

IMAGING THE CERVIX **PART I**

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During pelvic ultrasound (US), the examiner consistently reports findings in the uterine body, endometrium and adnexa, while the cervix is often not mentioned. This probably results from a training in transabdominal pelvic US, since the cervix is poorly seen with this technique. On the other hand, endovaginal pelvic US with the excellent image quality obtainable on new devices, allows detailed assessment of the cervix.

Endovaginal US can visualize the cervix in both the long axis and the short axis. The long axis lies parallel to the cervical canal, which extends from the internal os to the external os. In the long axis of the cervix, a central echogenic line is seen that correlates with the apposed surfaces of the anterior and posterior mucosal (or glandular) layers that line the cervical canal.

A small amount of fluid may be present within the cervical canal particularly in the periovulatory period. The mucosal layer, which lines the cervical canal, is iso- to hyperechoic and measures 2-4mm in thickness. Surrounding the mucosal layer is the stromal layer, which is moderately echogenic and forms the bulk of the cervix. Between the mucosal and stromal layer, a thin 1-2mm hypoechoic line may be seen that represents the submucosal layer (Figure 1).

Endovaginal US in the short axis shows the cervix as round or oval, containing a central echogenic spot representing the cervical canal surrounded by an iso- to hyperechoic mucosal layer, which is in turn surrounded by the echogenic stromal layer. Frequently, folds may be seen in the mucosal layer that represent the plicae palmatae (Figure 2).

Magnetic resonance imaging (MRI) allows the best visualization of the cervix and is used to characterize indeterminate US abnormalities. MRI is the gold standard for staging cervical cancer. On T2-weighted images, the cervix shows a distinctive trilaminar appearance, with an innermost hyperintense layer measuring 3-8 mm that corresponds to

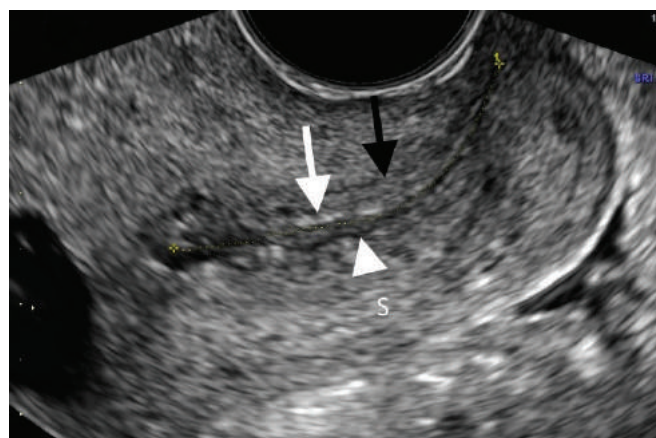


Figure 1. Endovaginal US scan in the long axis of the cervix at 15-week gestation showing a central echogenic line that represents the apposed surfaces of the cervical mucosa (white arrow), surrounded by the mucosal layer (black arrow) and stromal layer (S). A thin hypoechoic submucosal layer lies between the stromal and mucosal layers (arrowhead).

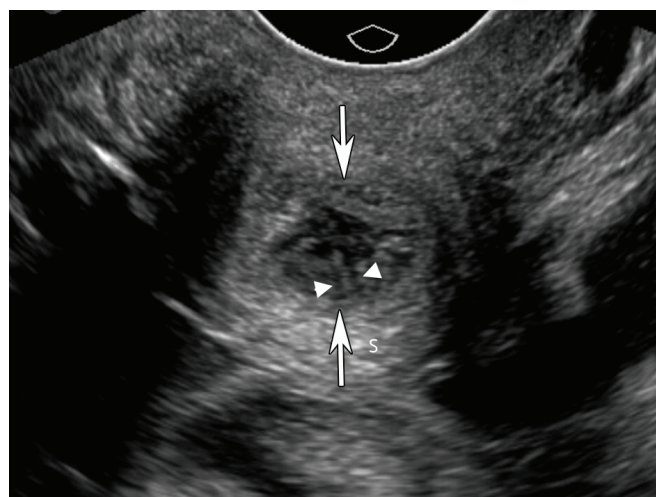


Figure 2. Endovaginal US scan in the short axis of the cervix showing the mucosal layer (arrows) and the stromal layer (S). Plicae palmatae are present in the mucosal layer (arrowheads).



mucosa and secretions, a middle low-signal-intensity layer representing the inner cervical stroma that measures 3–8 mm, and an outermost intermediate-signal-intensity layer representing the outer cervical stroma that measures 2–8 mm (Figure 3).

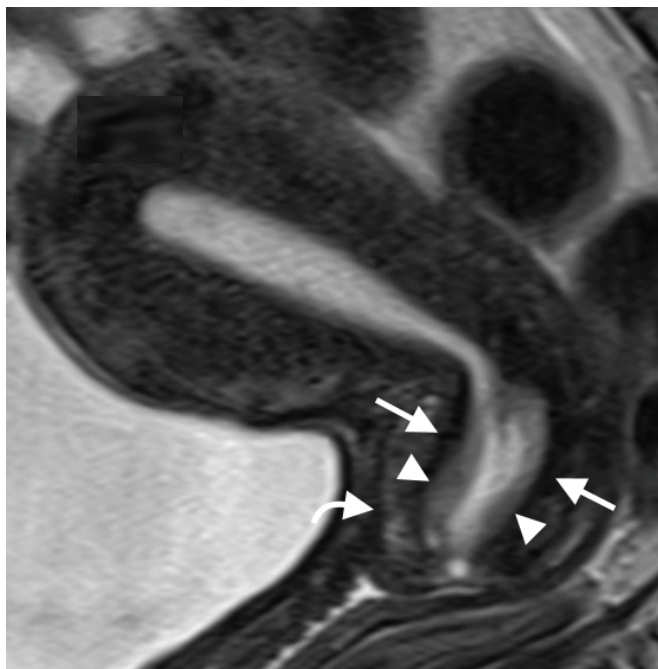


Figure 3. MRI scan of the cervix in longitudinal section showing the mucosal layer (arrowheads), the inner stromal layer (arrows) and the outer stromal layer (curved arrow).

CONGENITAL ANOMALIES

Congenital anomalies of the cervix are readily seen on US but are best demonstrated on MRI. One of the most common congenital anomalies is a septate uterus and cervix accounting for circa 45% of all congenital uterine anomalies. This results

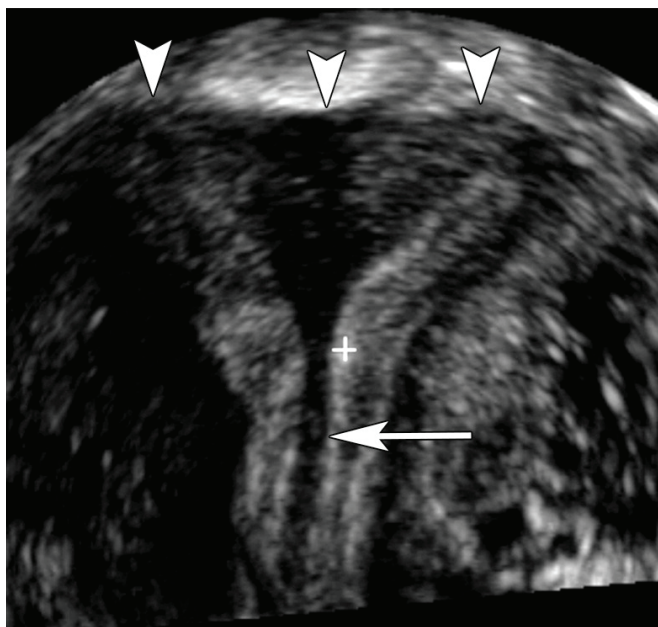


Figure 4. Coronal endovaginal US of the uterus and cervix showing a midline septum extending from the fundus (arrowheads) into the cervix (arrow). Note the flat shape of the fundus, a feature which is used to differentiate a septate from a bicornuate uterus (+internal os).

from incomplete fusion of the Müllerian ducts with persistence of an intervening septum. On US, it is best visualized in the coronal plane as a hypoechoic band extending from the uterine fundus into the cervix (Figure 4). The septum is composed mainly of fibrous stroma, which accounts for its hypoechogenicity. It shows increased vascularity on colour Doppler US in 70% of cases. MRI is the best imaging modality to evaluate a septate uterus and cervix; the fibrous septum is depicted as a low signal band extending from the flat uterine fundus into the cervix in the coronal plane (Figure 5). The septum may continue into the vagina in up to 25% of cases.

Uterus didelphys or “Double Uterus” represents a congenital anomaly where there is complete duplication of the endometrial cavity. The two endometrial cavities are separated not just by a fibrous septum as in a septate uterus but by a central stromal layer lined on either surface by mucosal layers. A uterus didelphys may contain two separate uterine cavities fusing into a single cervical canal or a fully duplicated cervix (Figure 6a). It may be difficult to distinguish a septate cervix from a duplicated

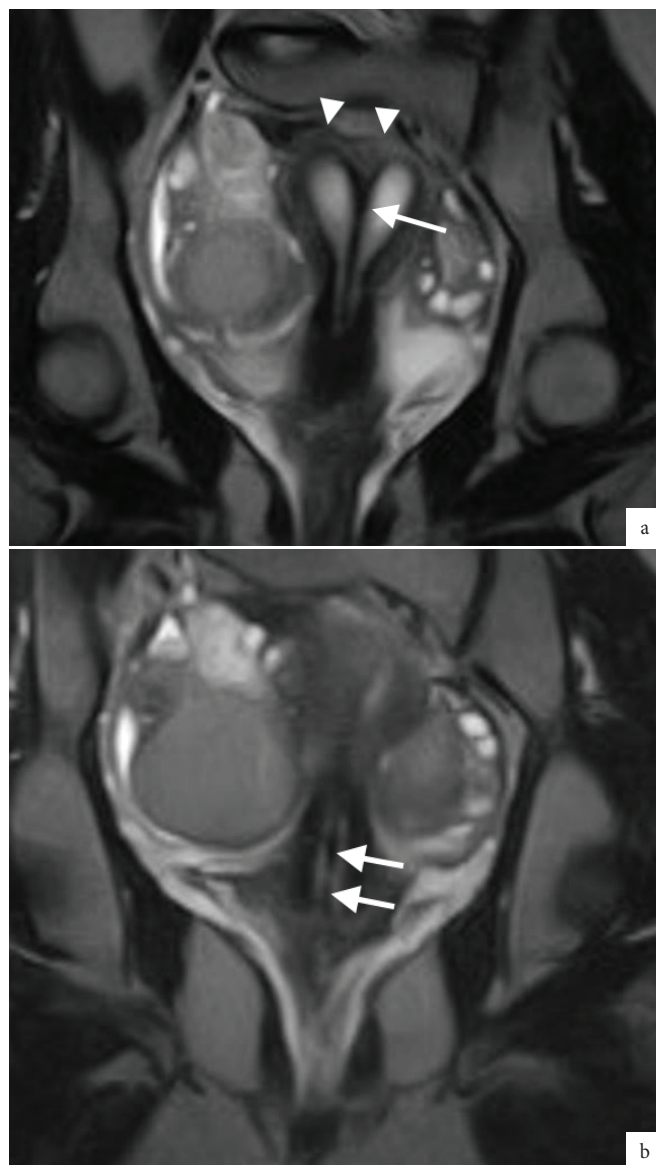


Figure 5. Coronal T2 weighted MRI images of the uterus (a) and cervix (a and b). A hypodense septum (arrows in a and b) extends from the flat fundus (arrowheads in a) into the cervix. Case courtesy of Dr Aneesh km, Radiopaedia.org, rID: 27061.

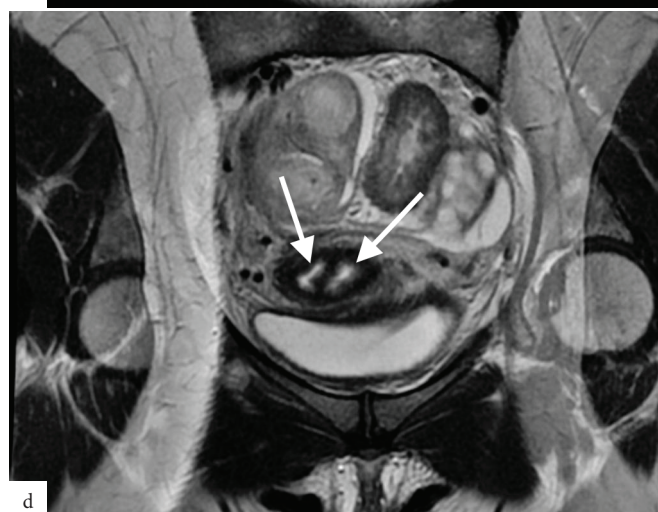
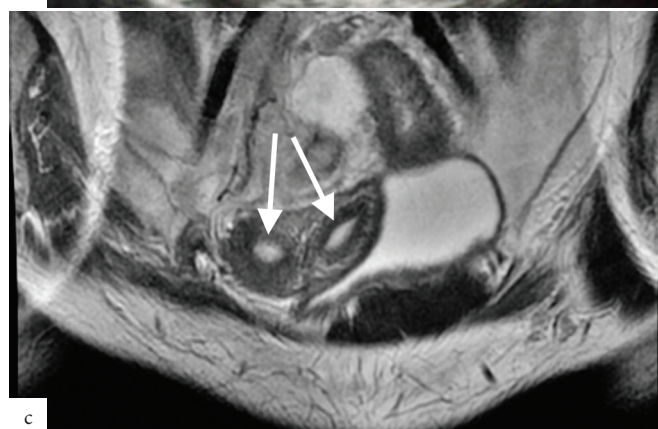
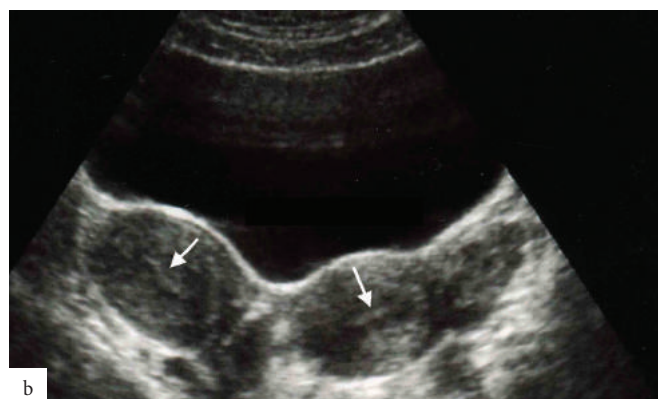
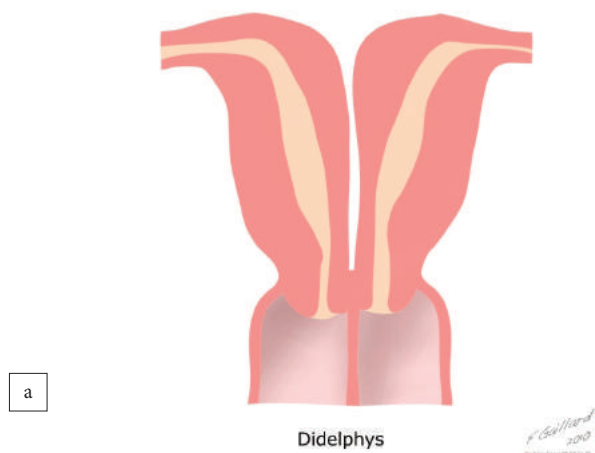


Figure 6. Diagram (a) showing a uterus didelphys with complete duplication of the cervix and a vaginal septum. US transverse scan (b) showing a duplicated uterine cavity (arrows). Short axis T2-weighted MR images showing duplication of the uterine cavity (arrows in c) and of the cervix (arrows in d) in a uterus didelphys. Case courtesy of Prof Frank Gaillard, Radiopaedia.org, rID: 11115.

cervix on ultrasound; in a duplicated cervix the band separating the two cervical canals is thicker than in a septate cervix (Figure 6b). Figures 6c and d illustrate separate endometrial cavities and cervical canals with a band of intervening stroma, clearly shown on MRI (Figure 6c and d).

CERVICITIS

Cervicitis is the term used to describe cervical inflammation, which may be acute or chronic. This is most often caused by infection, although trauma, pelvic radiation, chemical irritation, and sometimes malignancy may also cause cervical inflammation. Microorganisms such as *Trichomonas vaginalis*, *Candida albicans*, herpes simplex virus (especially type 2), *Neisseria gonorrhoeae* and *Chlamydia trachomatis* can also cause cervicitis. Patients usually present with purulent cervical and vaginal discharge and may complain of pelvic discomfort. US findings of cervicitis can be subtle or even completely occult, especially if the condition is of a chronic nature or if the patient is examined during or after effective antimicrobial treatment. At US, the cervix in patients with acute cervicitis shows a diffusely heterogeneous echotexture of the cervical mucosa and stroma (Figure 7a), with markedly increased vascularity on Doppler US imaging (Figure 7b). Hypervascularity can also be seen in cervical carcinoma, however in cervicitis, no mass lesion is seen. Cervicitis may lead to cervical canal stenosis and complex fluid collections within the cervical canal. Such fluid collections may mimic a cystic tumour in the cervical canal on US, however colour Doppler evaluation would confirm the avascular nature of the endocervical content (Figure 8).

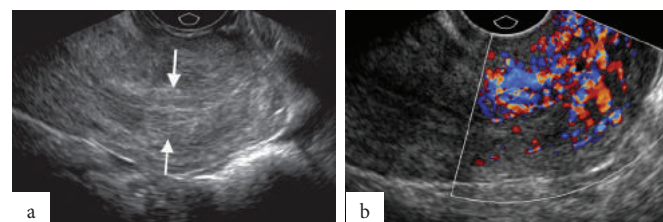


Figure 7. Sagittal US scans in a case of cervicitis showing heterogeneity of the mucosal layer (arrows in a) with marked hypervascularity on colour Doppler US (b).

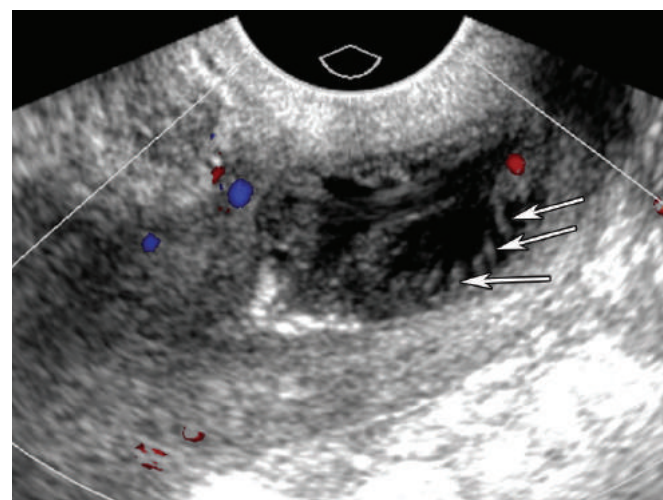


Figure 8. Sagittal US scan showing a complex fluid collection in the cervical canal; note the presence of plicae palmatae (arrows) as well as the absence of colour Doppler flow signal within the cervical canal.

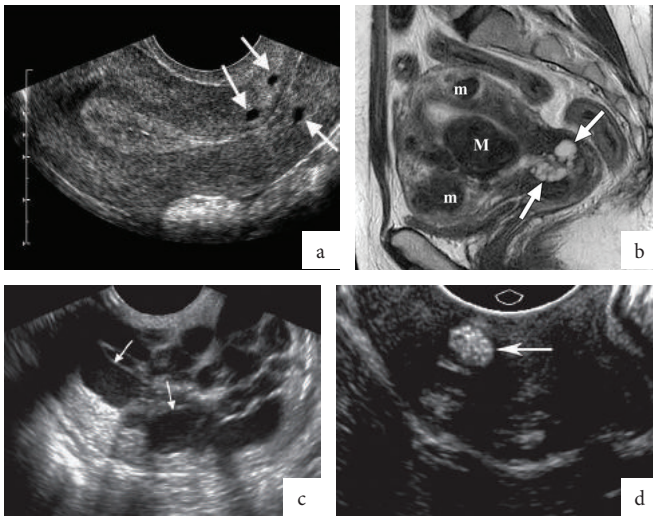


Figure 9a. Sagittal US scan of the cervix showing multiple small Nabothian cysts. b. Sagittal T2-weighted MRI scan of the uterus and cervix showing multiple Nabothian cysts (arrows) protruding into the stromal layer. Multiple fibroids (fibromyomas, M) are also present. c. Sagittal US scan through the cervix showing numerous Nabothian cysts with some containing echogenic material (arrows) indicating protein-rich fluid or intracystic haemorrhage. d. Sagittal US scan of the cervix showing crystalline deposits within a Nabothian cyst (arrow).

BENIGN UTERINE GROWTHS

Nabothian cysts are one of the most common findings on pelvic ultrasound. Nabothian cysts are mucus-retention or epithelial-inclusion cysts that arise from an obstruction of endocervical glands by proliferating squamous epithelium. They may or may not be associated with previous clinical or subclinical episodes of cervicitis. Nabothian cysts may appear as anechoic fluid collections in the mucosal layer of the cervical canal (Figure 9a), but can be quite large and protrude into the stromal layer (Figure 9b). They may also contain echogenic material due to secondary intracystic haemorrhage (Figure 9c) and even calcifications (Figure 9d).

Cervical polyps are the most common endocervical lesions and are also the most common cause for intermenstrual bleeding. They occur most commonly in women between the ages of 30 and 40 years of age and 25% are associated with an endometrial polyp. Cervical polyps appear slightly hyperechoic compared to the cervical mucosa on US (Figure 10a), they are seen to move on pressure with the endovaginal probe and are frequently noted to have a vascular pedicle on colour Doppler US (Figure 10b).

Cervical fibroids or fibromyomas are not uncommon and may lead to some diagnostic difficulty. They may also result in shoulder impaction during child birth. Cervical fibroids are seen as hypoechoic mass lesions in the cervical stroma (Figure 11a). MRI is the most reliable modality to confirm the diagnosis, which shows low signal on all imaging sequences (Figure 11b).

The second part of this article will discuss imaging of endometriosis in the cervical canal and also cervical cancer. The importance of imaging in staging of cervical cancer will be presented. ❄️

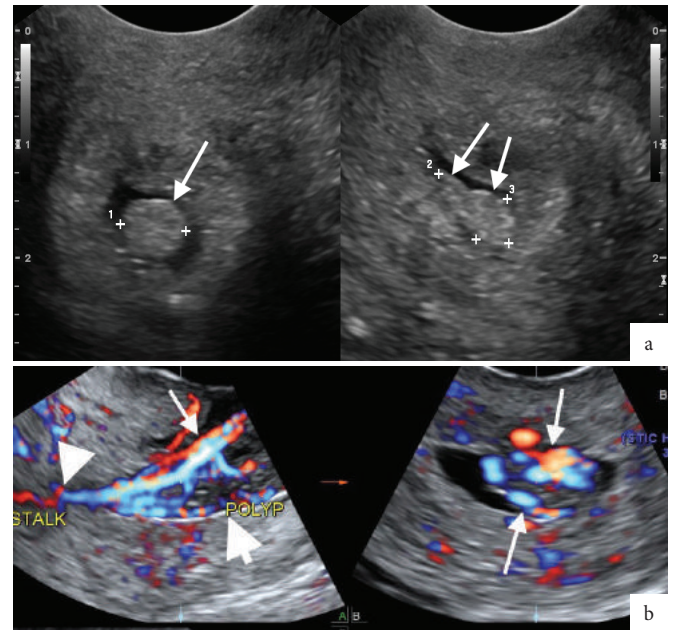


Figure 10a. Long and short axis US scans of the cervix showing an endocervical polyp (arrows). b. Long and short axis colour Doppler US scans showing an endocervical polyp (arrows) and the vascular pedicle (arrowhead).

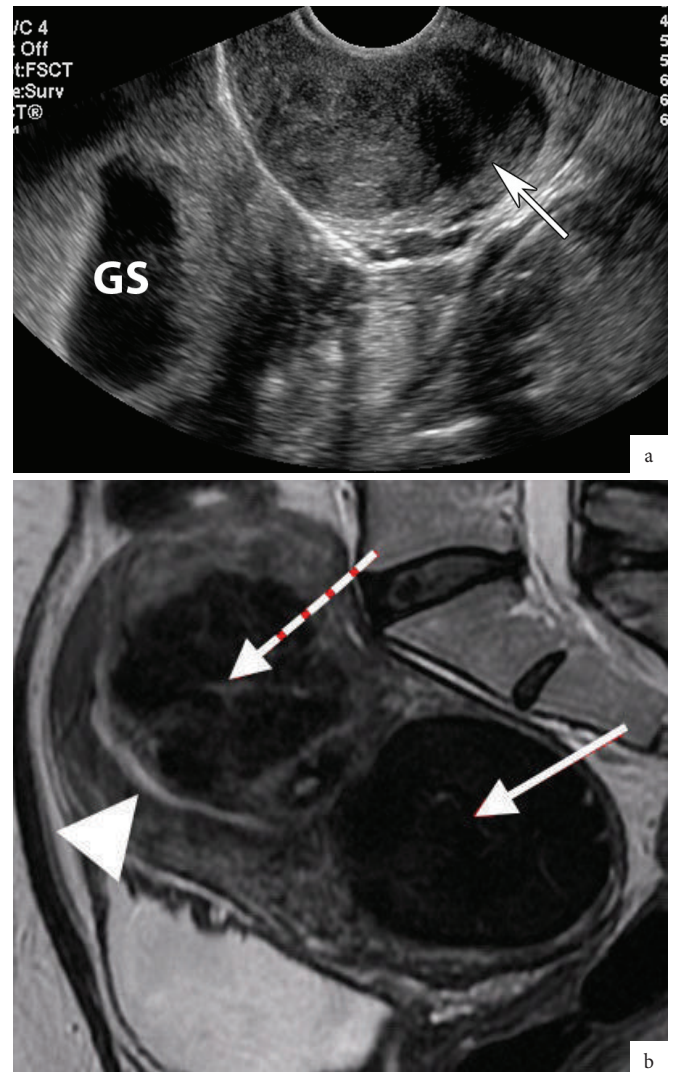


Figure 11a. Long axis US scan through the cervix showing a cervical fibroid appearing as a hypoechoic lesion (arrow) in the stromal layer. GS is an intrauterine gestational sac. b. Sagittal T2-weighted MRI scan showing a cervical fibroid (solid arrow) and a posterior body uterine fibroid (dashed arrow), the latter lying posterior to the endometrial cavity (arrowhead).

