



Understanding Gynaecological Embryology

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BMUS, April 26th 2024

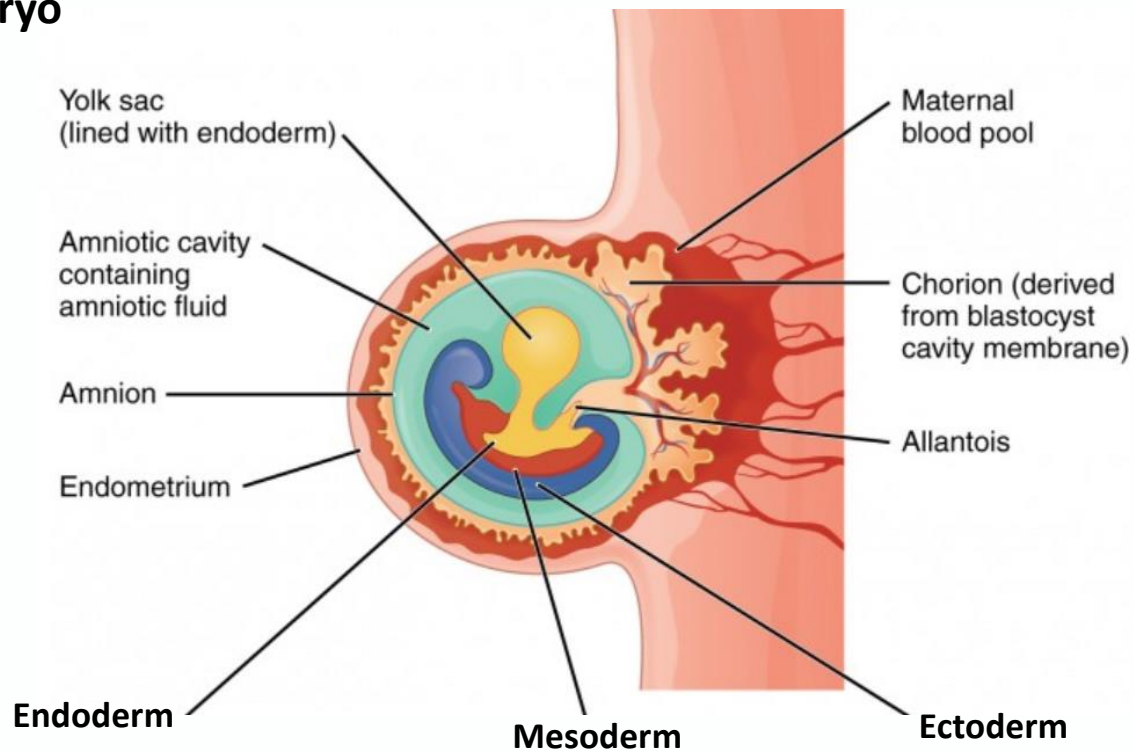
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Aims:

- Provide an overview of female reproductive embryology.
- Explain how uterine and ovarian congenital pathologies occur.
- How to diagnose pelvic pathologies with ultrasound.

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Day 21 embryo



<https://www.online-sciences.com/wp-content/uploads/2020/11/Second-third-week-of-Embryonic-development-1.jpg>

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Ectoderm

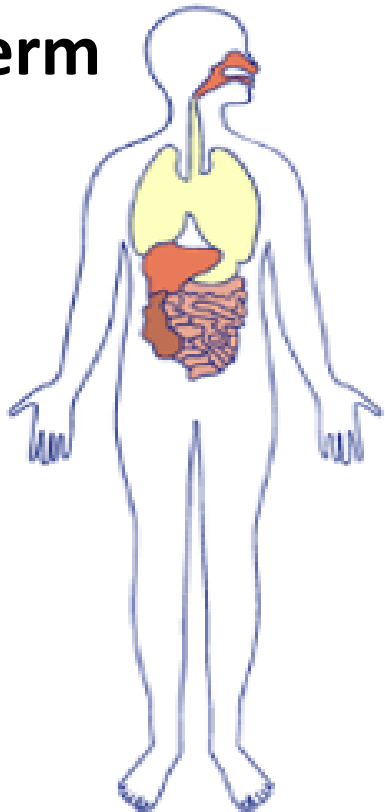


Responsible for outer components of body:

- Epidermis of skin
- Epithelial lining of mouth
- Cornea and lens of the eye
- Nervous system
- Adrenal medulla
- Tooth enamel

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Endoderm



Epithelial lining of:

- Digestive tract
- Respiratory system
- Urinary bladder and urethra
- Reproductive systems
- Liver
- Pancreas
- Thyroid

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Mesoderm



- Skeletal system
- Muscular layer of stomach and intestines
- Excretory system
- Circulatory and lymphatic systems
- Reproductive system (except ovaries)

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The female reproductive system derives from four origins:

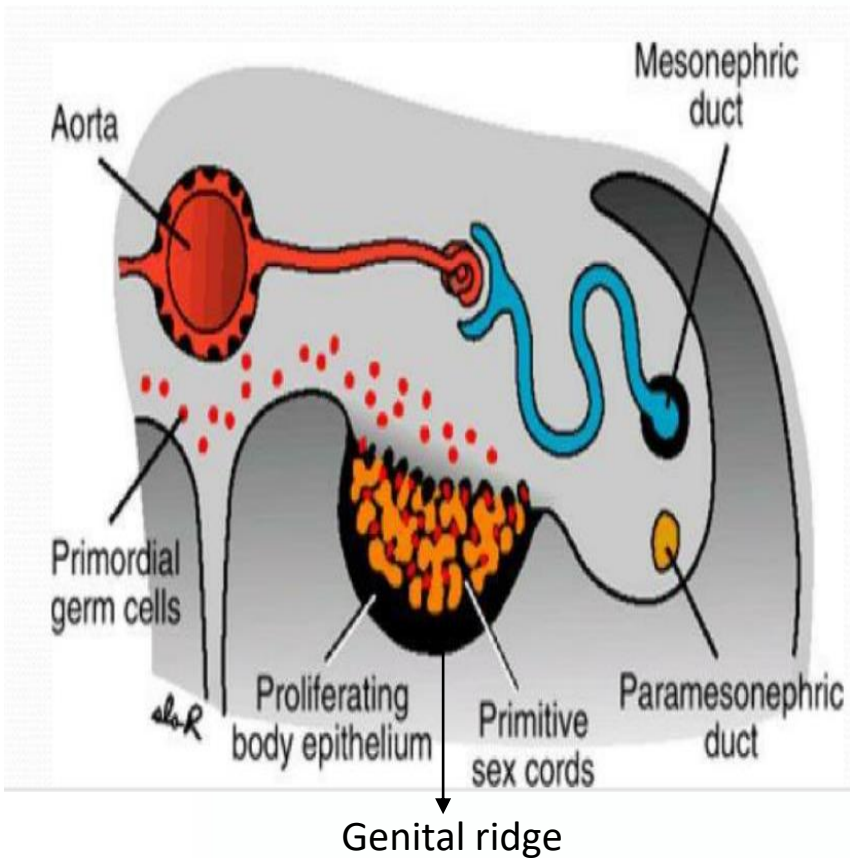
- Mesoderm
- Primordial germ cells
- Coelomic epithelium
- Mesenchyme

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- At 6 weeks: the primordial germ cells move from yolk sac to genital ridge.
- The genital ridge is located in the posterior wall of the embryo.

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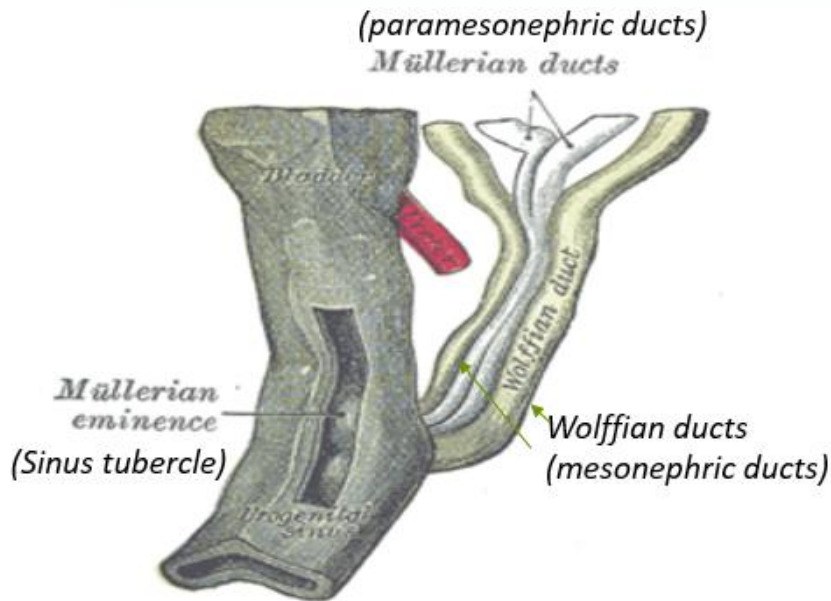


- Once the primordial germ cell reach the genital ridge, the coelomic epithelium undergoes marked proliferation.
- This gives rise to primitive sex chords, which form the adult gonad (either ovary or testis).

<https://image1.slideserve.com/3037917/slide7-l.jpg>

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At 7 weeks the male and female reproductive systems are indistinguishable.



- A single sinus tubercle.
- One pair of Wolffian ducts (mesonephric ducts).
- One pair of Müllerian ducts (paramesonephric ducts).

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Female sex chromosome

or



Male sex chromosome

If Y chromosome not present:

- the coelomic epithelium continues to proliferate
- the female primitive sex chords break up into clusters.
- The clusters form the medulla, stroma and follicular cells in the epithelium of the female gonad – the ovary.
- The primordial germ cells now develop into oogonium, which undergo meiotic division to become oocytes (eggs).

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- The Y chromosome produces testicular cells, which are responsible for the production of the Anti-Müllerian hormone (AMH).
- In the absence of AMH, the Müllerian ducts begin to develop into female reproductive organs.
- The Müllerian ducts develop into the upper 1/3 of vagina, cervix, uterus and Fallopian tubes.
- Müllerian ducts formation also dependent on the following genes EMX2, HOXA13, PAX2, LIM1, and WNT.

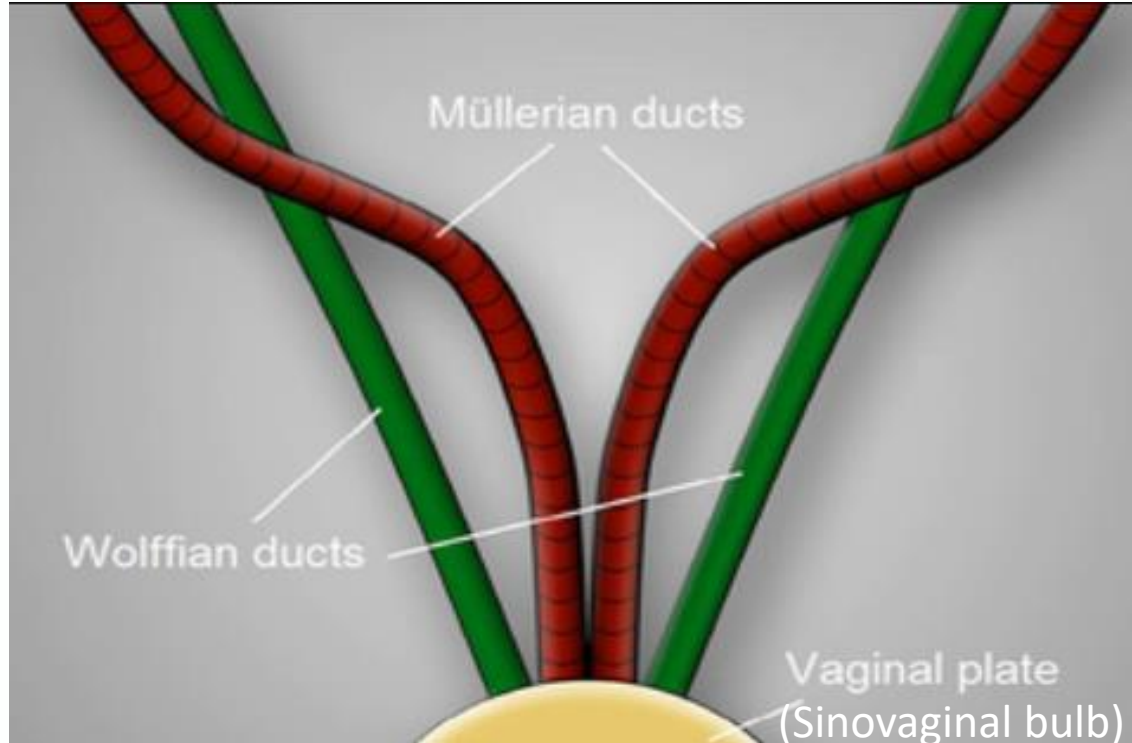
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Müllerian duct anomalies (congenital uterine anomalies) have the following prevalence:

- 5.5% in the unselected population
- 8.0% in subfertile women
- 13.3% with a history of recurrent miscarriage

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Organogenesis:



<https://www.researchgate.net/profile/Nienke-Kuijsters/publication/316040623/figure/fig1/AS:500142293909505@1496254623541/Embryology-of-the-uterus-A-Muellerian-red-and-Wolffian-green-ducts-B-Muellerian.png>

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Organogenesis: One or both Müllerian ducts may not develop fully, resulting in abnormalities such as:

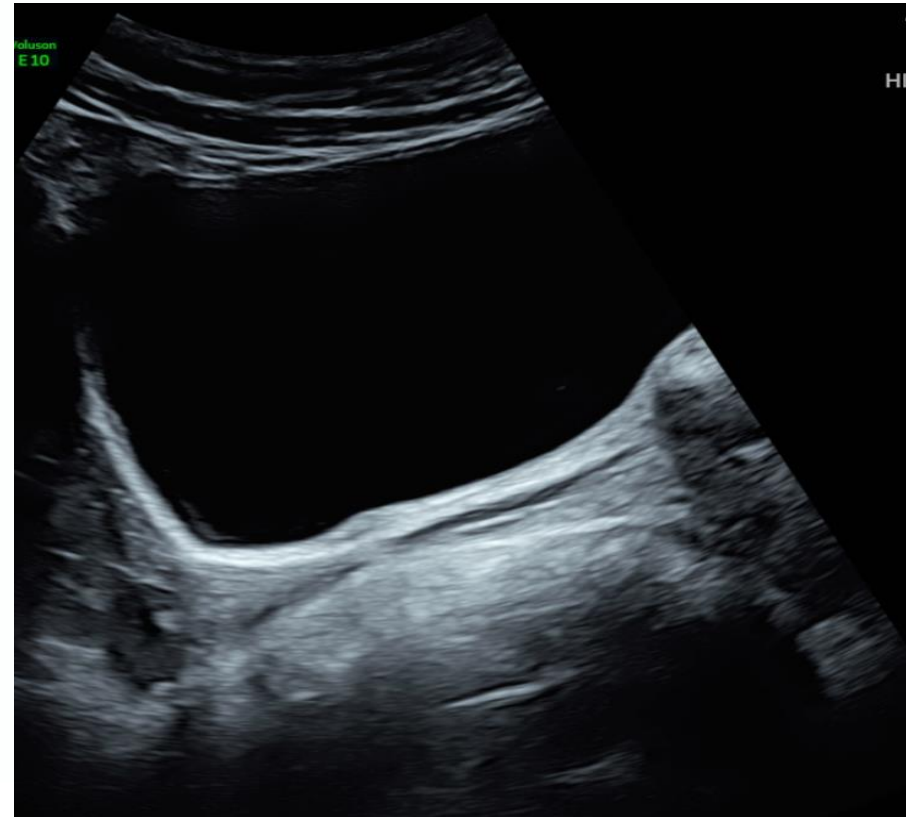
- Uterine aplasia (10% of all CUA)
- Unicornuate uterus (15% of all CUA)

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Clinical indications:

*Primary amenorrhoea with
normal gonadotrophins.*

Patient Virgo Intacta (VI).



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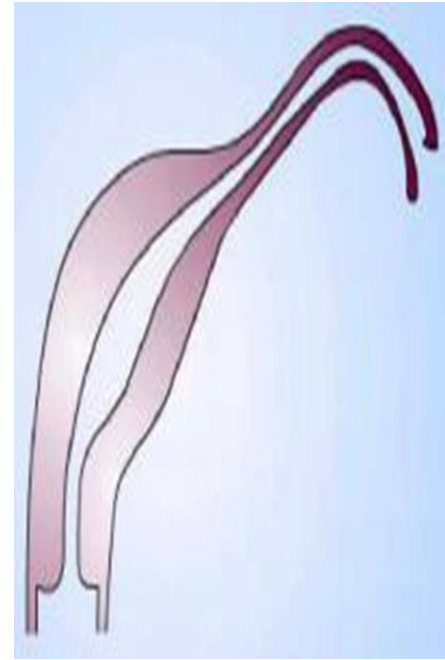
Ultrasound findings: Uterine agenesis:

- Common finding in Mayer-Rokitansky-Kuster-Hauser (MRKH) syndrome.
- 1:5000 females.
- Normal secondary sexual characteristics and genetic karyotype: 46XX.
- 30-40% of women will have an associated renal anomaly.

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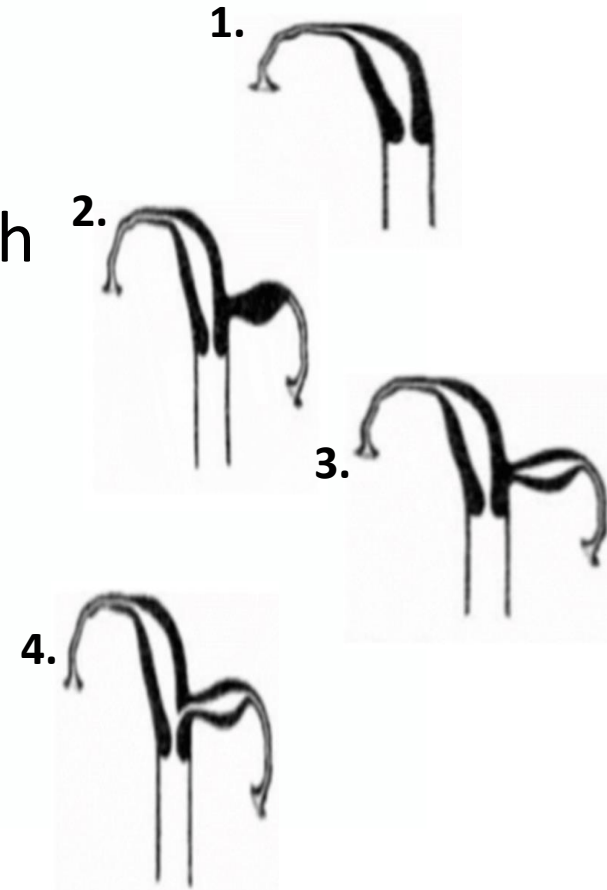
Unicornuate uterus – One side fully developed, the other side atrophic.

- Least common uterine anomaly: 2.4 – 13% of CUA.
- Women may present with painful periods.
- Can have fertility issues, as only one Fallopian tube functions.
- Pregnancy rate – 47%.
- Risk of miscarriage and premature labour.



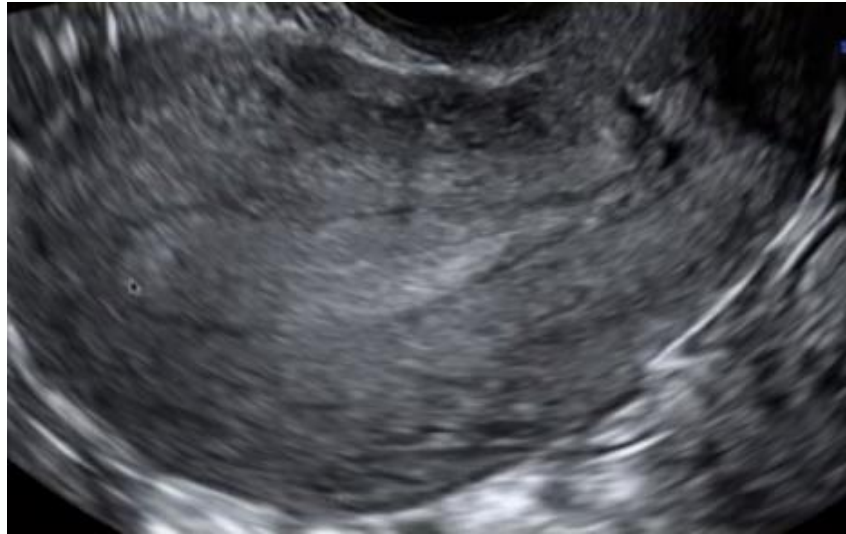
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1. 35% will have no rudimentary horn.
2. 33% will have a rudimentary horn with no cavity.
3. 22% will have a noncommunicating rudimentary horn.
4. 10% will have a communicating rudimentary horn.



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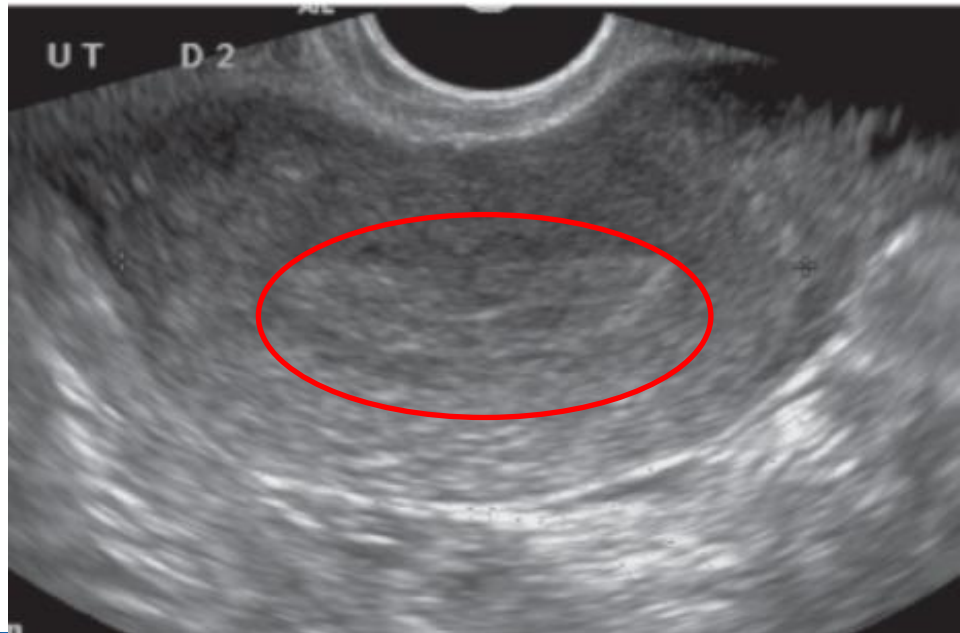
2D Unicornuate uterus
Longitudinal section



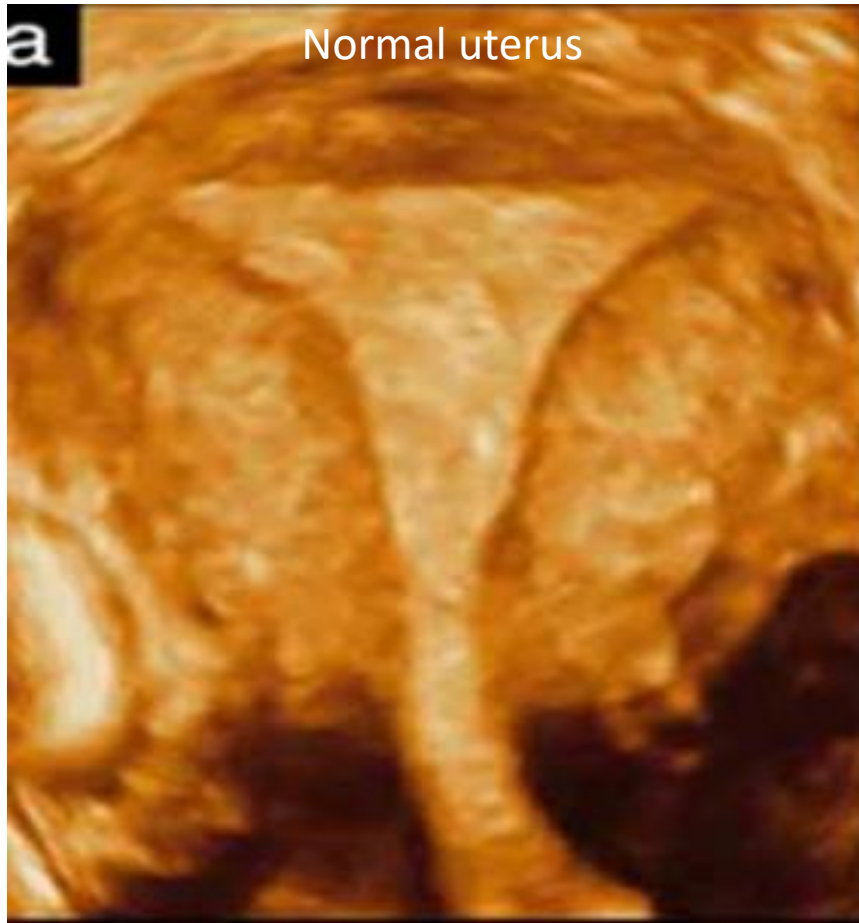
2D Unicornuate uterus
Transverse section



2D normal uterus
Transverse section

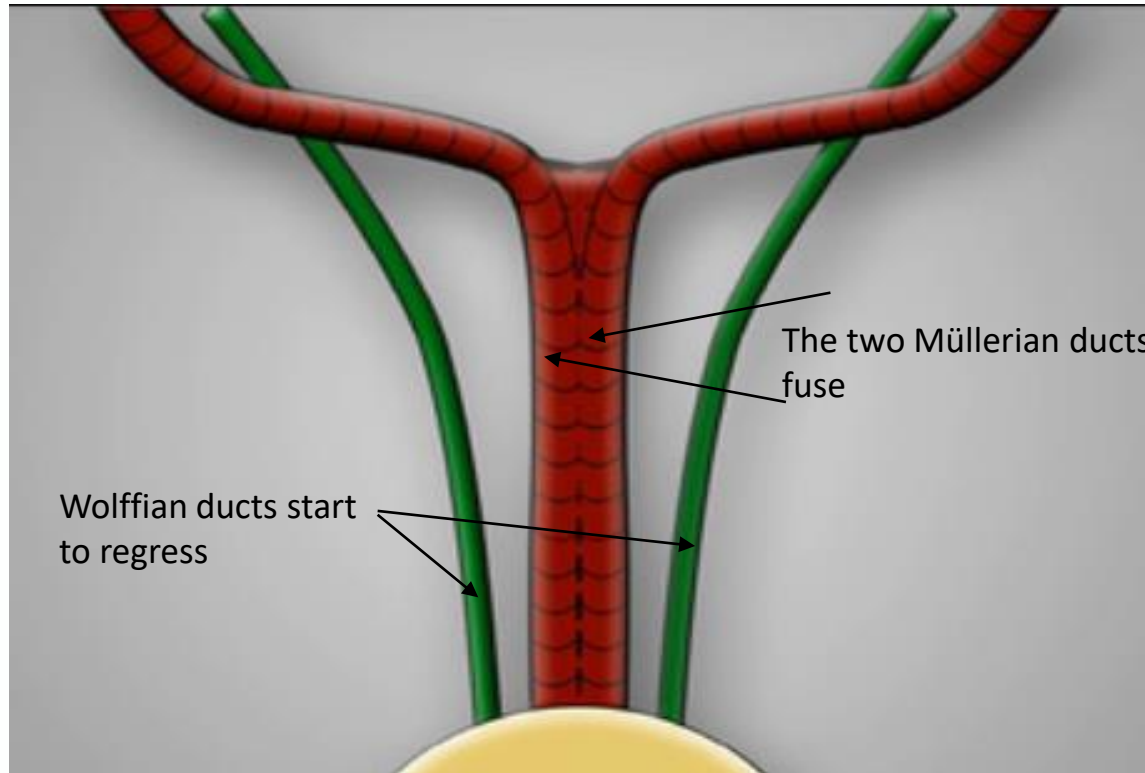


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Fusion:



<https://www.researchgate.net/profile/Nienke-Kuijsters/publication/316040623/figure/fig1/AS:500142293909505@1496254623541/Embryology-of-the-uterus-A-Muellerian-red-and-Wolffian-green-ducts-B-Muellerian.png>

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Fusion: The lower segments of the Müllerian ducts fuse to form the uterus, cervix and upper 1/3 of the vagina.

Failure of fusion results in:

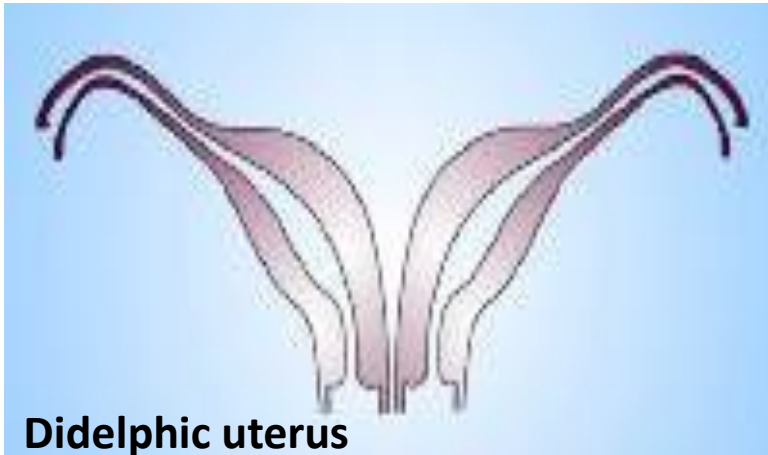
- Didelphic uterus
- Bicornuate uterus

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Didelphic uterus:

- Two separate uterine bodies: can have two cervixes and two vaginas or one shared cervix and vagina.
- Accounts for 11% of CUA.
- Patient may experience dyspareunia.
- Pregnancy rate - 60%.
- Risk of premature labour and miscarriage due to incompetent cervix.

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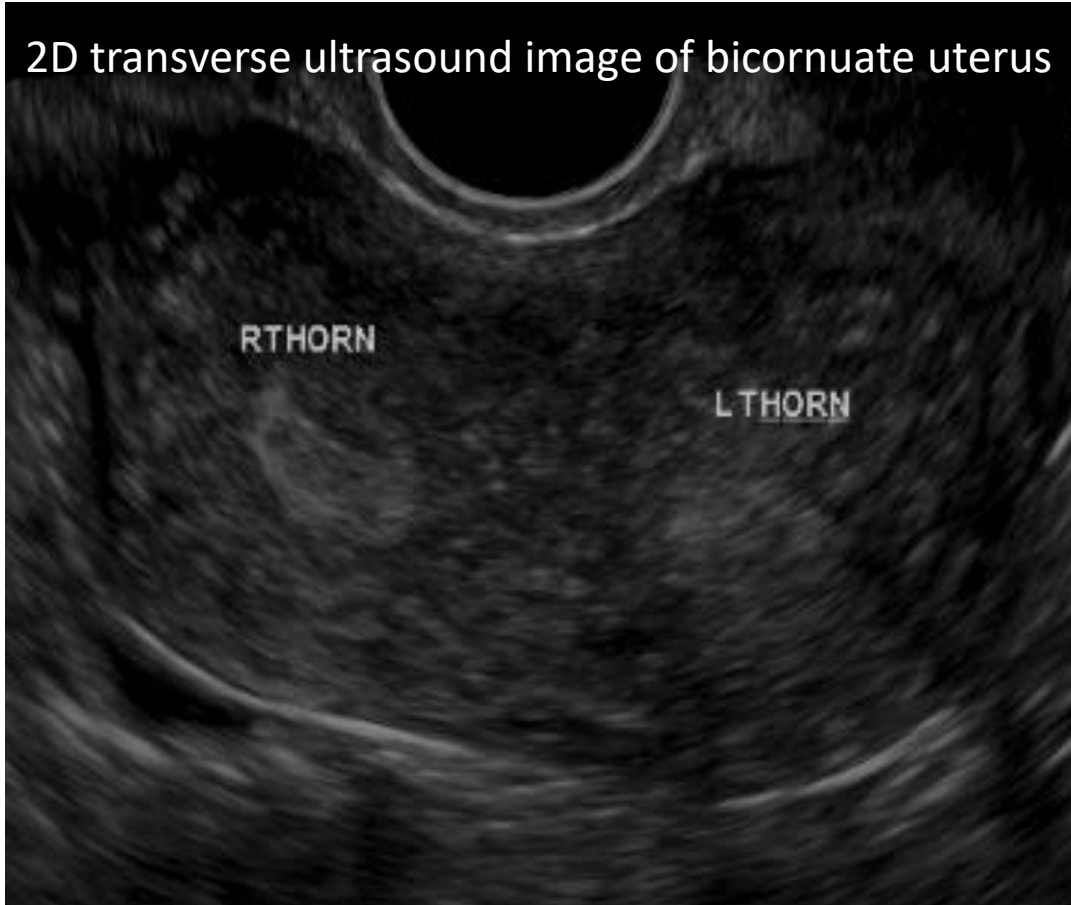
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Bicornuate uterus:

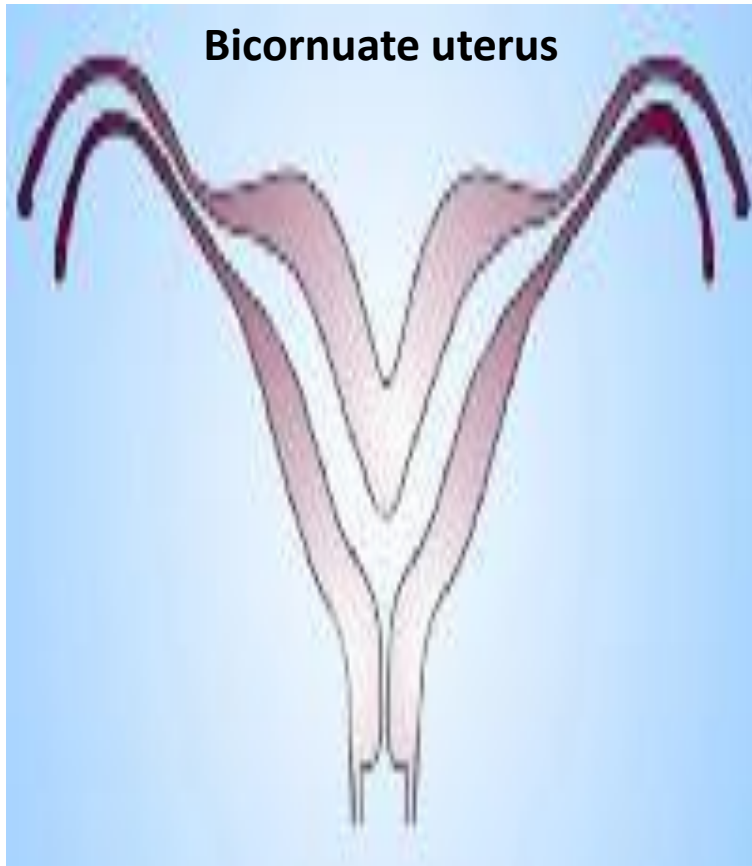
- Failure of the cranial portions of the Müllerian ducts to fuse at the fundus.
- In TS: two endometrium are seen.
- Accounts for 25% of CUA.
- Pregnancy rate - 60%.
- Risk of miscarriage and cervical incompetence.

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2D transverse ultrasound image of bicornuate uterus

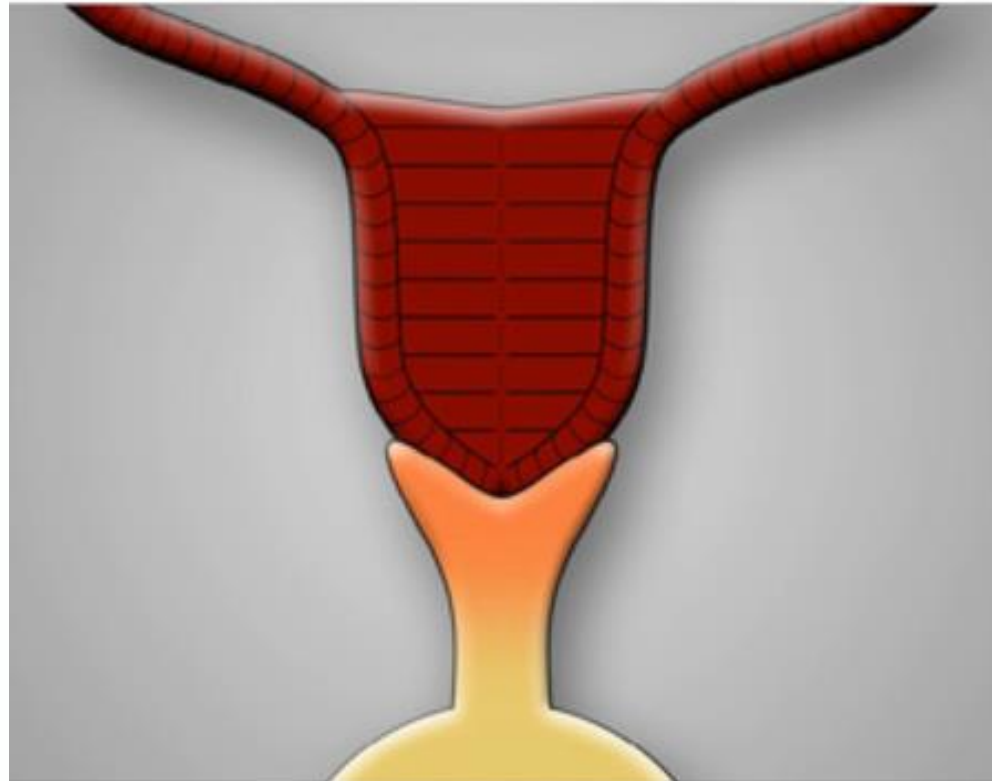


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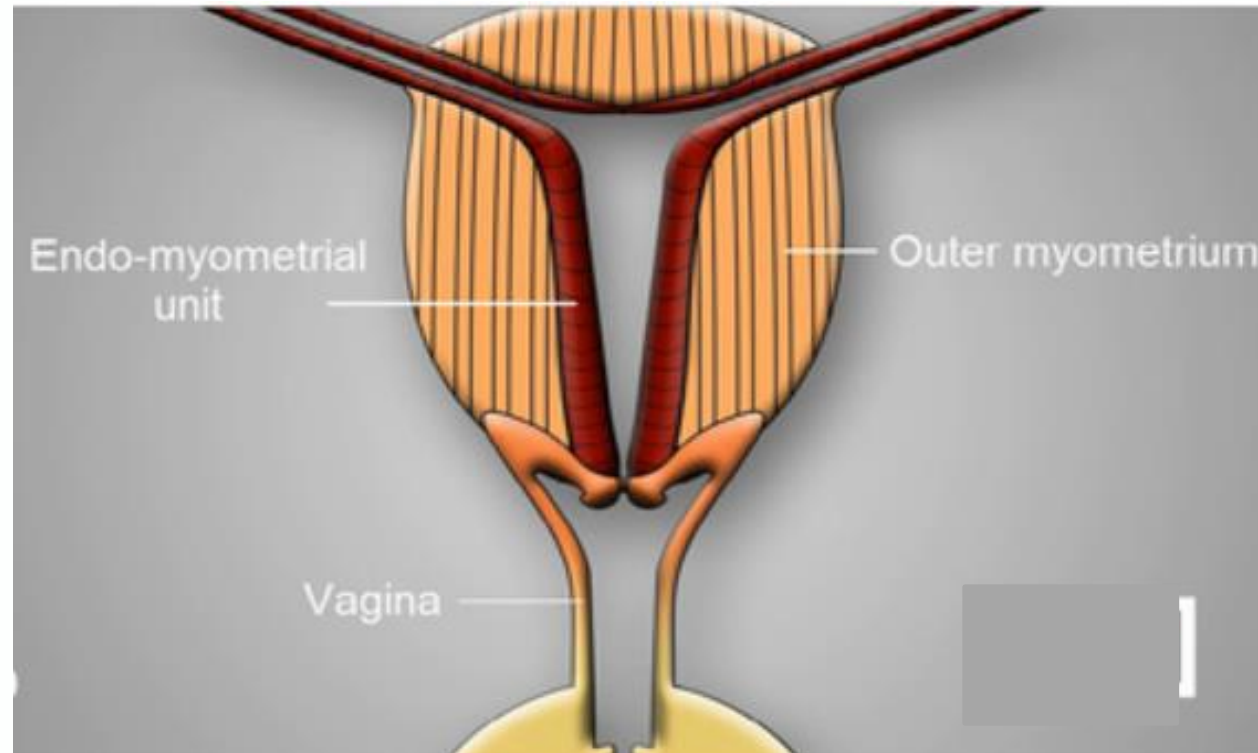
Septal resorption:



<https://www.researchgate.net/profile/Nienke-Kuijsters/publication/316040623/figure/fig1/AS:500142293909505@1496254623541/Embryology-of-the-uterus-A-Muellerian-red-and-Wolffian-green-ducts-B-Muellerian.png>

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Septal resorption:



<https://www.researchgate.net/profile/Nienke-Kuijsters/publication/316040623/figure/fig1/AS:500142293909505@1496254623541/Embryology-of-the-uterus-A-Muellerian-red-and-Wolffian-green-ducts-B-Muellerian.png>

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Septal resorption:

- After the caudal Müllerian ducts fuse, resorption must occur to form a single uterine cavity and cervix.
- Failure of resorption causes:
 - septate uterus
 - subseptate uterus
 - arcuate uterus

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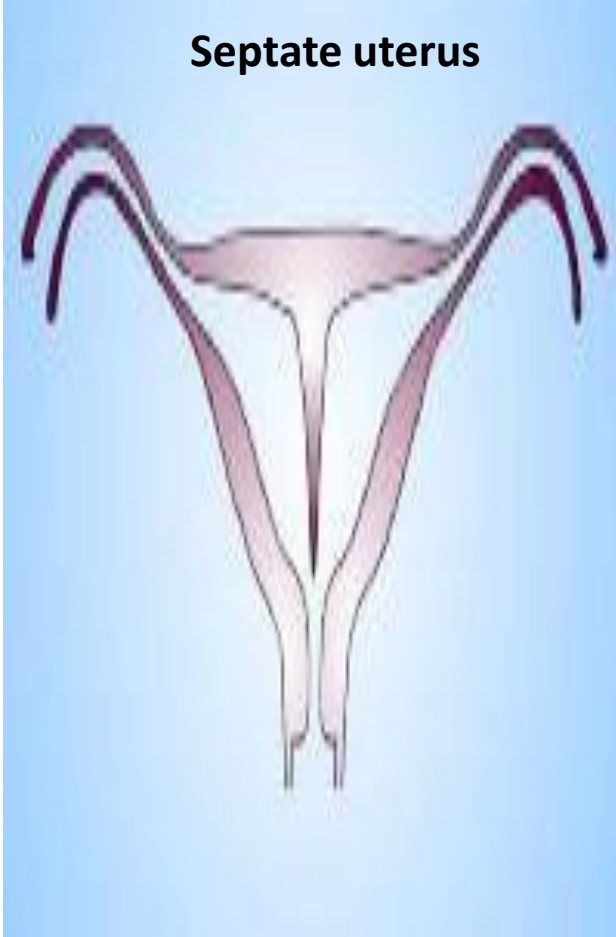
Septate uterus:

- Looks normal on the outside, but the uterine cavity is divided by a septum.
- Incidence of 45% (most common CUA)
- Can cause subfertility, but miscarriage is the commonest complaint.
- Metroplasty (hysteroscopic septum incision) can be performed to remove the septum and reshape the uterus.
- Pregnancy rate – live birth rates increase from 6.1% to over 80% after metroplasty.

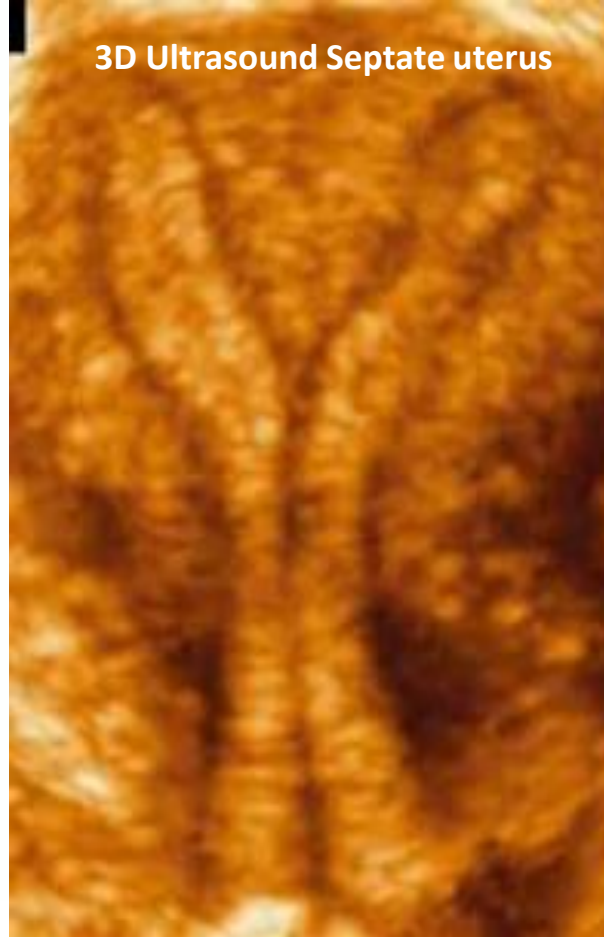
(Palter, S., 2009, Hysteroscopy for evaluating and treating recurrent pregnancy loss. Hysteroscopy. pp157-169.)

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Septate uterus



3D Ultrasound Septate uterus



3D Ultrasound Subseptate uterus



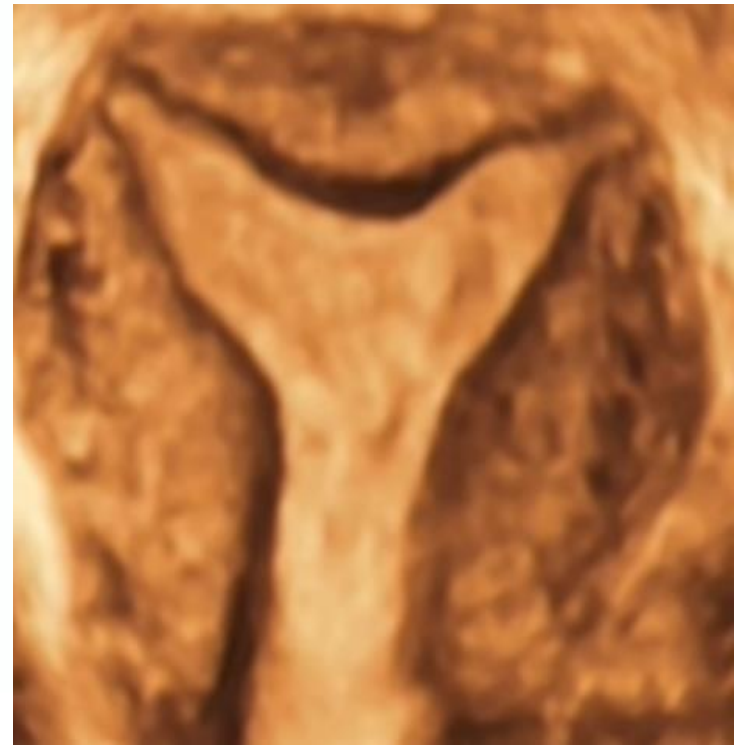
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Arcuate uterus:

- Mild thickening of the midline fundal myometrium, resulting in fundal endometrial cavity indentation.
- Normal outer fundal contour.
- Used to be considered a normal variant, but is associated with miscarriage and fertility difficulties.
- Accounts for 7% of Müllerian duct anomalies

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Arcuate uterus:

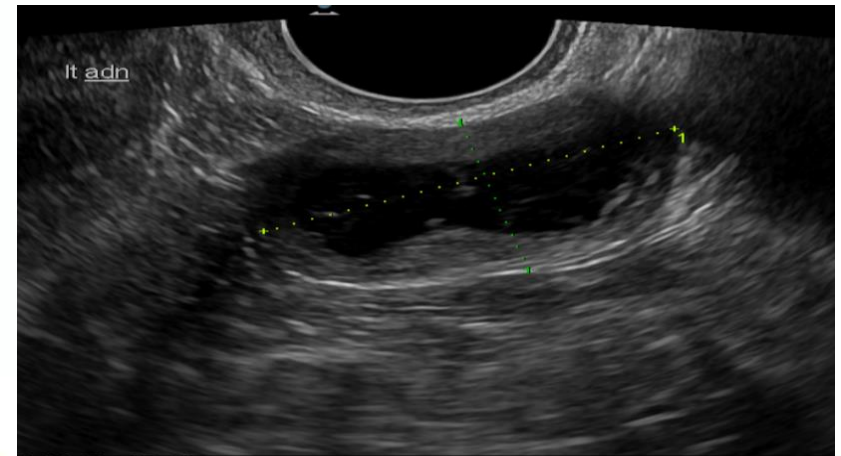
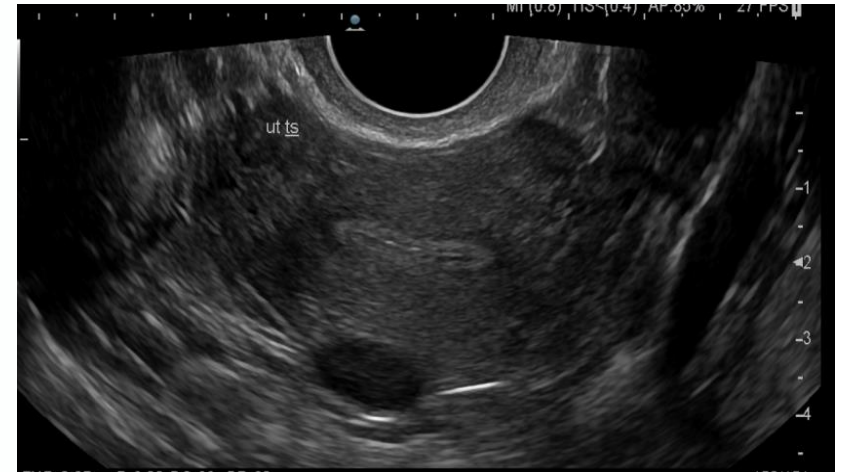


Abnormal Gynaecological Appearances

Clinical indications:

- *C/o chronic intermittent lower left abdominal pain for 9-12 months.*
- *Pain worsening last 2-3 months.*

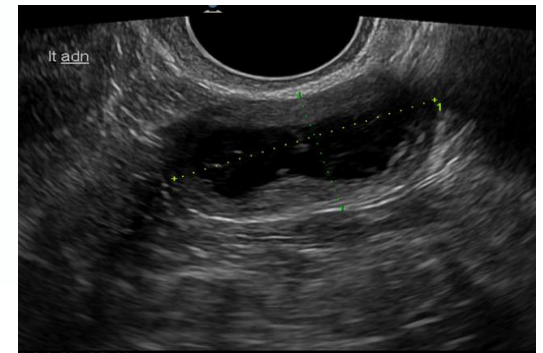
Finding: Accessory cavitation uterine malformation (ACUM)



Abnormal Gynaecological Appearances

Accessory cavitation uterine malformation (ACUM)

- Women present with severe dysmenorrhoea or chronic pelvic pain.
- Appears as an oval accessory cavity, which does not communicate with a normal uterus.
- Very rare.



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FERTILITY AND STERILITY
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Vol. 49, No. 6, June 1988
Printed in U.S.A.

The American Fertility Society classifications of adnexal adhesions, distal tubal occlusion, tubal occlusion secondary to tubal ligation, tubal pregnancies, Müllerian anomalies and intrauterine adhesions

Human Reproduction, Vol.28, No.8 pp. 2032–2044, 2013
Advanced Access publication on June 14, 2013 doi:10.1093/humrep/det098

human
reproduction

ORIGINAL ARTICLE ESHRE pages

The ESHRE/ESGE consensus on the classification of female genital tract congenital anomalies^{†‡}

Grigoris F. Grimbizis^{1,2,*}, Stephan Gordts¹, Attilio Di Spiezio Sardo¹, Sara Brucker¹, Carlo De Angelis¹, Marco Gergolet¹, Tin-Chiu Li¹, Vasilios Tanos¹, Hans Brölmann¹, Luca Gianaroli¹, and Rudi Campo¹

ASRM müllerian anomalies classification 2021

Samantha M. Pfeifer, M.D., Marjan Attaran, M.D., Jessica Goldstein, R.N., Steven R. Lindheim, M.D., M.M.M., John C. Petrozza, M.D., Beth W. Rackow, M.D., Evan Siegelman, M.D., Robert Troiano, M.D., Thomas Winter, M.D., Andrea Zuckerman, M.D., and Sarah D. Ramaiah, M.S.Ed.

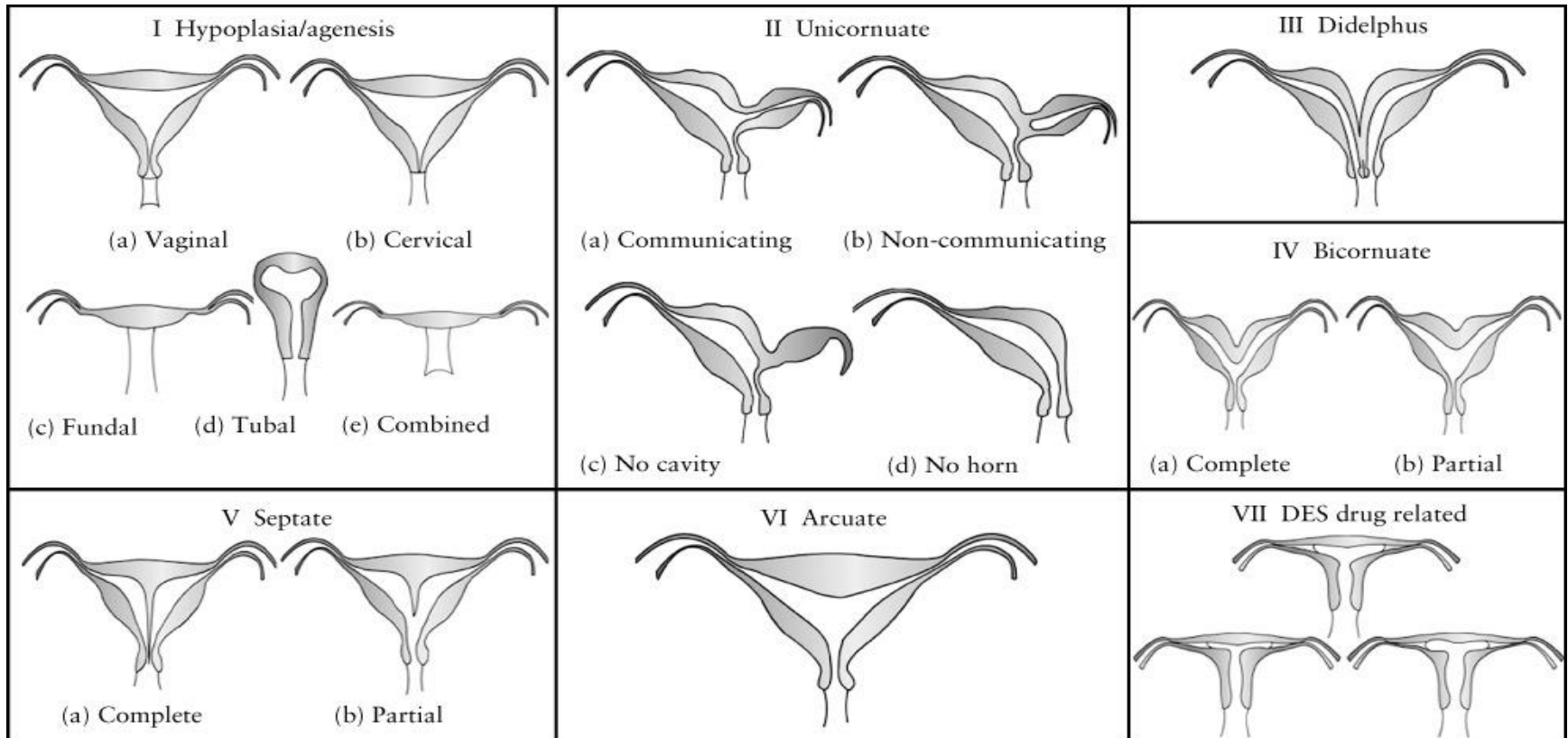
Ultrasound Obstet Gynecol 2022; 60: 7–21
Published online 9 June 2022 in Wiley Online Library (wileyonlinelibrary.com)

Opinion

ASRM Müllerian Anomalies Classification 2021: a critical review

A. LUDWIN^{1,2,*}, S. TUDORACHE³ and W. P. MARTINS⁴

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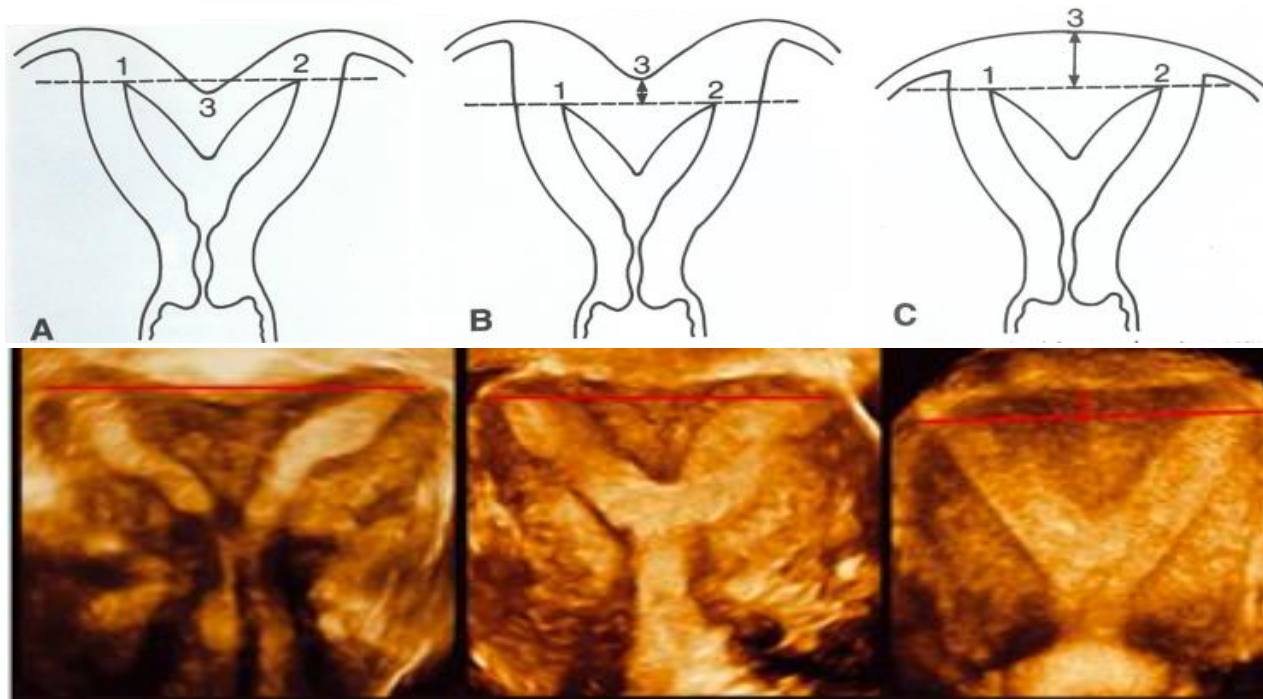
The American Fertility Society classifications of adnexal adhesions, distal tubal obstruction, tubal occlusion secondary to tubal ligation, tubal pregnancies, Mullerian anomalies and intrauterine adhesions. *Fertil Steril* 1988; 49: 944–955.

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Uterine shape	Internal contour fundus	External contour fundus
Normal	Straight or convex	Convex or indentation < 10 mm.
Arcuate	Concave indentation angle > 90°	Convex or indentation <10 mm.
Subseptate	Septum does not extend to cervix. Central septal angle < 90°	Convex or indentation <10 mm.
Septate	Septum extends to cervix.	Convex or indentation <10 mm.
Bicornuate	Two well-formed uterine cornua.	Fundal indentation > 10 mm dividing the two cornua.
Unicornuate (+/- rudimentary horn)	Single uterine cornu and only one Fallopian tube.	Fundal indentation > 10 mm (if rudimentary horn present.)

Salim, R. et al (2003) Reproducibility of 3D ultrasound diagnosis of congenital uterine anomalies. *Ultrasound Obstet Gynaecol*; 21: 578-582.

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Classification criteria for ultrasound differentiation of septate from bicornuate uteri. **A:** When apex (3) of the fundal external contour occurs below a straight line between the tubal ostia (1,2,) or **B:** 5 mm (arrow) above it, the uterus is bicornuate. **C:** When apex is more than 5 mm (arrow) above the line, uterus is septate. Troiano R, McCarthy S. (2004) Müllerian duct anomalies: imaging and clinical issues. *Radiology*; 233: 19–34.

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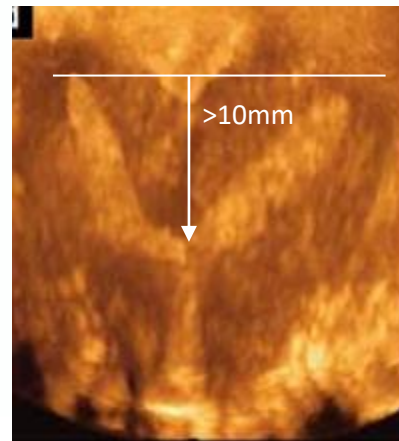
Normal uterus



Unicornuate uterus



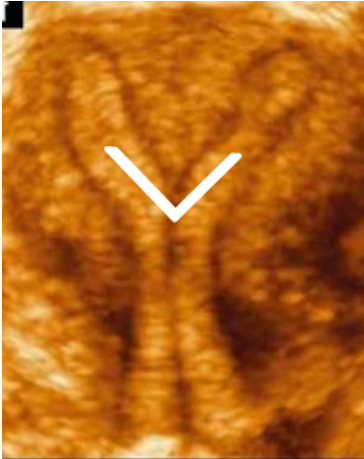
Didelphic uterus



Bicornuate uterus

<https://radiologykey.com/congenital-uterine-anomalies/>

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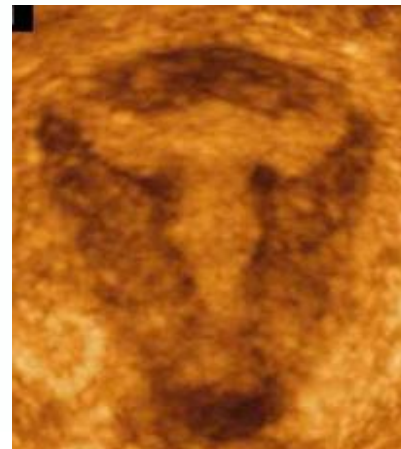
Septate uterus



Subseptate uterus



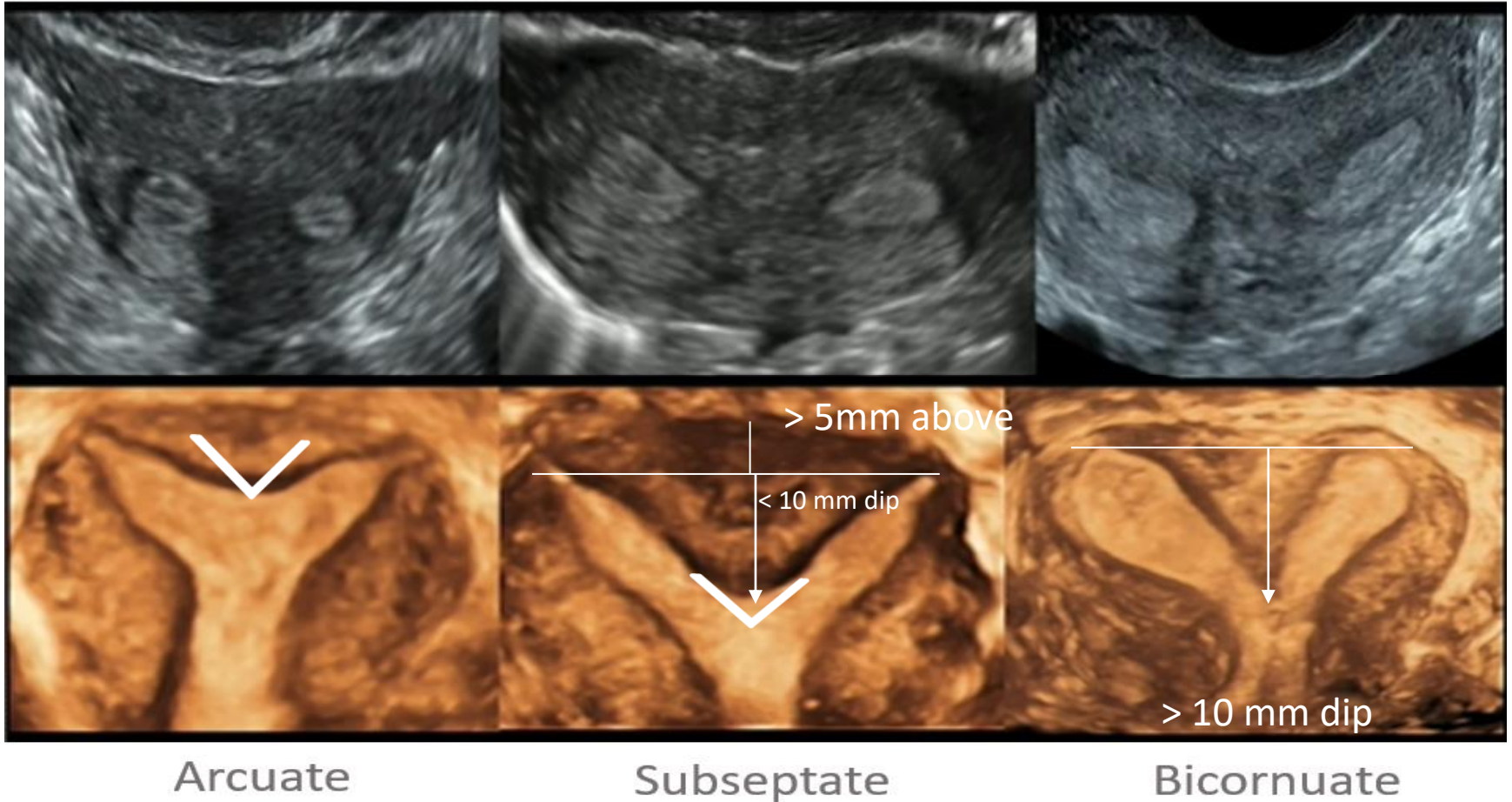
Arcuate uterus



Uterus with diethylstilbestrol (DES)
(T-shaped uterus)

<https://radiologykey.com/congenital-uterine-anomalies/>

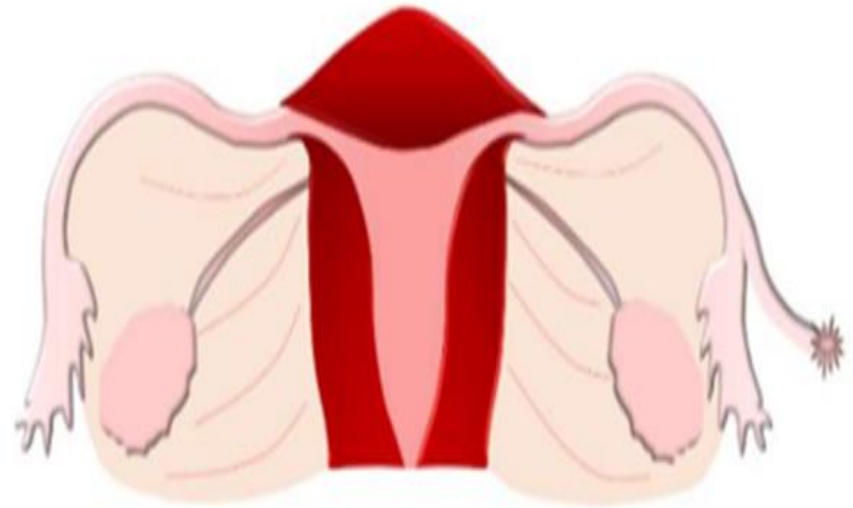
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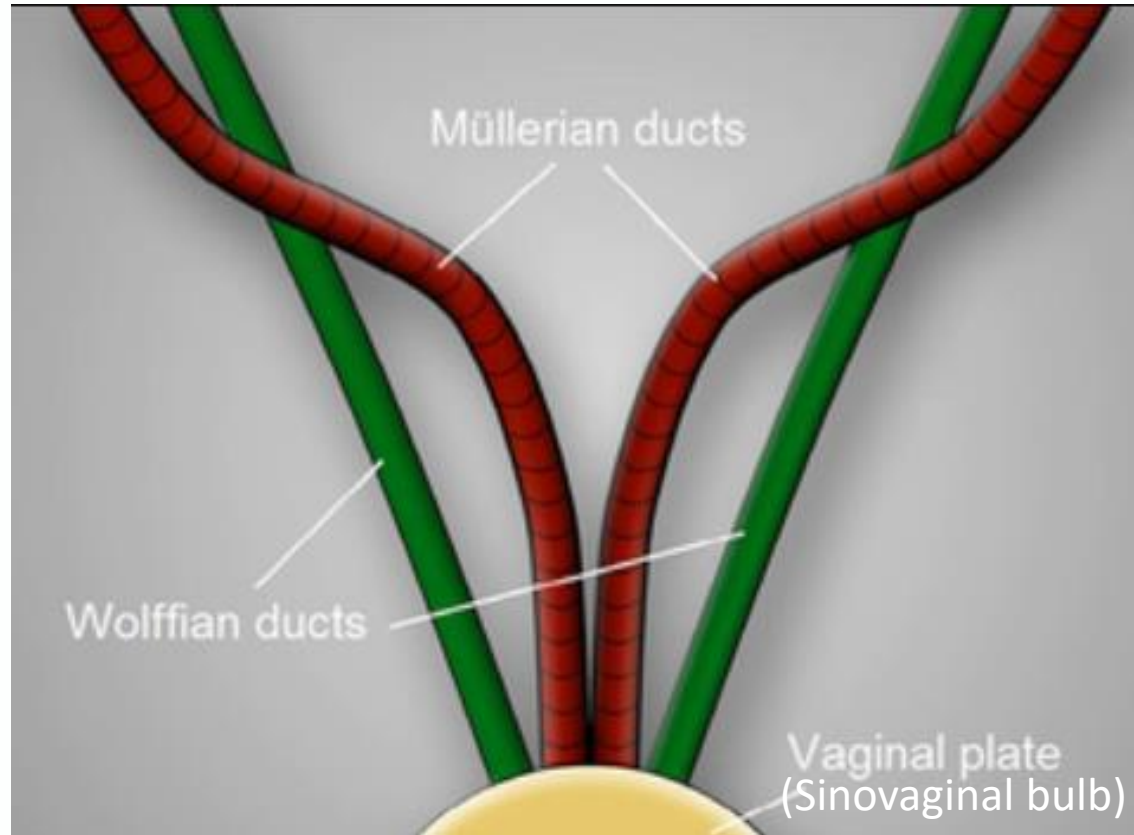
Accessory Fallopian tubes:

- Characterised as a congenital anomaly caused by bifurcation of the cranial ends of the Müllerian ducts.
- The accessory Fallopian tube is usually a cylindrical structure attached to the ampullary part of the normal Fallopian tube.



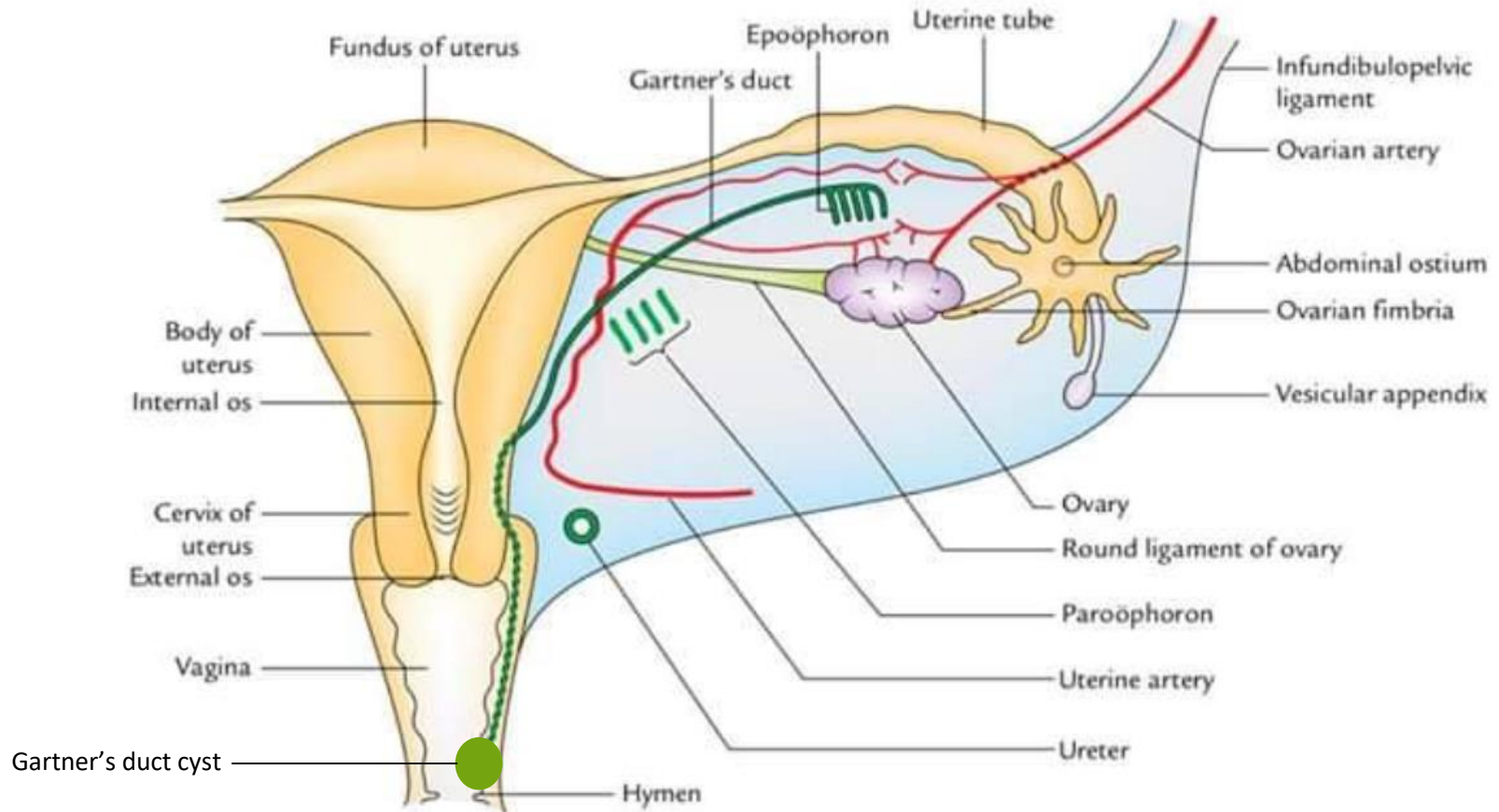
Physiol. Res. 71 (Suppl. 1): S35-S49, 2022 <https://doi.org/10.33549/physiolres.935035>
REVIEW The Overview of Anatomical Variations and Congenital Anomalies of the Uterine Tubes and Their Impact on Fertility Mária CSÖBÖNYEIOVÁ1, Martin KLEIN1, Claudia FEITSCHEROVÁ1, Lada PAVLÍKOVÁ2, David KACHLÍK3, Ivan VARGA1

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<https://www.researchgate.net/profile/Nienke-Kuijsters/publication/316040623/figure/fig1/AS:500142293909505@1496254623541/Embryology-of-the-uterus-A-Muellerian-red-and-Wolffian-green-ducts-B-Muellerian.png>

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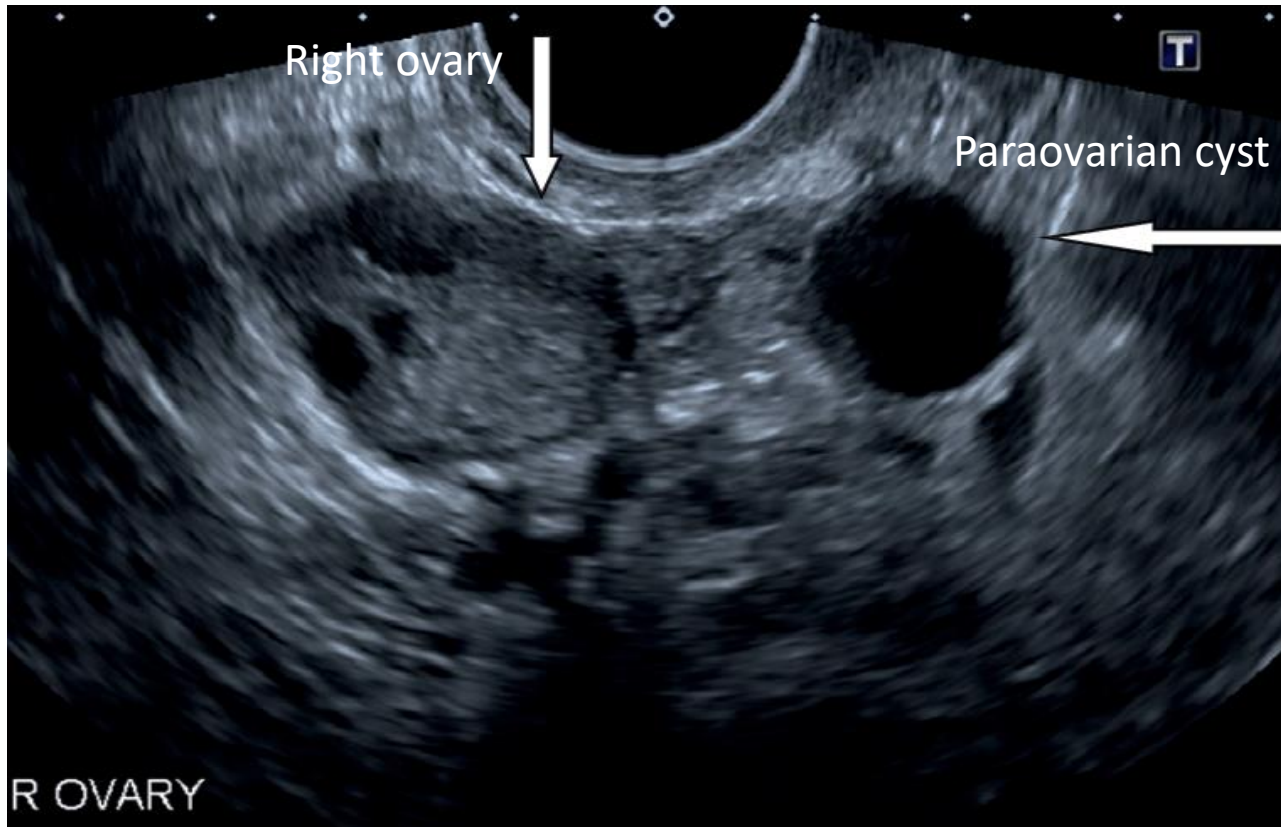
FCPS PART 1 - IMPORTANT ANATOMY TOPICS IN FCPS PART 1 (OBS... | Facebook

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Paraovarian cysts:

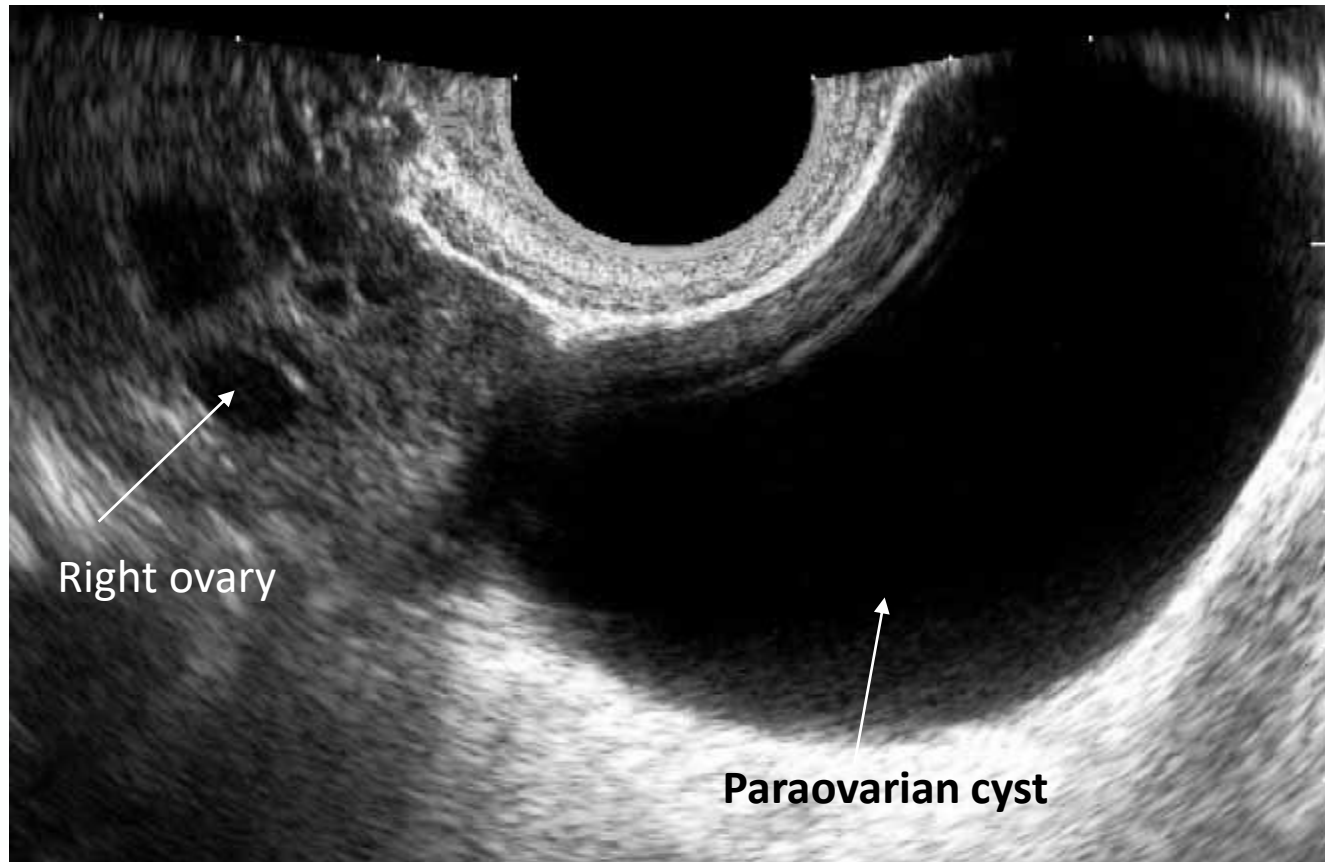
- Arise from remnants of the Wolffian ducts.
- Account for 10-20% of all adnexal masses.
- Majority are < 50 mm.
- Most common in women 30 - 40 years of age (unusual finding in children.)
- Paraovarian cyst torsion (2-16%). More common in pregnant women due a tendency for rapid enlargement.
- Low risk of neoplastic transformation (<3%)

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<https://targetovariancancer.org.uk/OvarianCyst>

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Ultrasound Obstet Gynecol 2006;28: 330 – 334

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Fimbrial cysts:

- Benign and small (usually around 10 –20 mm).
- Pedunculated and arising from the fimbriated end of the Fallopian tubes.
- Simple and filled with clear serous fluid.

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Fimbrial cyst

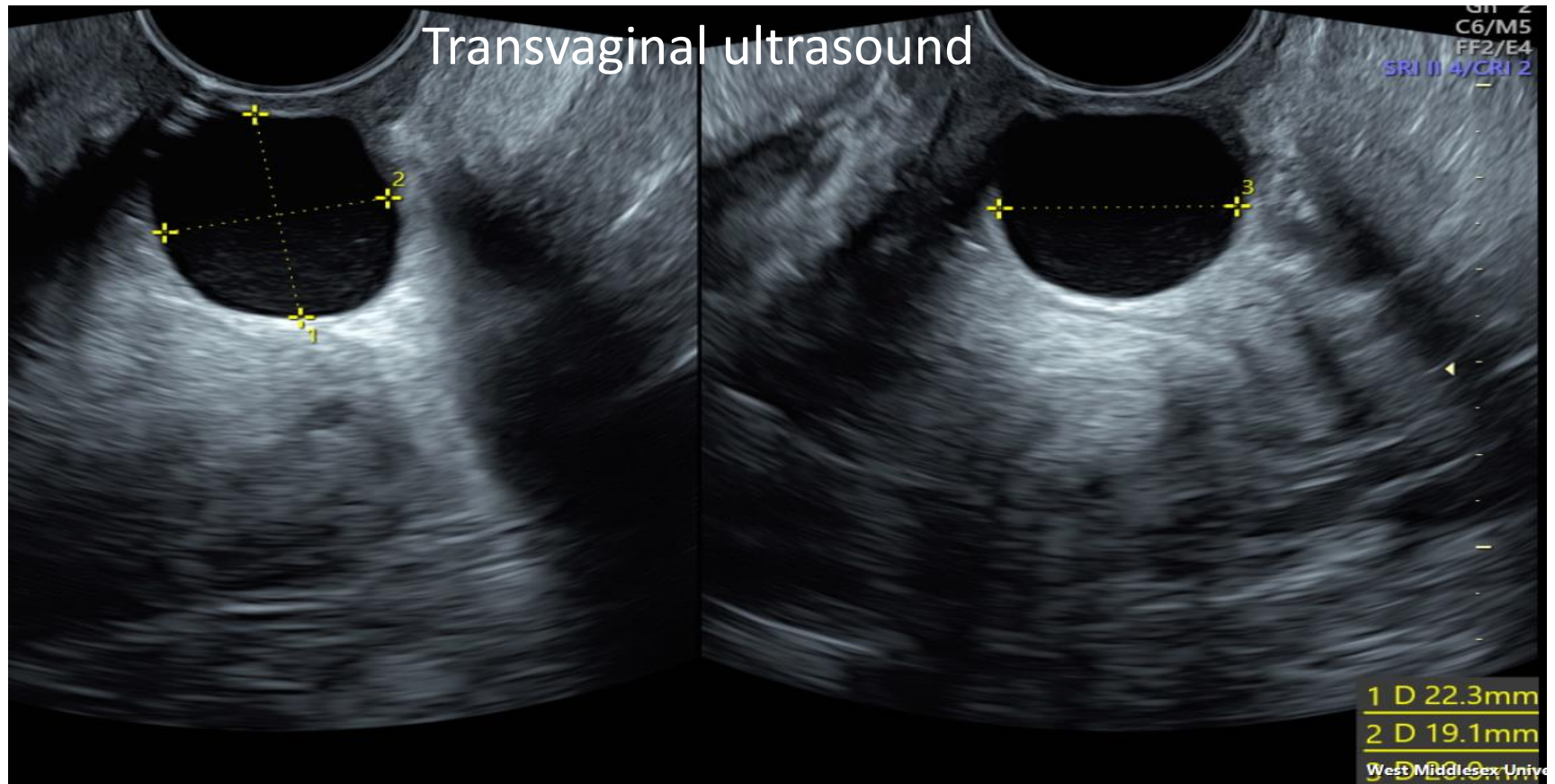


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Gartner's duct cyst



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THE OVARY

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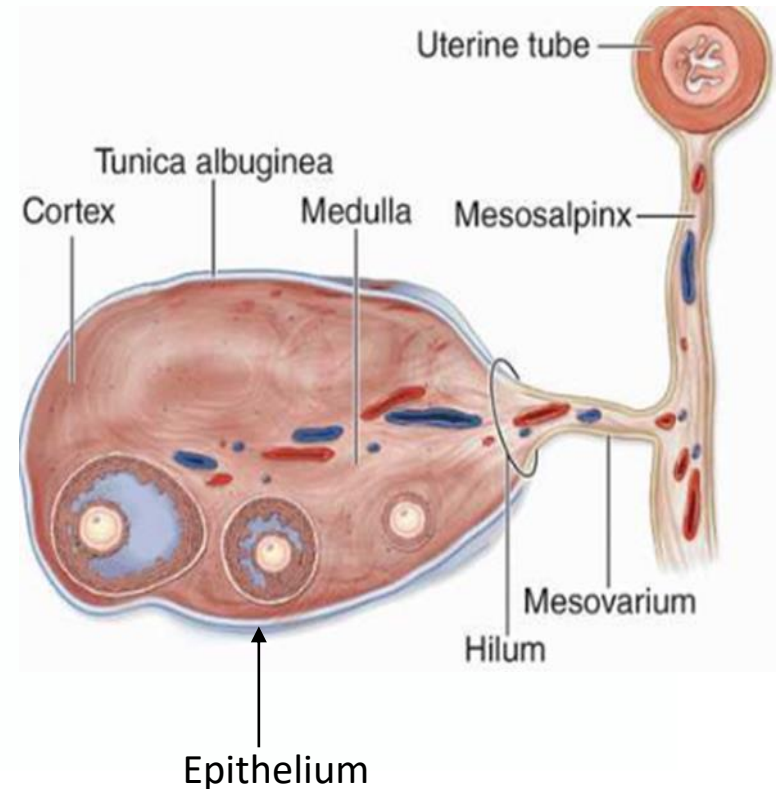


- By 20 weeks = 4 million oocytes.
- Oocyte atresia begins at 24 weeks.
- By birth = 2 million oocysts
- By puberty = 300,000 oocytes.
- Only 1% will ever reach ovulation (300 oocytes).

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The ovary is made up of four layers:

- Germinal epithelium
- Tunica albuginea
- Outer cortex
- Inner medulla



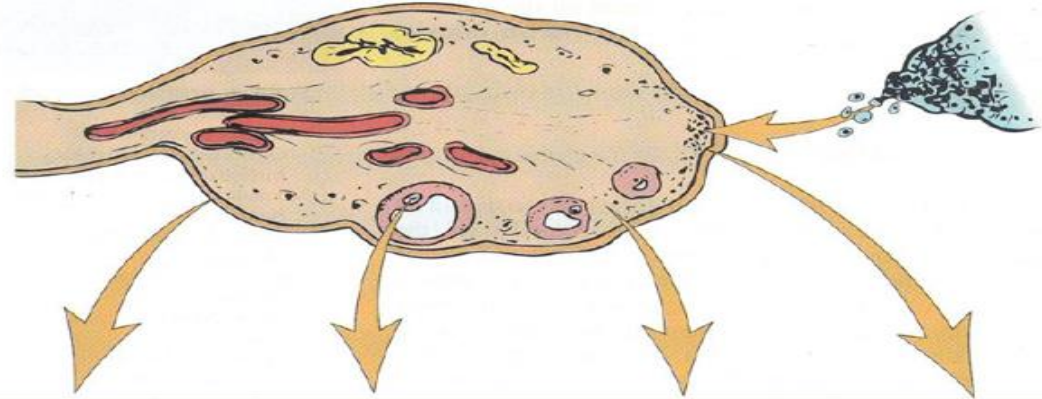
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Ovarian cancer:

- Comprises of more than one disease.
- We often say “cancer of the ovary” – but there are actually three different types of ovarian cancer – classified by where the cancerous cells first began to grow:
 - Epithelial tumours
 - Germ cell tumour
 - Sex-cord stromal tumour

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Ovarian Tumors- Classification



1. Surface epithelial cells
"Epithelial Tumors"

2. Germ cell
"Germ-Cell Tumors"

3. Ovarian stroma
"Sex-Cord Stromal Tumors"

4. Other (Metastases)

Frequency:

Age group affected:

Types:

65-70%

20+ years

- Serous
- Mucinous
- Endometriod
- Clear cell
- Transitional cell
- Undifferentiated

15-20%

0-25+ yrs

- Dysgerminoma
- Endodermal sinus
- Embryonal carcinoma
- Teratoma (dermoid)
- Yolk sac tumour

5-10%

All ages

- Granulosa cell tumour
- Sertoli-Leydid cell tumour
- Theca cell tumour
- Fibroma

5%

Variable

- Krukenberg tumour

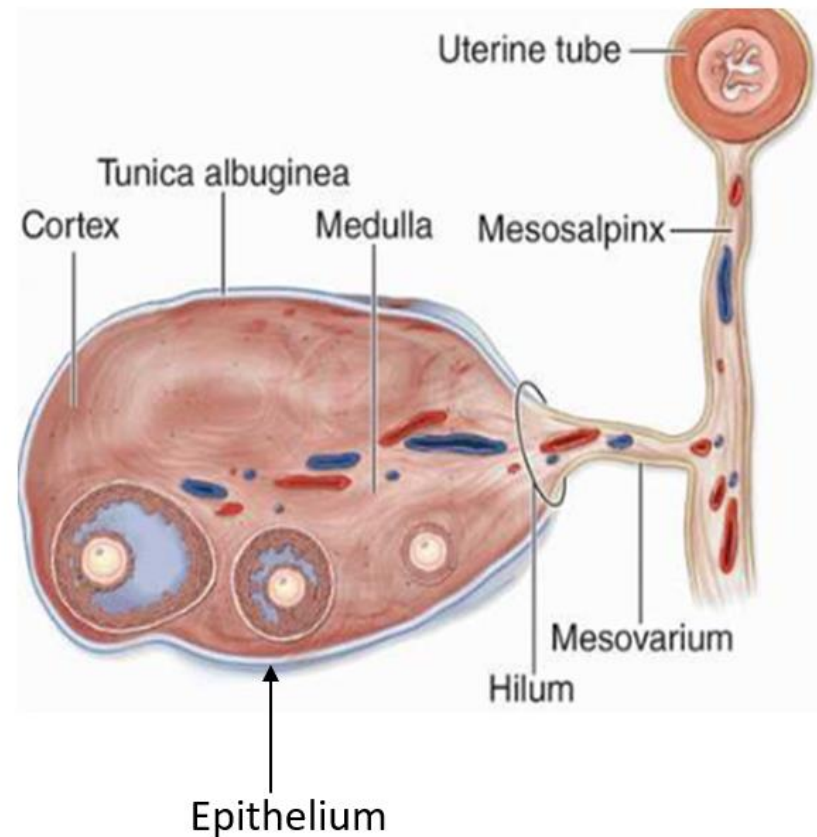
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Ovarian cancer:

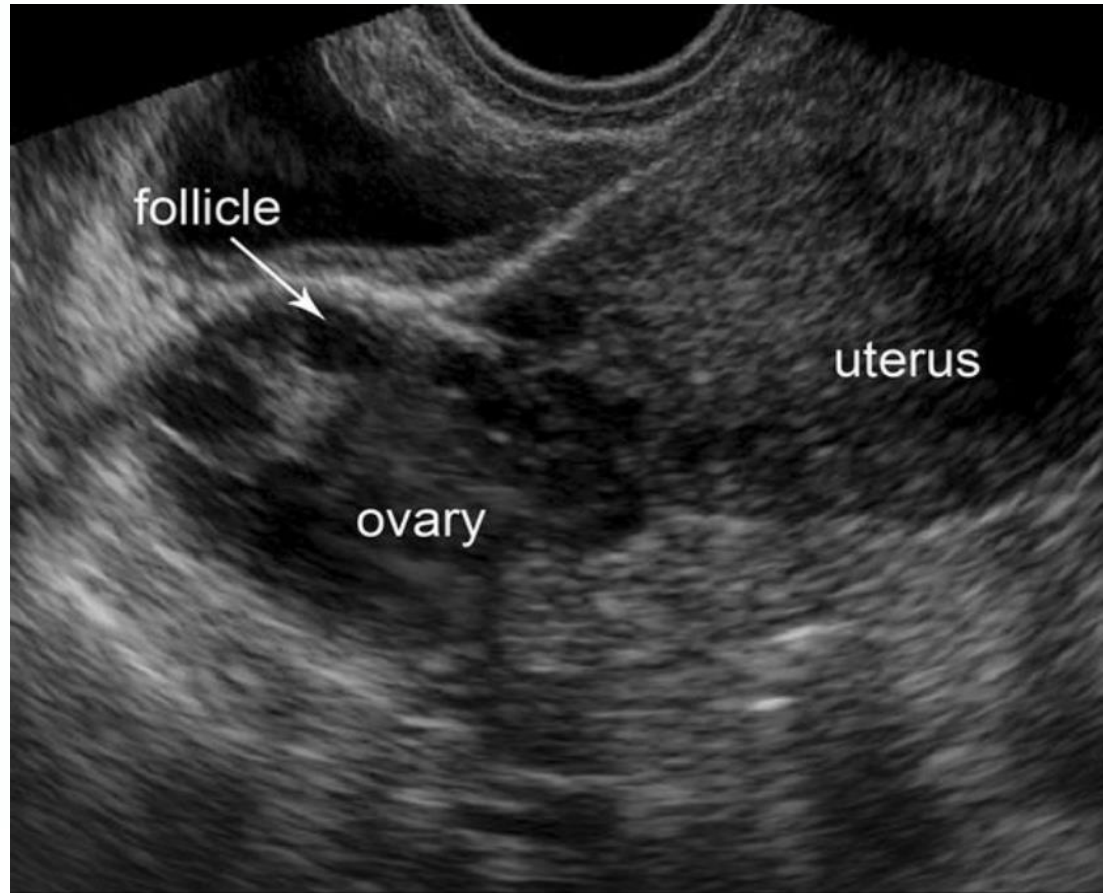
- 4th most common cause of cancer death in females
- Peak incidence in the 40-65 age group
- 60% of patients present with widespread disease, as the early stages of the disease are often asymptomatic.

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- Late diagnosis of ovarian cancer is due to the ovary's unique morphology.
- The tunica albuginea is rich in elastic fibres, so allows the ovary to stretch without causing pain.



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Thank you for listening!

