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Indian FERTILITY Society

SONO-NAVIGATOR SERIES

ROLE OF ULTRASOUND IN DIAGNOSING MULLERIAN ANOMALIES

INTRODUCTION

The prevalence of congenital anomalies of the reproductive tract is estimated to be as high as 7% in the female population. These anomalies usually present with pain, pregnancy complications (fetal malpresentation, preterm labor, recurrent pregnancy loss), or infertility. The American Fertility Society/American Society of Reproductive Medicine (AFS/ASRM) and more recently the European Society of Human Reproduction and Embryology (ESHRE) and the European Society for Gynaecological Endoscopy (ESGE) are the commonly followed classification systems.¹ Various imaging modalities can be used but the **key to diagnosis is the morphology of the outer fundal contour.**

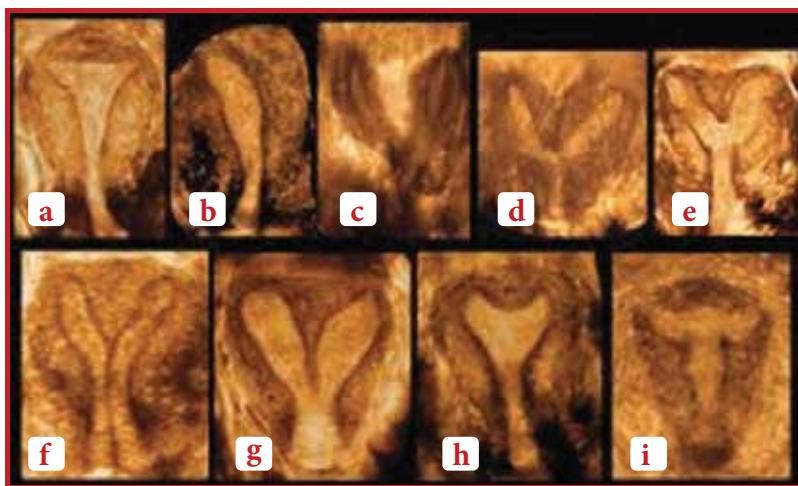


Fig 1. Three-dimensional surface rendered ultrasound images showing different types of uterine malformation using the American Fertility Society classification:
 (a) Normal uterus
 (b) Unicornuate uterus (Type IIc)
 (c) Didelphic uterus (Type III)
 (d) Complete bicornuate uterus (Type IVa)
 (e) Partial bicornuate uterus (Type IVb)
 (f) Septate uterus with two cervixes (Type Va)
 (g) Partial septate/subseptate uterus (Type Vb)
 (h) Arcuate uterus (Type VI)
 (i) T shaped uterus, DES related (Type VII)

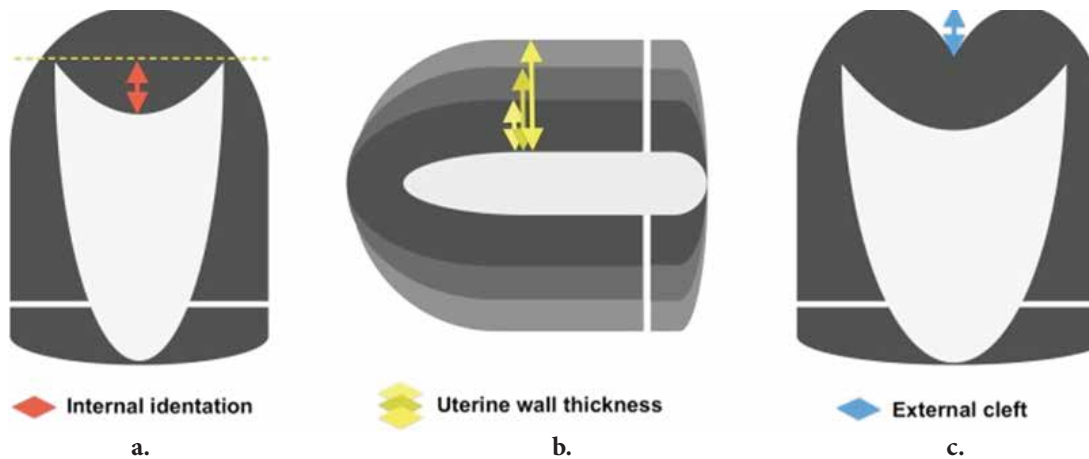
Imaging techniques: Advantages and Pitfalls

Hysterosalpingography (Hsg)	Ultrasound	MRI	Laparo-hysteroscopy
<p>Before the advent of MRI and US, the primary imaging modality for evaluating uterine anomalies was limited to hysterosalpingography (HSG). Normal uterine cavity is seen as a typical trigone. (fig. 2) Because HSG cannot show the external uterine fundal contour, it is of limited use.</p> <p>Limitations:</p> <ul style="list-style-type: none"> - Invasive and Painful. - Uses radiation - Contraindicated in pregnancy and active pelvic infection. 	<p>Ultrasonography (US) is the preferred method. Readily available, inexpensive, and rapid and does not use ionizing radiation. "Three-dimensional (3D) techniques, US may provide diagnostic accuracy similar to MRI."²</p> <p>Imaging uterus in coronal plane (fig. 3) provides information about fundus which is vital in characterising various sub types of abnormalities. Better to carry it on during secretory phase when endometrium is thick.</p> <p>Limitations:</p> <ul style="list-style-type: none"> - operator dependent, bowel gases, retroverted uterus, vaginal septum (TVS cannot be done). 	<p>Because of superior multiplanar imaging capability, MRI is generally considered the most definitive imaging modality. (fig. 4) MRI provides high-resolution images of the uterine body, fundus, and internal structure. In addition, it can help evaluate the urinary tract for concomitant anomalies. Also, MRI is very good in evaluation of the septum extent and its fibrous and muscular component.</p> <p>Limitations:</p> <ul style="list-style-type: none"> - Claustrophobia - Patients with metallic implant. - expensive 	<p>Gold standard diagnostic technique which is diagnostic as well as therapeutic, as in some cases, procedures like septal resection, adhesiolysis, excision of rudimentary horn etc, can be performed in the same setting.</p> <p>Limitations: However its invasive, has anaesthetic complications. So, lesser invasive techniques like 3D USG and MRI have largely replaced its diagnostic use.</p>

Practical tips and tricks in diagnosis.

A common finding is separation of the uterine cavity into right and left compartments. A **divided uterine cavity can result from septate, bicornuate, or didelphys uterus**. Certain criteria are used to increase confidence in diagnosing 1 of the 3 entities.

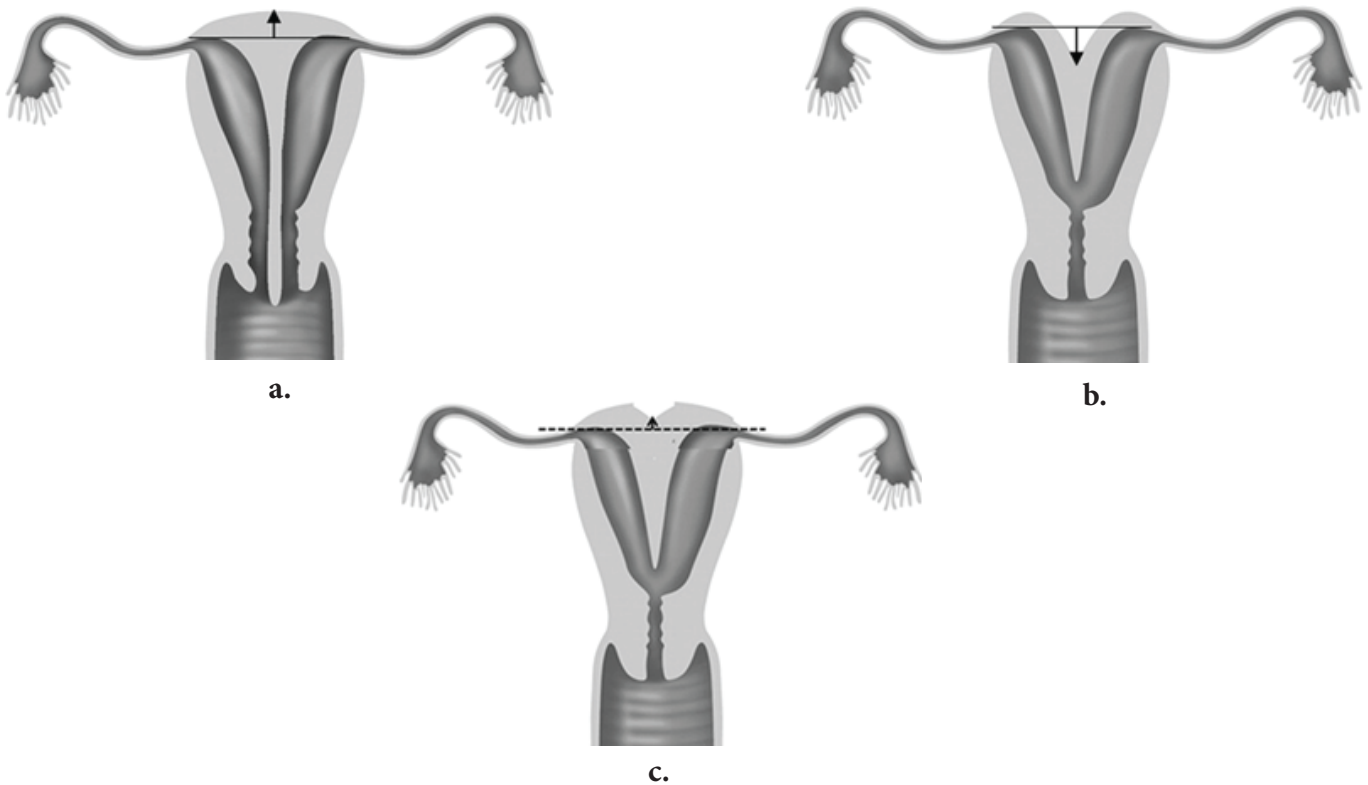
- 1. Intercornual distance** - It is the distance between the distal ends of the horns (ends that are continuous with fallopian tubes).
When it is **less than 2 cm**, the likelihood of **septate uterus** is increased.
If the distance is **greater than 4 cm**, the likelihood of **didelphys uterus /bicornuate uterus** is increased. Measurements of 2-4 cm (typical distance in a normal uterus) are indeterminate in an abnormal cavity configuration. (**fig. 5**)
- 2. Intercornual angle** - Is the angle formed by the most medial aspects of the 2 uterine hemicavities. If the angle is less than 75° , septate uterus is more likely. For larger angles, the anomaly is more likely to be a bicornuate uterus (angle generally $>105^\circ$). (**fig 5**)
- 3. External/fundal indentation** - On the outer surface: distance between intercornual line and present cleft between the horns/the apex of external fundus.
- 4. Internal Indentation** - Distance between line touching tips of endometrial cavities and the deepest point between endometrial cavities.



Uterine measurements to classify anomalies according to modified classification system of American Fertility Society proposed by Salim et al. for congenital uterine anomalies.

A. Measurement of Uterine cavity width (W), cavity indentation (I) and angle of cavity indentation. B. Measurement of external indentation (E)

5. **A Deep Fundal Cleft greater than 1 cm** - reported to be 100% sensitive and specific in differentiation of **fusion anomalies (didelphys and bicornuate)** from **reabsorption anomalies (septate and arcuate uterus)**. (fig. 6)
6. **Troiano and McCarthy criteria** - (a) When the apex of the fundal contour is more than 5 mm (arrow) above a line drawn between the tubal ostia, the uterus is septate. When the apex of the fundal contour is below (arrow in b) or less than 5 mm above (arrow in c) a line drawn between the tubal ostia, the uterus is bicornuate.



7. **Differentiation between arcuate and septate uteri** - Its carried out in the coronal plane on both 3D ultrasound and MRI. While both types of uterus have a **normal external contour**, in arcuate uterus the **internal indentation appears as an obtuse angle at the central point, with a depth of 1cm to 1.5 cm**, whereas septate uterus is characterized by an internal indentation with an **acute angle at the central point, with a depth of 1.5 cm or more**. (fig. 7)
8. **Differentiation between a didelphys uterus and bicornuate uterus** - In didelphys uterus, the individual horns are **fully developed and almost normal in size**. A deep fundal cleft and two cervixes are present. A longitudinal or transverse vaginal septum may be present. The horns of the bicornuate uteri are **not as fully developed and are smaller than those in the didelphys uteri**. The central myometrium may extend to the level of the internal cervical os (bicornuate unicollis) or external os (bicornuate bicollis). Uterus didelphys may be difficult to differentiate from uterus bicornuate bicollis as both may have double cervixes.
9. **Uterine agenesis and hypoplasia** - Findings include absence of the cervix and/or uterus with a blind-ending vagina. In uterine agenesis, no identifiable uterine tissue is present. In uterine hypoplasia, the endometrial cavity is small with a **reduced intercornual distance (< 2 cm)**.
10. **Unicornuate uterus** - uterus appears **banana shaped, deviated to one side** without the usual rounded fundal contour and triangular appearance of the fundal cavity. Uterine zonal anatomy is normal. If present, a rudimentary horn can be observed as a soft-tissue mass with echogenicity to that of myometrium. If obstructed, a rudimentary horn with functioning endometrium may present as a complex hemorrhagic cystic structure.

Table showing differential diagnosis of duplication anomalies

Characteristics	Bicornuate	Septate / Subseptate	Arcuate
External Contour	Concave	Flat / Convex	Flat and broad / Convex
External Fundal cleft	>1 cm	Absent / <1 cm	Absent / <1 cm
Intercornual angle	>105°	<75°	>90°
Intercornual distance	>4 cm	<4 cm	Not Applicable
Medial endometrial shape	Convex	Flat / Acute	Flat / Obtuse

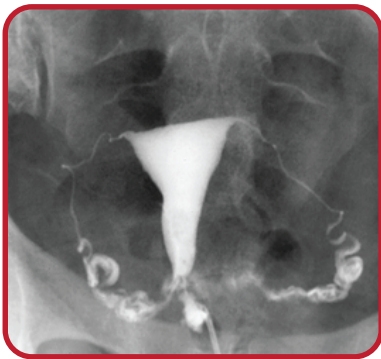


fig 2. A normal HSG showing a trigone shaped cavity.



fig 3. A normal endometrial cavity on 3 D ultrasound



fig 5. Hysterosalpingography showing the widened intercornual distance (>4 cm) and the widened intercornual angle (>60°), most probably a bicornuate uterus.

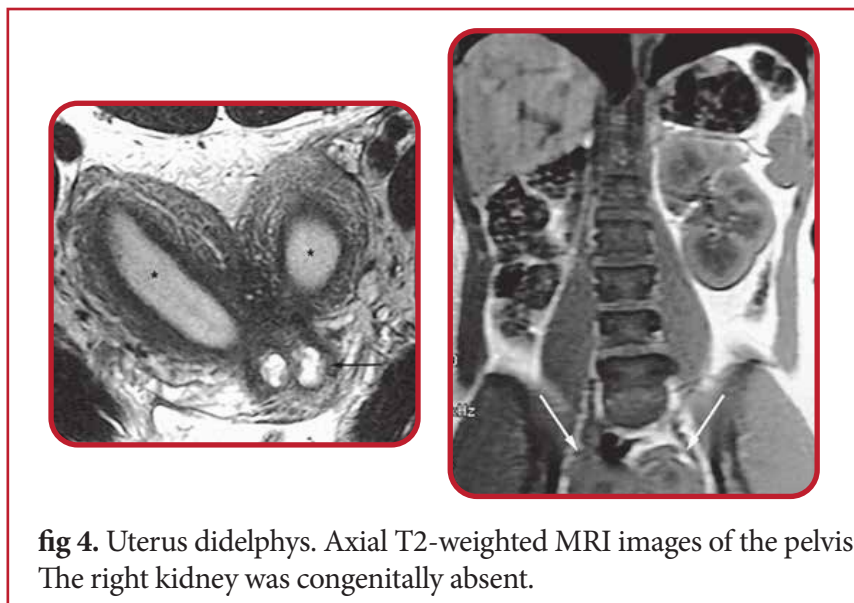


fig 4. Uterus didelphys. Axial T2-weighted MRI images of the pelvis. The right kidney was congenitally absent.

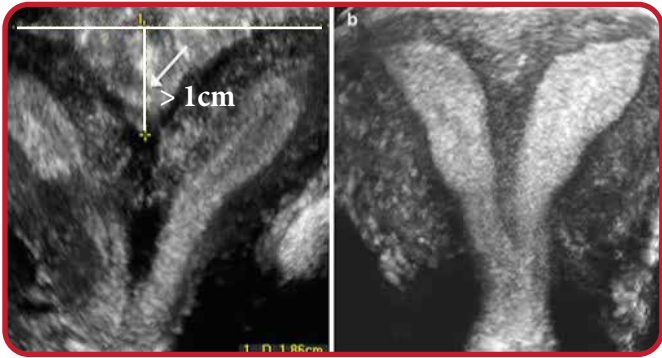


fig 6. Fusion vs resorption anomalies Three dimensional image on the front shows the angle separation of the two horns in the uterine fundus, which exceeds 10 mm.

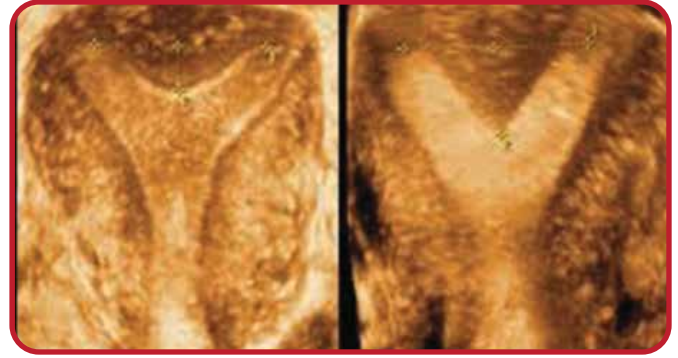


fig 7. Arcuate vs septate- obtuse vs acute angle and indentation depth <1.5 cm vs >1.5 cm.

References

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2. Abuhamad A.(2014). Ultrasound in obstetrics and gynaecology: A practical approach.

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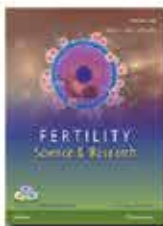
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