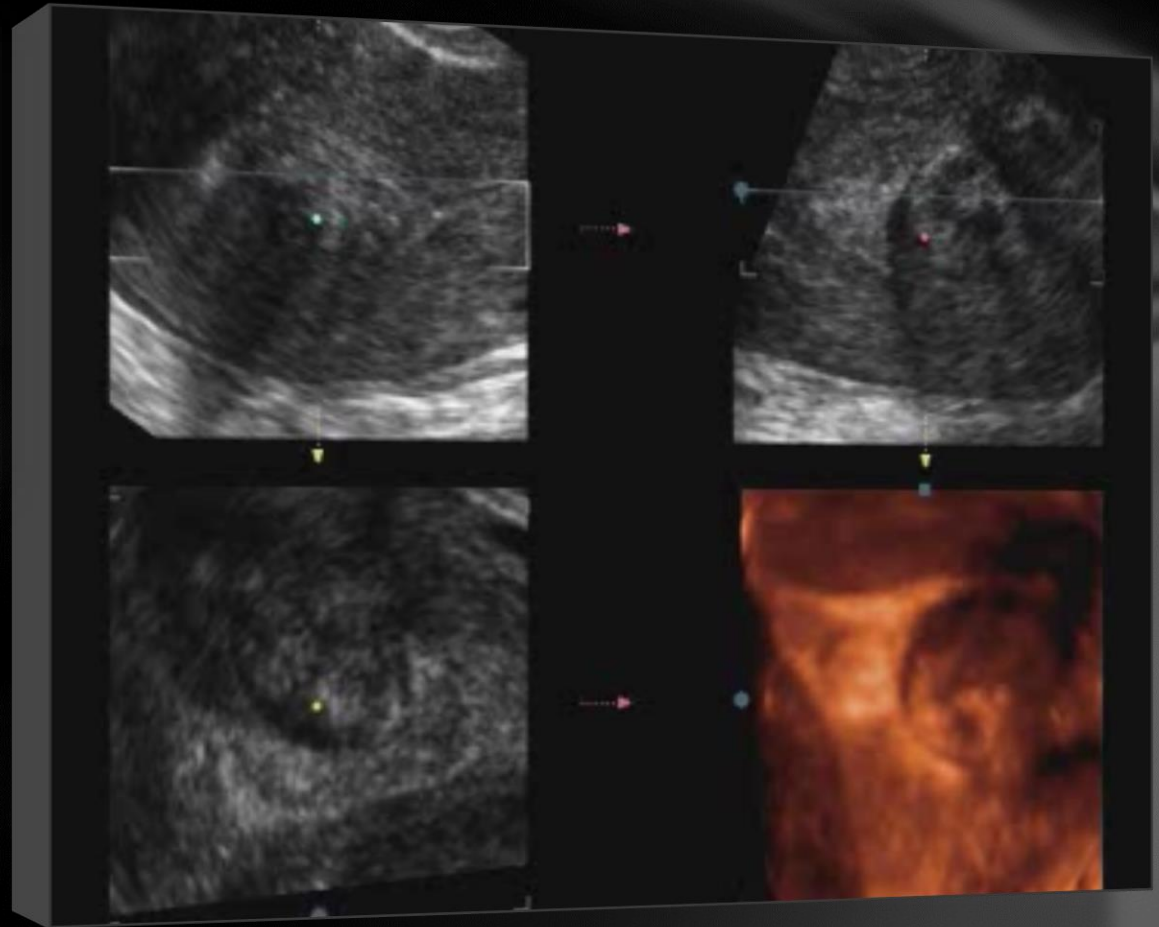
Submucosal Myoma Classification
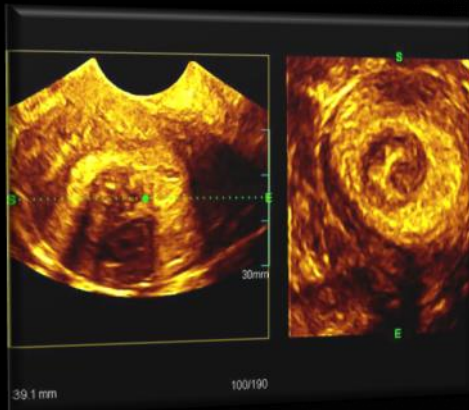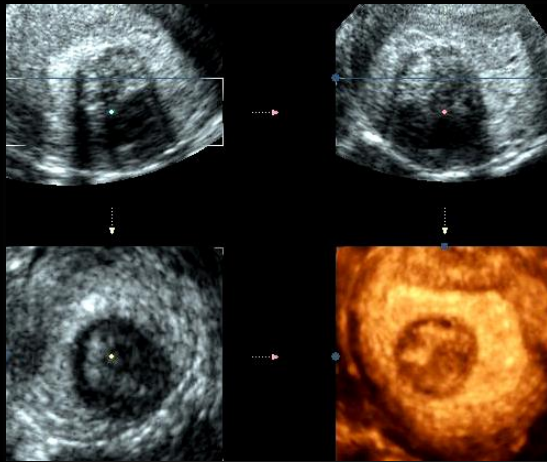
Adapted from the European Society of Hysteroscopy

- T0 = pedunculated submucosal myoma without intramural extent

- T1 = sessile myoma with an intracavitary component of more than 50%

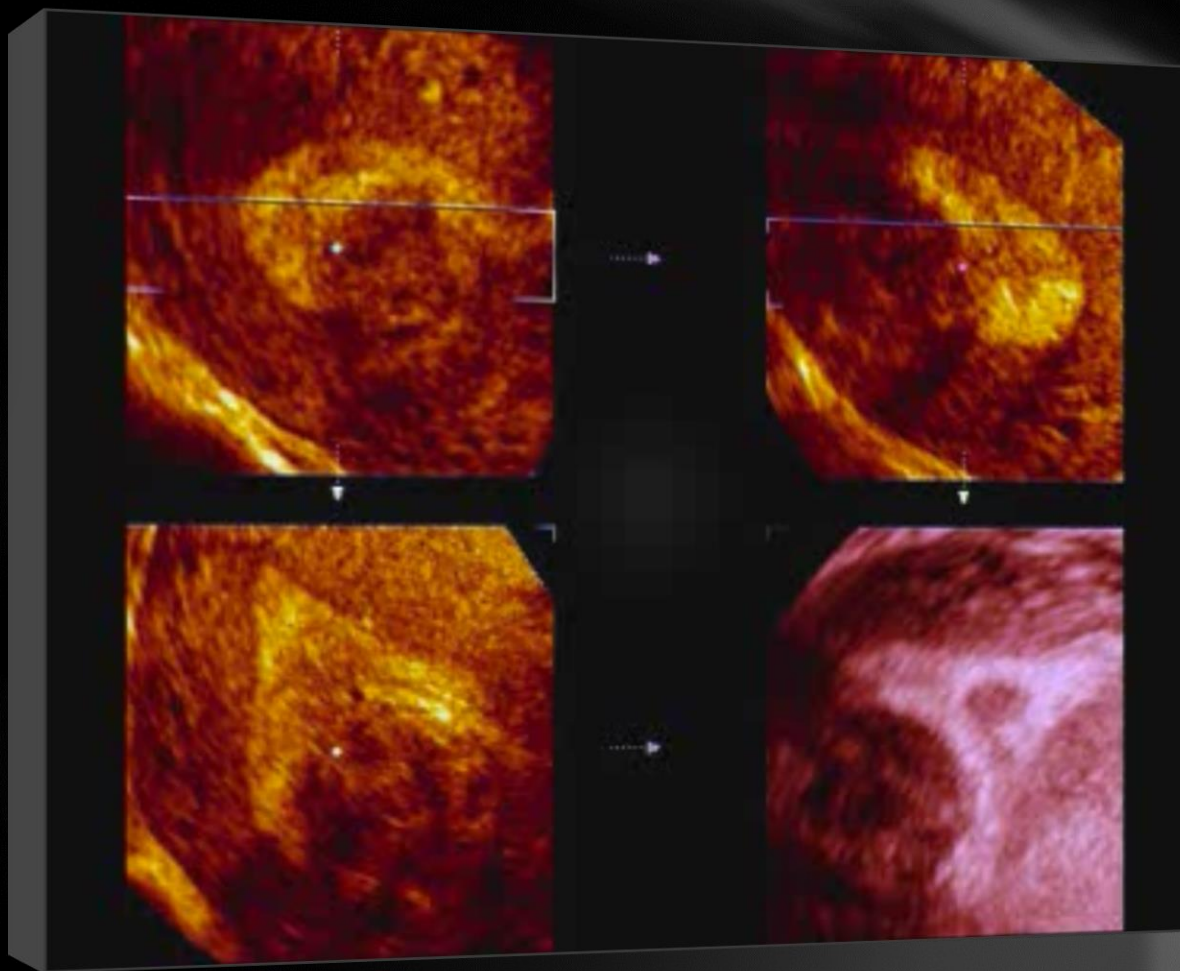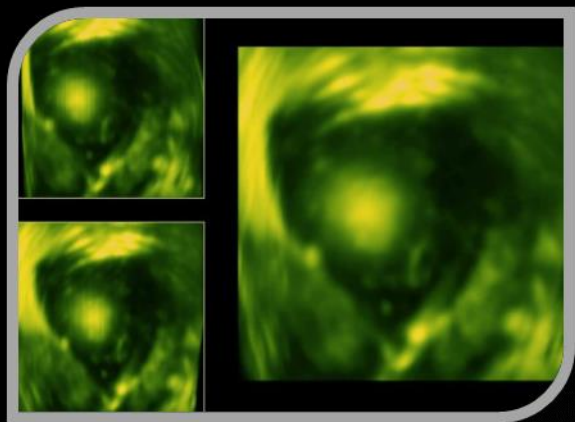- T2 = sessile myoma with an intracavitary component of 50% or less

Fibroids – To class

Fibroids – T1 class

Fibroids – T2 class
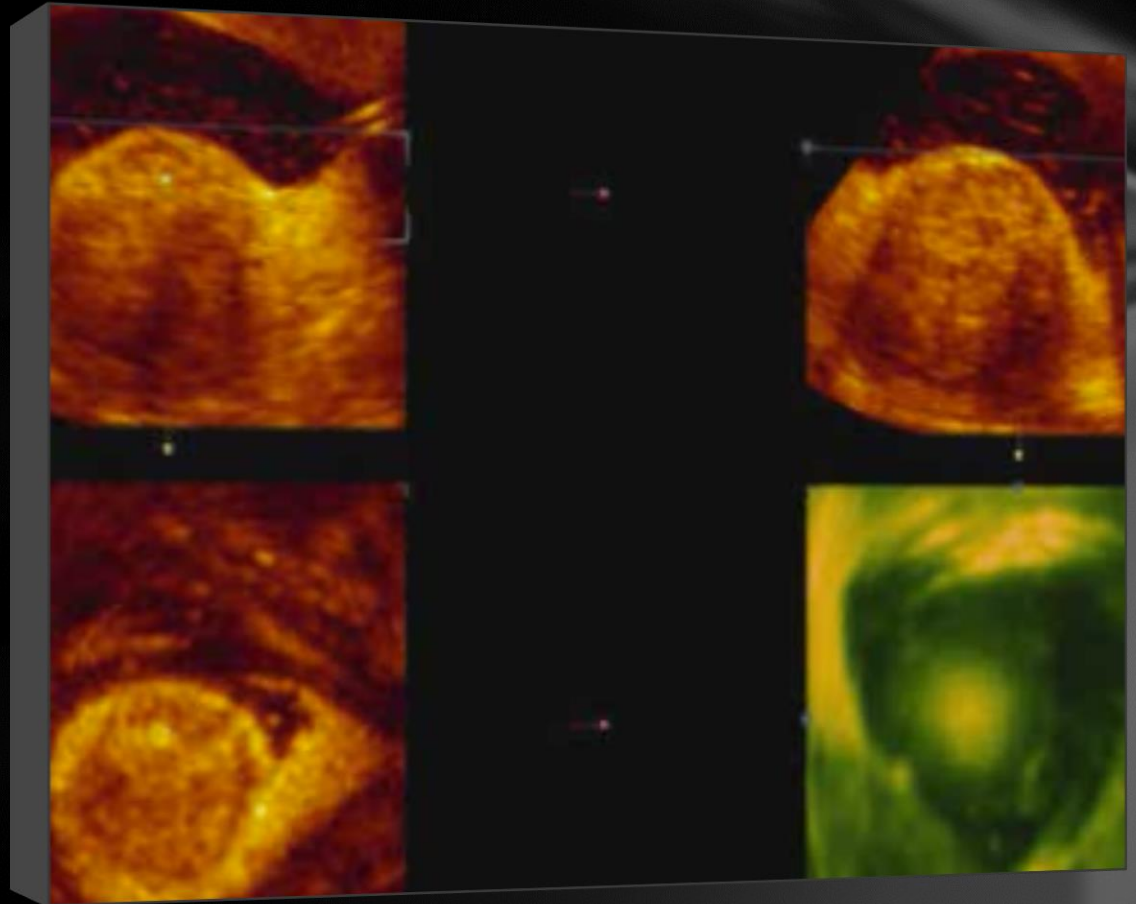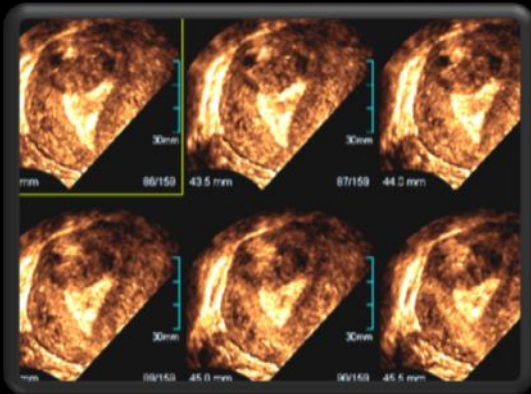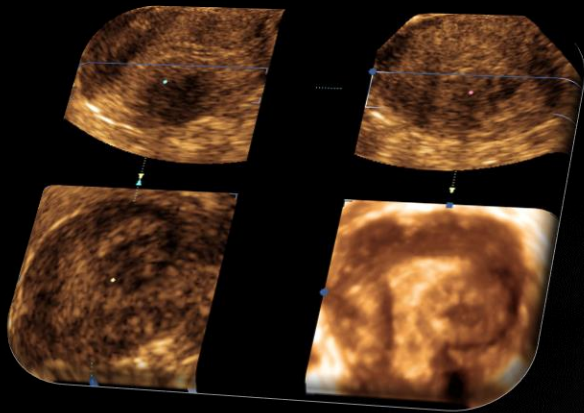
Intramural fibroids
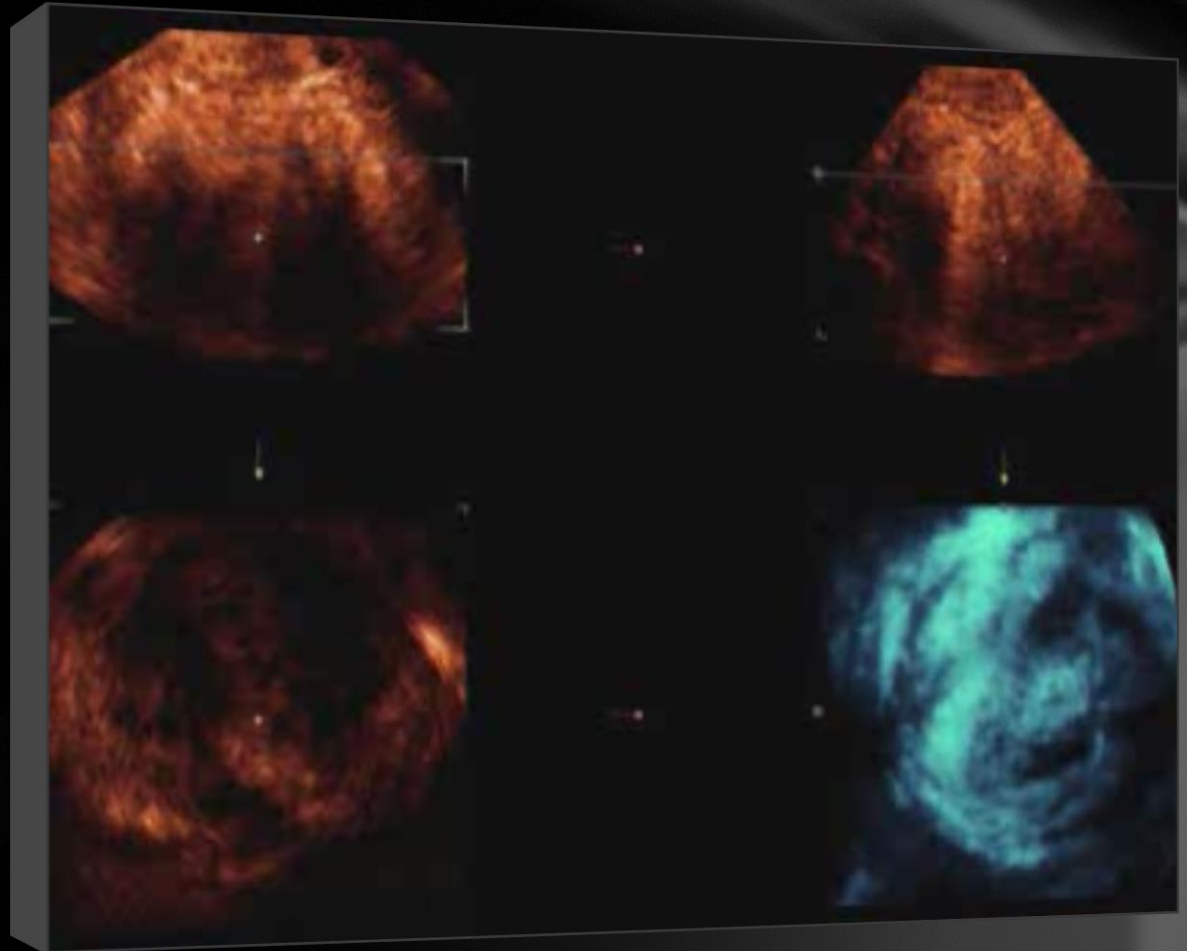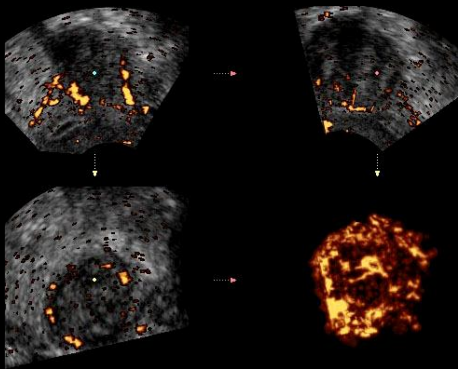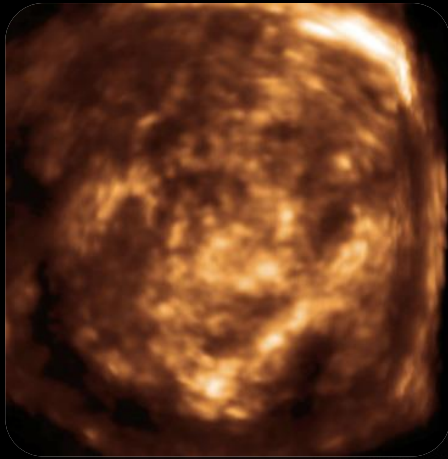
Ovarian cyst
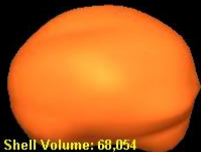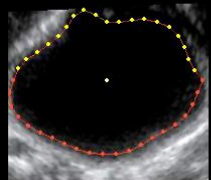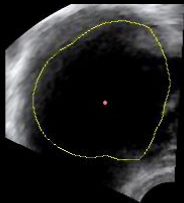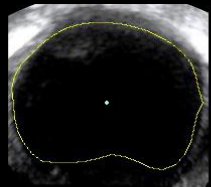
Shell Volume: 68,054
Reference   : 68,054
Inside   : 0,000
Outside   : 68,054
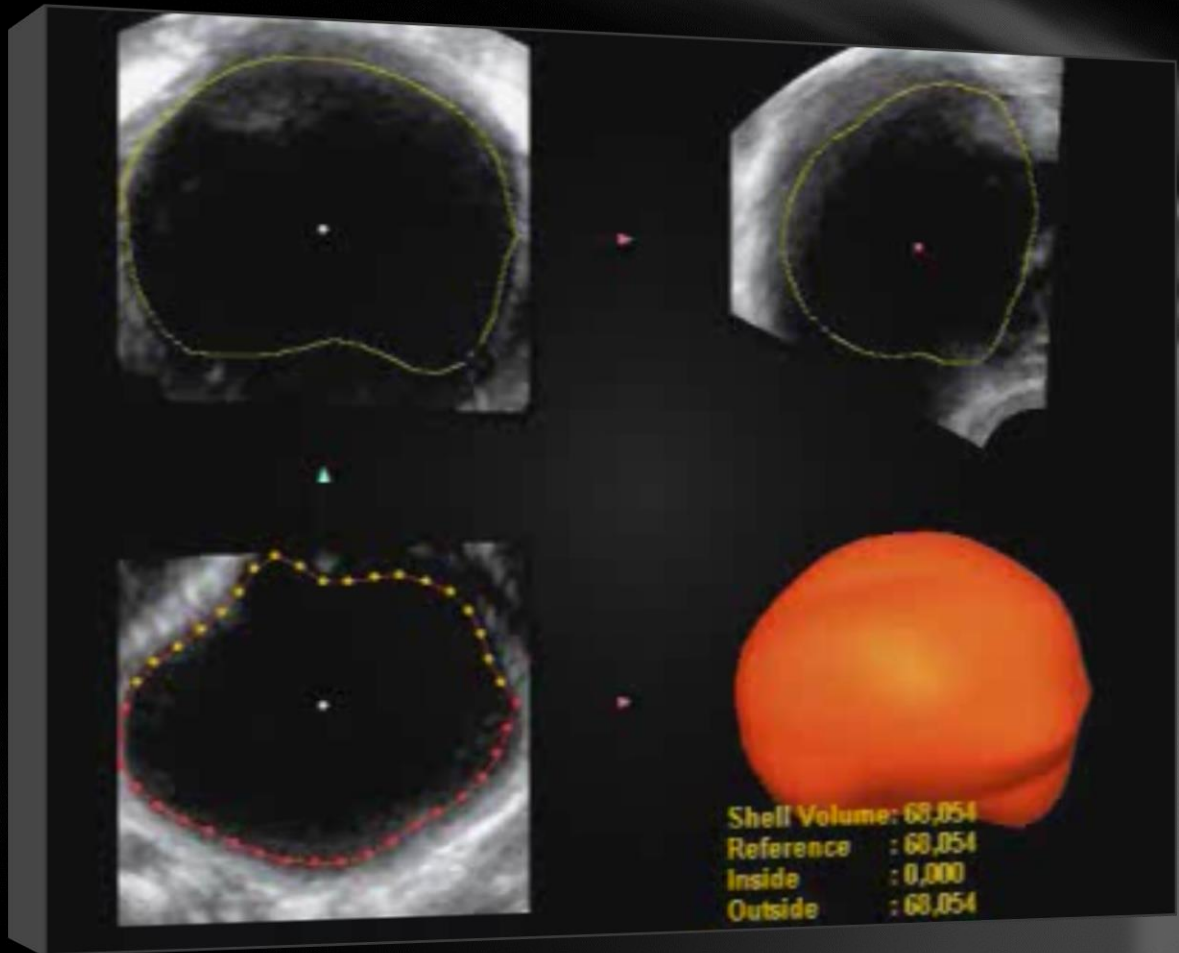
Shell Volume: 68,054
Reference   : 68,054
Inside   : 0,000
Outside   : 68,054

Corpus luteum cyst
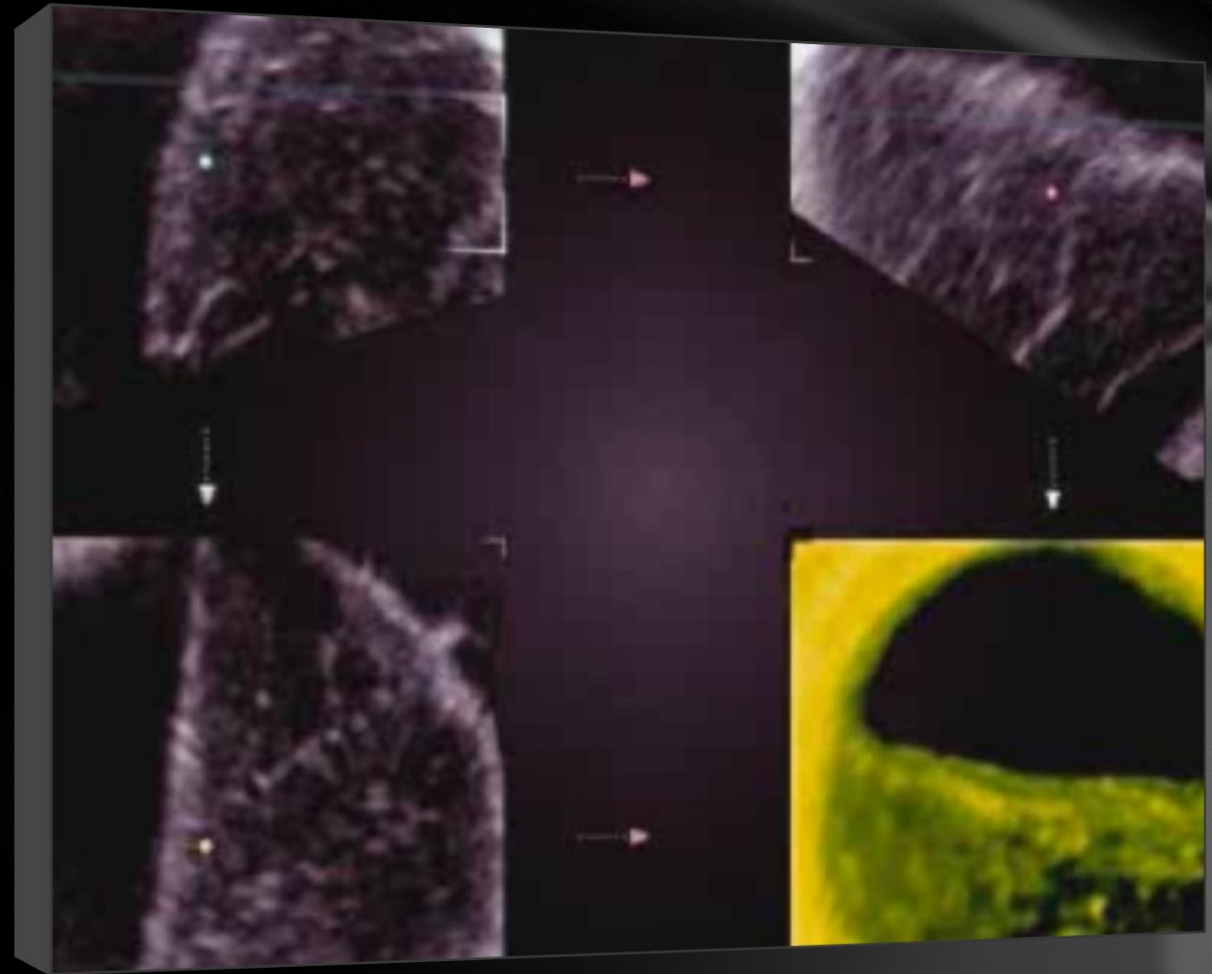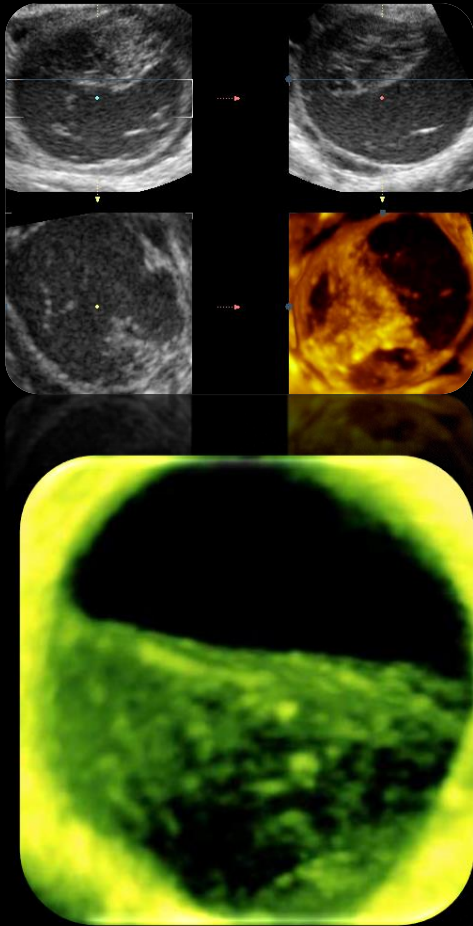
Typical sonographic appearance
of a haemorrhagic cyst throughout the staging process

- Fine reticular pattern
- Retracting blood clot
- Fluid debris level
- Haemorrhagic ovarian cyst simulating ectopic pregnancy
- Haemorrhagic ovarian cyst simulating ovarian neoplasm
- Haemorrhagic ovarian cyst simulating solid ovarian mass

Kiran A, Jain MD. Sonographic spectrum of hemorrhagic ovarian cyst. J Ultrasound Med 2002; 21: 879-86

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PCOS
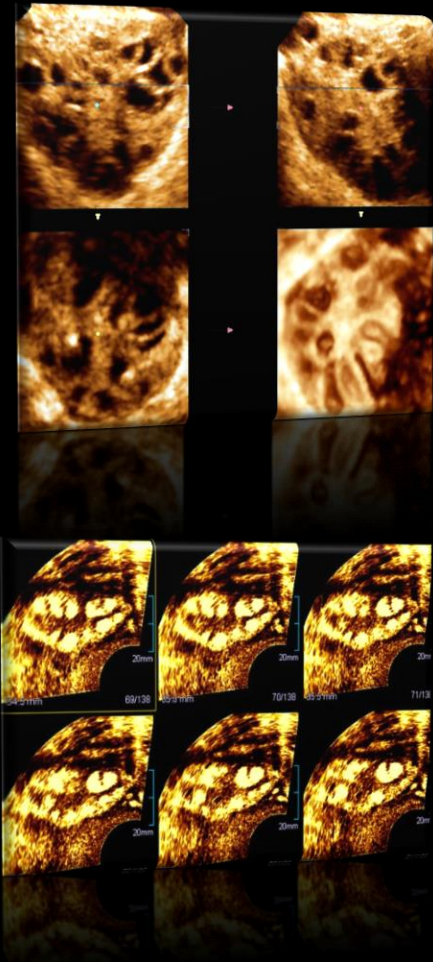
Pathological ovarian cyst

- Benign ovarian cysts
  - ❑ Dermoid cyst
  - ❑ Endometriosis

- Low malignant potential tumor
  - ❑ Cystadenoma

- Malignant ovarian cysts
  - ❑ Ovarian carcinoma

Ultrasound features used in scoring systems to differentiate benign from malignant ovarian masses
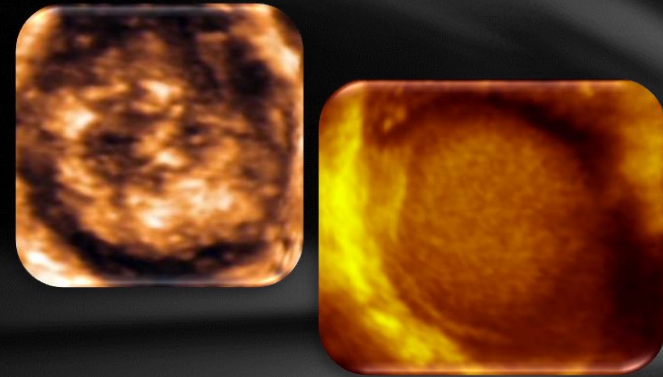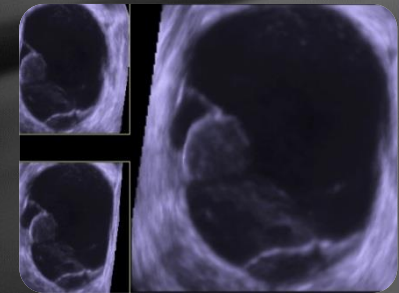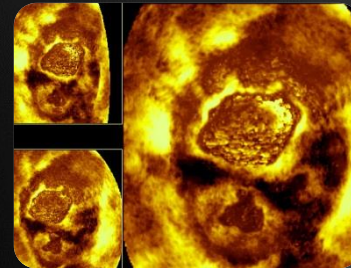
Size
- Larger masses more likely to be malignant

Wall thickness
- Thick walled masses score more highly for malignancy than those with thin walls

Composition
- Complex, mainly fluid masses score more highly for malignancy than simple cysts

Doppler presence/absence
- Non-vascular masses more likely to be benign

Distribution
- Masses confined to the wall or with a regular pattern are more likely to be benign than masses with irregular vascular distribution throughout
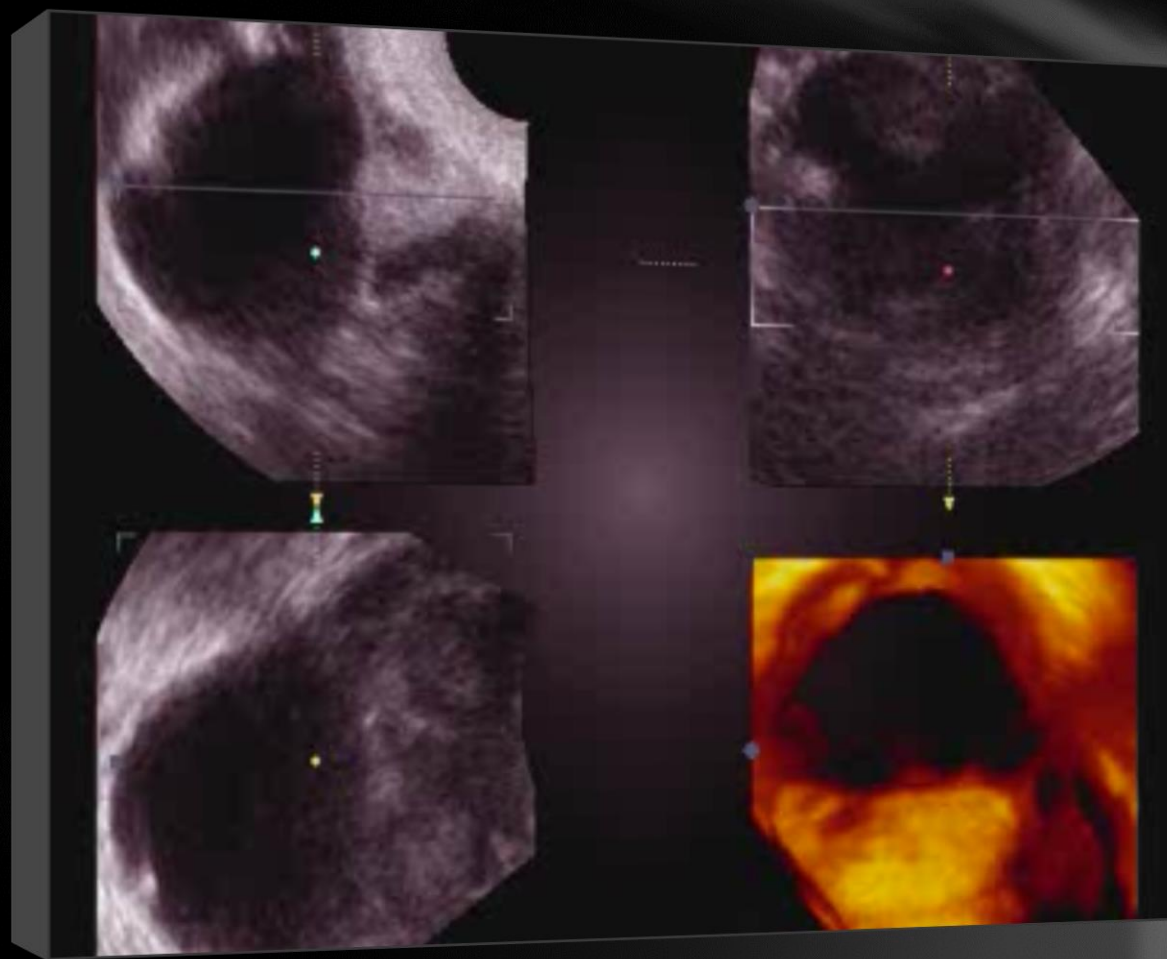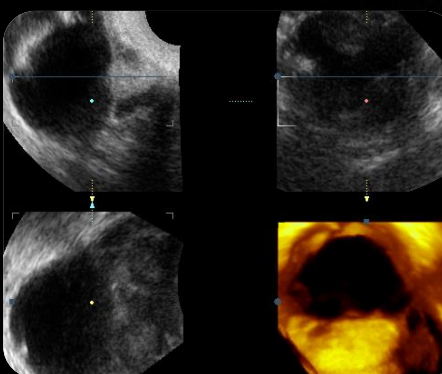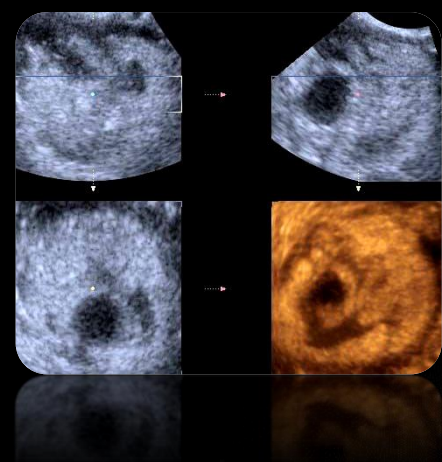
Resistance
- Low-resistance (high end-diastoli flow velocity) scores more highly for malignancy

Rottem S, Levit N, Thraler I et al. Classification of ovarian lesions by high frequency transvaginal sonography. J Clin Ultrasound 1990; 18: 359-63

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Dermoid cyst

Classification of dermoid cysts based on sonographic features

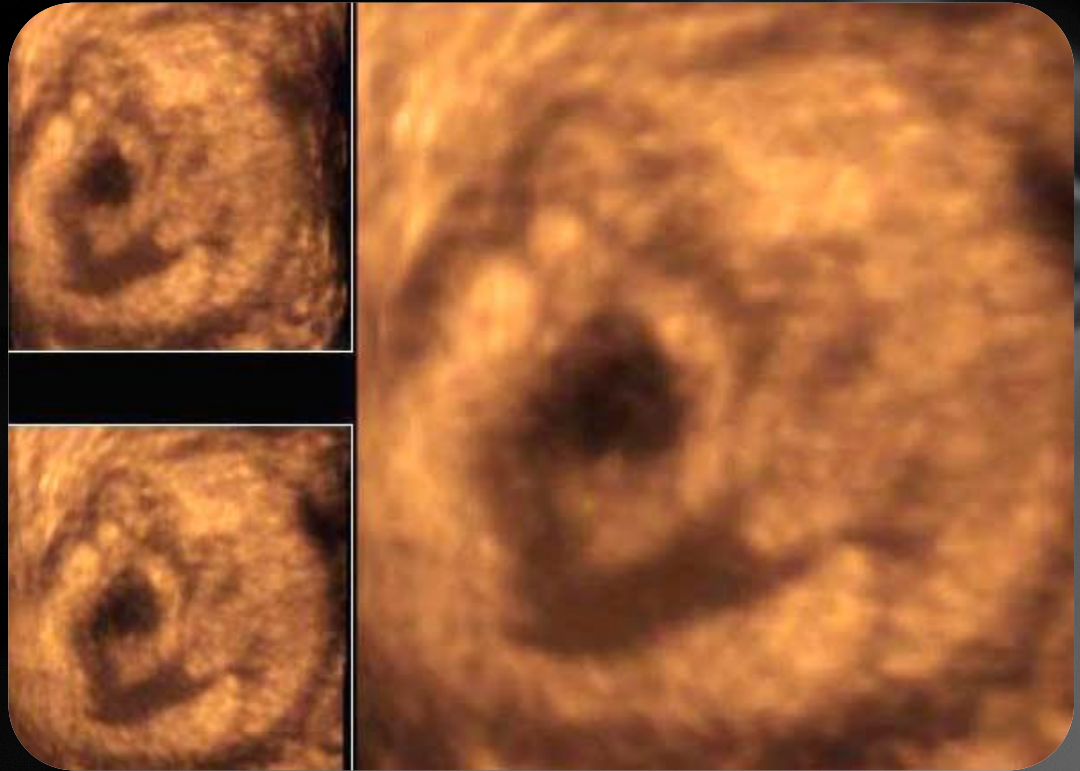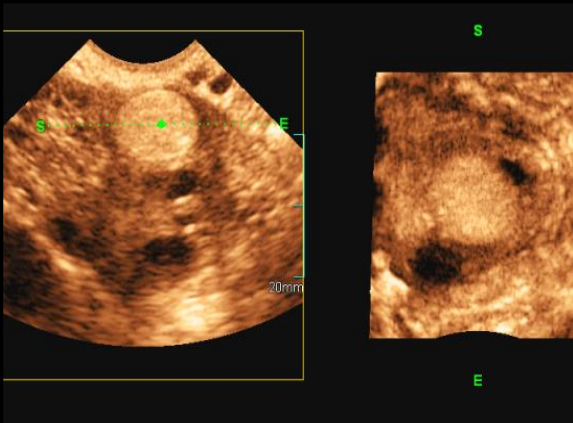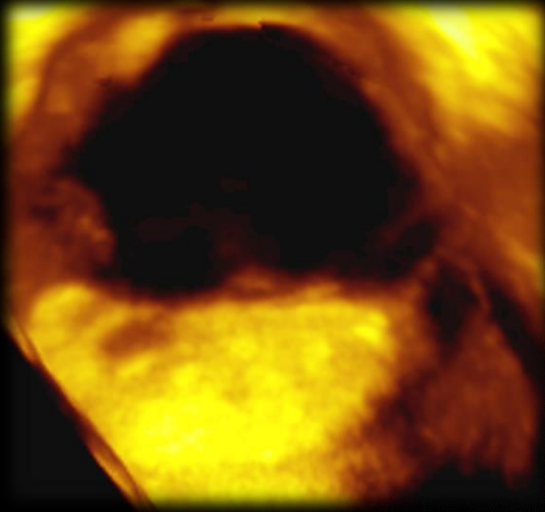I: an echogenic mass of varying density and shadowing subdivided into:

- A: all borders visible
- B: distal border visible
- C: only proximal border visible: "tip of the iceberg"

II: echogenic particles in a hypoechoic medium "dermoid mesh"

III: Cyst with fat-fluid level, where the uppermost oil layer is echo-free
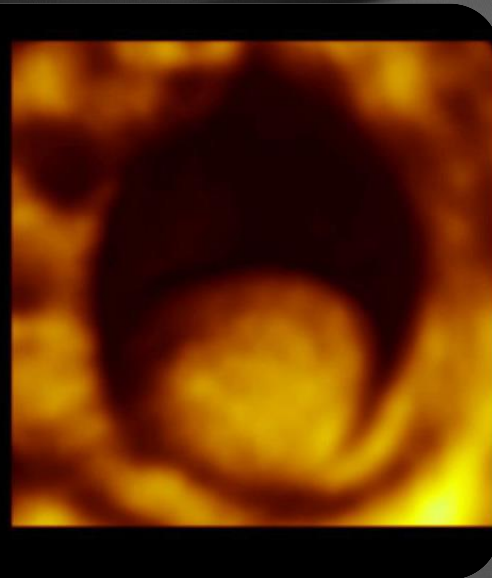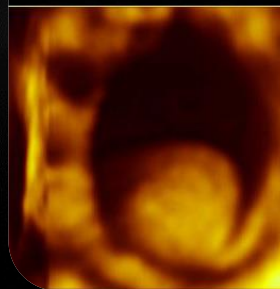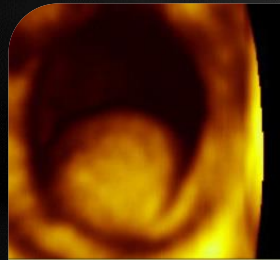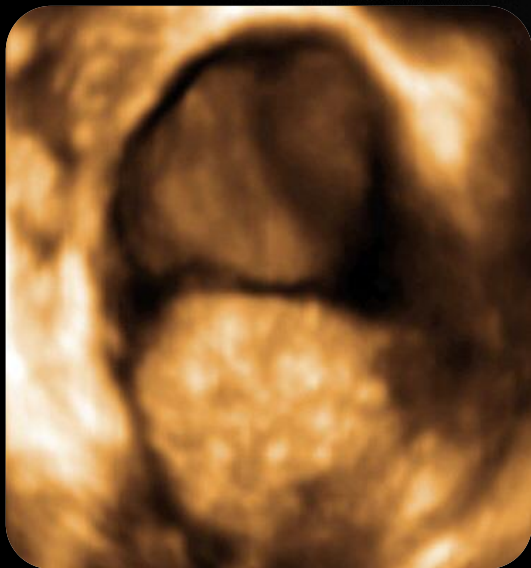
Caspi B, Appelman Z, Rabinerson D et al. Pathognomonic echo patterns of benign cystic teratomas of the ovary: classification, incidence and accuracy rate of sonographic diagnosis. Ultrasound Obstet Gynecol 1996; 7: 275-9
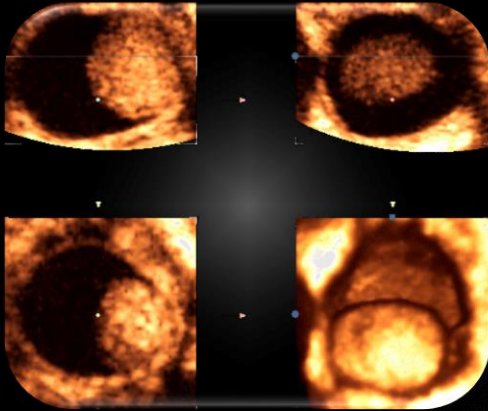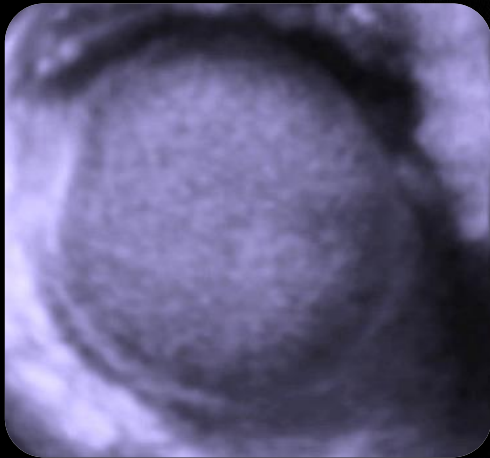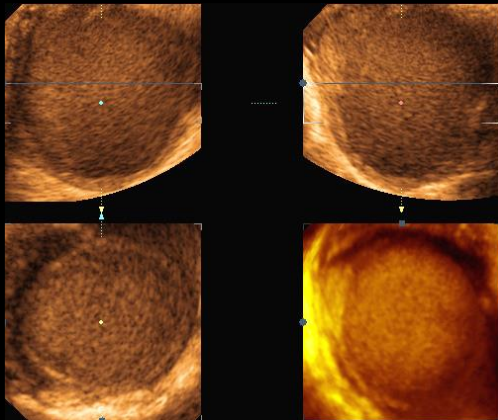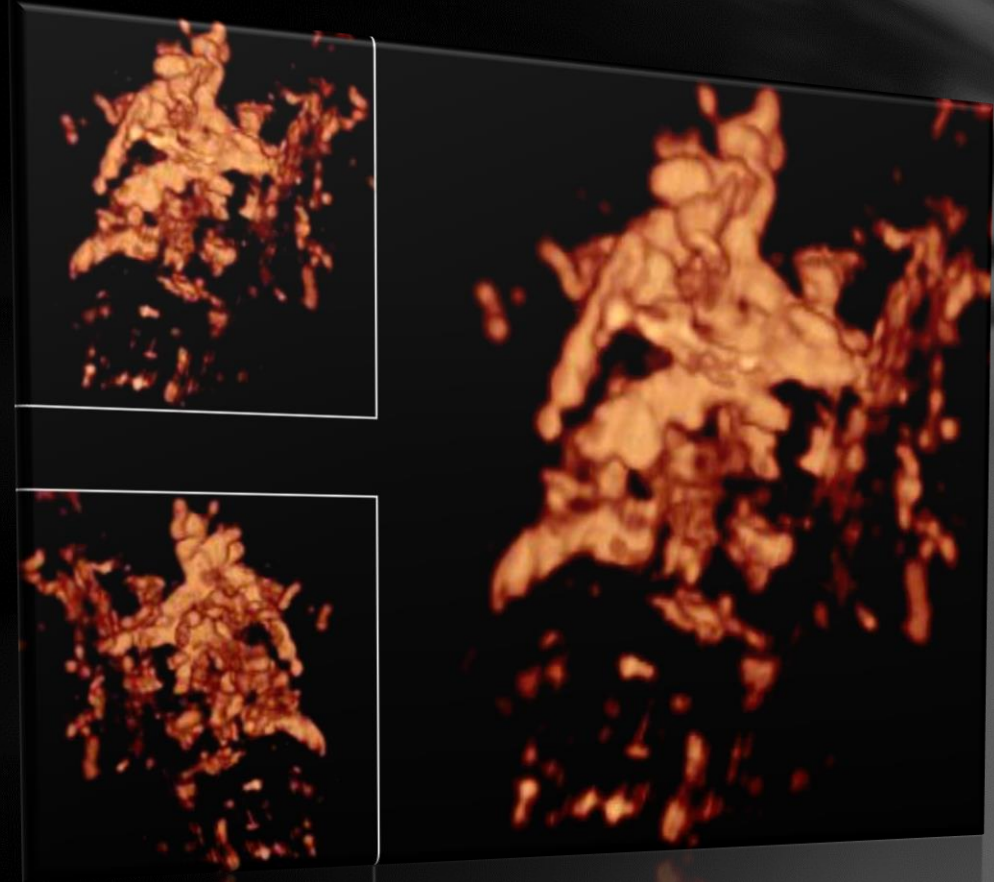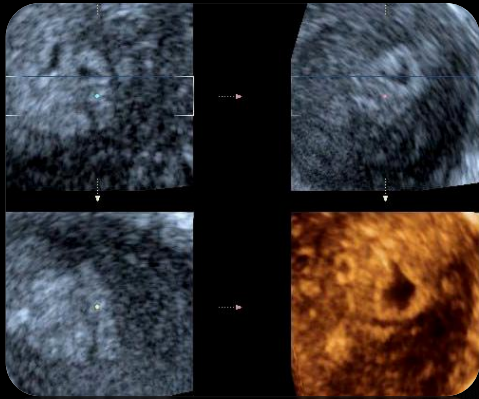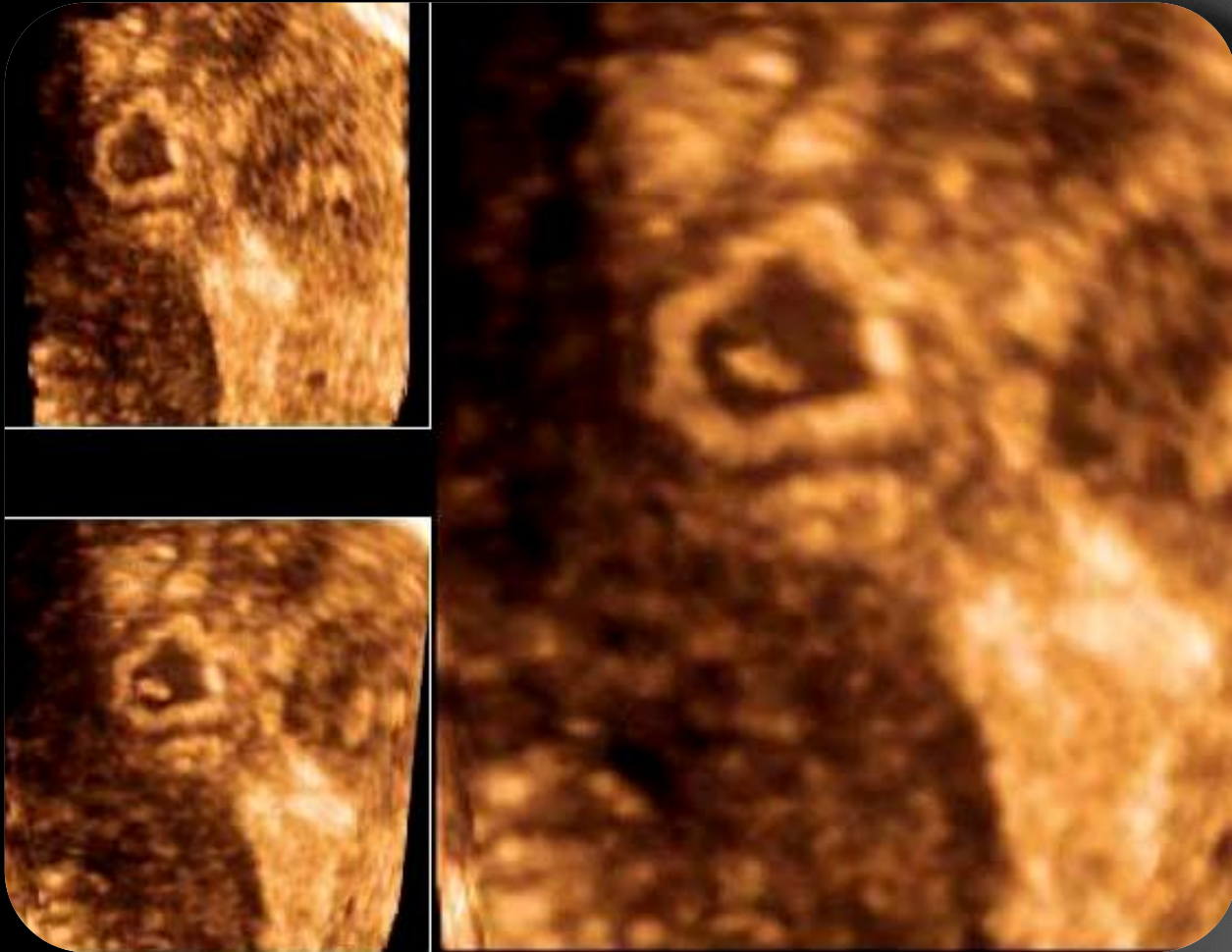
Dermoid cyst

Dermoid cyst
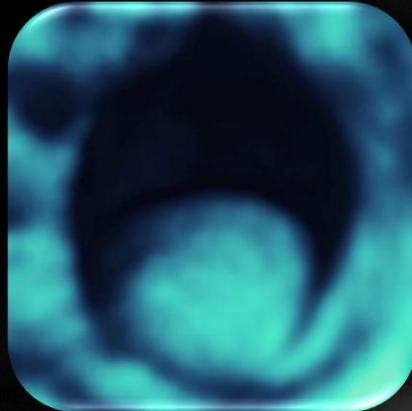
Endometriosis
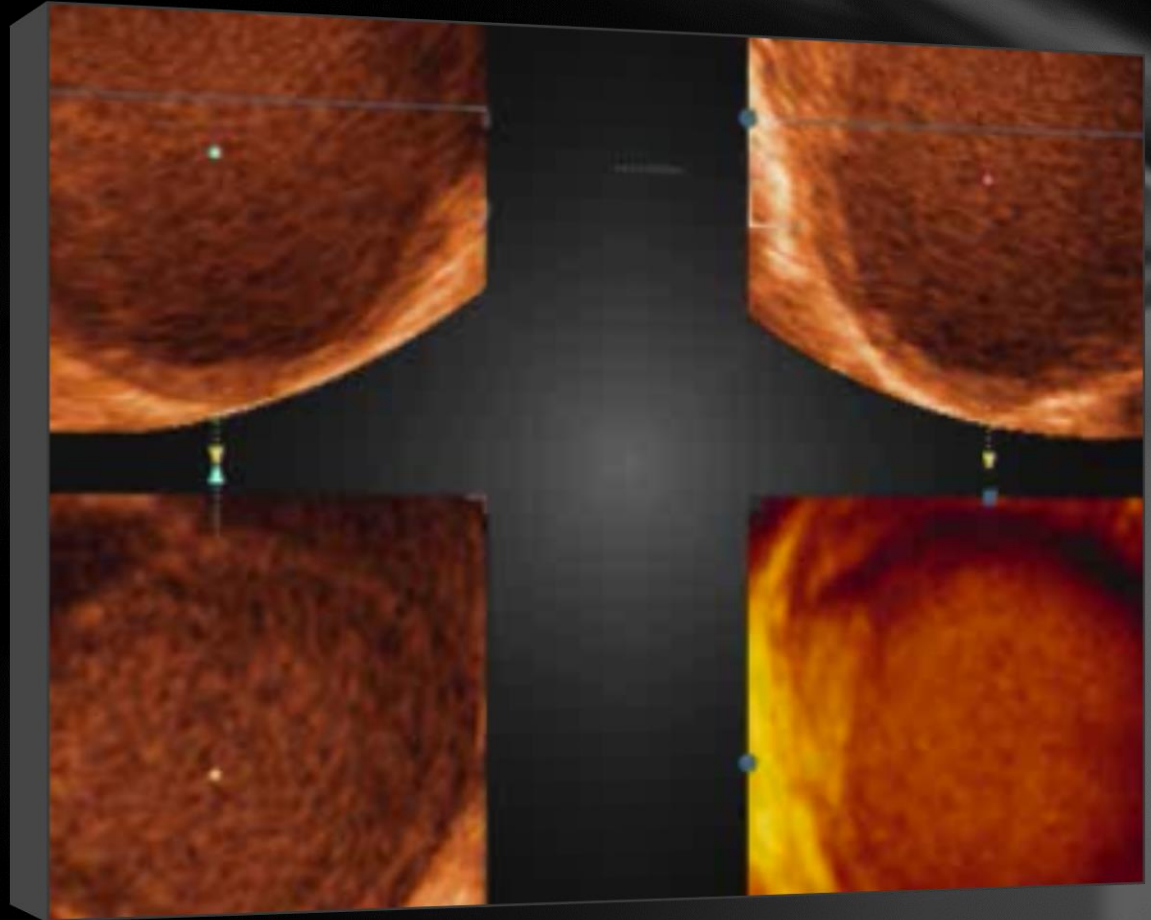
Adenomyosis

Adenomyosis

Suspect ovarian cyst
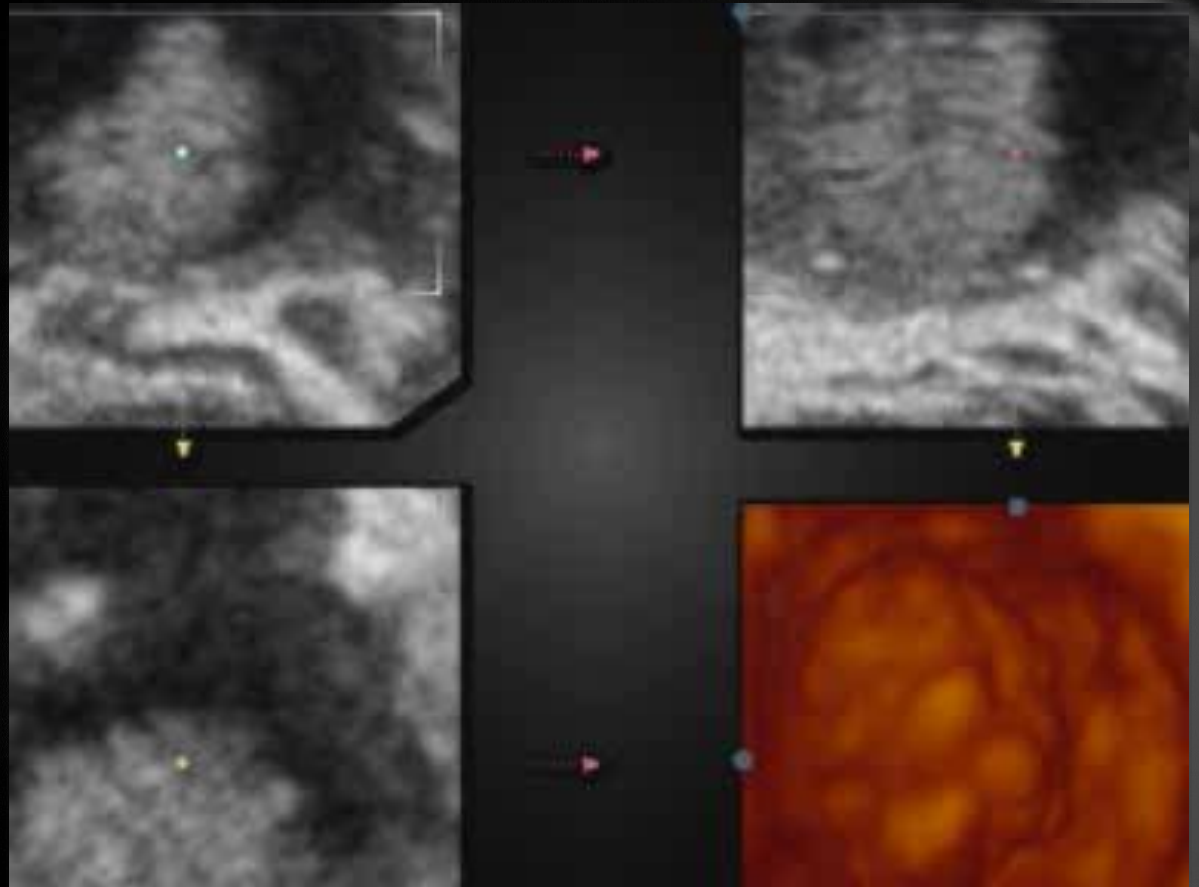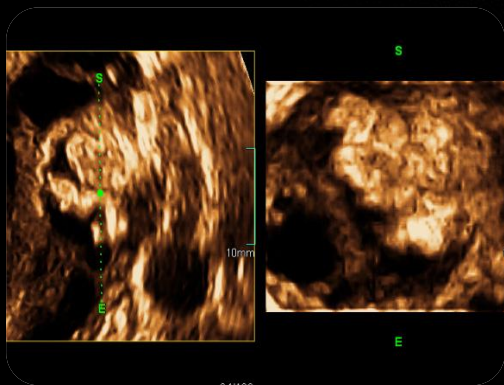
3D color/power Doppler HSSG
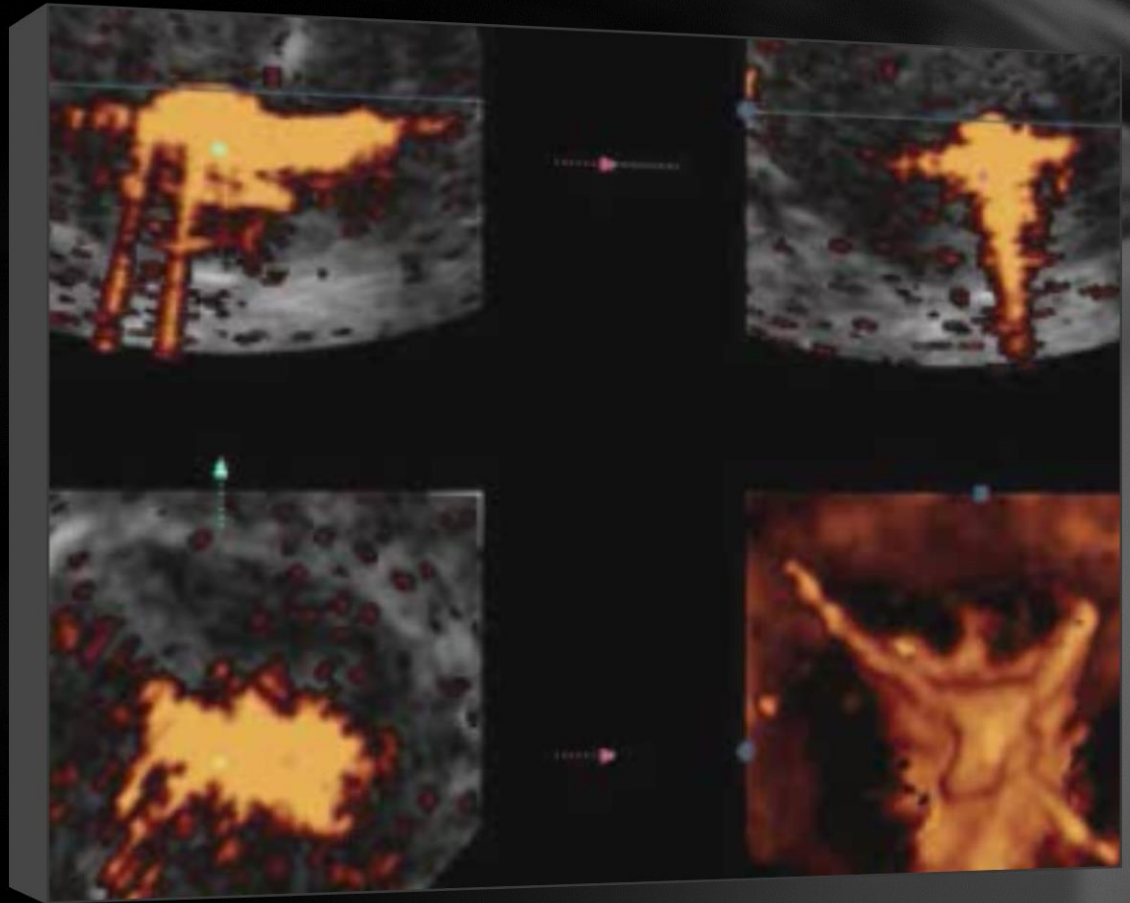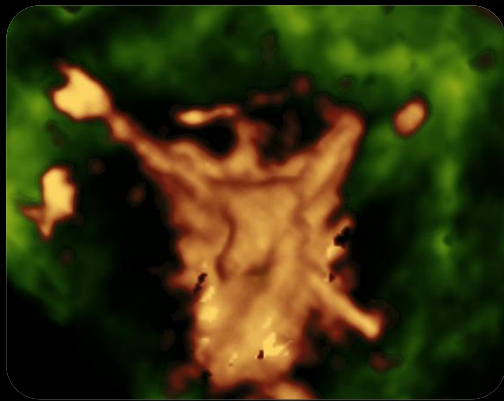
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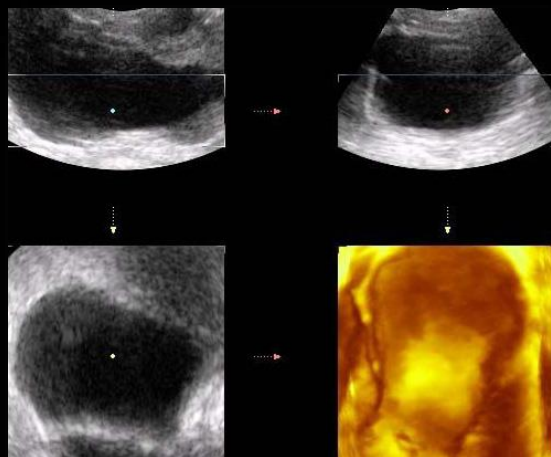
3D volume imaging is one of the most important advances in modern sonography

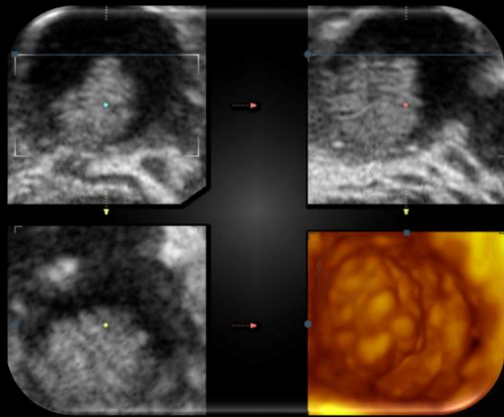3 - dimensional imaging is not new, as CT and MR have used it for decades with reconstruction of volumes in many planes and displaying the images in soft tissue or bone windows.
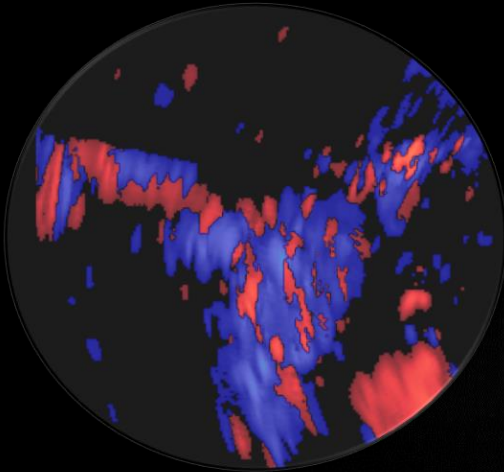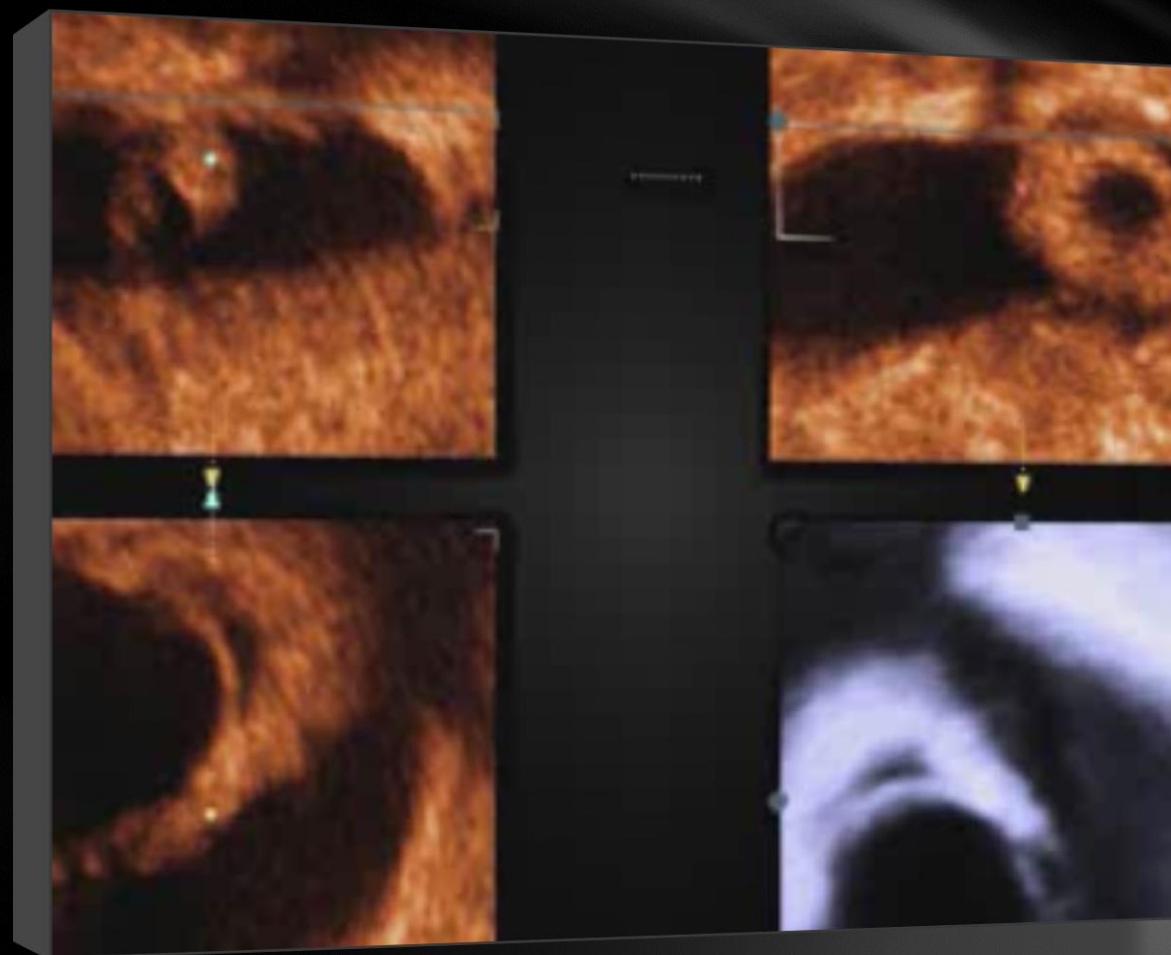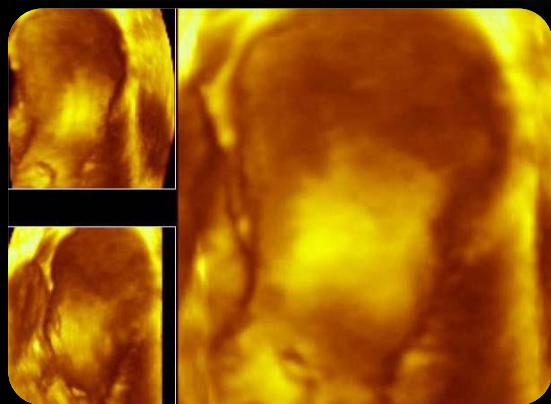
Now that ultrasound has acquired similar capabilites, the benefit of using ultrasound as the first imaging test are infinite. 3D ultrasound will challenge MR's imaging capabilites.

…it is now up to the ultrasound community to discover the areas that have become accesible to ultrasound due to this ability to reconstruct any plane and scan it in realtime.

This progress allows us to maintain and cement ultrasound's role in cross-sectional imaging applications…

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Beryl Benacerraf