PLACENTAL HAEMATOMAS. PLACENTAL ABRUPTION

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1. INTRODUCTION

Placental haematomas can be classified into three types depending on location with respect to the chorion:

1. **Subamniotic haematoma:** between the amnion and the chorionic plate.
2. **Subchorionic haematoma:** between the chorion and the uterine wall.
3. **Retroplacental haematoma:** between the placenta and its adjacent decidua.

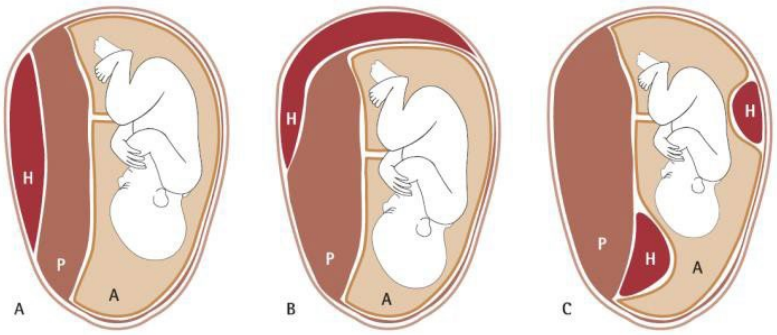
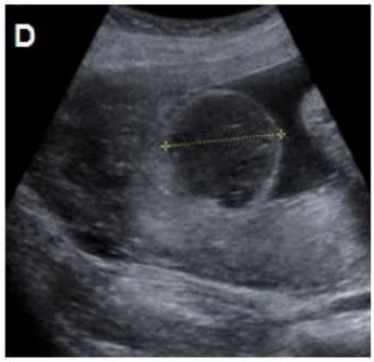
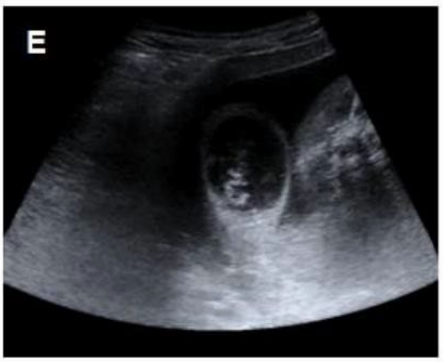


Figure A: *Retroplacental haematoma*
Figure B: *Subchorionic marginal haematoma*
Figure C: *Left, subamniotic haematoma. Right, subchorionic haematoma.*

The origin of bleeding in retroplacental and subchorionic haematomas is maternal, whereas subamniotic haematomas result from the rupture of fetal vessels branching from the cord.

All of these lesions can be identified on prenatal ultrasound examination. Sonographically, the appearance of the haematoma in the acute haemorrhage phase is initially hyperechoic or relatively isoechoic compared to the placenta (Figure D). After one or two weeks of evolution, the image is more hypoechoic (Figure E). The Doppler study is very useful in differentiating haematomas from other placental images since, regardless of their location, they are never vascularised.





2. TYPES OF HAEMATOMAS

2.1 SUBAMNIOTIC HAEMATOMA

Preplacental haematoma located between the amniotic membrane and the fetal chorionic plate.

Incidence

The occurrence of a subamniotic haematoma is relatively rare and is usually an incidental ultrasound finding. Most are diagnosed in the third trimester or at the time of delivery.

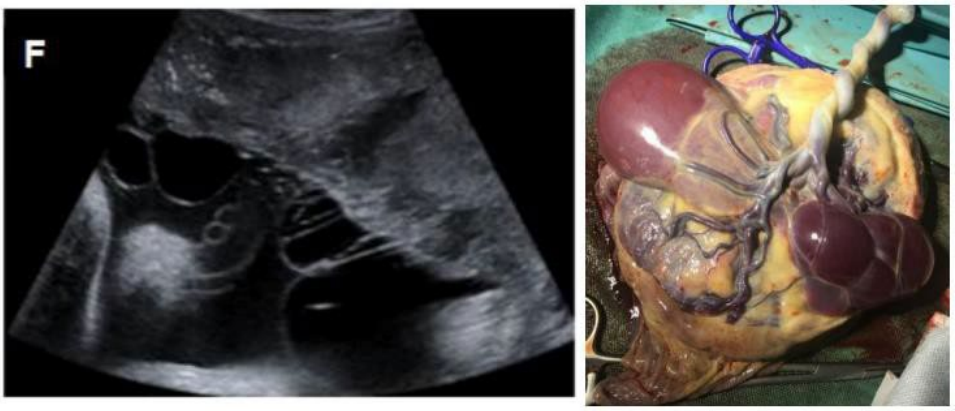
Aetiology

Low-pressure bleeding occurs as a result of the rupture of fetal vessels branching from the umbilical cord near the placental cord insertion site. Vessel trauma may be caused by excessive umbilical cord traction due to fetal movements or external pressure (uterine contraction), or spontaneously by the intravascular pressure at a focus of lower vascular wall resistance.

Although most cases are reported at the time of delivery, it can also occur as a complication of an invasive procedure (cordocentesis, fetoscopy). Finally, an unusual prenatal evolution of a chorionic bump has been reported in the literature as a possible origin of a subamniotic haematoma in the second trimester.

Ultrasound

The diagnosis can be suspected prenatally by visualising an oval-shaped cystic lesion protruding from the fetal surface of the placenta and surrounded by the thin amniotic membrane (Figure F). It may appear pedunculated into the intra-amniotic cavity. Depending on the time of evolution, its echogenicity may change.



Clinical findings

Subamniotic haematoma is asymptomatic. It consists of an ultrasound finding that is not associated with clinical signs of metrorrhagia.

Prognosis

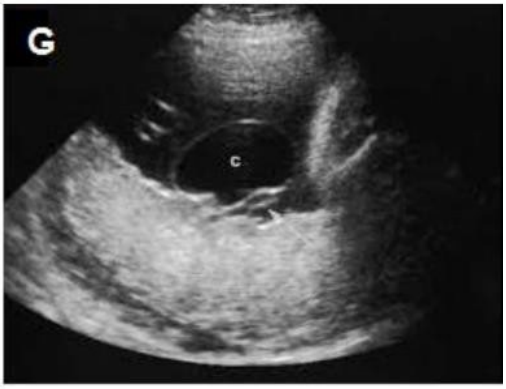
The clinical consequences of subamniotic haematoma are poorly understood. Bleeding is usually self-limited, as the clot is firmly contained by the amnion.

To date, it has not been related to severe obstetrical complications. It can be associated with feto-maternal haemorrhage, which can lead to fetal anaemia, and intrauterine growth restriction (IUGR). Therefore, if the diagnosis is made in the second trimester, serial sonographic evaluation, including fetal growth and Doppler ultrasound examination, may be appropriate.

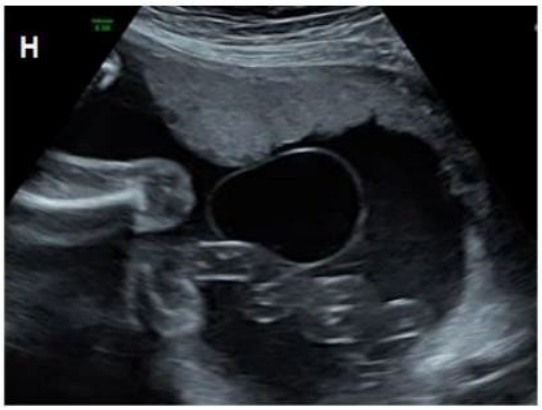
Differential diagnosis

It is important to correctly recognise the sonographic image of a subamniotic haematoma in order to exclude other conditions associated with possible adverse obstetrical outcome. There are a number of possible differential diagnoses when considering the finding of a cystic lesion in relation to the placenta.

- **Placental cyst or cytotrophoblastic cyst:** they can be located, like subamniotic haematomas, between the amniotic membrane and the chorionic plate in close proximity to the placental insertion of the umbilical cord (Figure G). They contain a gelatinous material rather than blood. They are usually small, but some may exceed 5 cm in size. Since they are isolated from the placental circulation, colour Doppler shows no evidence of any vascular flow. The prevalence of these cysts is higher than that of subamniotic haematomas, around 3% in the first trimester. It is an important differential diagnosis, as more than 20% of cases are associated with fetal chromosomal or structural defects, especially when located close to the placental insertion of the cord.



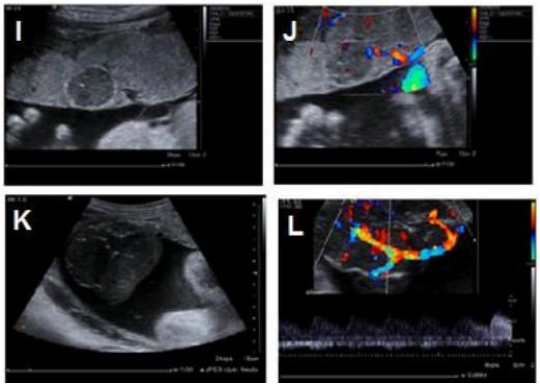
- **Umbilical cord cyst** (Figure H): they can be found in up to 3% of pregnancies in the first trimester. However, they are rare in the second and third trimester. The pathological classification of cord cysts is as true cysts or pseudocysts. The differentiation between both entities at a prenatal level is almost impossible because their appearance is similar. The prognosis differs depending on the time of gestation at which they appear. Most cord cysts diagnosed in the first trimester are transient and are not associated with adverse perinatal outcomes. There is an increased association with certain chromosomal and structural anomalies, especially when there are additional sonographic abnormalities and if there is persistence in the second or third trimester. Multiple cysts have been associated with an increased risk of miscarriage, trisomies 18 and 13, omphalocele, VACTERL association and fetal growth restriction.



- **"Vanishing twin"**: it can also give rise to a cystic structure sonographically. Evidence of this phenomenon is usually only found in early pregnancy showing a multiple gestation with an empty sac. It can be associated with metrorrhagia.

- **Subchorionic haematoma** (see point 2.2)

- **Chorioangioma**: the main difference with respect to subamniotic haematoma is that it is vascularized (Figures I, J, K, L). Most placental chorioangiomas are small and are not clinically important. However, those measuring more than 4-5 cm in diameter may be associated with maternal and fetal complications due to the presence of arteriovenous shunts with the placenta (polyhydramnios, preterm delivery, fetal anaemia, non-immune hydrops and cardiac insufficiency).



- **Avillous spaces or placental lakes**: they give the placenta a multicystic appearance. These hypoechoic cystic spaces are mainly located within the placental tissue, and they are not associated with any uteroplacental complication. They contain turbulent blood flow.

Clinical management

The first ultrasound scan after the diagnosis should be performed by the specialist in placental pathology within 7-10 days.

1. In those haematomas that involve more than 25% of the placental surface (or more than 4 cm), the risk of developing fetal anaemia is higher, thus a follow-up every 1-2 weeks is recommended.
2. In case of small haematoma (less than 25% of the placental surface or less than 4 cm), follow-up may be every 3-4 weeks.

The following should be evaluated in the transvaginal and abdominal ultrasound examination:

1. Location and size of haematoma
2. Measurement of fetal middle cerebral artery peak systolic velocity given the associated risk of feto-maternal transfusion and fetal anaemia
3. Fetal biometry (estimated fetal weight) because of its association with fetal growth restriction.
4. Cervical length
5. Amount of amniotic fluid (maximum vertical pocket)

If there are no associated complications, termination of pregnancy will be considered after 37 weeks, giving the option of vaginal delivery.

2.2. SUBCHORIONIC HAEMATOMA

Subchorionic haematomas can be classified into three types: preplacental (if located between chorionic plate and chorion frondosum), intraplacental or extraplacental (if located between chorionic plate and parietal decidua).

Incidence

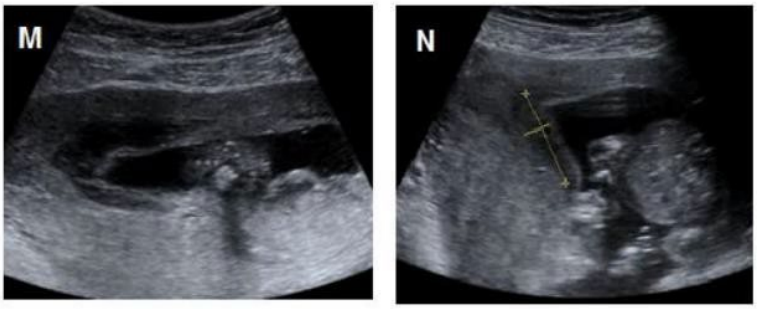
It is the most common placental haematoma (incidence ranges grom 1.3 to 3.1%). It typically occurs within the first 20 weeks of gestation. It is the most frequent cause of first and second trimester bleeding.

Aetiology

Although the exact pathophysiology is still unknown, it is suggested that there is poor placentation resulting in the formation of weak vessels that easily tear. It consists of a low-pressure haemorrhage caused by the tearing of marginal uteroplacental veins (bleeding of maternal origin).

Ultrasound

It is identified sonographically as an anechoic or hypoechoic area between the chorion and uterine wall. It is typically crescent-shaped (Figures M, N).



Clinical findings

Subchorionic haematoma is a common finding during the first trimester in both asymptomatic patients and those presenting with vaginal bleeding. Mostly this bleeding is not associated with pain.

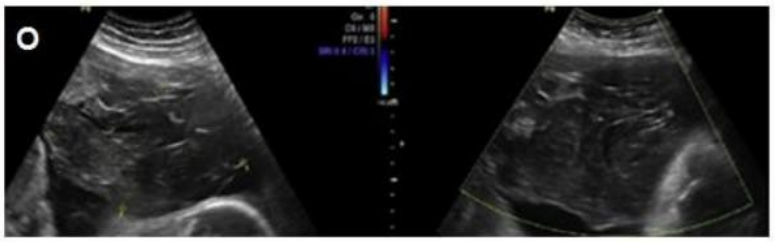
Prognosis

Fetal outcome is dependent on the size of the haematoma, maternal age, and gestational age. The subchorionic haematoma often regresses spontaneously (approximately 70%), especially if it is small in size. Large haematoma removing at least 30-40% of placenta away from the endometrium may increase in size, compressing the gestational sac, with consequent spontaneous abortion. The bleeding does not appear to be related to the risk of miscarriage in the first trimester.

In the second and third trimesters, they are possible causes of preterm labour and premature rupture of membranes (PROM), with greater risk in case of metrorrhagia and a large-sized haematoma (>3-4 cm).

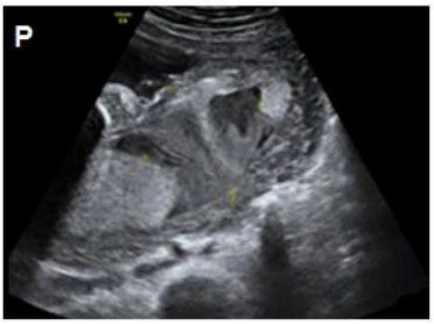
Differential diagnosis

- **Massive subchorionic thrombohematoma (Breus' mole)**: is a very rare condition in which a large amount of blood of maternal origin collects and separates the chorionic plate from the villous chorion (Figure O). The diagnosis is made through ultrasound imaging of the fluid-fluid level without blood flow, which is produced by a sedimentation effect due to sequential bleeding with parts of the clot being solid and others being liquid. This condition is frequently complicated by intrauterine growth restriction (IUGR) and intrauterine fetal death (50% of the cases). The mechanism of IUGR is due to uteroplacental insufficiency. The haematoma can easily compress the umbilical vessels. For this reason, when a massive subchorionic thrombohematoma is diagnosed, strict feto-maternal surveillance is recommended. In case of placental insufficiency, termination of pregnancy should be decided on the basis of gestational age and fetal well- being.



- **Chorioangioma**: the main difference is that subchorionic haematoma is not vascularised.

- **Avillous spaces or placental lakes**: the difference with the placental lakes is that they show a turbulent flow in the ultrasound study (Figure P).



Clinical management

Transvaginal and abdominal ultrasound is the first-line imaging test for the diagnosis, with the aim of detailing the following points:

1. Location and size of the haematoma
2. Measurement of fetal middle cerebral artery peak systolic velocity given the associated risk of feto-maternal transfusion and fetal anaemia
3. Fetal biometry (estimated fetal weight) because of its association with fetal growth restriction.
4. Cervical length (to assess the risk of preterm delivery)
5. Amount of amniotic fluid (maximum vertical pocket) because of its association with premature rupture of membranes

Anti-D immunoglobulin (intramuscular injection of 300 µg or 1500 UI) will be offered to RhD negative patients who presented with significant metrorrhagia, if it has not been administered previously or within the last five weeks.

Depending on the intensity of the bleeding and the gestational age, the patient will be admitted to the hospital. Antenatal corticosteroids for fetal lung maturation and magnesium sulphate for fetal neuroprotection will be considered if there is a risk of imminent preterm delivery (see corresponding guidelines). The use of tocolytics is not contraindicated, but will be assessed on an individual basis.

If there are no associated complications, termination of pregnancy will be considered after 37 weeks, giving the option of vaginal delivery. Outpatient management and periodicity of obstetric controls will be the same as in subamniotic haematomas.

2.3. RETROPLACENTAL HAEMATOMA

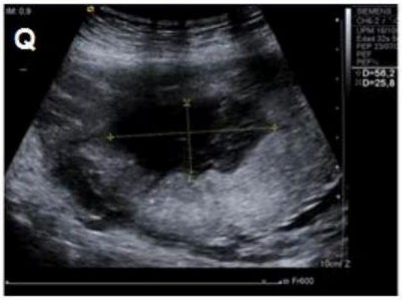
Retroplacental haematoma is the result of bleeding that separates the chorion frondosum from the basal decidua. When the haematoma is located at the placental margin, if it separates the chorion frondosum, it is included in the retroplacental category.

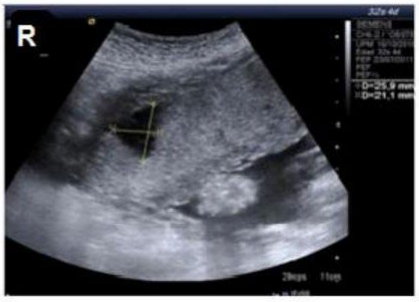
Aetiology

It is a high pressure bleeding, probably secondary to rupture of a decidual spiral artery and haemorrhage into the decidua basalis (maternal origin).

Ultrasound

Sonographically, retroplacental haematoma is usually seen as a biconcave area, well-demarcated, isoechoic, or anechoic with respect to the placenta, located in the posterior region of the placenta, separating it from the myometrium (Figures Q, R). It can be retroplacental or marginal when it detaches one of the margins of the placenta.





If the haemorrhage is large, it may cause localised bulging of the chorionic plate of the placenta. However, if haemorrhage areas are small, they may be only slightly larger than the normal dilated veins in the myometrium and decidua basalis, and may not be appreciated sonographically unless resolution is maximised. For this reason, the sensitivity of ultrasound is relatively low, but the positive predictive value is high. Therefore, ultrasound is considered the test of first choice when a retroplacental haematoma is suspected.

Areas of retroplacental haematoma may remain locally occult or dissect into the placenta causing linear regions of intraplacental haemorrhage and a thickened placenta. There is also the possibility that a massive haemorrhage may dissect into the amniotic cavity, resulting in an amniotic fluid/blood interface and giving the amniotic fluid a “speckled” appearance.

The main complication of retroplacental haematoma is placental abruption (or abruptio placentae), which is a clinical diagnosis. Ultrasound visualisation of the haematoma confirms diagnostic suspicion, but usually the detachment is not visible by ultrasound. Similarly, histological study of the placenta does not always confirm the diagnosis of placental abruption (only in 50% of cases).

Clinical findings

There are retroplacental haematomas that are silent and others that manifest with symptoms of idiopathic preterm labour or painless metrorrhagia. However, the clinical manifestations of retroplacental haematoma are the triad of placental abruption (metrorrhagia, uterine hypertonia and pathological cardiotocography).

3. PLACENTAL ABRUPTION

Placental abruption or abruptio placentae represents the early partial or complete separation of the placenta from the underlying myometrium, which occurs after the 20th week of gestation and before the end of the second stage of labour. The typical pathological injury is the retroplacental haematoma. Placental abruption is a leading cause of maternal morbidity and perinatal mortality (20%).

Incidence

It has a prevalence of 1/100-120 gestations. The majority of placental abruptions occur at term (60%), 25% of cases between 32 and 36 weeks, and only 15% before 32 weeks of pregnancy.

Risk factors

The exact aetiology of placental abruption remains unknown, although several risk factors have been identified:

1. The most predictive risk factor for abruptio placentae is a **history of placental abruption** in a previous gestation, which increases the risk 10 to 15 times. However, 70% of the cases occur in low-risk pregnancies with no history of placental abruption.
2. **Advanced maternal age** (>35 years).
3. **Cigarette smoking** (the higher the consumption, the higher the risk).
4. **Drug use** (such as cocaine due to its vasoconstrictor effect).
5. **Maternal hypertension** and **preeclampsia.**
6. **Maternal thrombophilia:** particularly, Factor V Leiden and prothrombin gene mutation are the most common thrombophilia related to abruption.
7. **Others:** polyhydramnios, multiple pregnancy, uterine malformation, trauma to the abdomen, short umbilical cord, sudden uterine decompression, etc.

Diagnosis

The diagnosis of placental abruption is usually clinical. The clinical hallmarks include metrorrhagia (typically mild and dark vaginal bleeding) accompanied by painful tetanic uterine contractions, uterine hypertonicity, and a nonreassuring fetal heart rate pattern. The absence of vaginal bleeding does not rule out the diagnosis of placenta abruption. A definitive diagnosis can only be made after birth when the placenta is examined.

Ultrasound has a low sensitivity but high specificity for the diagnosis of placental abruption. Ultrasound findings of placental abruption include the detection of haematomas. The low sensitivity is because acute and subacute haematomas can have echogenicity similar to the surrounding placental tissue. Therefore, differentiation of the concealed haemorrhage associated with placental abruption from the adjacent placental tissue is difficult. A thickened or progressive rapid thickening of the placenta on ultrasound may indicate an occult placental abruption.

Prognosis

The prognosis depends on the degree of abruptio, as well as the existence of other associated risk factors (coexistence of preeclampsia, cocaine use, trauma, etc). Placental abruption is associated with increased maternal, fetal, and neonatal morbidity and mortality.

Disseminated intravascular coagulopathy (DIC), uncontrolled blood loss, or risk of hysterectomy are known maternal complications of placental abruption. There is a higher risk of DIC if the detachment exceeds 50% of the placental surface or if the abruptio is associated with fetal death. Fetal complications include intrauterine growth restriction (IUGR), nonreassuring fetal heart rate, and fetal demise. Finally, neonatal complications include neonatal death, preterm delivery, low birth weight and perinatal asphyxia.

Management

Placental abruption is a potentially life-threatening situation and is considered an obstetric emergency. The degree of urgency and overall obstetric management is guided by fetal vitality and maternal status. When the fetus is alive, it may require an immediate termination of pregnancy and in most cases we have to perform an emergency caesarean, unless vaginal delivery is imminent.

At the time of admission, the following points should be taken into consideration:

1. **Anamnesis and physical examination** with abdominal palpation to detect uterine hypertonicity are essential for the patient evaluation.
2. **Cardiotocography** (CTG) is necessary to check fetal well-being.

3. **Complete blood count (CBC)** and **blood coagulation test** are prescribed to rule out the occurrence of DIC.
4. An **ultrasound** will be performed if the fetal and maternal status allows it. It should be kept in mind that a normal ultrasound does not exclude the diagnosis of placental abruption. An estimation of fetal weight can be made (for its association with IUGR), as well as the fetal middle cerebral artery peak systolic velocity (to evaluate fetal repercussions, despite the fact that it is a bleeding of maternal origin).
5. Tocolytics are **contraindicated** as they may mask clinical signs of placental abruption.
6. Avoid anticoagulant treatment.
7. At the moment of diagnosis, a **urine drug test** will be requested.

In relation to the **delivery,** the urgency and route of delivery will depend mainly on the type of placental abruption, which is influenced by the fetal and maternal condition. There can be different clinical scenarios:

- **Ultrasound finding of retroplacental haematoma with no clinical signs of placental abruption** (absence of vaginal bleeding, no uterine hypertonicity and normal CTG trace). In this case, as there is no clinical evidence of placental abruption, there is no indication for immediate termination. Conservative management with weekly monitoring of haematoma and biweekly monitoring of fetal growth is the preferred option.

  If the maternal and fetal situation remains unchanged, the moment of termination of gestation will be individualised according to the haematoma size, clinical picture, and fetal well-being. An elective caesarean section will be indicated. The risk of placental abruption is higher in case of associated preeclampsia, even if the patient is asymptomatic.

- **Haemodynamically unstable patient or pathological pattern of cardiotocography**. Active termination of pregnancy by emergency caesarean section is indicated. The use of tocolytics before the surgery should be avoided, as it increases the risk of postpartum haemorrhage.

- **Intrauterine fetal death.** There is an increased risk of complications such as DIC and severe postpartum haemorrhage. If the pregnant patient is haemodynamically stable, vaginal delivery will generally be chosen. If the patient is haemodynamically stable but with DIC criteria, the route of delivery will depend on cervical dilation. If imminent delivery is expected, a vaginal delivery may again be the best option. However, if the cervix is unfavourable, an emergency caesarean section should be performed, since DIC worsens as long as the origin is not addressed. Finally, an emergency caesarean section is indicated if the pregnant patient is haemodynamically unstable.

The management of postpartum haemorrhage and DIC will be the same as in other situations where these complications occur. In severe placental abruptions, blood may permeate into the myometrium, resulting in a blue-violet ecchymosis. This situation is known as **Couvelaire uterus**, which is diagnosed by the direct visualisation of the uterus. In very rare instances, the bleed can extend into the uterine serous layer and peritoneal cavity. In this setting, uterine atony may respond worse to conventional treatment of postpartum haemorrhage, so these patients may eventually require hysterectomy.

In case of heavy metrorrhagia, anti-D immunoglobulin should be administered to RhD negative patients (intramuscular injection of 300 µg or 1500 UI) if it has not been administered previously or within the last five weeks. After postpartum period, a selective testing for thrombophilia will be requested, due to its association with placental abruption.

	SUBAMNIOTIC	SUBCHORIONIC	RETROPLACENTAL
Incidence	Very rare	The most common	Rare
Origin	Fetal vessels (low pressure)	Maternal (low pressure)	Maternal (high pressure)
Location	Between the amnion and the chorionic plate	-Preplacental: between chorionic plate and chorion frondosum -Intraplacental -Extraplacental: between chorionic plate and parietal decidua	Between the placenta and its adjacent decidua
Clinical features	Asymptomatic	Metrorrhagia	-Asymptomatic -Idiopathic preterm labour -Painless metrorrhagia -Triad of placental abruption
Prognosis	-Good -Fetal anaemia and IUGR	-Preterm labour -PROM	-Preterm labour -Associated to preeclampsia and IUGR -If placental abruption: 20% of fetal death, 1% maternal mortality, DIC.
Follow-up	-After the diagnosis, ultrasound scan in 7-10 days. -If it involves >25% of the placental surface or there is a fetal complication: follow-up every 1-2 weeks. Otherwise, follow-up may be every 3-4 weeks.	-After the diagnosis, ultrasound scan in 7-10 days. -If it involves >25% of the placental surface or there is a fetal complication: follow-up every 1-2 weeks. Otherwise, follow-up may be every 3-4 weeks.	Depending on the size of the haematoma, gestational age and clinical features.
Termination of pregnancy	If there are no associated complications, termination of pregnancy will be after 37 weeks, giving the option of vaginal delivery.	If there are no associated complications, termination of pregnancy will be after 37 weeks, giving the option of vaginal delivery.	-Asymptomatic: if no associated complications, elective caesarean section after 37 weeks. -Haemodynamically unstable patient or pathological pattern of cardiotocography: emergency caesarean section. -Fetal death: ·If haemodynamically stable patient: vaginal delivery. In case of DIC criteria, the route of delivery will depend on cervical dilation. ·If haemodynamically unstable patient: emergency caesarean section.

Table I. Characteristics of different types of placental haematomas.

REFERENCES

1. Ruiter L, Ravelli ACJ, de Graaf IM, et al. Incidence and recurrence rate of placental abruption: a longitudinal linked national cohort study in the Netherlands. Am J Obstet Gynecol 2015;213:573.e1-8.

2. Youwen Mei & Yonghong Lin (2018) Clinical significance of primary symptoms in women with placental abruption, The Journal of Maternal-Fetal & Neonatal Medicine, 31:18,2446-2449, DOI: 10.1080/14767058.2017.1344830.

3. Ananth CV, Lavery JA, Vintzileos AM, et al. Severe placental abruption: clinical definition and associations with maternal complications. Am J Obstet Gynecol 2016;214:272.e1-9.

4. Xiang L, Wei Z, Cao Y (2014) Symptoms of an Intrauterine Hematoma Associated with Pregnancy Complications: A Systematic Review. PLoS ONE 9(11):e111676. doi:10.1371/journal.pone.0111676

5. Deans A., Jauniaux E. Prenatal diagnosis and outcome of subamniotic hematomas. Ultrasound Obstet Gynecol 1998;11:319-323.

6. RCOG. Antepartum haemorrhage. (Green-top Guideline No. 63) .

7. Wanqing Ji, Weidong Li, Shanshan Mei & Ping He (2017) Intrauterine hematomas in the second and third trimesters associated with adverse pregnancy outcomes: a retrospective study, The Journal of Maternal-Fetal & Neonatal Medicine, 30:18, 2151-2155, DOI: 10.1080/14767058.2016.1241762.

8. El-Agwany, AS. Large subchorionic Hematoma: Breu's Mole. Journal of Medical Ultrasound (2017) 25, 248e250

9. Qiu Y, Wu L, Xiao Y, Zhang X. Clinical analysis and classification of placental abruption. J Matern Neonatal Med 2021; 34 {18}: 2952-6.

10. Brăila AD, Gluhovschi A, Neacşu A, Lungulescu CV, Brăila M, Vîrcan EL, et al. Placental abruption: Etiopathogenic aspects, diagnostic and therapeutic implications. Rom J Morphol Embryol. 2018;59(1):187–95

11. Lee YJ, Calvert K, Jape K. Couvelaire uterus resulting in haemoperitoneum. J Surg Case Reports. 2022;2022(1):1–3.

12. Fadl SA, Linnau KF, Dighe MK. Placental abruption and hemorrhage—review of imaging appearance. Emerg Radiol. 2019;26(1):87–97.

13. Ott J, Pecnik P, Promberger R, Pils S, Binder J, Chalubinski KM. Intra-versus retroplacental hematomas: A retrospective case-control study on pregnancy outcomes. BMC Pregnancy Childbirth. 2017;17(1):1–8.

14. Owada M, Shibata Y, Suzuki S. Case Series of Intrauterine Subamniotic Hemorrhage. Case Rep Obstet Gynecol. 2019

15. Van Den Bosch T, Van Schoubroeck D, Cornelis A, Dubin M. Prenatal diagnosis of a subamniotic hematoma. Fetal Diagn Ther. 2000;15(1):32–5

16. Khan RI, Taimoor A, Nazir A, Zaman U, Azmat S, Nawaz F. Association Of Subchorionic Hematoma With Preterm Labour In Patients With Threatened Abortion. J Ayub Med Coll Abbottabad. 2021;33(3):451–5

17. Khan RI, Taimoor A, Nazir A, Zaman U, Azmat S, Nawaz F. Association Of Subchorionic Hematoma With Preterm Labour In Patients With Threatened Abortion. J Ayub Med Coll Abbottabad. 2021;33(3):451–5.

18. Hashem A, Sarsam SD. The Impact of Incidental Ultrasound Finding of Subchorionic and Retroplacental Hematoma in Early Pregnancy. J Obstet Gynecol India 2019;69(1):43–9.

19. Yanagisawa F, Aoki S, Odagami M, Miyagi E. Massive subchorionic hematoma (Breus' mole) presents a variety of ultrasonic appearances: A case report and literature review. Clin Case Reports. 2019;7(4):744–8.

20. Yamada T, Atsuki Y, Wakasaya A, Kobayashi M, Hirano Y, Ohwada M. Characteristics of patients with subchorionic hematomas in the second trimester. J Obstet Gynaecol Res. 2012;38(1):180–4.

21. Heller HT, Asch EA, Durfee SM, Goldenson RP, Peters HE, Ginsburg ES, et al. Subchorionic hematoma: Correlation of grading techniques with first-trimester pregnancy outcome. J Ultrasound Med. 2018;37(7):1725–32.