



## Interstitial pregnancies and literature review

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### Abstract :

### Introduction :

Interstitial pregnancy develops at the intra myometrial origin of the tube, the hemorrhagic rupture of interstitial pregnancies appears to be more sudden and associated with a higher mortality than tubal forms. However, thanks to ultrasound, the diagnosis is most often made before the rupture stage. The classic treatment of interstitial pregnancies was cornulectomy by laparotomy and some cases may have required hysterectomy.

### Objective:

To present our experience with the surgical management of interstitial pregnancies (IP) and to evaluate the subsequent fertility of our patients in the long term.

### Patients and method

Twenty patients were operated in our department for interstitial pregnancy over a period of 15 years. In this retrospective work we present: the symptomatology that led to the diagnosis, the treatments performed, the fertility and the subsequent obstetrical outcome.

### Results

The mean gestational age at diagnosis was 8 weeks' gestation, the median Bhcg level was 7411 IU/L, and the mean age of the patients was 30 years. 90% of the patients had at least one risk factor for ectopic pregnancy. Pain or metrorrhagia were the most frequent symptoms on admission; 4 patients were admitted in hypovolemic shock. The interstitial location of this ectopic pregnancy was discovered intraoperatively in 45% of cases. Six patients had a large hemoperitoneum greater than 1 L, 5 patients had GI on uterine stump after salpingectomy for EP. The surgical technique used most often was 60% excision by

Endo GIA® stapling with antegrade salpingectomy. Concerning fertility, 12 patients wished to become pregnant after the operation, 10 had at least 1 pregnancy, among them 1 contralateral ampullary ectopic pregnancy, and 1 contralateral interstitial pregnancy recurrence. Four patients delivered by caesarean section and 4 patients delivered vaginally, some of them several times. No uterine rupture was recorded.

## **Conclusion**

Interstitial pregnancy is a rare ectopic pregnancy, difficult to diagnose, which can be life-threatening and can affect maternal fertility. During subsequent pregnancies, the clinician should be aware of the risks of recurrence of interstitial pregnancy and uterine rupture.

**Key words** : Interstitial pregnancy -Lioscopy

### **I. Introduction:**

Interstitial pregnancy develops at the intra myometrial origin of the tube, the hemorrhagic rupture of interstitial pregnancies appears to be more sudden and associated with a higher mortality than tubal forms. However, thanks to ultrasound, the diagnosis is most often made before the rupture stage. The classic treatment for interstitial pregnancies was cornulectomy by laparotomy and some cases may have required hysterectomy. Laparoscopic treatment consisting of coronal resection or salpingotomy has been reported by several teams. Interstitial location is associated with an increased risk of bleeding. Several technical devices have been used to minimize this risk, including the placement of one or more endoscopic lassos at the level of the uterine horn or the use of a preventive circular suture. Given the surgical risks, some authors have implemented medical treatment with methotrexate.

### **Definitions:**

Interstitial, angular, and cornual EPs are often grouped together and represent the same clinical and therapeutic entity. Strictly speaking, interstitial ectopic pregnancy develops in the intramural portion of the tube. This is a canal 0.7 mm wide and about 1 to 2 cm long, whose muscular wall allows for relatively late development (7 to 16 SA). The sac is placed next to the round ligament. [1-6-7] Angular EP develops at the tubal ostium at the bottom of the uterine horn. Unlike interstitial pregnancy, it is located in the axis of the round ligament. The risk of rupture here is rarer as it is an implantation in the endometrial cavity. [1-8].

An EP implanted in the rudimentary horn of a bicornuate uterus is defined as horn-shaped. By extension this definition applies to pregnancies implanted in the horn of a septate uterus. Some also group under this definition the development of trophoblastic tissue on the remaining stump of a tube that has been treated by salpingotomy. [1-8]

### **Epidemiology:**

#### **Prevalence:**

The prevalence of interstitial pregnancies is estimated to be between 2 and 4% of total ectopic pregnancies. Its incidence is 1/2500 to 1/5000 pregnancies. [6] Risk factors:

The risk factors associated with interstitial pregnancy are similar to those associated with ectopic pregnancy located in other tubal segments. In a series of 32 interstitial pregnancies, the most common risk factors were tubal damage from a previous ectopic pregnancy (40.6%), salpingectomy homolateral to the current interstitial EP or a history of bilateral salpingectomy (37.5%), conception after in vitro fertilization (34.4%), and history of a sexually transmitted disease (25.0%). Another series of 27 patients with interstitial pregnancy found that 54% had a history of salpingectomy or tubal ligation, 54% had a previous ectopic pregnancy, 29.7% had in vitro fertilization, and only 12.5% had a history of sexually transmitted disease. Indeed, no risk factor was specifically associated with interstitial pregnancy without being associated with ampullary or isthmic ectopic pregnancy. [6]

### **Mortality:**

It is in the range of 2-5%, far higher than the mortality rate secondary to another form of ectopic pregnancy. [6-11-12]

### **Pathophysiology**

Interstitial pregnancy is an ectopic pregnancy implanted in the interstitial part of the uterine tube, defined as a tubal segment crossing the muscular wall of the uterus. This segment begins at the tubal ostium; follows a tortuous path obliquely upward and laterally away from the uterine cavity to the point of birth of the isthmic portion at the uterine fundus. Averaging 0.7 millimeters in diameter and 1-2 centimeters in length, this relatively thick section of the tube is thought to have a significantly greater capacity for distension than the other tube segments. For this reason, interstitial pregnancy can remain asymptomatic until 7-16 days after conception, in rare cases, rupture can then cause cataclysmic haemorrhage, especially as the vascularisation is very rich in this region due to the multiple anastomoses between the branches of the uterine and ovarian arteries. [1-6-11]

### **Clinical study :**

An early diagnosis is a capital asset in the management of patients with interstitial pregnancy. Indeed a diagnosis before the myometrial rupture, makes conservative treatment possible and minimizes the morbidity and mortality rates associated with interstitial pregnancy and surgery. [1-6]

Early diagnosis has become possible with advances in ultrasound; ultrasensitive B HCG assays. Interstitial pregnancy is diagnosed at a gestational term of 6.9-8.2 SA. [6-9] Contrary to what has long been accepted, the rupture of an interstitial pregnancy as a mode of revelation does not occur later than in classic EP. The symptoms most frequently found in interstitial pregnancy are abdominal pain and metrorrhagia in the first trimester of pregnancy. [1-6].

Although Felmus and Pedowitz [13] reported in 1953 that 71% of patients presented with shock at diagnosis, Soriano et al [10] reported in 2007 in 27 patients; only 22.2% presented with ruptured interstitial pregnancy and hemorrhagic shock, while 48% presented with abdominal pain, 29% presented with vaginal bleeding, and 33.3% were asymptomatic at diagnosis. Vaginal bleeding appears to be less common in interstitial pregnancy than in other forms of ectopic pregnancy.

On physical examination, a painful adnexal mass; painful uterine mobilization; asymmetric spreading of the uterine fundus; acute abdomen with signs of hemorrhagic shock in cases of a cornu rupture may be objectified. [1-6]

### **Complementary examination:**

#### **Endovaginal ultrasound**

Endovaginal ultrasound is a mainstay in the diagnosis of interstitial EPs, as the majority of interstitial pregnancies are often discovered in asymptomatic patients during the first trimester ultrasound.

However, interstitial pregnancy can be difficult to differentiate from angular pregnancy. Four sonographic signs appear to be quite specific for the diagnosis of interstitial pregnancy [14] :

- The gestational sac is eccentric to the uterine sagittal axis. cardiac activity is found in 18% of cases, an embryo without cardiac activity in 28% of cases, an empty sac in 36% of cases, or a solid tumor in 18% of cases. The sac is surrounded by a "ring of fire" on Doppler, indicating trophoblastic vascular flow;

- The absence of a decidua around the interstitial EP explains the absence of the double decidual sac sign found in the case of intrauterine pregnancies;

- Interstitial EP is entirely bordered by a myometrial sheet of less than 5 mm;

- The ultrasound sign of the interstitial line is the interstitial part of the tube that joins the endometrium to the trophoblast. This sign appears to be the most specific and the most sensitive of the ultrasound signs. Its observation, when diagnosing the location of a pregnancy, makes it possible to differentiate an interstitial EP from an angular pregnancy and from a UTI. It is found in almost 92% of interstitial EPs. Classically, the distance between the edge of the uterine cavity (visible endometrium) and the trophoblast (external part of the egg on ultrasound) is at least 10 mm.

Three-dimensional ultrasound may offer more information than conventional two-dimensional ultrasound in cases of interstitial EP. 3D ultrasonography has yet to be evaluated in this indication, it could allow more precise visualization of the trophoblastic corona (3D power Doppler) and distinguish a tubal location from an interstitial EP (thin hypoechoic peritubal border). [11-14-40]

#### **BHCG**

Classically, the initial HCG level is often higher compared to tubal EP. This would be explained by the greater ease of the horn to undergo pregnancy-related development. Thus, compared to a classic tubal EP, the interactions between the egg and its implantation bed would be of better quality, improving the kinetics of HCG. For the same reason, it is not uncommon to observe cardiac activity within these interstitial EPs. [1]

#### **MRI**

MRI makes it possible to specify the location of the pregnancy in difficult cases where several ultrasound images may suggest a gestational sac. It allows the genital organs to be perfectly differentiated from possible lesions of other pelvic organs (notably the

peritoneum).The MRI criteria allowing the diagnosis of an interstitial pregnancy have not been well described. It seems difficult to identify sufficiently validated relevant criteria. However, images comparable to those of ultrasound can be found. [14]

-The pregnancy is eccentric with respect to the sagittal axis of the uterus. The gestational sac classically has a cystic appearance in T1 hypo signal, T2 hyper signal, surrounded by a ring in T2 hypo signal. As on ultrasound, the appearance is variable depending on the proportion of haemorrhagic areas (heterogeneous area in T2 hypo signal)

-There is a mantle of myometrium surrounding the entire interstitial EP.

-The interstitial line can also be identified: a solution of continuity between the endometrium and the trophoblast seems to be an additional argument for the diagnosis.

-MRI, because of its cost and accessibility, should be reserved for difficult diagnoses, while ultrasound remains the first line imaging examination in the diagnosis of interstitial pregnancy.

### **Intraoperative diagnosis**

Many interstitial pregnancies are not diagnosed before surgical exploration, either because ultrasound was not performed in the first trimester or because the pregnancy was confused with other types of ectopic pregnancy. In one series, only 23 of the 32 patients (71%) with an interstitial pregnancy were diagnosed before surgery. In another series, 56% of the interstitial pregnancies were diagnosed preoperatively. During laparoscopy or laparotomy, the unruptured interstitial pregnancy will appear as an asymmetric bulge in the cornu region. [6]

### **Differential diagnosis:**

#### **- Angular EP:**

Angular pregnancies are very rare: 1/1000 to 15/1000 of ectopic pregnancies; 1/10000 to 1/100000 pregnancies. The angular pregnancy is a graft of the embryo in the uterine horn outside the tube, it implants opposite the angle of the uterine cavity, at the height of the tubal ostium, in the axis of the round ligament. Histologically, the placental villi are inserted into the wall of a uterine horn, the interstitial portion of the tube is free. The risk of rupture is rarer but not absent in this case, as it is an implantation in the endometrial cavity.

An angular pregnancy is a viable intrauterine pregnancy that is implanted in one of the lateral angles of the uterine cavity, medial to the utero-tubal junction. Angular pregnancies induce an asymmetric and painful enlargement of the uterus. Spontaneous abortion is observed in 38.5% of cases. Persistent pelvic pain, recurrent vaginal bleeding during pregnancy, placental retention during delivery, and rarely uterine rupture are among the potential complications of angular pregnancy. But in a number of cases, the pregnancy is continued normally. During laparoscopy, angular pregnancy appears as an asymmetric bulge in one of the uterine angles, medial to the round ligament and shifting its reflection laterally. [8]

#### **- Cornual pregnancy:**

The occurrence of pregnancy in a rudimentary uterine horn is a rare situation with an estimated incidence of 1/100,000 to 1/140,000. The incidence of unicornuate uteri is

estimated to be one per 1000 women and represents 10% of uterine malformations. The occurrence of pregnancy in this rudimentary horn is thought to result from intraperitoneal migration of sperm or fertilized oocyte. When this malformation is unrecognized, the localization of the pregnancy is difficult in antenatal care. It is important to emphasize the importance of the first obstetrical ultrasound, one of the goals of which is to diagnose an intrauterine pregnancy and to verify the absence of uterine malformation.

The vast majority of these pregnancies (90%) evolve towards rupture of the rudimentary horn, most often in the second trimester of pregnancy, with a picture of peritoneal flooding and a low fetal rescue rate of around 2%. Rarely, the extensibility of the rudimentary horn allows the term to be approached and a live child to be extracted. Exceptionally, the rupture may be asymptomatic (about 2% of cases) with intra-abdominal development of the pregnancy. In the remaining cases (about 10%) the rudimentary horn remains intact and the pregnancy is interrupted and it is in the face of a failed aspiration that the diagnosis of the malformation is made.

The rupture of the rudimentary horn is accompanied by intense abdominal pain of sudden onset, associated or not with the presence of a hemoperitoneum or even maternal shock requiring emergency laparotomy. This situation is burdened with a maternal mortality estimated at 0.5%. [15]

- Non-interstitial tubal EP

- Other etiologies of shock and hemoperitoneum in a pregnant woman:

The occurrence of spontaneous hemoperitoneum in the second or third trimester of pregnancy is a rare situation, the origin of which is most often only revealed during surgical exploration. Among the obstetrical causes, uterine rupture and "atypical" ectopic pregnancies of late revelation should be mentioned: abdominal pregnancy, angular pregnancy, pregnancy in a rudimentary uterine horn. It can also be arterial vascular ruptures (aneurysms of the splenic artery, renal artery, ovarian artery, uterine artery) or venous ruptures (splenic vein, utero-ovarian venous network...). Cases of aortic dissection, occurring preferentially in the third trimester of pregnancy, have also been reported, particularly in cases of Turner's syndrome or genetic connective tissue disease (Marfan's syndrome, Ehlers-Danlos syndrome, etc.). Finally, rare cases of spontaneous rupture of the liver or spleen have been reported, most often in the context of severe pre-eclampsia. [15]

#### **Treatment:**

The choice of treatment depends on the gestational age at the time of diagnosis; whether or not a coronal rupture has occurred; and the patient's desire for subsequent conception.

If the diagnosis is made before rupture, minimally invasive surgery or medical treatment may be employed. A ruptured interstitial pregnancy is a medical emergency that requires surgical intervention. The choice between laparoscopy or laparotomy, depends on the hemodynamic status of the patient and the surgical habits of the medical staff caring for this patient.

## **1- Abstinence:**

Spontaneous abortion is a common occurrence in both intrauterine and ectopic pregnancies. Abstinence in distal tubal ectopic pregnancy has proven to be an acceptable approach in the presence of a spontaneously decreasing B HCG level in an asymptomatic patient.

The potential risks of abstinence in the face of interstitial EP are potential catastrophic coronal rupture, associated maternal morbidity and mortality, unpredictable resolution (even with decreasing B hCG levels), and the need for prolonged hospitalization. Other potential disadvantages include the risk of recurrence of the interstitial pregnancy, due to the persistence of tubal factors favoring ectopic implantation of the gestational sac, and the risk of uterine rupture during the subsequent pregnancy. Downey and Tuck reported uterine rupture at 24 weeks of amenorrhea after spontaneous resolution of an interstitial pregnancy.

Some series [16-17-18-19-20] described abstinence as an interesting therapeutic option in interstitial EP, however; this attitude is far from being consensual. In fact, these studies that put forward the success of abstinence do not carry much weight in view of the potential risk of jeopardizing the vital prognosis, nor in view of the disadvantages mentioned above, and above all in view of the conservative therapeutic arsenal for interstitial pregnancies.

## **2- Medical treatment**

In view of the surgical risks, some authors have implemented a medical treatment based on methotrexate. As early as 1982, Tanaka [21] reported a case. The author successfully used methotrexate IM 30 mg and then 15 mg on two successive occasions, 48 hours apart. Since then, many observations have been reported with quite varied doses and injection methods [4]. Most often, the dose used is 1 mg/kg/d every 48 hours until D7 [22]. Any treatment not involving surgery, whether conventional or laparoscopic, is considered successful.

While a single injection of methotrexate has become the standard for classical tubal EPs, it seems that for interstitial EPs repeated doses are more interesting. [23-24] Indeed, in the case of systemic injection, a number of failures have been reported. [1-6-22] The use of scores such as that proposed by Fernandez or Stovall is difficult to extrapolate to interstitial EPs.

It seems that hCG initially decreases fairly rapidly but that total negativation is often long, possibly exceeding 8 weeks after the initial injection [21-22-41]. [21-22-41] With regard to the ultrasound appearance, the disappearance of the sac is often very long. The diameter slowly decreases over several weeks to months. Monitoring the appearance of the corneal vascularization with color Doppler seems interesting. On the other hand, in case of growth of the sac under treatment; an imminent rupture is to be feared. Injection of methotrexate under laparoscopic or hysteroscopic ultrasound control has also been proposed. In a review of the literature, Lau [4] found 86% success with this method compared with 80% with the use of systemic MTX.

In local use, some authors describe the use of KCl, which seems especially interesting in cases of heterotopic pregnancy, thus avoiding the potentially teratogenic risk of MTX [25]. [25]

Actinomycin D has been used. After failure of a treatment with MTX IM, Chen proposes the use of etoposide locally under ultrasound control. This is an anti-mitotic molecule used in oncology for certain hematological diseases. [26]

In 1998, Fisch attempted to define criteria that would make it possible to avoid rupture of the EP under medical treatment, and to predict therapeutic success. A myometrial thickness around the EP of 5 mm would seem to rule out the risk of imminent rupture and thus allow medical treatment.

All in all, apart from a context of rupture, it is legitimate to propose medical treatment to patients. There is no consensus regarding the limit of hCG levels or the presence of cardiac activity. Local treatment appears to have better results than systemic MTX in interstitial pregnancy. If sac growth occurs on MTX, surgical treatment is required. [1-42]

### **3- Arterial embolization:**

Recent therapeutic advances have made it possible to propose selective embolization as an effective treatment for interstitial pregnancies without resorting to surgical intervention. It may allow the preservation of subsequent fertility. In addition, it could limit the risk of bleeding in case of secondary surgery. However, the number of cases is still too limited to make it a reference technique. Uterine artery embolization is a technique widely used in obstetrics and gynecology, particularly in cases of hemorrhage or as a treatment for uterine fibroids. Pregnancy after embolization is possible, but the data are limited and do not allow conclusions to be drawn concerning the conditions under which such pregnancies occur. Nevertheless, there seems to be a greater risk of dystocic presentation, intrauterine growth retardation, premature delivery, caesarean section or haemorrhage of the delivery. [27]

### **4- Contribution of hysteroscopy:**

In 1989, Meyer [28] treated an interstitial EP by hysteroscopy under laparoscopic control by performing a resection of the EP. Goldenberg [29], in 1992, injected MTX by hysteroscopy. Sanz [30], in 2002, described an interstitial pregnancy treated with MTX IM. Monitoring of hCG showed satisfactory regression. After an unspecified period of time, which was considered too long, the ultrasound image persisted. Under ultrasound and hysteroscopic control, the egg was then removed using a biopsy forceps. However, this technique appears to be marginal in the literature and hysteroscopy does not appear to be a method that can currently be used for the treatment of interstitial EPs. [1]

### **5- Surgical treatment**

In the presence of an acute abdominal syndrome, haemodynamic instability, or haemoperitoneum, it is essential to envisage immediate surgical treatment. Surgery is also indicated in situations where a blood supply cannot be guaranteed; necessary in cases of catastrophic rupture and/or massive blood loss. Surgical treatment is also the therapeutic option of choice in cases of heterotopic pregnancy; recurrent interstitial pregnancy; failure or refusal by the patient of medical treatment.

Early diagnosis is a major asset in the management of patients with an interstitial pregnancy. Indeed, diagnosis before myometrial rupture makes conservative treatment possible and



minimizes the morbidity and mortality rates associated with interstitial pregnancy and surgery.

According to X. Douysset et al [38-43] the surgical technique most often used was 60% excision by Endo GIA® stapling with antegrade salpingectomy.

#### **Transcervical curettage:**

It is performed under double ultrasound control (endorectal ultrasound) and laparoscopy. Few series have studied this technique, and it seems that its indications and its choice in the treatment of interstitial pregnancies is far from being consensual. [6]

#### **Laparotomy versus laparoscopy:**

Traditionally, treatment of interstitial pregnancy has consisted of salpingectomy combined with cornuate resection by laparotomy. Hysterectomy, which has been used in some particularly dramatic cases, should be avoided. Currently, thanks to the progress in laparoscopic equipment and the improvement in the experience of the medical teams, laparoscopic treatment of unruptured and even ruptured interstitial pregnancies is becoming more adopted [1-6-10-12-39]. However, laparotomy remains the preferred approach in case of lack of laparoscopic experience of the medical staff or in the case of a patient with very unstable haemodynamic parameters. [6]

Laparoscopy offers several advantages over laparotomy including a shorter hospital stay, a quicker return to normal activities and a lower health care cost. Different laparoscopic techniques have been described in recent years.

#### **Cornual salpingotomy**

Cornual salpingotomy is a variety of Cornuotomy in which the incision is made at the insertion point of the tube at the uterine fundus, extraction of the gestational sac is possible through this defect. This approach can be used when the interstitial pregnancy is discovered at an early gestational age. However, visualization of the implantation site is limited with the use of this technique. The use of prophylactic single-dose methotrexate by intramuscular injection just after laparoscopic salpingotomy for tubal ectopic pregnancies significantly reduces the risk of trophoblastic persistence. Although a similar benefit cannot be demonstrated in the literature in cases of interstitial pregnancy, the use of methotrexate seems to be a reasonable option whether it is preventive or in cases where the BHCG level remains plateaued or rises after conservative surgical techniques. [1-6-11-12 ,38]

#### **Laparoscopic coronal resection.**

Several laparoscopic surgical approaches have been presented recently for the treatment of interstitial pregnancy. The most commonly described approach remains cornual resection or excision. This procedure is simply a laparoscopic version of the traditional coronal resection performed by laparotomy.

The interstitial pregnancy and surrounding uterine horn are excised en bloc through a circular incision followed by suture closure of the myometrium. This approach appears to be particularly useful for pregnancies larger than 4 centimeters in diameter. [6]

Most surgeons begin by injecting dilute vasopressin solution around the gestational sac into the myometrium below and lateral to the pregnancy. The coronal resection can then be performed with the scalpel, scissors, or with electrosurgery (mono polar; ultracisor or liguasur). An automatic stapler has also been used successfully for laparoscopic excision of a ruptured interstitial pregnancy with simultaneous closure of the excision site. Next; the tube and mesosalpinx adjacent to the pregnancy are cut transversely by electrosurgery or conventional mechanical dissection. Finally, hemostasis is achieved by electrocoagulation followed by closure by suturing the myometrial defect with extra or intracorporeal knots.

**Triangular coronal resection by laparotomy:**

Traditionally, triangular cornual resection by laparotomy was the standard treatment in the face of interstitial pregnancy. It involves en bloc excision of all involved tissues, which implies resection of the interstitial pregnancy and all surrounding myometrium. Although blood loss is minimal when performing this technique, the invasive nature of the laparotomy remains a concern. However, triangular coronal resection remains an appropriate surgical option for interstitial pregnancy when the medical team does not have adequate laparoscopic expertise.

**Cornual mini-excision:**

Two cases described by Moawad et al [32] in which the interstitial pregnancy was evacuated; through a defect designed by an elliptical incision at the axis of the interstitial pregnancy opposite the thinnest region of the myometrial mantle. The base of the interstitial pregnancy was left intact and judiciously coagulated. No suturing was required unless the myometrial cavity secondary to the evacuation of the interstitial pregnancy was large, in which case suture closure was required to minimize the risk of uterine rupture in subsequent pregnancies. This approach preserves the architecture and vascularity of the uterus; leaving the base intact.

**Hysterectomy:**

Although it used to be the standard treatment for more than 50% of interstitial EPs, its indication should be restricted due to the high morbidity and permanent infertility it causes. Hysterectomy is recommended in women with uncontrollable hemorrhage or with a large interstitial EP, or in patients who no longer wish to have children or in whom there is another uterine pathology requiring hysterectomy. [6]

**Treatment risks:**

**Intraoperative blood loss:**

The importance of blood loss remains the main risk in the treatment of interstitial pregnancies, whatever the surgical technique used. Indeed, interstitial pregnancies are highly vascularized and their diagnosis is often made after the occurrence of the corneal rupture. For all these reasons, a blood reserve with cross match is a necessary and

mandatory measure in front of any suspicion of interstitial pregnancy. Blood loss may be excessive after coronal rupture or intraoperatively. Several methods have been described in order to minimize this blood spoliation such as

injection of dilute vasopressin into the myometrium surrounding the interstitial pregnancy. The dose of vasopressin used is 10 IU diluted in 10-100 cc of saline. Angina pectoris, myocardial ischemia, and myocardial infarction have been reported with doses of 20 IU of vasopressin. [6]

the creation of a bursa encircling the uterine horn concerned, with the two ends of the wire stretched to create a stricture, limiting the cornuate vascularization. The use of endoscopic lassos to enclose the base of the interstitial pregnancy achieves a mechanism similar to that of the bursa to limit intraoperative blood loss. [35-36]

ligation of the ascending branch of the uterine artery either by simple suture or by electrocoagulation or by prior arterial embolisation.

use of electrocoagulation to complete imperfect haemostasis

suturing the myometrial incision with intra and extracorporeal stitches after evacuation of the interstitial pregnancy.

According to X. Douysset and AL [38] six patients had a large haemoperitoneum greater than 1 L, and 5 patients presented a GI on the uterine stump after salpingectomy for EP.

#### **Risk of trophoblastic persistence:**

This risk is higher in patients who have had conservative treatment (cornuotomy; coronal salpingotomy or coronal mini-excision). These patients should be monitored postoperatively and should have BHCG kinetics.

#### **Recurrence of interstitial pregnancy:**

The incidence of recurrence is unknown. The probability of recurrence is greater in patients who have not had radical treatment because of the persistence of local risk factors that favored the occurrence of the first interstitial pregnancy. [6]

#### **Prognosis of subsequent pregnancy:**

Given that these techniques are only described for isolated cases, no data is available on the solidity of the horn scar during a subsequent intrauterine pregnancy. However, the operated uterine horn appears to be a fragile zone. Weissman [37] and X.Douysset [38] described a second trimester rupture after conservative surgery.

Most authors recommend a caesarean section before any onset of labour in a subsequent pregnancy. A few isolated observations of intra-uterine pregnancy after interstitial EP have been reported. Moon [35], who sutures the horn scar with a bursa or an Endoloop<sup>®</sup>, caesareanised before the start of labour in the 8 patients who subsequently developed a normal pregnancy. During these caesarean sections, some adhesions were observed at the level of the uterine scar, but none of the patients presented any worrying defect of the myometrium at this point.

Fertility according to X. Douysset and AL [38]: 12 patients wanted a pregnancy after the operation, 10 had at least 1 pregnancy, among them 1 contralateral ampullary ectopic pregnancy, and 1 recurrence of contralateral interstitial pregnancy. Four patients delivered by caesarean section and 4 patients delivered vaginally, some of them several times. No uterine rupture was recorded.

### **Conclusion:**

Early diagnosis is a major asset in the management of patients with interstitial pregnancy; this has become possible thanks to the progress of ultrasound; ultrasensitive B HCG assays. Treatment involves several techniques with different approaches, with laparoscopy taking pride of place.

### **Conflicts of Interest:**

The authors declare no conflicts of interest.

### **Author Contributions:**

All authors also declare that they have read and approved the final version of the manuscript.

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