



Ectopic pregnancy

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Ectopic pregnancy accounts for approximately 2% of all pregnancies
most common cause of pregnancy-related mortality in the first trimester

history : 5–9-week of amenorrhea, mild pelvic pain, and vaginal spotting
Up to 50% are asymptomatic

As an EP enlarges, its risk for rupture increases

The severity of pelvic pain does not necessarily correlate with the size of an EP, and pain may even decrease or disappear following tubal rupture

Hypovolemic shock and shoulder pain secondary to diaphragmatic irritation are indirect signs of a ruptured ectopic pregnancy

Risk Factors of Ectopic Pregnancy

Prior ectopic pregnancy

History of pelvic inflammatory disease

History of gynecologic surgery

Infertility

Use of intrauterine device

History of placenta previa

Use of in vitro fertilization

Congenital uterine anomalies

History of smoking

Endometriosis

Exposure to diethylstilbestrol

Laboratory Evaluation

β -hCG levels begin to ascend in a curvilinear fashion early in pregnancy and continue until they reach a plateau at approximately 9–11 Weeks. The plateau lasts for only a few days, and begin to decline at 20 W.

average doubling time of β -hCG in a normal pregnancy is approximately 48 hr.

If β -hCG levels increase by less than 50% during a 48-hour period, there is almost always a nonviable pregnancy associated, be it intra- or extrauterine.

85% of viable intrauterine pregnancies reflect an increase in β -hCG levels of 66% or more during a 48-hour period.

However, up to 21% of ectopic pregnancies demonstrate a β -hCG doubling time identical to that of intrauterine pregnancies. Arriving at a β -hCG plateau early in the pregnancy is highly suggestive of an ectopic pregnancy.



A normal serum progesterone level in viable pregnancies is typically more than 25 ng/mL.

Ninety-nine percent of nonviable pregnancies have a progesterone level of less than 5 ng/mL

The combination of a low serum progesterone level and an abnormal rise in serum β -hCG is nearly diagnostic of a nonviable pregnancy

However, progesterone levels often take several days to process. If a laboratory is unable to report a value within 24 hours, the test has limited use

Because of the delay in measuring progesterone levels, clinical management often relies on measuring β -hCG levels and on the patient's clinical picture

US Evaluation

Transvaginal US should be able to demonstrate a gestational sac when β -hCG levels are greater than 2000 mIU/mL, which is the discriminatory level of β -hCG .

Transabdominal US can demonstrate an intrauterine pregnancy when β -hCG levels reach 6500 mIU/mL



The goal of first-trimester screening is to document the presence of an intrauterine pregnancy, be it normal or abnormal

In normal pregnancies, transvaginal US can demonstrate an intradecidual sign approximately 4.5 weeks after the last menstrual period

The intradecidual sign is a small collection of fluid that is eccentrically located within the endometrium and is surrounded by a hyperechoic ring

At approximately 5 weeks: the double decidual sac

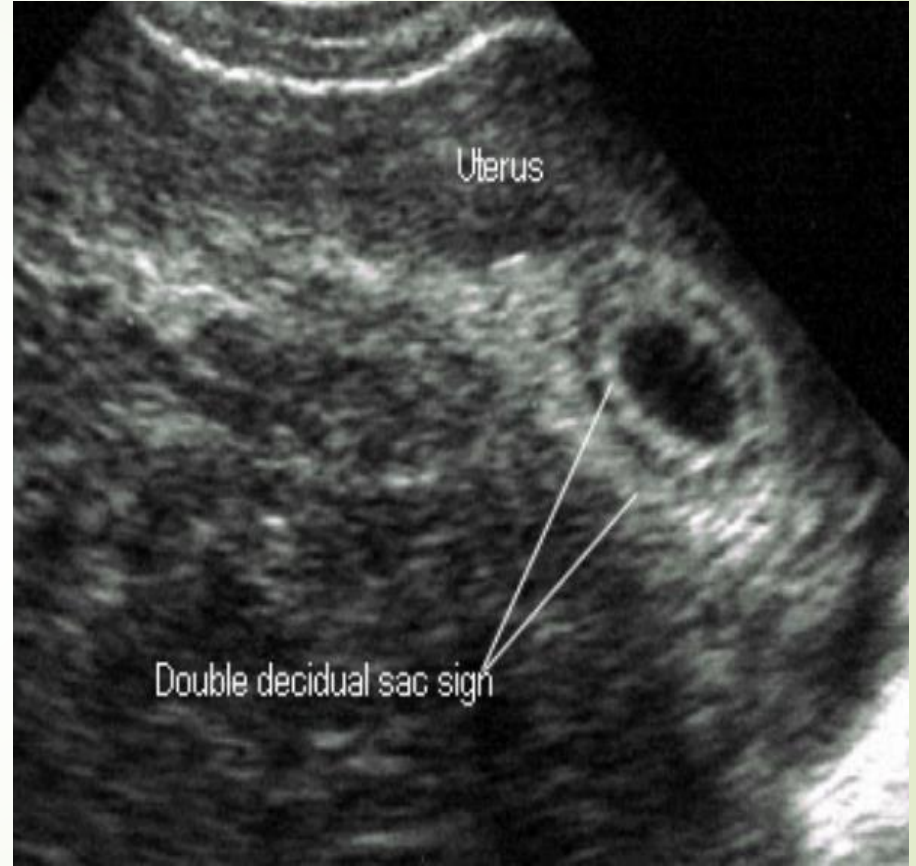
The double decidual sac sign consists of two concentric hyperechoic rings that surround an anechoic gestational sac in a normal intrauterine Pregnancy

The secondary yolk sac may be identified at transvaginal US at approximately 5.5 weeks, when the gestational sac reaches 10 mm


Embryonic cardiac activity should also be visualized at transvaginal US at approximately 5–6 weeks, when the gestational sac measures more than 18 mm or when the embryonic pole measures 5 mm or more

Early pregnancy failure: CRL of 7mm w/o heartbeat

MSD of 25 mm w/o an embryonic pole



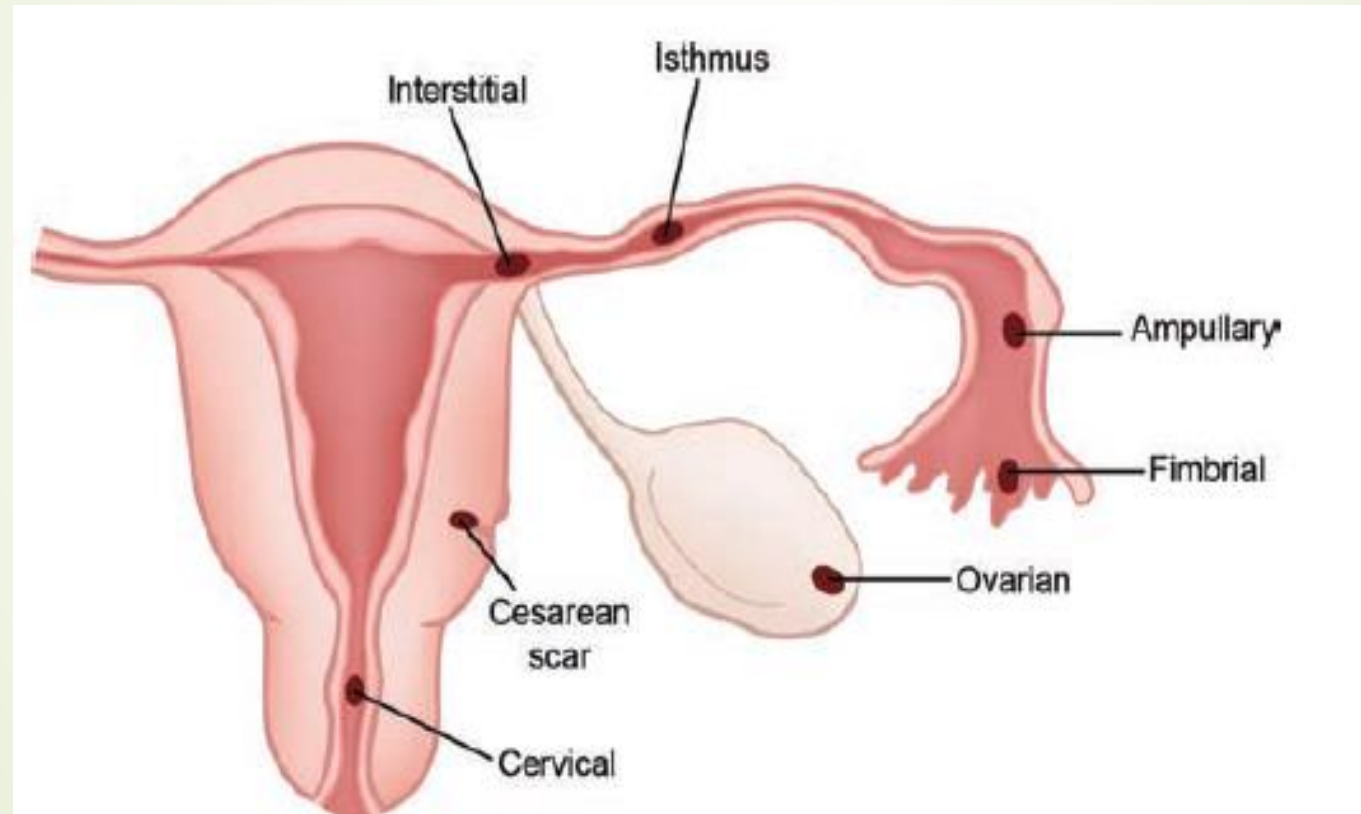
When neither an intrauterine pregnancy nor specific findings of an ectopic pregnancy can be documented in a patient with a subthreshold β -hCG level, the patient should be closely monitored with serial US examinations, and β -hCG levels should be continually tested until either an ectopic or an intrauterine pregnancy is identified



When an abnormal pregnancy is suspected because of hormonal assays, a spectrum of abnormalities can be detected at pelvic US. The absence of an intrauterine gestational sac should trigger a detailed search for an ectopic pregnancy.

In addition, up to 35% of ectopic pregnancies may not display any adnexal abnormalities

US Findings by Location



Tubal Pregnancy

Ninety-five percent of ectopic pregnancies are tubal; they occur mostly in the ampulla (70%) or isthmus (12%) and are less common in the fimbria (11.1%)

most common finding of a tubal pregnancy :

adnexal mass that is separate from the ovary (up to 89%–100%)

An adnexal mass is more specific for an ectopic pregnancy when it contains a yolk sac or a living embryo or when it moves

Independently from the ovary


However, an extrauterine mass may not be detected at transvaginal US in 15%–35% of patients with an ectopic pregnancy



The tubal ring sign: second most common sign of a tubal pregnancy, describes a hyperechoic ring surrounding an extrauterine gestational sac.

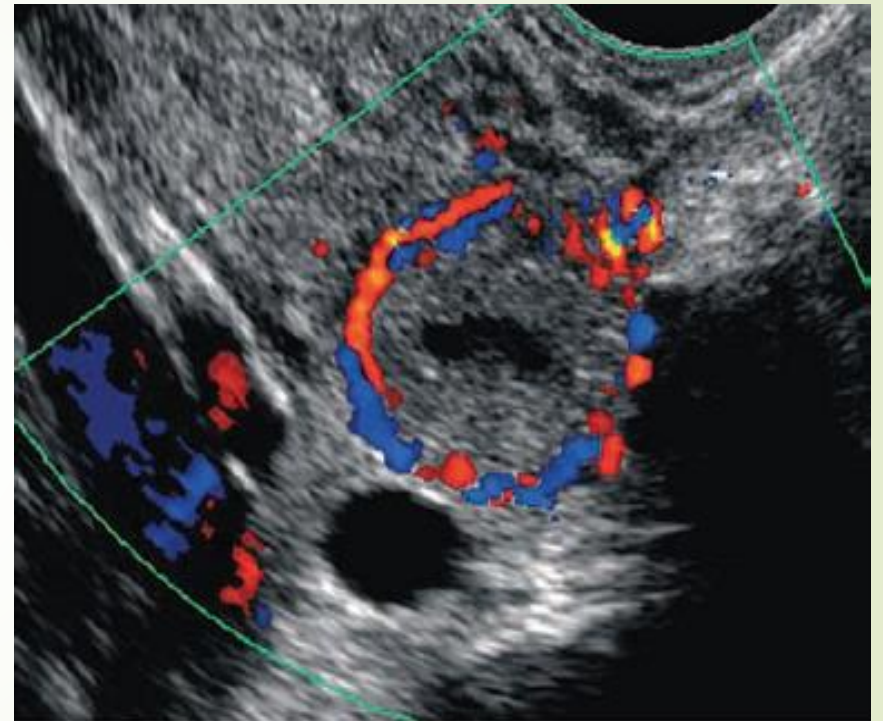
A related finding is the “ring of fire” sign, which is recognized by peripheral hypervascularity of the hyperechoic ring(high-velocity, low-impedance flow)

Peripheral hypervascularity is a nonspecific finding of the ring of fire sign and may also be seen surrounding a normal maturing follicle or a corpus luteal cyst



Therefore, the ring of fire sign should not be used to describe the corpus luteum. Determining the location of this type of flow, whether it is within the ovary or outside the ovary, is most important to distinguish between an ectopic pregnancy and a corpus luteum.

However, the ring of fire sign is most helpful when no definite ectopic pregnancy is seen on gray-scale images. Color Doppler images of the adnexa may demonstrate the ring of- fire flow in an otherwise nondescript adnexal lesion and thereby may improve confidence in the diagnosis of ectopic pregnancy



- Intrauterine findings of an ectopic pregnancy include a “normal endometrium,” a pseudo– gestational sac, a trilaminar endometrium, and a thin-walled decidual cyst. A pseudo–gestational sac represents a thick decidual reaction surrounding intrauterine fluid
10% of patients with an EP demonstrate a pseudo–GS

The absence of double decidual sac sign helps distinguish a pseudo–gestational sac from a true viable gestational Sac



a pseudo-GS: located centrally within the endometrial Canal

a normal gestational sac: located eccentrically within the canal.

A viable gestational sac: exhibit low-resistance arterial flow on color Doppler flow

A trilaminar endometrium is formed during the late proliferative phase of the normal menstrual cycle.

When an abnormal pregnancy is suspected based on laboratory results, the absence of a true gestational sac in the presence of a trilaminar endometrium on US images is highly suggestive of an ectopic pregnancy

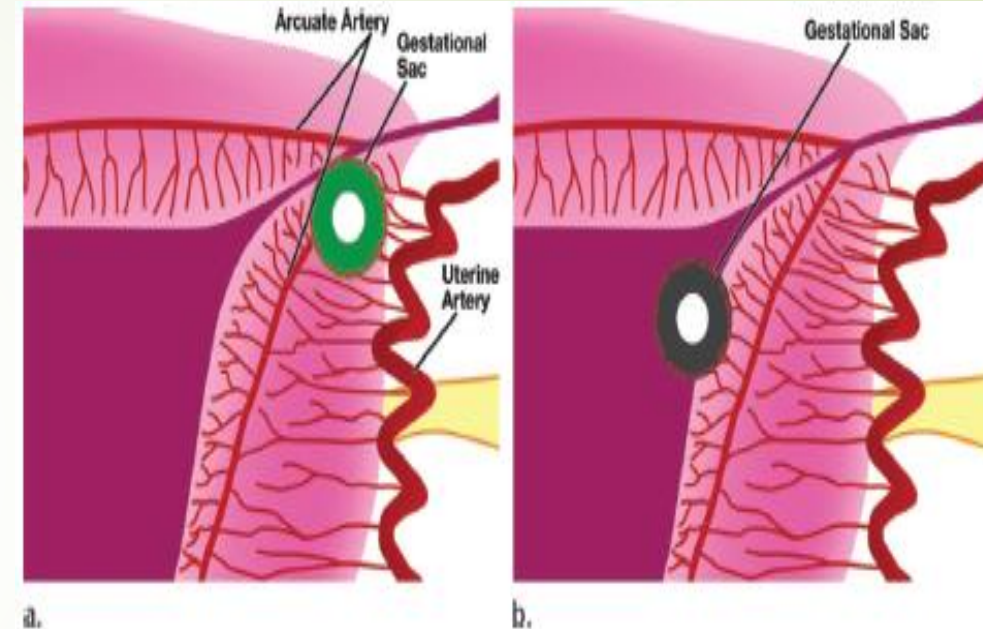
Thin-walled decidual cysts are found at the junction of the endometrium and the myometrium and may be seen in both normal and abnormal pregnancies.

Extrauterine findings of ectopic pregnancy include pelvic free fluid, hematosalpinx, and hemoperitoneum.

Interstitial Pregnancy

2%–4% of all EP

Risk factors include prior salpingectomy and in vitro fertilization



Interstitial pregnancies occur when the gestational sac implants in the intramyometrial segment of the fallopian tube.

Because of the increased distensibility of this segment of the fallopian tube, interstitial pregnancies may be seen as late as the 16th week of gestation. Rupture of an interstitial pregnancy can lead to life-threatening hemorrhage because of the proximity of the uterine artery to the fallopian tube

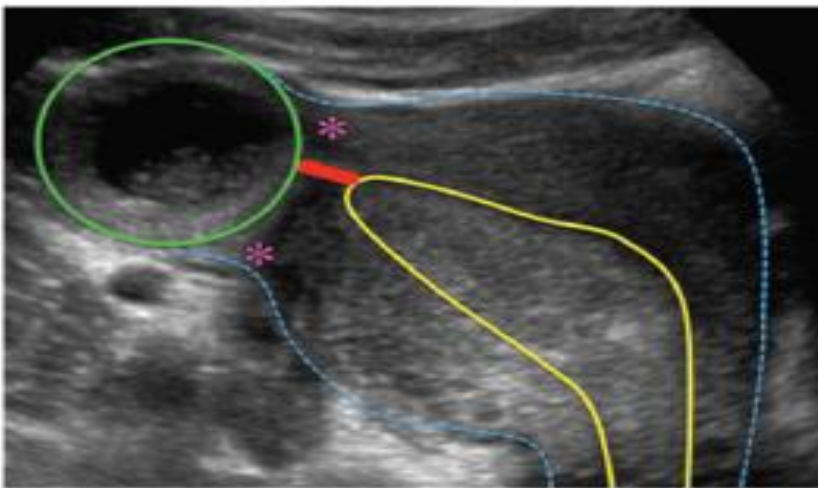
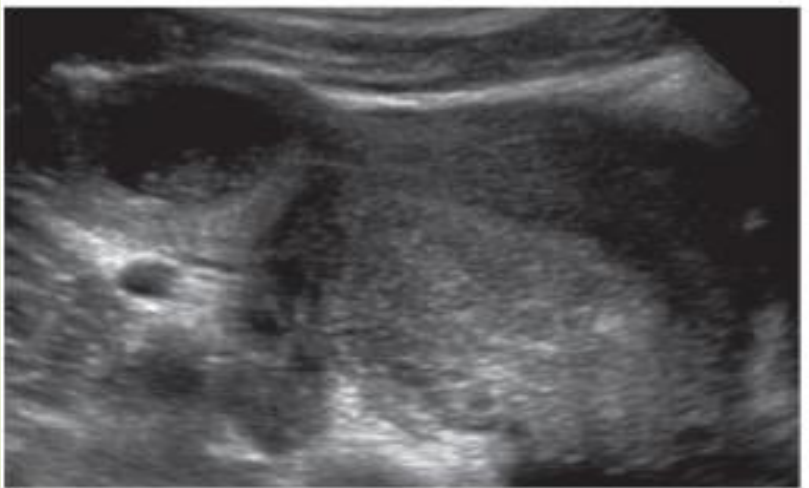
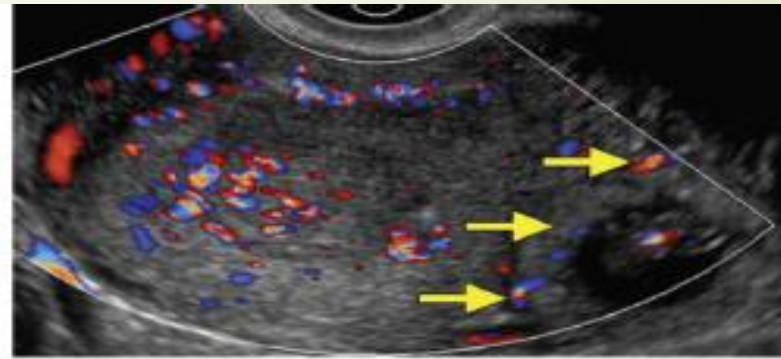
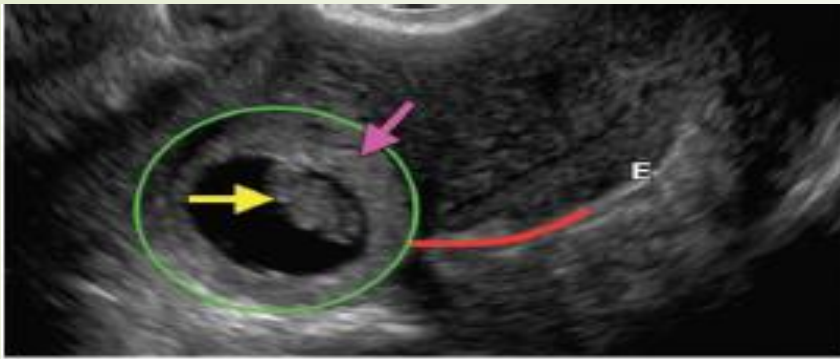
US findings of an interstitial pregnancy include an eccentrically located gestational sac surrounded by a thin layer of myometrium that measures less than 5 mm

At times, a normal pregnancy that appears to be eccentrically located because of distortion from uterine fibroids, contractions, or anomalies may be confused with an interstitial pregnancy.

A more specific finding is the interstitial line sign, which represents “an echogenic line that extends into the upper regions of the uterine horn and borders the margin of the intramural gestational sac”

This echogenic line most likely represents the interstitial portion of the fallopian tube .

the interstitial line sign was 80% sensitive and 98% specific for an interstitial pregnancy.



Cornual Pregnancy

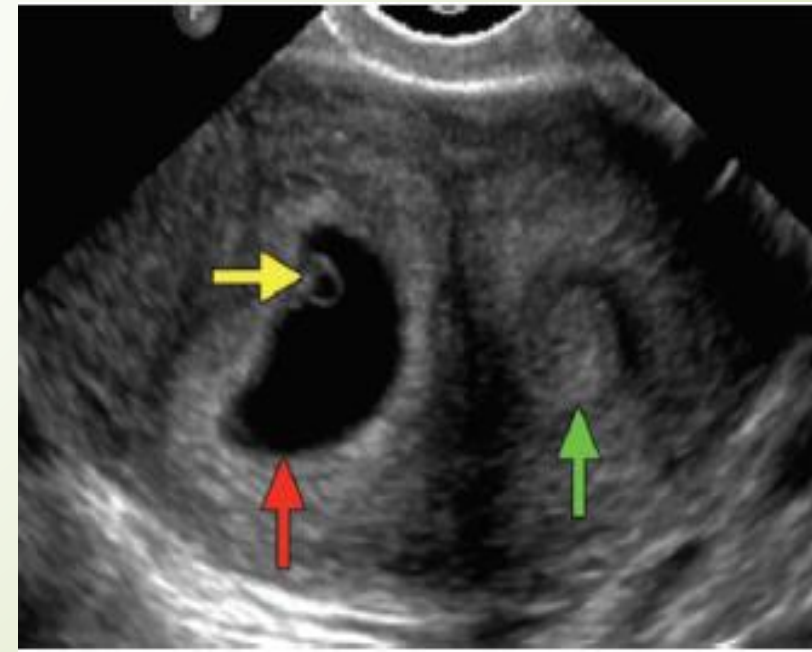
cornual pregnancy specifically refers to the implantation of a blastocyst within the cornua of a bicornuate or septate uterus

Cornual pregnancies are rare and account for less than 1% of all ectopic pregnancies

Rupture of a cornual pregnancy also results in catastrophic hemorrhage.

In a cornual pregnancy, the gestational sac is surrounded by a thin rim (<5 mm) of myometrium

In addition, the sac is in an eccentric position and is more than 1 cm from the lateral wall of the endometrial cavity



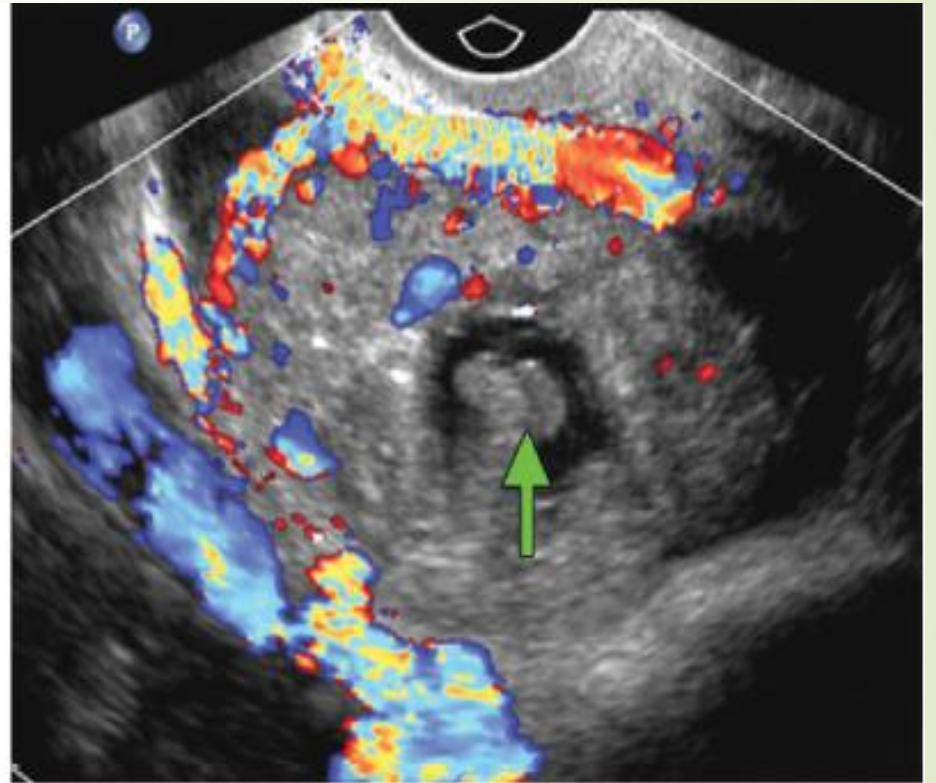
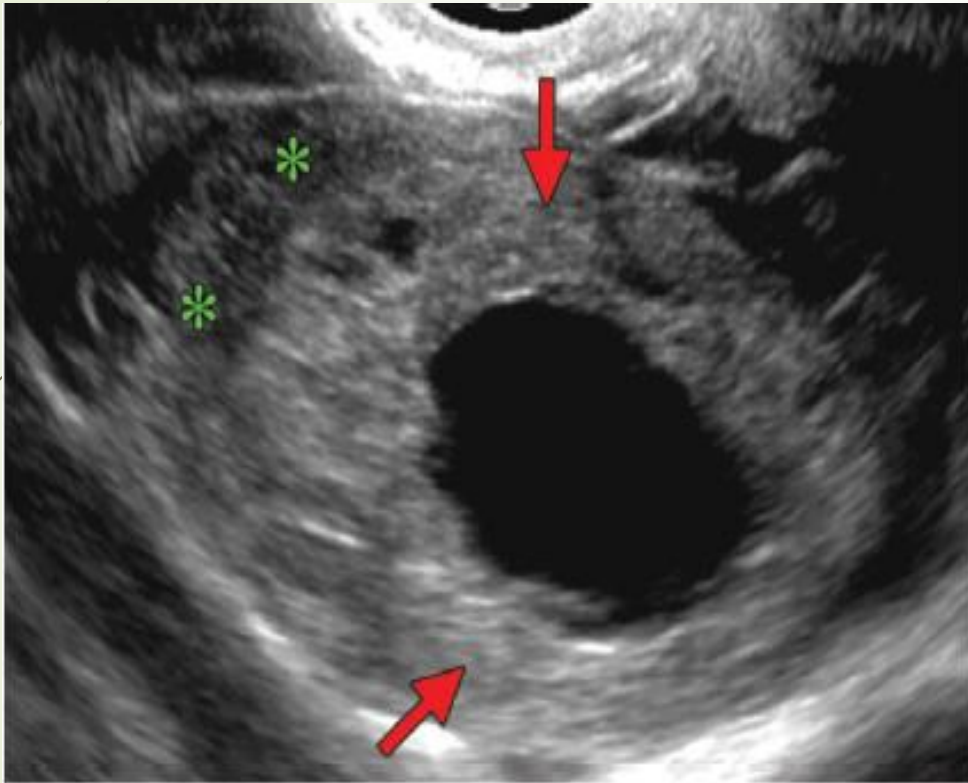
Ovarian Pregnancy

An ovarian pregnancy occurs when an ovum is fertilized and is retained within the ovary.

Ovarian pregnancies account for 3% of ectopic pregnancies; sometimes they manifest as part of a heterotopic pregnancy.

Ovarian pregnancies are strongly associated with the use of intrauterine devices and often manifest at the same time as tubal pregnancies .

The presence of a gestational sac, chorionic villi, or an atypical cyst with a hyperechoic ring within the ovary, along with the normal fallopian tubes, is suggestive of an ovarian pregnancy



Cervical Pregnancy

implantation within the endocervical canal (<1%)

associated with in vitro fertilization and a history of prior curettage

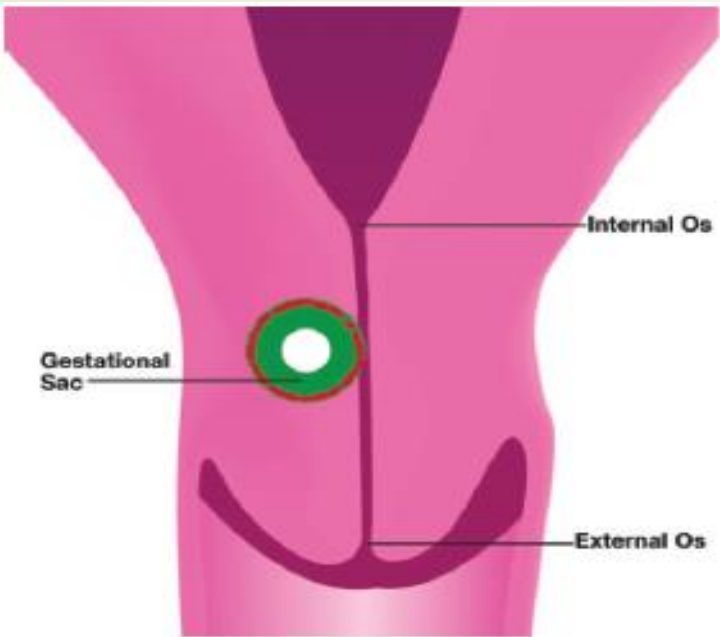
In a cervical pregnancy, the uterus may be shaped like an hourglass or a figure eight as the fetus expands within the cervix

cardiac activity below the internal os is highly suggestive of a cervical pregnancy.

When a gestational sac is visualized in the region of the cervix, gentle manipulation of the gestational sac should be attempted to differentiate a cervical pregnancy from an abortion in progress

If the sliding sign is seen this confirms that the gestational sac is not adherent to the cervix (excluding cervical pregnancy), which indicates that an abortion is in progress

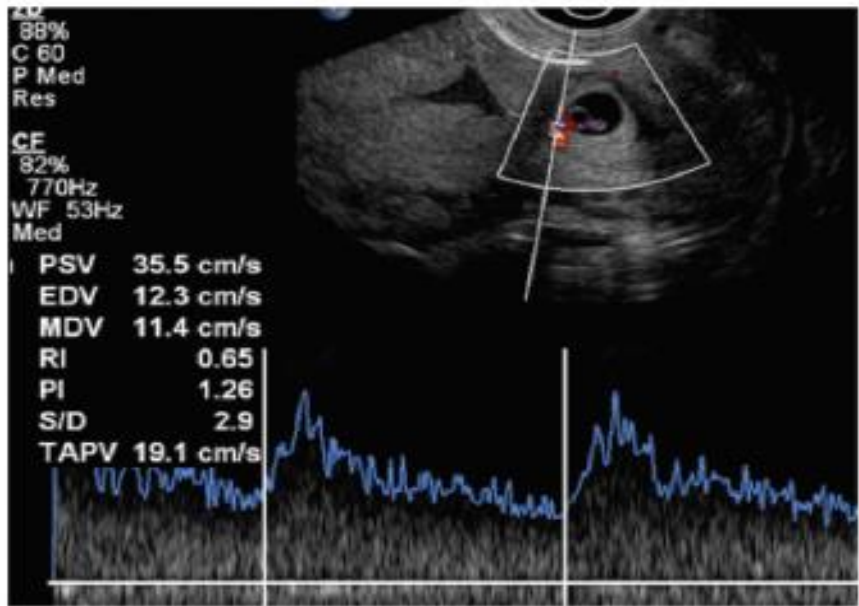
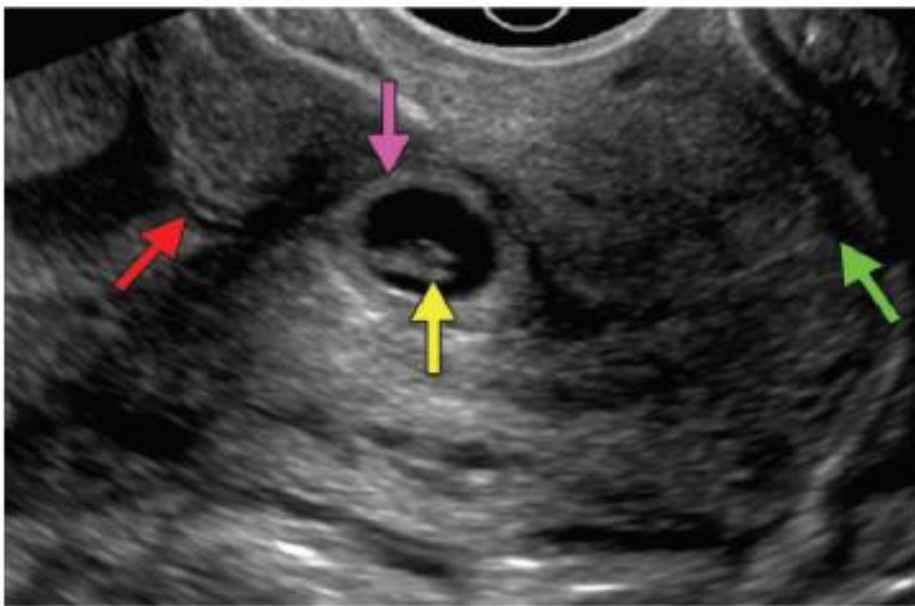
An embryo with a heartbeat, in a gestational sac in the endocervical canal below the cervical internal os, indicates a cervical ectopic pregnancy . At color Doppler US, peritrophoblastic flow around the ectopic gestational sac can be an additional helpful sign; however, it is not essential for diagnosis of cervical ectopic pregnancy.

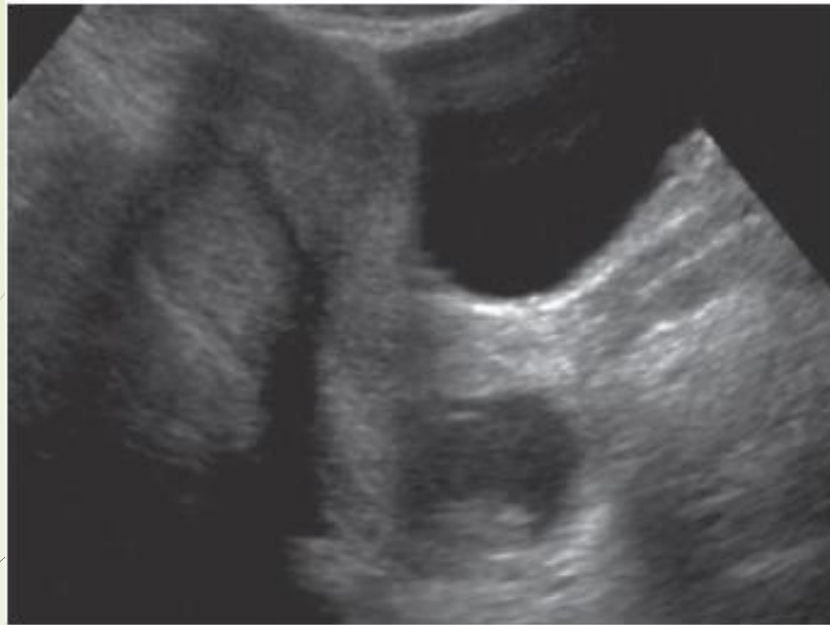


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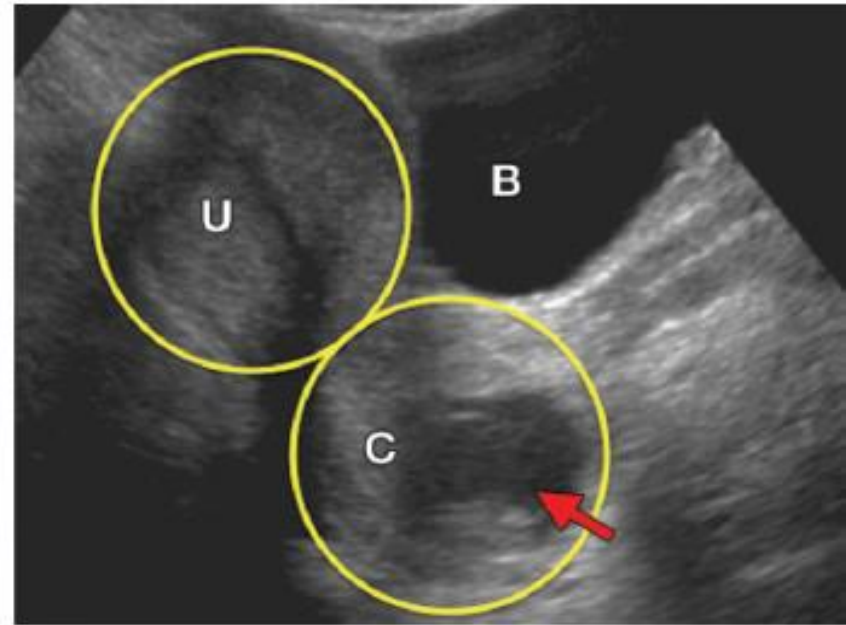


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a.



b.

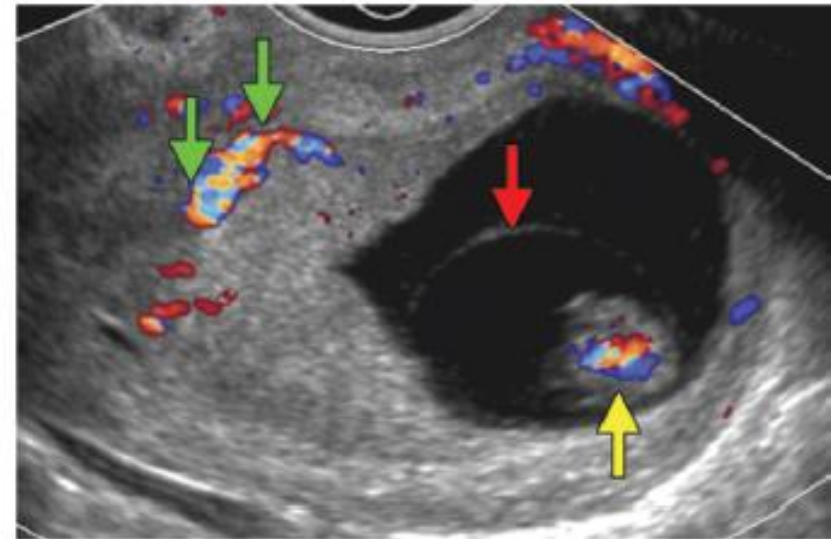
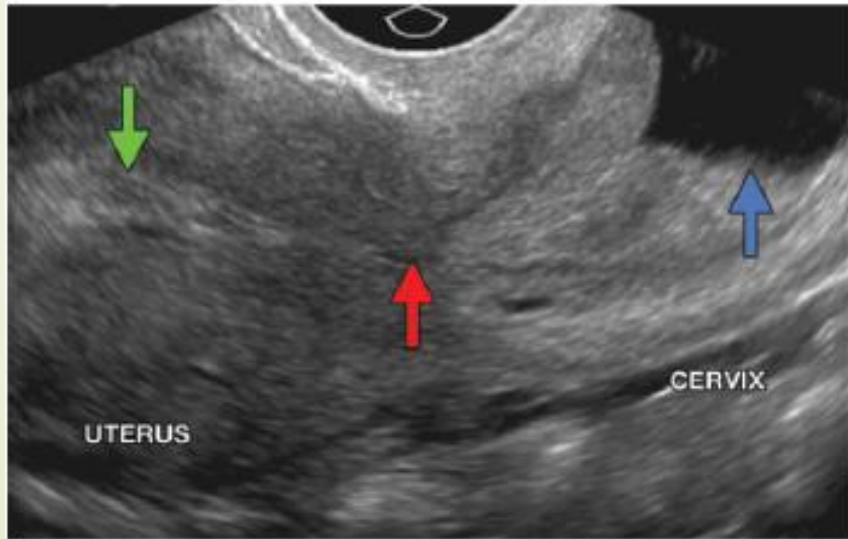
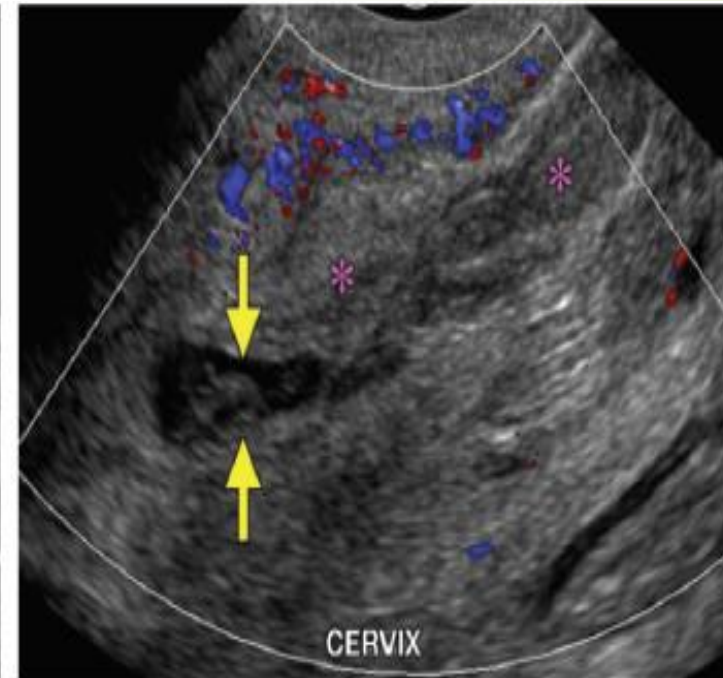
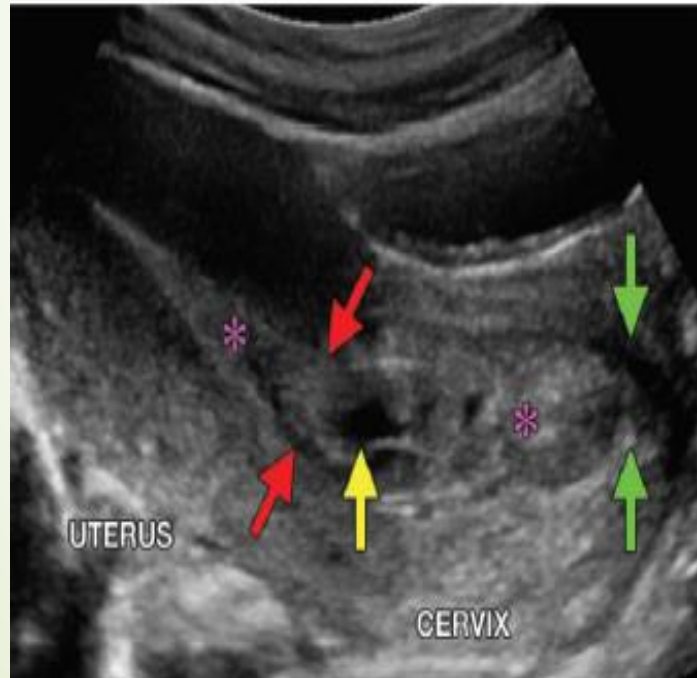
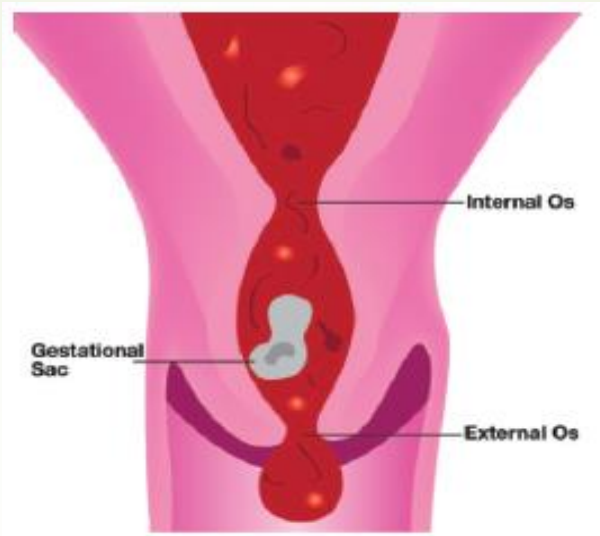


Table 3: US Features of Cervical Ectopic Pregnancy and Abortion in Progress

Cervical Ectopic Pregnancy	Abortion in Progress
Implantation of gestational sac in cervix	Gestational sac not attached to cervix
Round gestational sac	Gestational sac with irregular and deformed borders
Echogenic surrounding margins	No surrounding echogenic ring
Peritrophoblastic flow	No peritrophoblastic flow
Well-formed yolk sac or fetal pole	Poor visualization of fetal parts
No blood products in endometrium	Blood products in endometrium
Hourglass or figure-eight shape (with gestational age >7 weeks)	Globular enlarged uterus
Closed internal cervical os	Open internal cervical os
Fetal cardiac activity below internal cervical os (most specific finding)	Absent fetal cardiac activity below internal cervical os
Negative sliding sign	Positive sliding sign



Scar Pregnancy

less than 1% of all pregnancies

Implantation within anterior lower uterine segment at the site of a cesarean scar , separate from the endometrial cavity

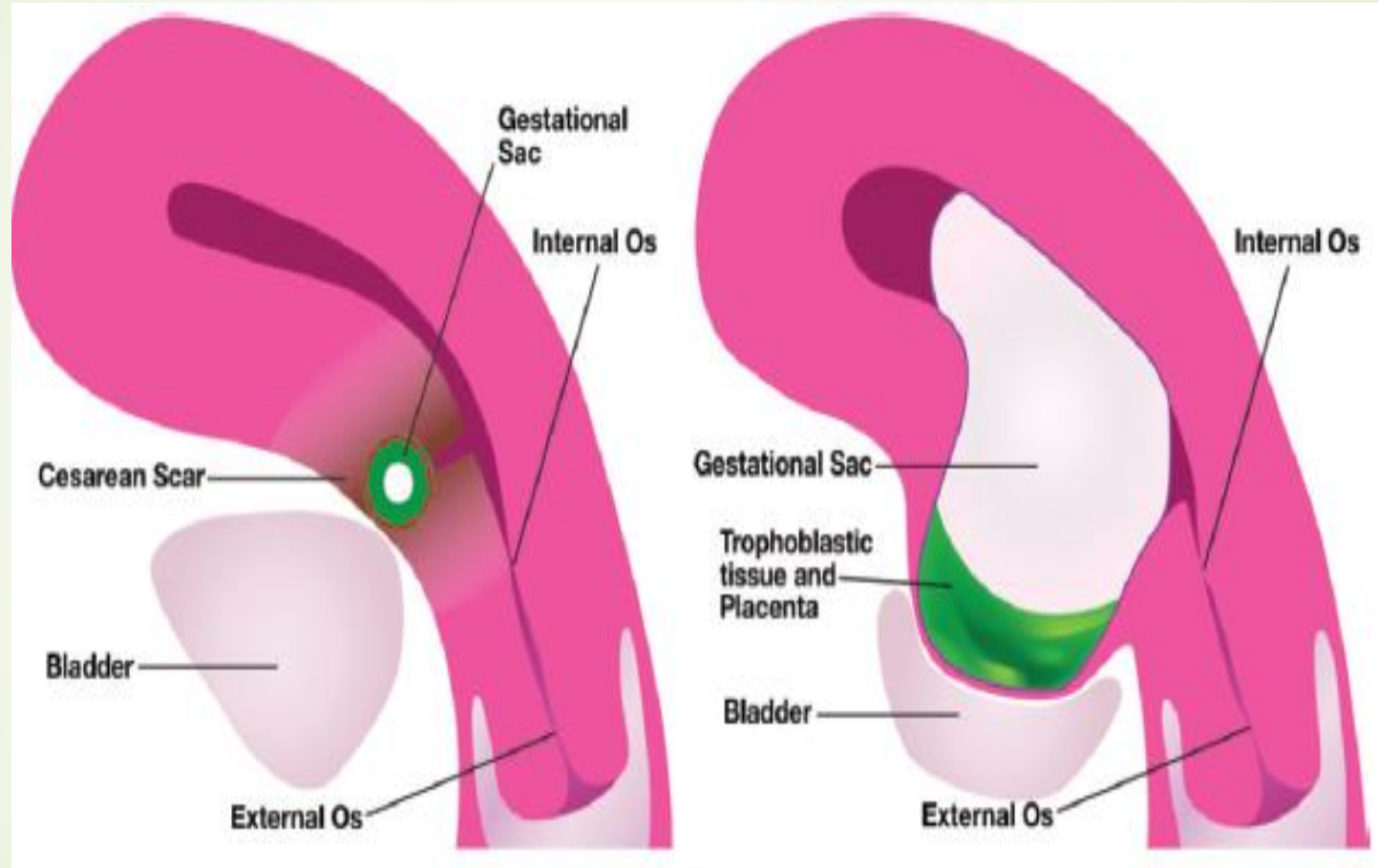
Within the scar, the blastocyst is surrounded by myometrium and fibrous tissue

A suggested mechanism is that a tract connects the endometrial canal and the uterine myometrium; this tract facilitates implantation within the scar.

Patients who have a scar pregnancy may present with vaginal bleeding as early as 5–6 weeks and as late as 16 weeks. Scar pregnancies may also rupture, which can result in

severe hemorrhage and hemodynamic collapse. In a scar pregnancy, a gestational sac may be visualized within the anterior wall of the inferior aspect of the uterus
Secondary to

compression by the gestational sac, the myometrium may also be thinned anteriorly
Thinning of the myometrium may predispose a patient to uterine rupture



US Features of Cesarean Scar Ectopic Pregnancy

Empty uterine cavity

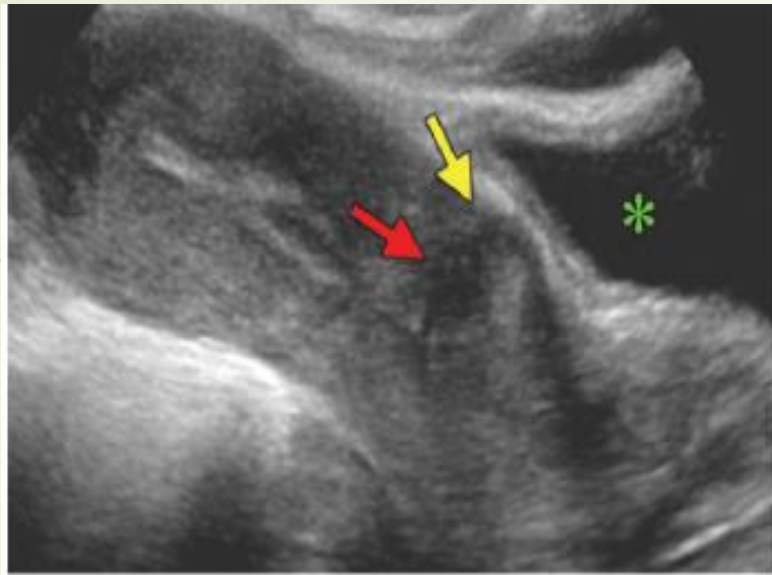
Clearly visible empty cervical canal with no contact with gestational sac

No adnexal mass or free fluid in the pouch of Douglas (unless gestational sac has ruptured)

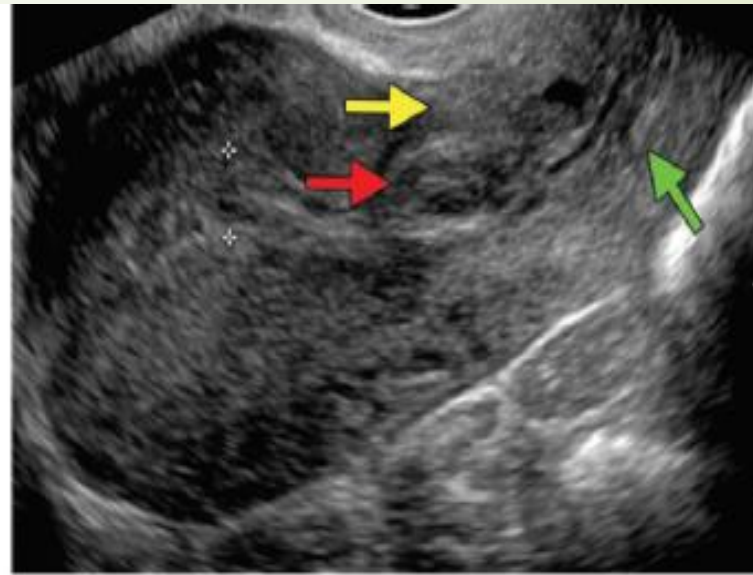
Gestational sac in anterior-inferior uterine wall (best seen on sagittal images)

Myometrial thinning anterior to gestational sac

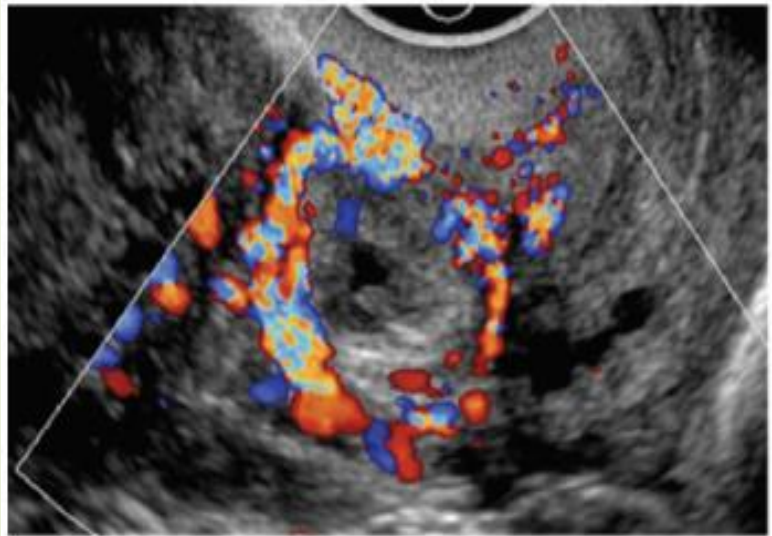
Gestational sac with echogenic margins and peritrophoblastic flow at scar site



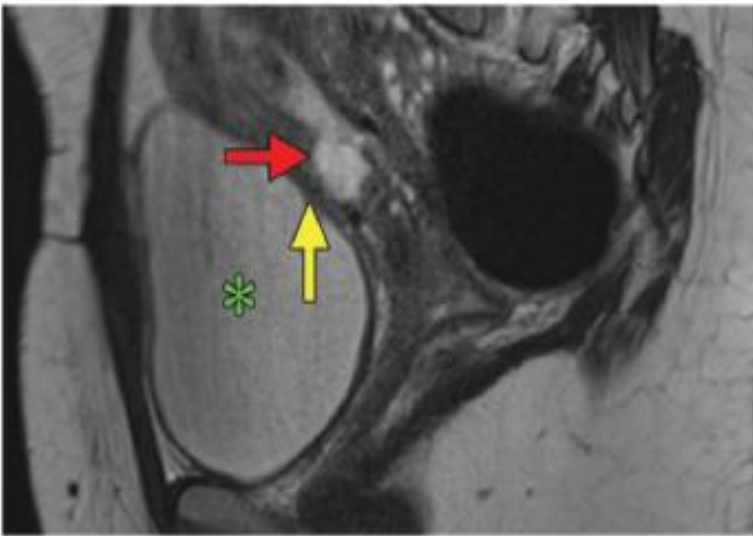
a.



b.



c.



d.

Intraabdominal Pregnancy

In an intraabdominal pregnancy, implantation occurs within the intraperitoneal cavity excluding tubal, ovarian, and intraligamentous locations.

This is a rare but it is more common in patients who undergo assisted reproduction , and it may represent 1.4% of ectopic pregnancies.

Because of significant hemorrhage, maternal mortality associated with intraabdominal pregnancy is 7.7 times that of other locations of ectopic pregnancy

Heterotopic Pregnancy

intrauterine and an extrauterine pregnancy occur simultaneously

More in assisted reproduction, particularly ovulation induction.

The prevalence of heterotopic pregnancy in women who undergo assisted reproduction has been reported to be 1%–3%

Heterotopic pregnancy remains a diagnostic challenge and should be kept in mind when a patient who has undergone assisted reproduction presents with pelvic pain.

Patients who have a known heterotopic pregnancy can potentially undergo US-guided ablation or laparoscopic removal of the extrauterine fetus to permit the intrauterine pregnancy to continue normally.

If a patient undergoes an abortion of an intrauterine pregnancy and continues to experience persistent adnexal pain with abnormal β -hCG levels, heterotopic pregnancy should be suspected.