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GYNECOLOGIE & OBSTÉTRIQUE PRATIQUE

Ultrasound monitoring of early medical abortion (EMA)

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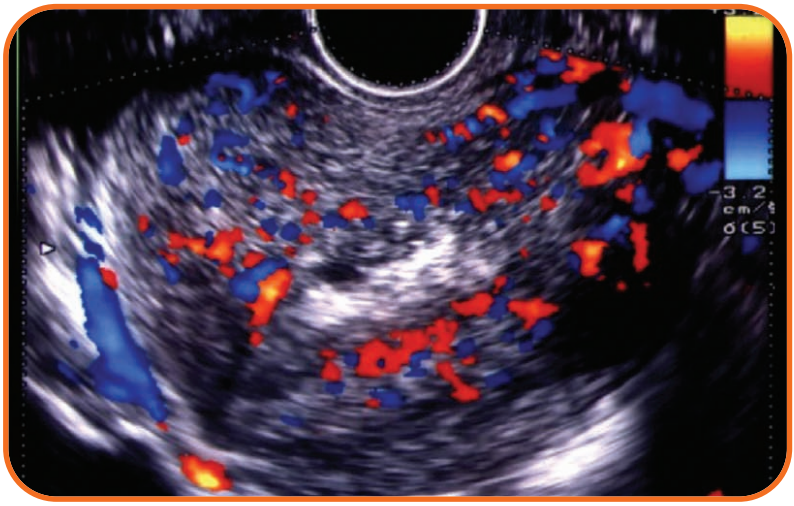

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Ultrasound monitoring of early medical termination of pregnancy

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Medical termination of pregnancy up to 63 days amenorrhoea is now authorised and routinely carried out in many countries. The treatment regimen used and protocols followed are variable and depend on the stage of the pregnancy. Thus, before commencing the treatment, it is vital, as far as is possible both to confirm that pregnancy is intra-uterine (so excluding ectopic pregnancy), and to date the pregnancy. After the intervention it is essential to confirm termination of the pregnancy and reassuring to document complete evacuation of the uterus.

After taking in to account patient symptoms, results of clinical examination and the β-hCG level, an ultrasound examination is frequently used at each juncture. Nevertheless, ultrasound images are open to errors of interpretation which can lead to unnecessary interventions.

This paper reviews the main features of ultrasound imaging at each stage of medical termination of pregnancy.

Pre-treatment assessment

Confirmation of pregnancy and exclusion of ectopic implantation

The definitive diagnosis of pregnancy and exclusion of a pseudo gestational sac require the ultrasound detection of an embryo or a yolk sac (umbilical vesicle) within an intra-uterine gestational sac *(figure 1)* .

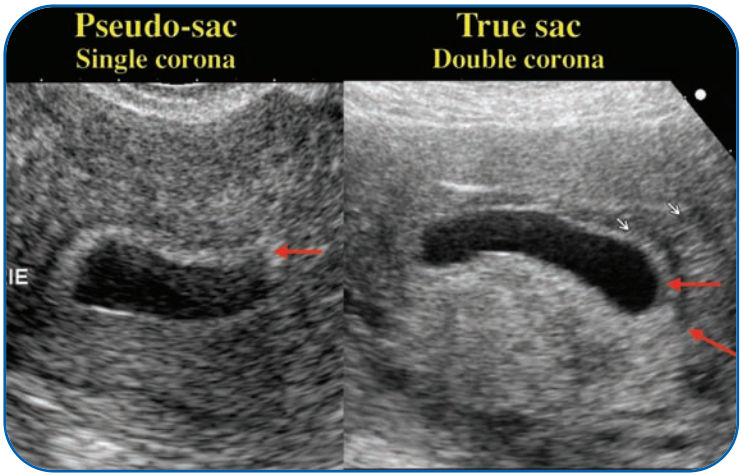
Gestational sac and umbilical vesicle

At around 5 weeks of amenorrhoea, the mean gestational sac diameter lies between 6 and 10 mm.
The yolk sac can be recognised in the form of two small parallel echoes 1-2 mm apart, off centre and in contact with the wall of the gestational sac. Some days later the whole contour is clearly delineated with a mean diameter which increases rapidly to 3 to 5 mm *(figure 2)*.

Embryonated gestational sac

At around 5 weeks and 3 days of amenorrhoea, that is 24 days since fertilisation, the embryo is theoretically visible on transvaginal ultrasound views. Its length lies between 1 and 2 mm. Cardiac activity can usually

Figure 1



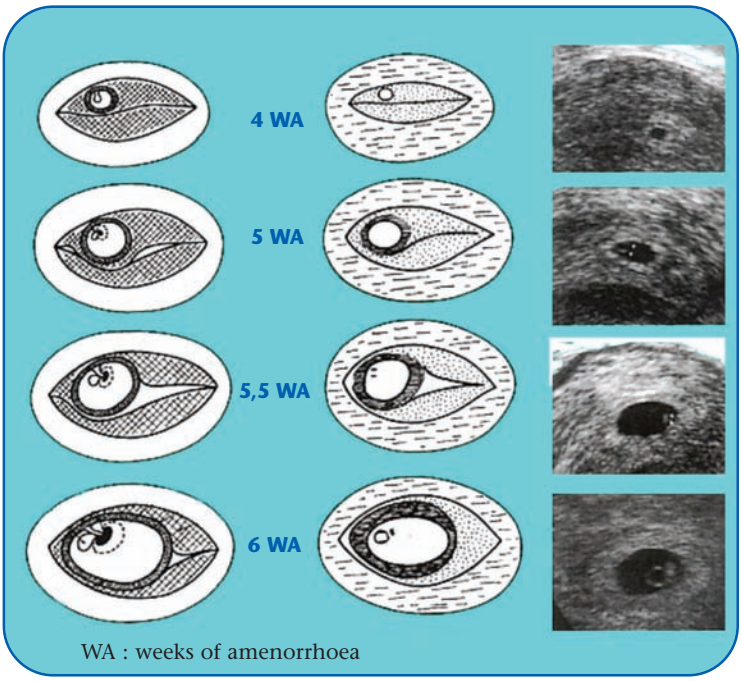


Figure 2

be detected as soon as the embryo is seen. The rate is quite slow at 80 beats per minute. Contractions of the cardiac tube can be seen perfectly in B-mode and the rate can be assessed in TM-mode. It is not useful to perform an echo-Doppler study of an embryo at this stage.

Summary

- A gestational sac which is more than 10 mm size normally contains a yolk sac.
- A gestational sac more than 16 mm normally contains a living embryo.
- An embryo of 4 mm or more normally has cardiac activity.

Uncertain situations and confusing images

Four diagnostic difficulties exist. Firstly, the uterine cavity may appear to be empty. Secondly, a small liquid image is seen. The third possibility is that the image resembles a pseudogestational sac. Finally, spontaneous abortion may be in progress.

Uterine cavity seems empty or is poorly visible

If suprapubic ultrasound results in a poorly visualised uterus or an apparently empty cavity, then a per-vaginal probe should be employed

Figure 3a. Supra-pubic view β-hCG 1,500: uterus empty and right adnexal mass, ectopic pregnancy?

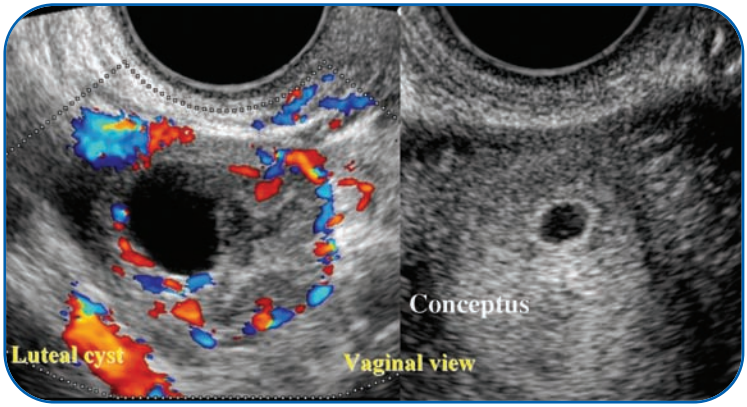


Figure 3b. In the vaginal view an intrauterine pregnancy is visualised. The right adnexal mass corresponds to a corpus luteal cyst.

(figures 3a and b). If the examination remains unsatisfactory (obesity, large uterus, fibroid, scarring), then it becomes necessary to: remeasure β-hCG to monitor development;
repeat ultrasound after 48 hours;
If doubt remains and the β-hCG level is greater than 1,500 mIU/ml the probability of ectopic pregnancy is high.

Liquid image less than 1 centimetre: pregnancy or misleading image?

Between 4 and 5 weeks of amenorrhoea the umbilical vesicle is no longer visible and the trophoblastic corona is not yet well defined.
At this stage it is not possible to differentiate morphologically between a small gestational sac, a large endometrial cyst and other problem images:

■ **Intraglandular cysts** are frequently seen when there is a decidual reaction and can be seen particularly with ectopic pregnancy. They form small fluid density images up to 2 to 3 mm, sometimes multiple with a glandulocystic appearance. They may simulate an early gestational sac.

■ **Intracavitary images**: fluid collections (haematometra, hydrometra, pyometra) and especially glandulocystic intracavitary polyps, which can sometimes be very misleading *(figure 4)*.

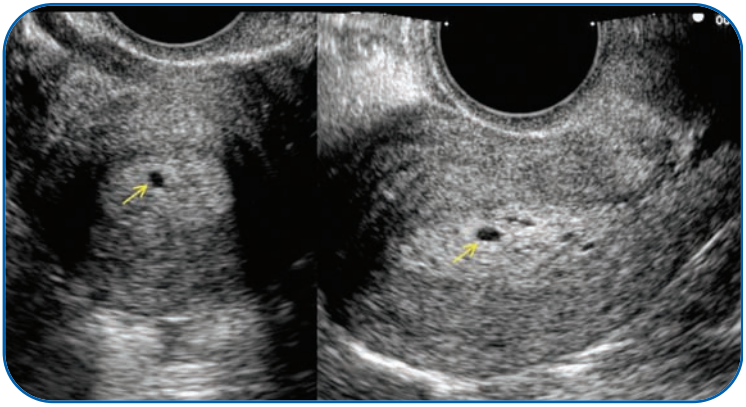


Figure 4. Glandulocystic polyp simulating a conceptus at 4 weeks amenorrhoea.

Submucosal myometrial images

Small necrosing submucosal fibromas or adenomyotic nodules are seen and can be misleading when they have a disc like shape. The extra-mucosal position of such images suggests the correct diagnosis *(figure 5)*.

Large empty sac image: pseudo-sac or missed abortion?

This pitfall corresponds either to endometrial hypertrophy surrounding a hydro-haematometra or to detached uterine decidua with central fluid *(figure 6)*.

The differential diagnosis depends on the following factors:
the position of the sac: a conceptus is usually eccentric, whereas a pseudo-sac is central. A coronal cut of the uterus possibly in 3D mode can prove useful to elucidate this sign;
the structure: intra-uterine pregnancy forms a double echogenic "corona" corresponding to the uterine decidua and the trophoblast, while a pseudo-sac has only a single endometrial corona;
Doppler: as it is formed of endometrium, a pseudo-sac has no surrounding

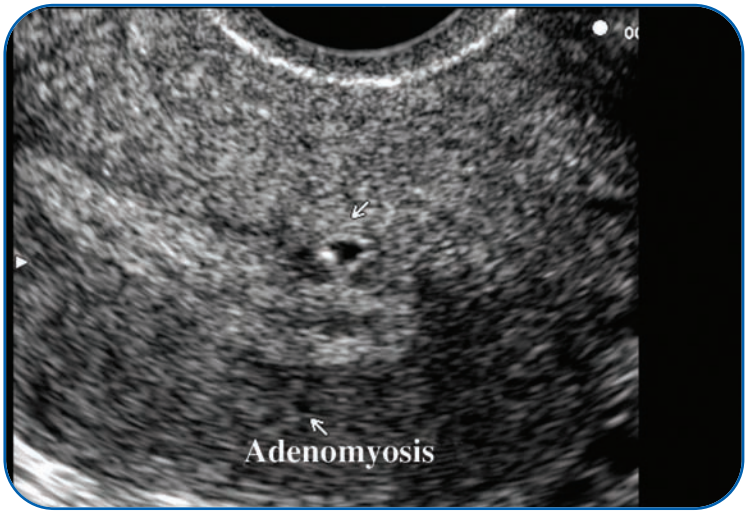


***Figure 5.** Adenomyosis. Image of adenomyosis with pseudo-pregnancy appearance, situated outside the uterine cavity.*

arterial or venous flow. The demonstration of such flow with circulatory velocity of more than 20 cm/sec confirms the presence of a pregnancy and excludes a pseudo-sac (sensitivity 84%, specificity 100%).

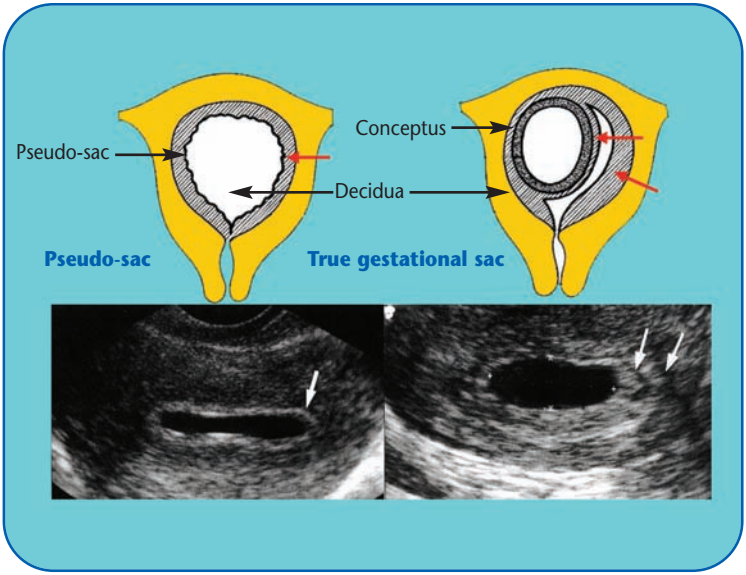


Figure 6

Features in favour of a pregnancy in the face of a small "cystic" image within the uterus, measuring 2 to 10 mm

– The conceptus is initially intramucous and not intracavitary.
– The presence of a trophoblastic corona which will rapidly differentiate the conceptus from a cystic gland. The latter does not change over time during ultrasound monitoring.
– Growth: a normal gestational sac grows around 1 mm a day during this period and is followed by the rapid appearance of embryonic structures such as the yolk sac and then the embryo itself.
– At the implantation site blood vessels develop and can be detected using colour Doppler.

Dating the pregnancy

Ultrasonography must be correlated with plasma β-hCG levels.
We shall work with the following figures:
– β-hCG < 10 mIU/ml: no pregnancy;
– β-hCG between 10 and 500 mIU/ml: ultrasound equivocal;
– β-hCG between 500 and 1000 mIU/ml: conceptus measures 1 to 3 mm;
– β-hCG between 1000 and 7000 mIU/ml: the value of 1500 mIU/ml is now held to be the threshold level for detection of an intrauterine conceptus using a per-vaginal view; the level for detection with abdominal ultrasound being 2500;
– β-hCG > 7000 mIU/ml: an intrauterine conceptus remains visible and contains a characteristic primary yolk sac (umbilical vesicle);
– β-hCG > 10000 mIU/ml: an embryo and cardiac activity are usually found.

Correlation between plasma level of β-hCG and ultrasound.

β-hCG level (mIU/ml)	**Pervaginal ultrasound**
< 10 10-500	No pregnancy Conceptus not seen
500-1000	Diameter conceptus: 5-10 mm Embryo: 1-3 mm (visible in a third of cases) Cardiac activity detectable
1000-1500	Embryo: 3-6 mm Cardiac contraction
> 2500	Visible with supra-pubic ultrasound
> 7000	Embryo > 6-7 mm

– β-hCG > 1000-1500 mIU/ml and conceptus not seen: suspicion of ectopic pregnancy.

Echo-doppler

Doppler studies can be very helpful in detection of early pregnancy when there is diagnostic uncertainty but it is important to use very highly sensitive colour imaging. Colour Doppler facilitates identification of developing vessels in the endometrium, where the latter is contiguous with the trophoblast from the time of implantation *(figure 7)*.

Sometimes a colour signal is seen in the implantation zone even before the menstrual period is known to be delayed and before the gestational sac is apparent. A low resistance arterial flow (Resistance Index = 0.40 to 0.50) is seen with systolic velocity usually exceeding 20 cm per second. This type of flow, similar to that associated with a corpus luteum, is not found in the normal endometrium and virtually excludes the possibility of an ectopic pregnancy.

The demonstration of flow of venous quality is less useful because this may be seen with a decidual reaction whatever the site of implantation.

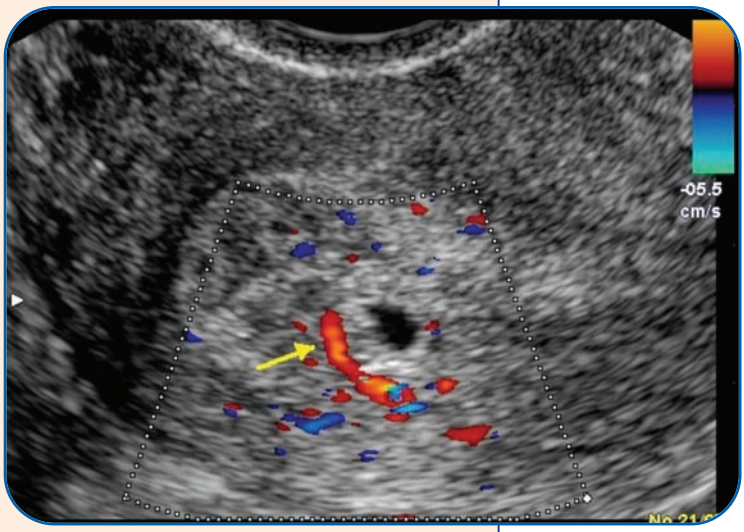


Figure 7. Intrauterine pregnancy, 4.5 weeks: Doppler of the uterus, feeding vessel visible at the site of implantation. (→).

Follow up assessment

The best time for ultrasound examination is between the 14th and 21st day after administration of mifepristone. Indications for ultrasound are the development of untoward clinical manifestations and inadequate fall of β-hCG level or even an increase in this.
Ultrasonography must be performed if, 2 to 3 weeks after attempted termination, plasma β-hCG is greater than 10% of the initial level.
In this situation it is essential to devote particular attention to the appearance of the uterine cavity and to assess endometrial thickness.

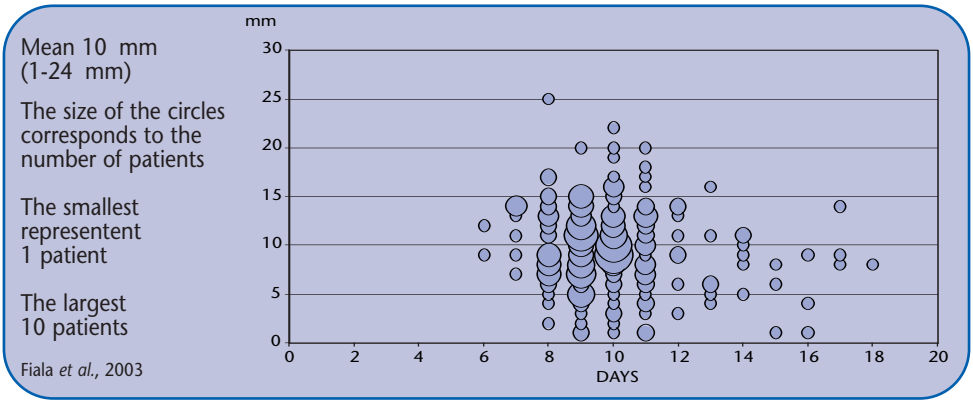


Figure 8a. Thickness of the endometrium measured on ultrasound imaging.

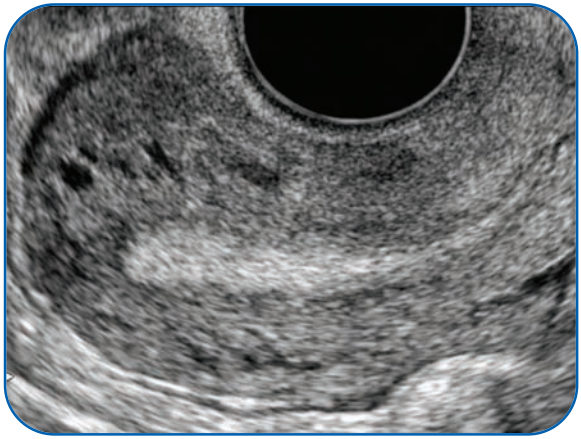


Figure 8b. Thick endometrium (13 mm) after drug-induced termination. This is a normal appearance and should not cause alarm.

Results of ultrasound examinations between the 14th and 21st day after abortion

Complete evacuation (figure 9)

The cavity is empty. Endometrium is absent or not prominent, sometimes surrounding a small residual haematometra.

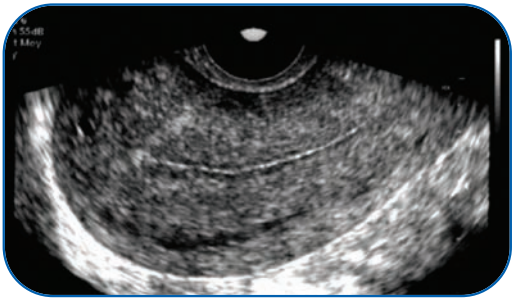


Figure 9. Complete evacuation: virtual cavitary line.

Persisting pregnancy

Continuation of pregnancy occurs in 1 to 5% of attempted medical abortions. It is suggested by a high β-hCG and is easily confirmed by ultrasound. Suction evacuation must be considered.

Missed abortion (figure 10)

Ultrasound can show a non-embryonated gestational sac, which does not develop, or a clear conceptus, often flaccid and flattened. These appearances may require surgical aspiration or further medical treatment.

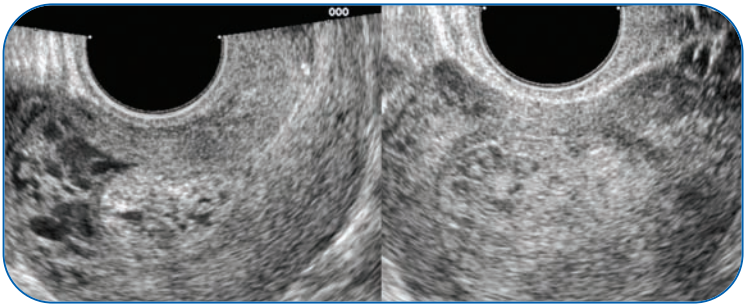


Figure 10. Post "termination" retention.

Evacuation proceeding (figure 11)

Ultrasound sometimes reveals the conceptus during expulsion. It is deformed in to the shape of an hour-glass as it passes through the cervical canal. It is vital to inspect both the cervix and the isthmus. The gestational sac can also be located in the vagina. The expulsion of a dead conceptus occurs spontaneously in two stages: first the amniotic sac, with or without the embryo, then the trophoblast. A further ultrasound examination might be indicated later to demonstrate that evacuation is complete.

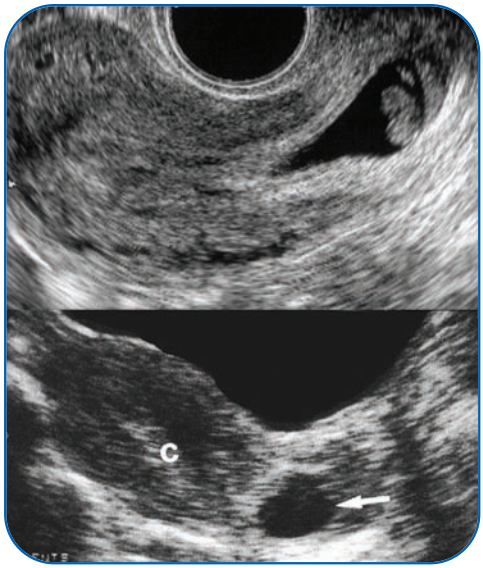


Figure 11. Conceptus being expelled.

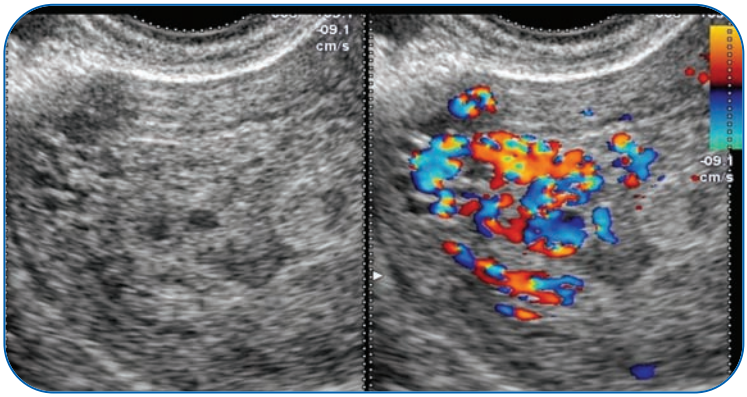


Figure 12. Retention of hypervascular trophoblast in colour Doppler.

Partial retention (figures 12 and 13)

The cavity is seen to contain hyperechogenic structures which could correspond to trophoblast, decidua or clots. This is the most difficult situation as it is often hard to identify the trophoblast clearly.
The presence of an arterial colour Doppler signal in the cavity suggests retention of trophoblast *(figure 12)*.
In contrast, the presence of a broad heterogeneous cavity of less than 15 mm with no Doppler signal is a normal appearance after termination. This ultrasound appearance is misleading and should not routinely justify curettage. In most cases it represents debris of decidua and clots, which will be expelled spontaneously or after a further dose of prostaglandins *(figure 13)*.

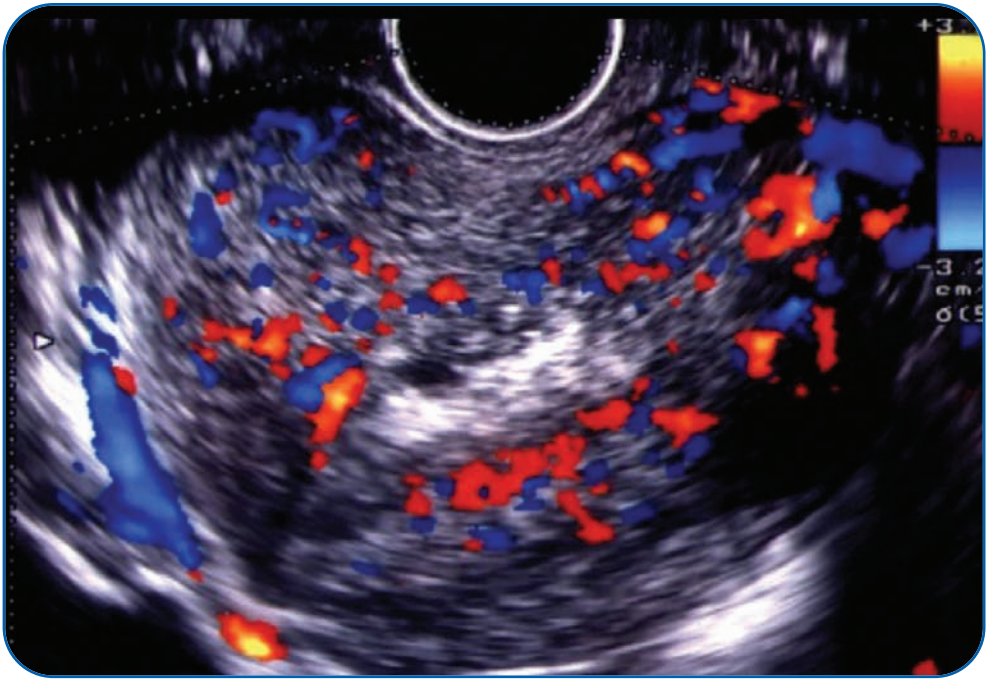


Figure 13. Post termination retention, echo images which are not vascularised on Doppler examination: debris of clots and decidua.

Factors influencing the risk of failure of medical termination

A study* of 1,850 patients undergoing medical abortion of pregnancy of up to 49 days of amenorrhoea with mifepristone (600 mg) and oral misoprostol (400 µg misoprostol once or twice) carried out by the Family Planning department of the *Hôpital de la Fraternité* (Roubaix) showed that termination was successful in 97.08% of cases. 54 failures were recorded (2.92%): 7 were due to continuing pregnancies, 42 were due to retained products of conception, there were 4 emergency admissions and one case was lost to follow-up.
The results were:
– the mean age of those who had a failed medical termination procedure was higher than the age of those for whom the intervention was successful (30.8 years versus 27.2 years);
– nulliparous women were significantly less likely to have a failure than multiparous (1.37% vs 4.30%);
– the success rate was not dependent on the duration of the pregnancy (43 days of amenorrhoea on average);
– in those where termination succeeded the mean level of β-hCG on day 1 was lower than that in the failed group (37,000 mIU/ml vs 46,000 mIU/ml)
– 638 (34.5%) patients expelled products of conception after the first dose of misoprostol 400 µg; 1149 (62%) patients received a second dose of 400 µg misoprostol 3 hours after the first; 35 (1.9%) patients did not abort but did not receive a second dose (dose refused or patients left the department); 28(1.5%) did not receive misoprostol at all because they aborted in the interval between mifepristone administration and the visit for prostaglandin administration. In the group that received two doses of misoprostol, 43 (3.7% of those receiving two doses or 2.3% of total) failed. Of these, 2 were readmitted the same day for bleeding and one for pelvic pain.

In summary, the over all effectiveness of the treatment protocol used was very satisfactory. This applies to all patient groups. However, it does remain necessary to inform women of high parity (beyond 3 or 4 children) of the increased chances of failure of the method.

* XXII^{es} Journées de Techniques Avancées, Guadeloupe 2007.

Advice on practice

- Per-vaginal ultrasound is the gold-standard investigation. It should be performed before medical termination, so as to confirm pregnancy and to localise and date it.

- Ultrasound examination after termination is not always essential. In fact, it can give rise to unnecessary curettage procedures for apparent retained products of conception. As a general rule, the clinical picture and serial assessment of β-hCG levels should be sufficient.
  It is best to confine ultrasound to cases where the level of β-hCG remains greater than 10% or 20% of the initial level. In any case it should not be performed prematurely, except when it is certain that there has been no expulsion of products of conception or when there are worrying developments such as substantial continuing bleeding or excessive pain.
  The persistence of a gestational sac is the only ultrasound finding which confirms a failure.

- Intervention when the cavity appears large and heterogeneous on ultrasound is only justified when there are associated clinical features, suspicion on echo-Doppler of trophoblast retention or an unsatisfactory reduction in β-hCG level.

- There is a risk of iatrogenesis as a result of poor quality ultrasound examinations or of difficulties in interpretation of images. While it is desirable for the same individual to perform the procedure before and after the intervention, this is not essential. It is sufficient to know the typical ultrasound appearances found after attempts at medical termination. The imaging should be reported in the knowledge that the decision about further management is in the hands of the doctor who manages the medical abortion procedure.

- Suprapubic ultrasound has limited indications.

- Echo-Doppler, which is not available in most centres, is sometimes useful but is indicated only when there are certain difficulties in image interpretation. This applies to the differential diagnosis between trophoblast retention and clot or uterine decidua. Its use should be confined to the following situations: no expulsion of products of conception, pain and/or late bleeding.
  French and European recommendations should define indications for ultrasound procedures. This would offer guidance to practitioners.

Licenced Treatment Protocols for medical termination of pregnancy with Mifegyne® (mifepristone)

Administration of the treatment for abortion must be carried out according with local law.

■ Up to 49 days of amenorrhoea

The licenced regimen is 600 mg of mifepristone (3x200 mg tablets) to be taken as a single oral dose, followed 36 to 48 hours later by administration of the prostaglandin analogues: misoprostol 400 µg as a single oral dose or gemeprost 1 mg vaginally.
If gemeprost is used 200 mg mifepristone may be sufficient.

■ Up to 63 days of amenorrhoea

The licenced regimen is 200 or 600 mg of mifepristone (1 or 3 x 200 mg tablets) as a single oral dose, followed 36 to 48 hours later by, gemeprost 1 mg p.v.

■ After 63 days of amenorrhoea

Mifegyne® (mifepristone) is not licenced for medical termination of pregnancy between 9 and 12 weeks gestation. Mifegyne® (mifepristone) at a dose of 200 mg is however licenced for softening and dilatation of the cervix before surgical termination during the first trimester; the tablet should be administered, 36 to 48 hours before the operative procedure.

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