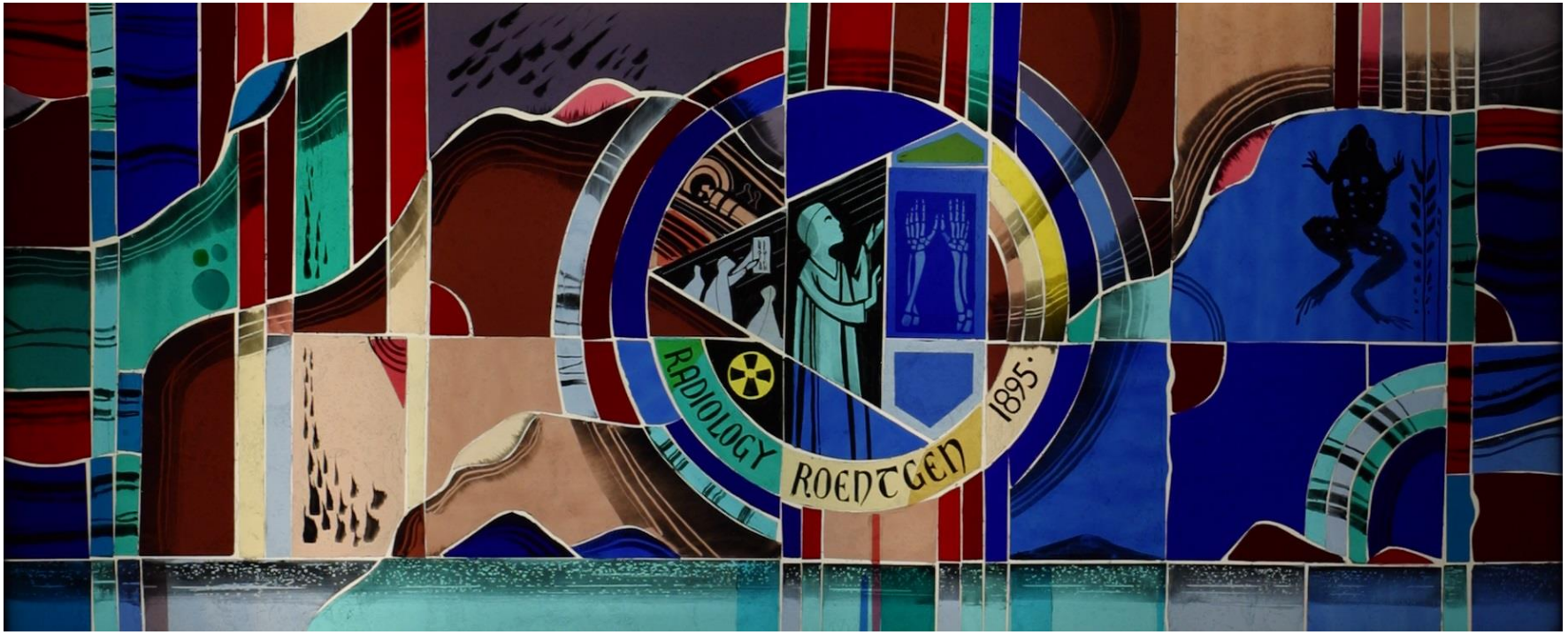
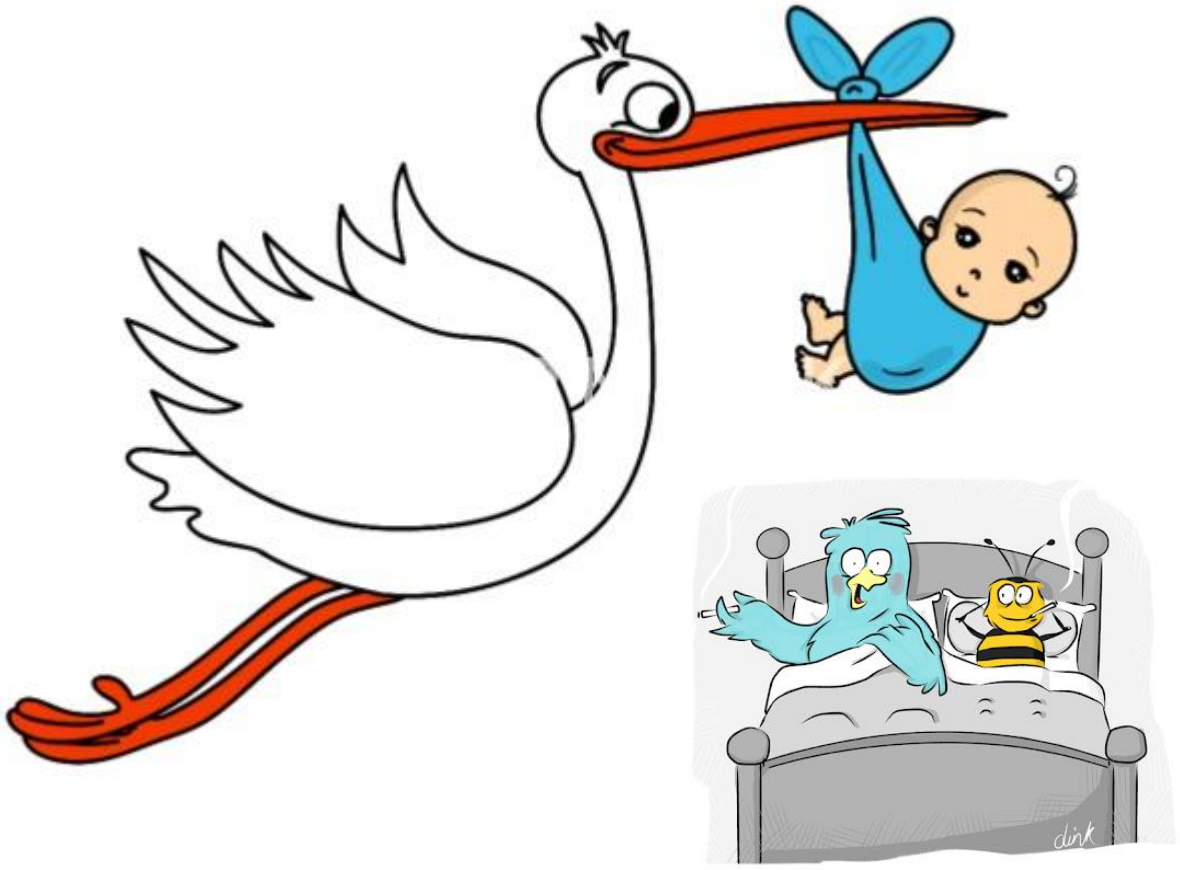


Tony Geoghegan
MB (Hons) MSc (Hons) MRCOG MRCPI FFRRCSI FCIRSE EDIUR EBIR
Interventional Radiology & GI-GU Imaging
The Mater University Hospital, Dublin

UCD & BMUS Lecture 19.10.2024

THE IRISH SOCIETY OF INTERVENTIONAL RADIOLOGY



"I always thought that was just a figure of speech."

THE IRISH SOCIETY OF INTERVENTIONAL RADIOLOGY

Saving Lives, Improving Mothers' Care

Lessons learned to inform maternity care from the UK and Ireland Confidential Enquiries into Maternal Deaths and Morbidity 2020-22

Compiled report including supplementary material

Key messages
from the report 2024

MBRRACE-UK
Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK

275 women died during pregnancy or up to six weeks after pregnancy in 2020-2022

13.56 women per 100,000 died during pregnancy or up to six weeks after pregnancy

Causes of women's deaths

The **national risk assessment tool** must be evidence-based, clear and accurate

Consider the effects of vomiting, dehydration, immobility and other **symptoms** that can increase risk

Risk happens early - define pathways so women who need medication to prevent blood clots can access it when they need it, including in the first trimester

Blood clots 16%

COVID-19 **14%**

Cardiac disease **13%**

Mental health conditions **11%**

Sepsis **9%**

Epilepsy and stroke **9%**

Other physical conditions **7%**

Obstetric bleeding **7%**

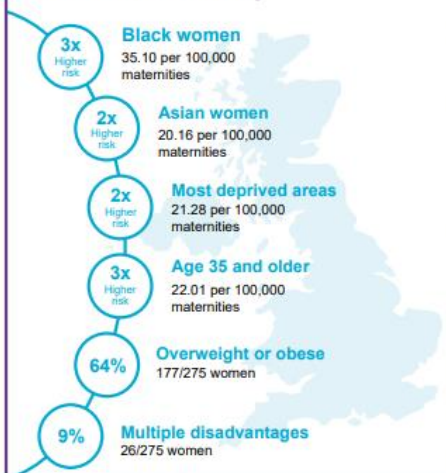
Early pregnancy disorders **5%**

Other direct causes **4%**

Cancer **3%**

Pre-eclampsia **3%**

Inequalities in maternal mortality



3x Higher risk — **Black women**
35.10 per 100,000 maternities

2x Higher risk — **Asian women**
20.16 per 100,000 maternities

2x Higher risk — **Most deprived areas**
21.28 per 100,000 maternities

3x Higher risk — **Age 35 and older**
22.01 per 100,000 maternities

64% — **Overweight or obese**
177/275 women

9% — **Multiple disadvantages**
26/275 women

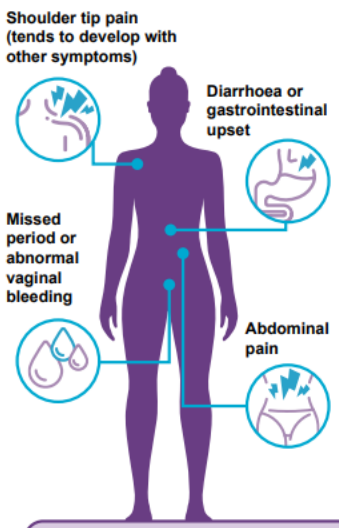
Key messages

for the care of women with ectopic pregnancies

MBRRACE-UK
Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK

'Think ectopic'

Be aware of the common symptoms of ectopic pregnancy:



Pre-hospital care

999 calls

Review risk categorisation for women who are pregnant, recently pregnant or who have the potential to be pregnant

Escalate repeat calls or calls made by minors

Ambulance

Urgently transfer reproductive age women in a state of shock or collapse to the emergency department

Resuscitation

Consider pregnancy and the reversible causes of maternal collapse including concealed bleeding

Consider a diagnosis of ectopic pregnancy and do a pregnancy test

Early Pregnancy Assessment Units (EPAUs)

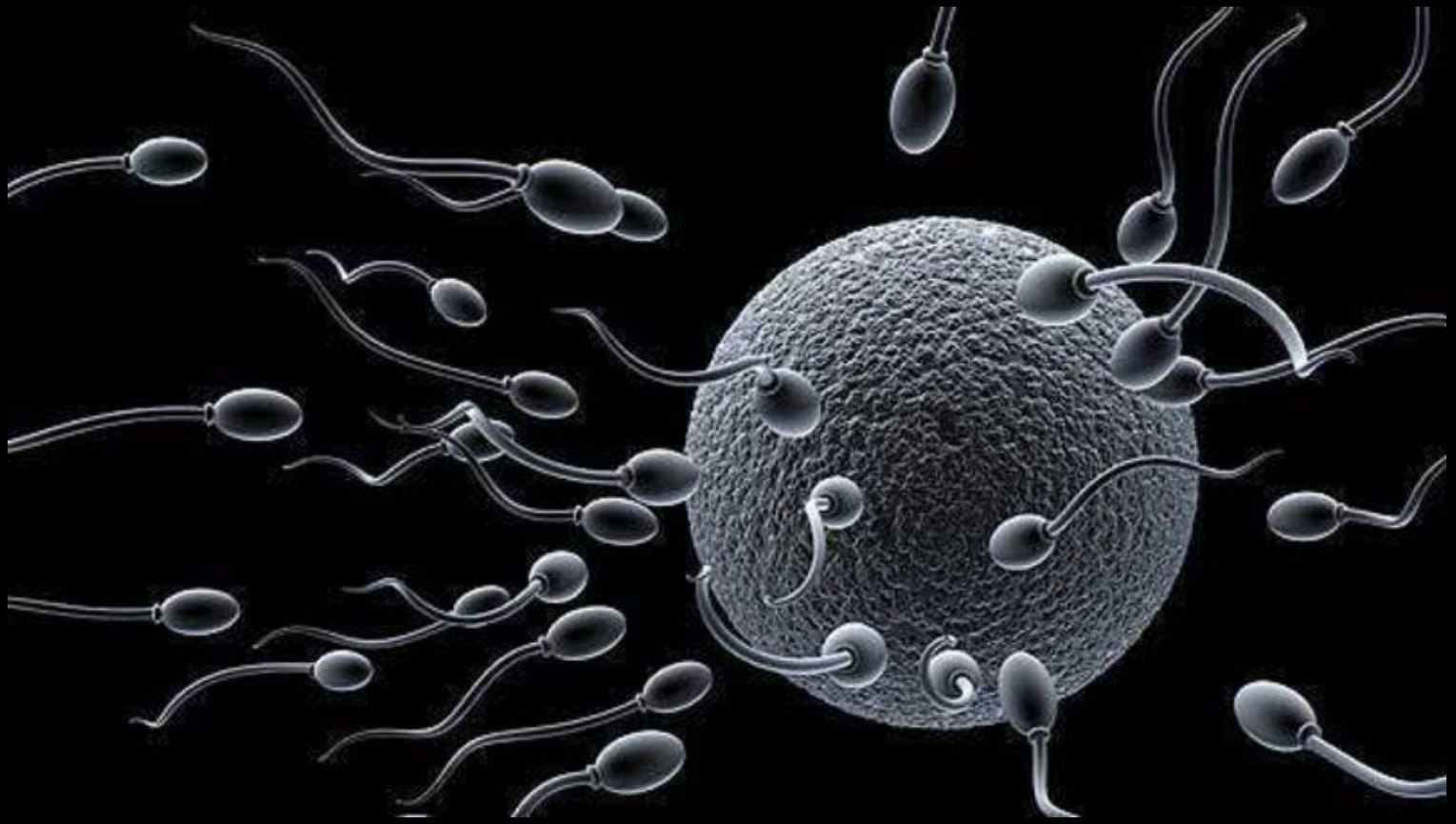
7 — **EPAUs should be available 7 days a week**

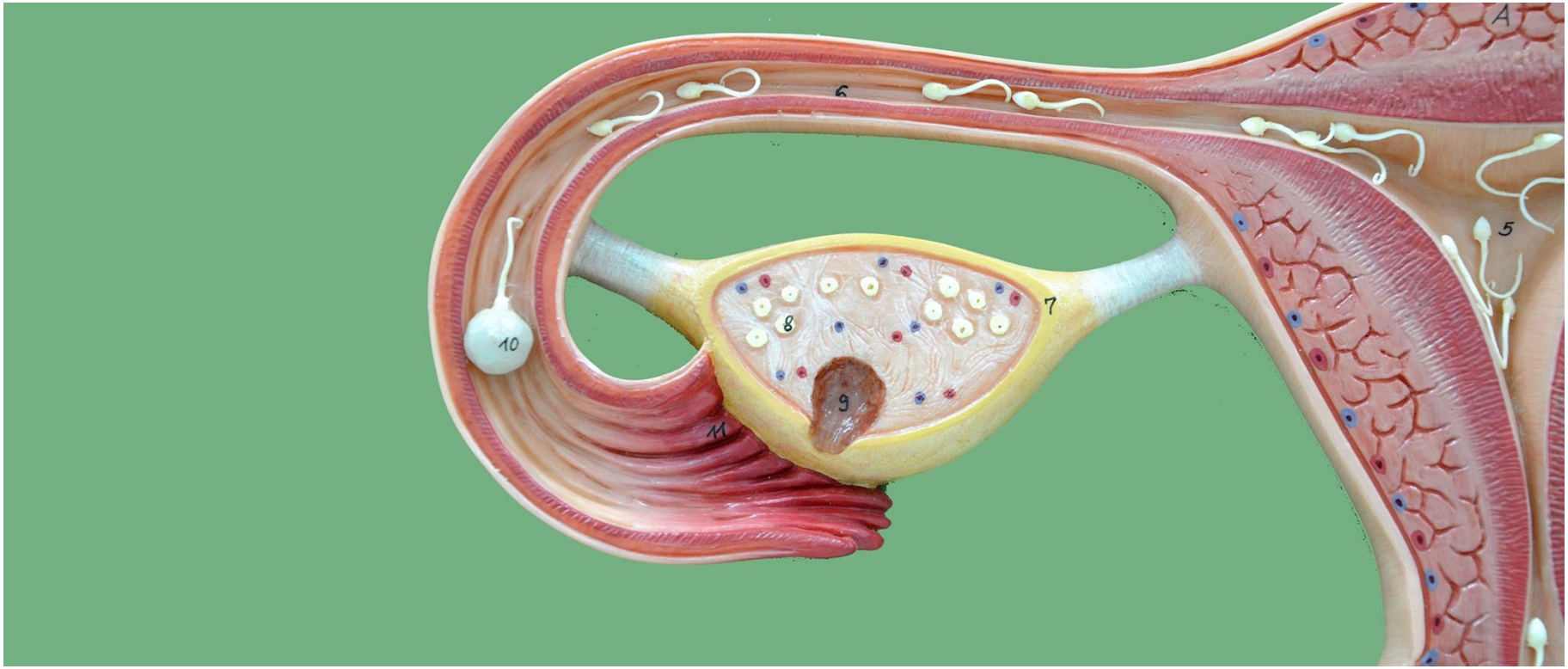
24 HOURS — **Provide women with an appointment within 24 hours of referral**

A review of deaths due to early pregnancy causes occurring in 2021-22 was expedited due to concerns over the number of deaths due to ectopic pregnancy. During this two-year period in the UK and Ireland, 12 women died from an early pregnancy-related cause, all due to ectopic pregnancy. Thus, in 2021-22 the rate of deaths in early pregnancy is 0.82 per 100,000 maternities (95% CI 0.42-1.43).

Ensure that women and clinicians are aware of the typical symptoms of ectopic pregnancy, which include:

- pain in the lower abdomen
- missed period or vaginal bleeding different from a normal period
- shoulder tip pain (tends to develop with other symptoms)
- diarrhoea or gastrointestinal upset
- atypical presentation for ectopic pregnancy is common
- breast tenderness, gastrointestinal symptoms, dizziness, fainting or syncope
- 7% of women, an ectopic pregnancy may be asymptomatic (National Institute for Health and Care Excellence 2019b)
- Women of reproductive age presenting to the Emergency Department collapse, in whom a pulmonary embolism is suspected, should have a Focused Assessment with Sonography in Trauma (FAST) scan to exclude intra-abdominal bleeding from a ruptured ectopic pregnancy (Knight, Nair et al. 2016)
- Vulnerable and Young Women
- Ensure that repeated calls and calls made by minors are escalated to enable a rapid response by appropriately trained paramedics. Ambulance Service (Priority) + 24/7 Early Pregnancy Assessment Units

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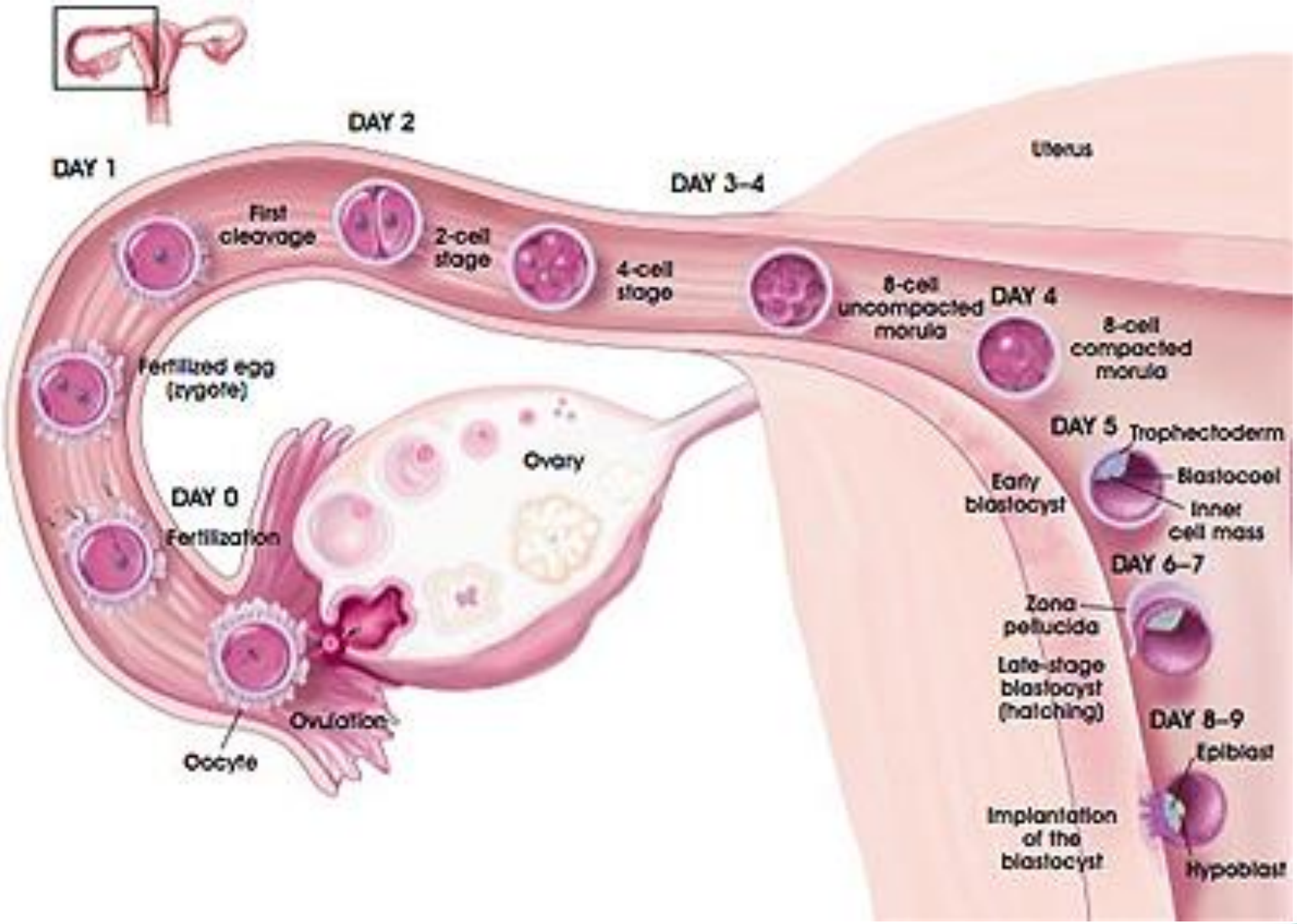
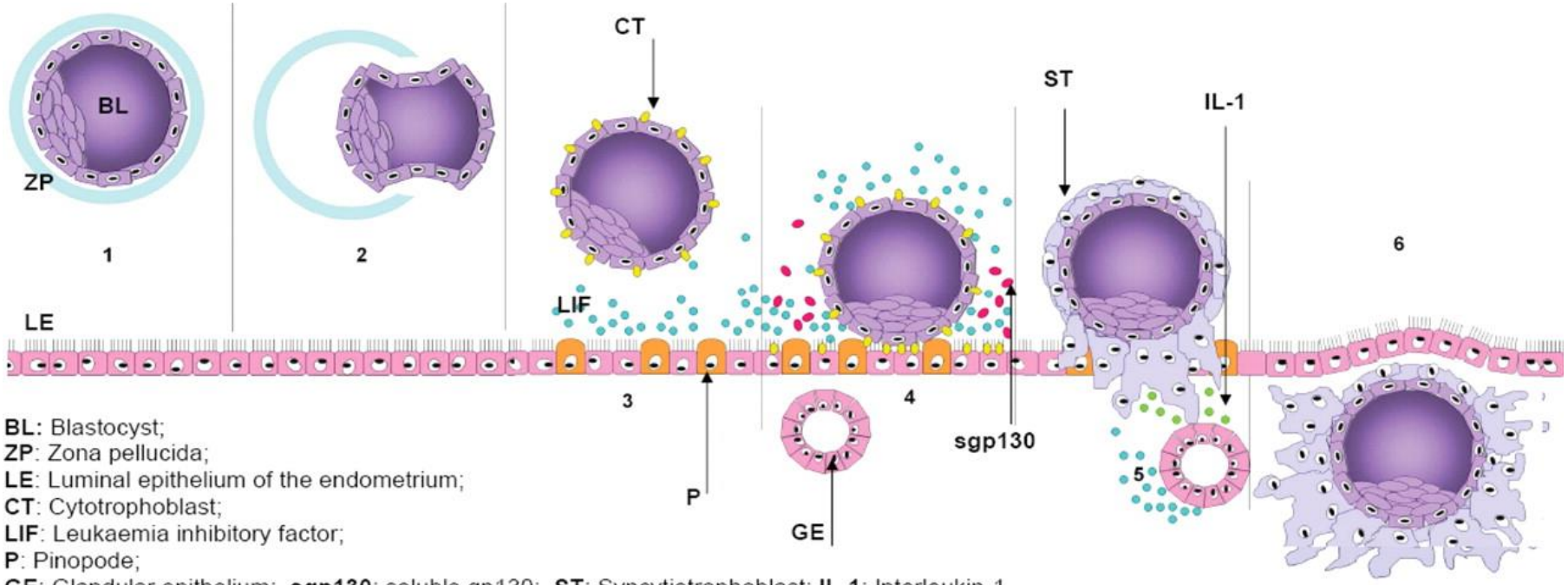
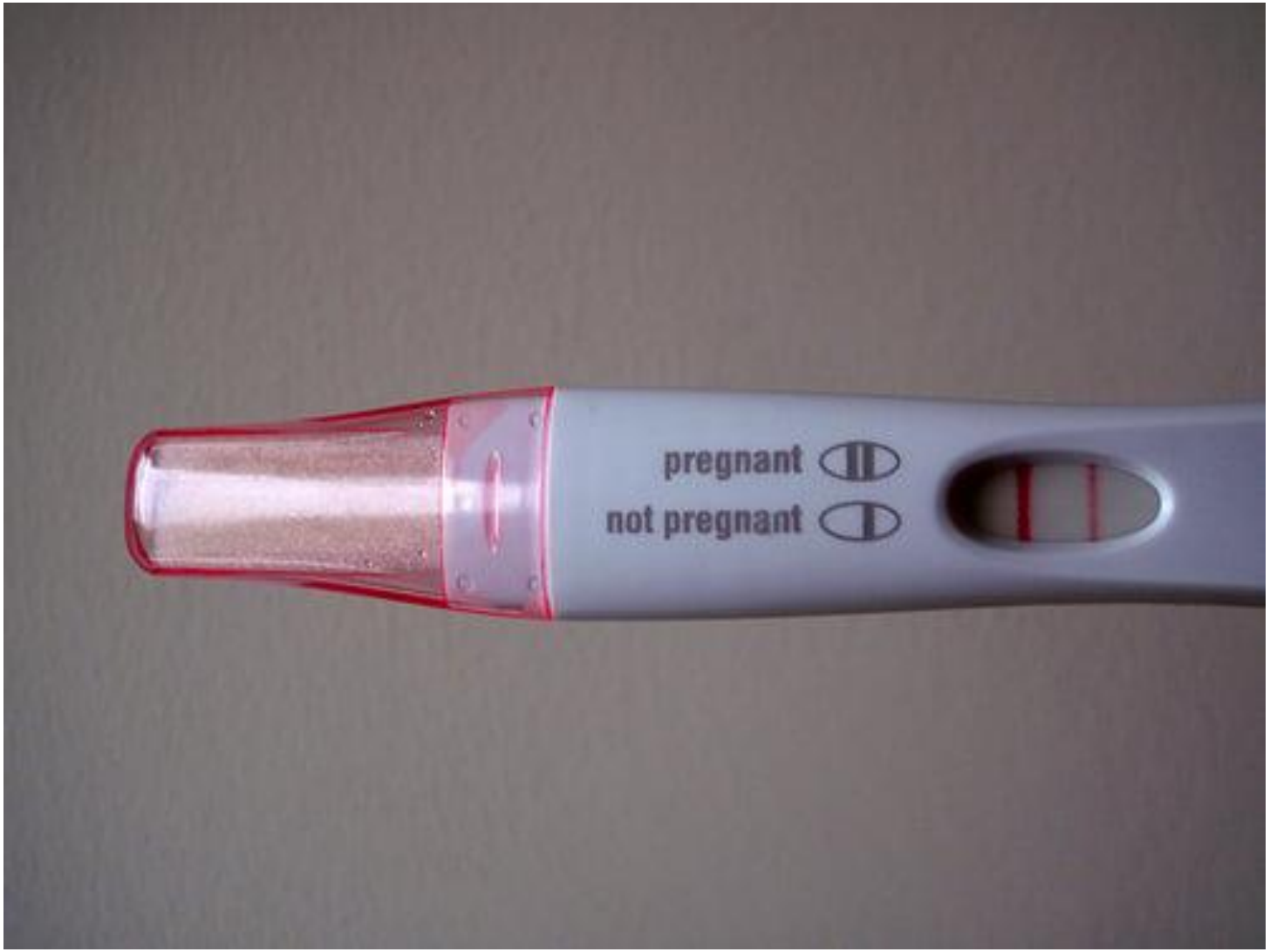
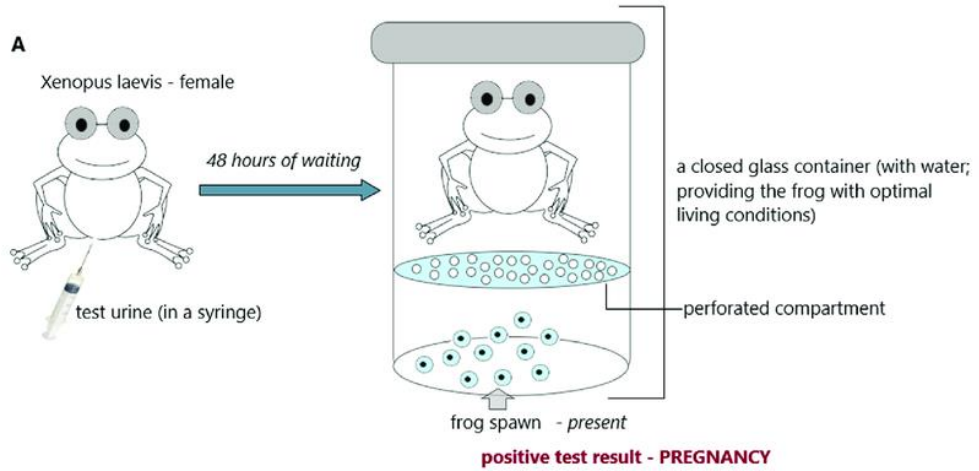
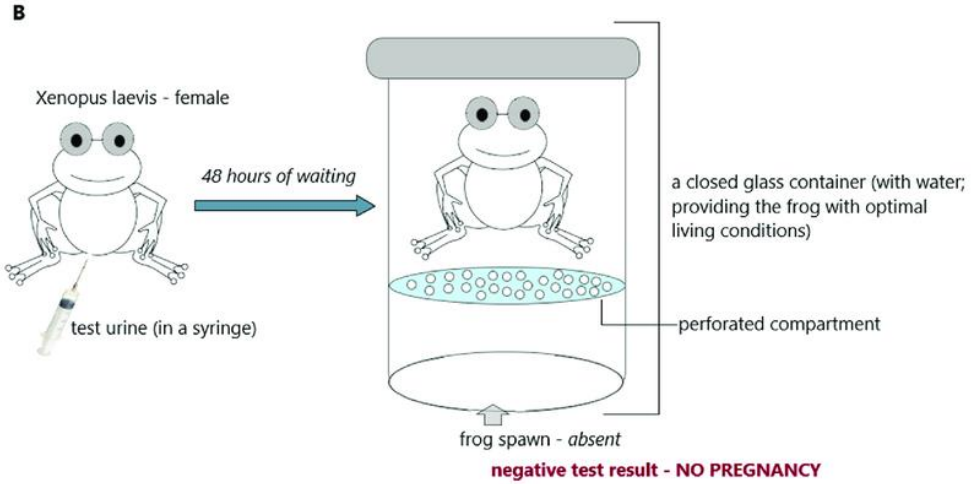

DAY 1
DAY 2
DAY 3–4
Uterus
First cleavage
2-cell stage
4-cell stage
8-cell uncompacted morula
DAY 4
8-cell compacted morula
Fertilized egg (zygote)
DAY 5
Trophectoderm
Blastocoel
Early blastocyst
Inner cell mass
Ovary
DAY 0
Fertilization
DAY 6–7
Zona pellucida
Late-stage blastocyst (hatching)
Ovulation
Oocyte
DAY 8–9
Epiblast
Implantation of the blastocyst
Hypoblast



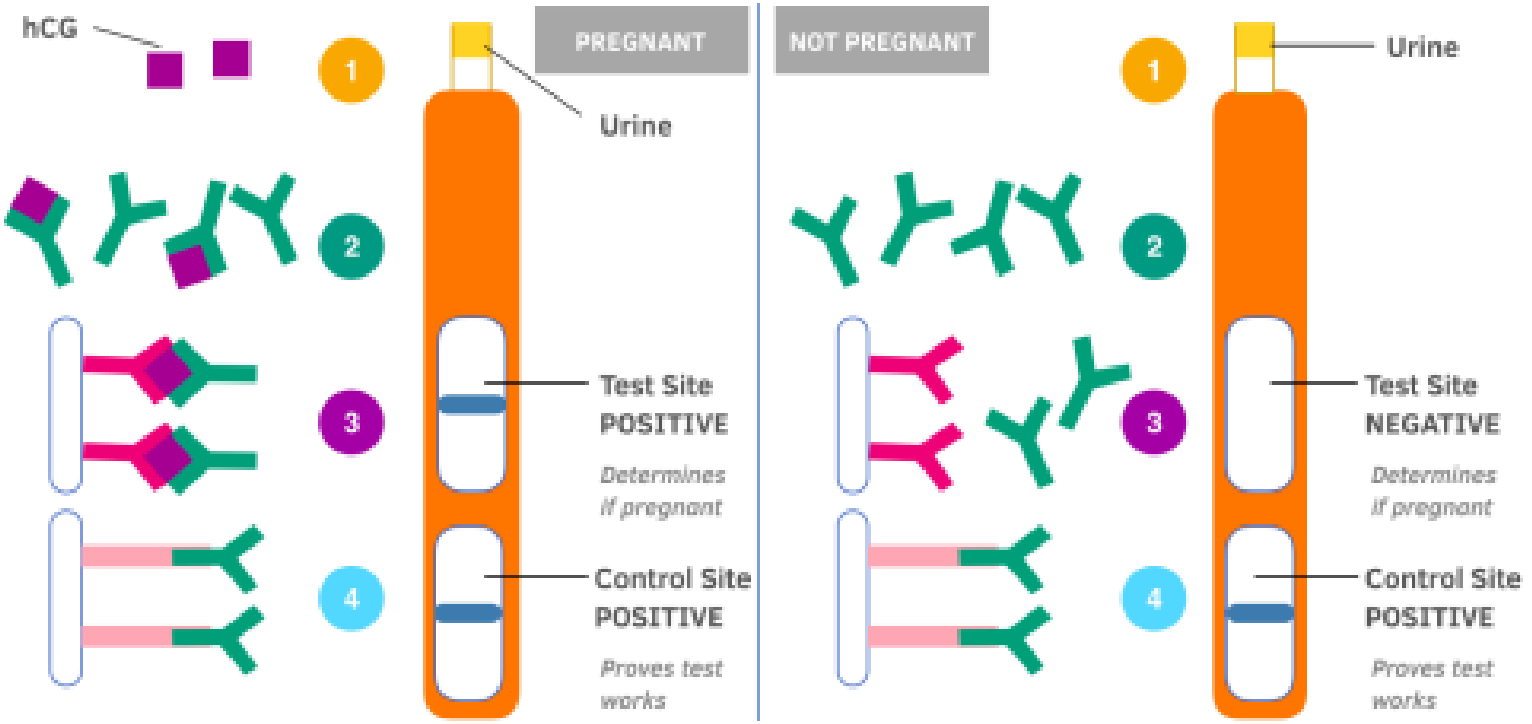
BL: Blastocyst;
ZP: Zona pellucida;
LE: Luminal epithelium of the endometrium;
CT: Cytotrophoblast;
LIF: Leukaemia inhibitory factor;
P: Pinopode;
GE: Glandular epithelium; **sgp130**: soluble gp130; **ST**: Syncytiotrophoblast; **IL-1**: Interleukin-1


pregnant
not pregnant





The Hogben test
1940-1960



Monoclonal antibodies are just laboratory made copies of naturally occurring antibodies, nothing fancy

hCG

- ✓ a hormone
- ✓ produced by the placenta
- ✓ stimulates the corpus luteum to produce progesterone
- ✓ appears in the blood or urine 10-11 days after fertilisation
- ✓ HCG levels peak at 10 weeks
- ✓ thickens the lining of the womb and stops normal cycle

- ✓ Urine sample
- ✓ Urine sample + hCG
- ✓ Reaction site: hCG + Free Antibody (+ dye enzyme)
- ✓ hCG + Free Antibody (+ enzyme) enter a “Test site”
- ✓ Test site contains a “Fixed Antibody”
- ✓ hCG is attracted  to the “Fixed Antibody” (so its binds to it and drags the Free Antibody + dye enzyme along with it just for the fun of it)
- ✓ Test site contains a dye + dye enzyme : Blue line!!

human chorionic gonadotrophin

(glycoprotein with alpha and beta subunits)

released into the blood and urine at implantation

around 10 days after fertilisation

urine tests become positive at 20-25 mIU/mL

(become positive in the first week of a missed period)

serum tests have a sensitivity of <10 mIU/mL

detect pregnancy two to four days earlier

human chorionic gonadotrophin

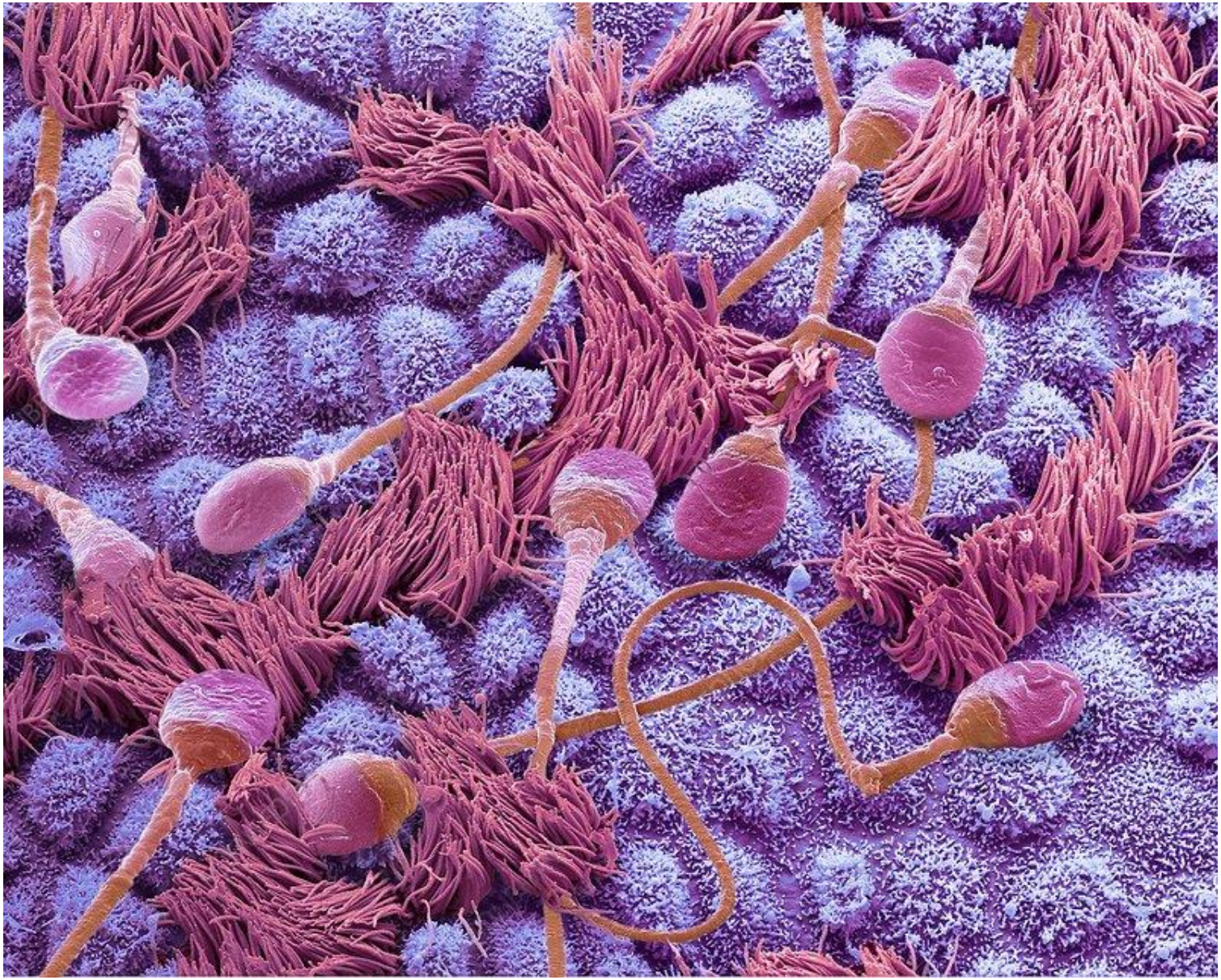
healthy non-pregnant females have serum levels < 5 mIU/mL

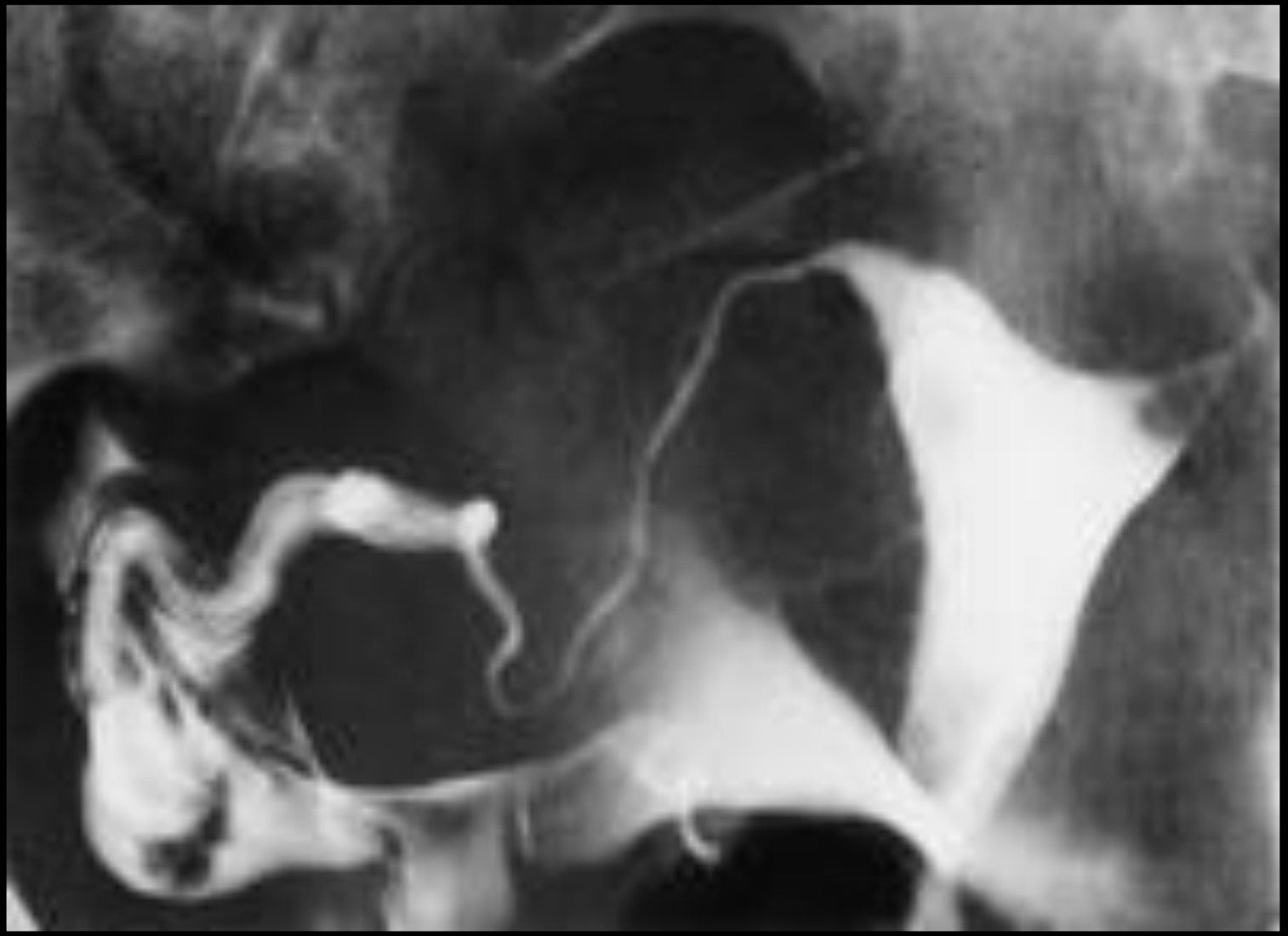
serum hCG levels > 25 IU indicate pregnancy

if the serum hCG is 5-25 mIU/mL

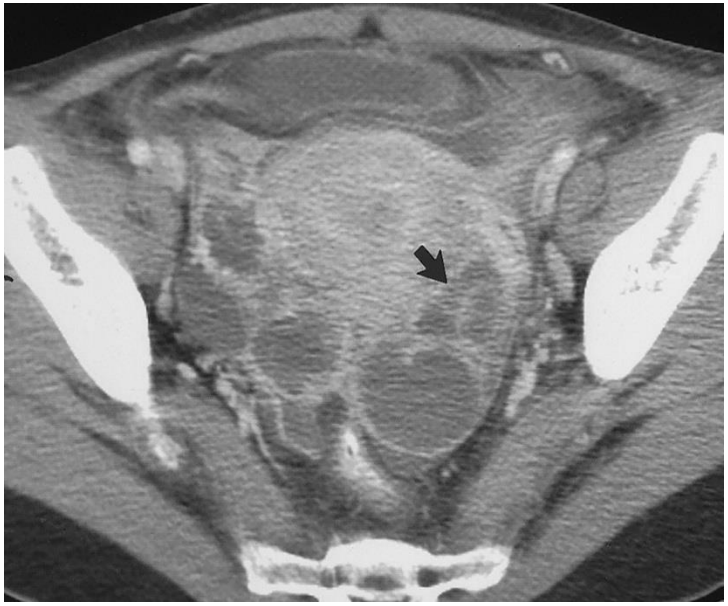
repeat in 48 hours

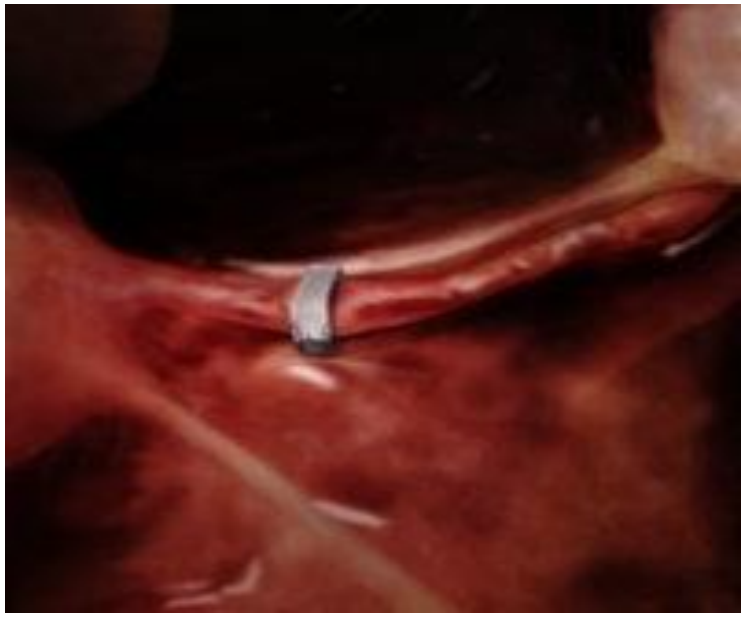
(doubles every 48 hours with intrauterine pregnancy)

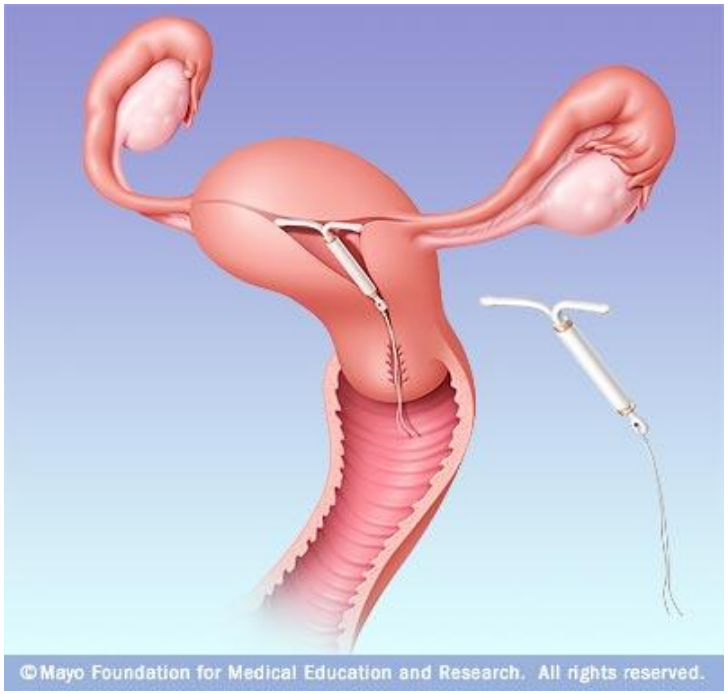




- ✓Age >35
- ✓Previous ectopic pregnancy (10%)
- ✓Prior fallopian tube surgery (subfertility)
- ✓ Assisted reproductive techniques (IVF)
- ✓Intra-uterine Contraceptive Device (IUCD)
- ✓Pelvic Inflammatory Disease (PID)
- ✓Endometriosis
- ✓Smoking (Ciliary and smooth muscle function)



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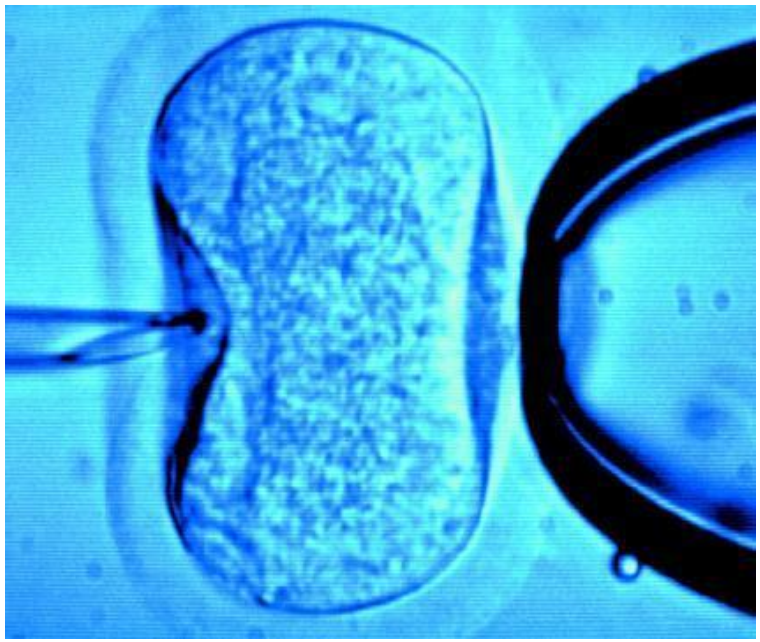


Seattle
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OHIO
NEVADA
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NEW MEXICO
MISSISSIPPI
SOUTH CAROLINA
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TEXAS
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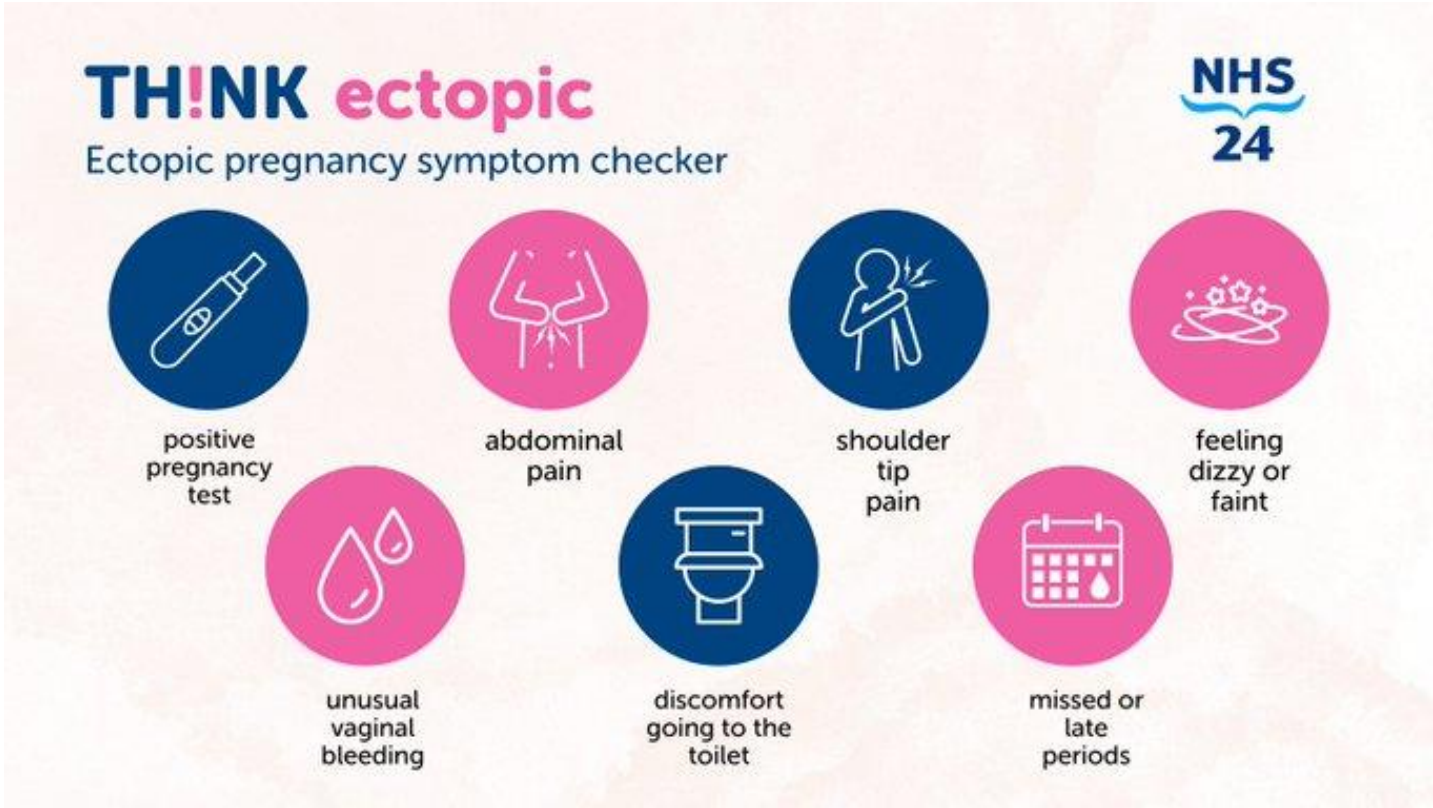
Houston
Map data ©2022 Google, INEGI

Globally 1-2% of all pregnancies


TH!NK ectopic
Ectopic pregnancy symptom checker
NHS 24
positive pregnancy test
abdominal pain
shoulder tip pain
feeling dizzy or faint
unusual vaginal bleeding
discomfort going to the toilet
missed or late periods

EMERGENCY MEDICINE CASES

Ectopic Pregnancy and Ruptured Ectopic: Pitfalls in Diagnosis

Up to **25%** lack the full triad, and **10%** may have no symptoms.

The classic triad of **abdominal pain, missed menses**, and **vaginal bleeding** is NOT sensitive.
Be aware of these **pitfalls** when suspecting ectopic pregnancy:

Relying on a **urine β -hCG** in **early pregnancy**

Urine ß -hCG are unreliable (false negatives early in pregnancy). ***Always obtain serum ß -hCG.***

Forgoing or delaying a TVU to rule out ectopic **based on history physical and β -hCG** in first trimester bleed or first trimester abdominal pain

First trimester bleed or pain ***should get a TV ultrasound in ED*** *as* ***no combination of history, physical, beta or progesterone can rule out*** *ectopic or ruptured ectopic.*

Ruling out Ectopic Pregnancy **based on BhCG levels**

There ***is no ß -hCG level or series of ß -hCG levels at which ectopic can be ruled out.*** *The* ***traditional teaching of a BhCG level <1000*** *ruling out ectopic can* ***distract*** *from* ***making the diagnosis*** *of ruptured ectopic in a timely manner. Ectopic pregnancy* ***may present with rising, falling or plateau, or even zero*** *ß -hCG levels.*

Assuming that a **patient taking methotrexate** for known ectopic pregnancy presenting with abdominal pain **has a low risk for rupture**

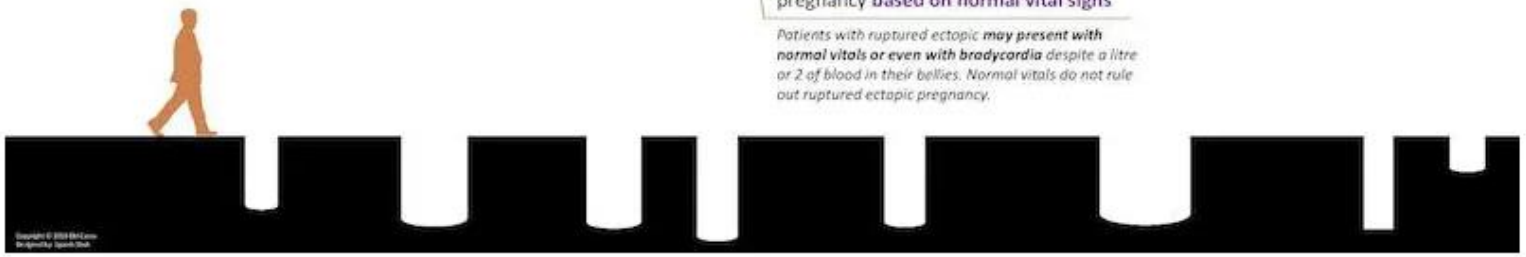
The risk of rupture *when patients are being* ***treated with methotrexate*** *for ectopic especially* ***if relative contraindications to methotrexate is 6%.*** *The level of ß -hCG correlates with failure rate: guidelines suggest only* ***trying methotrexate with BHCG <5000).***

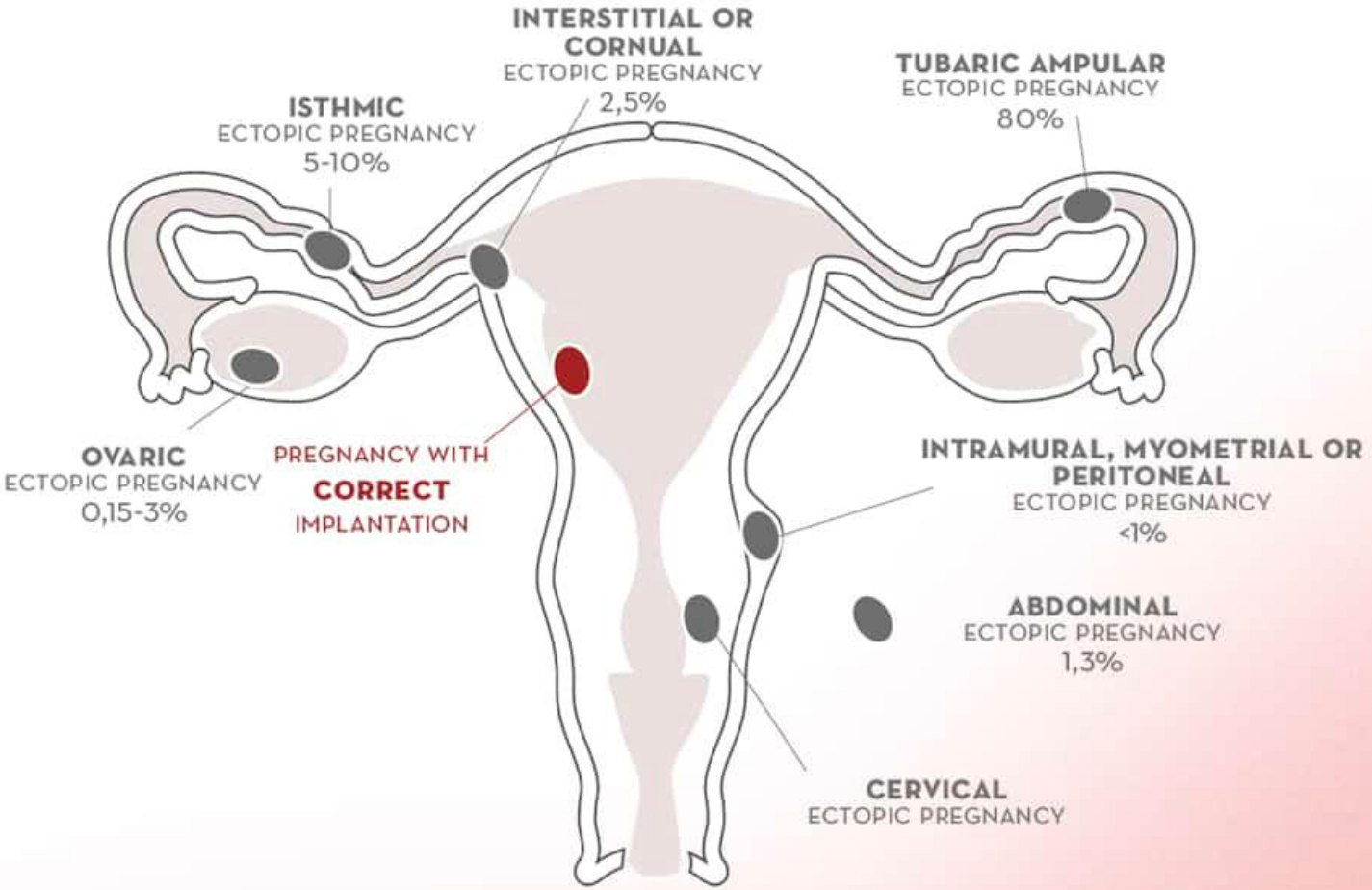
Assuming low risk of **ruptured** ectopic pregnancy **with no identifiable risk factors**

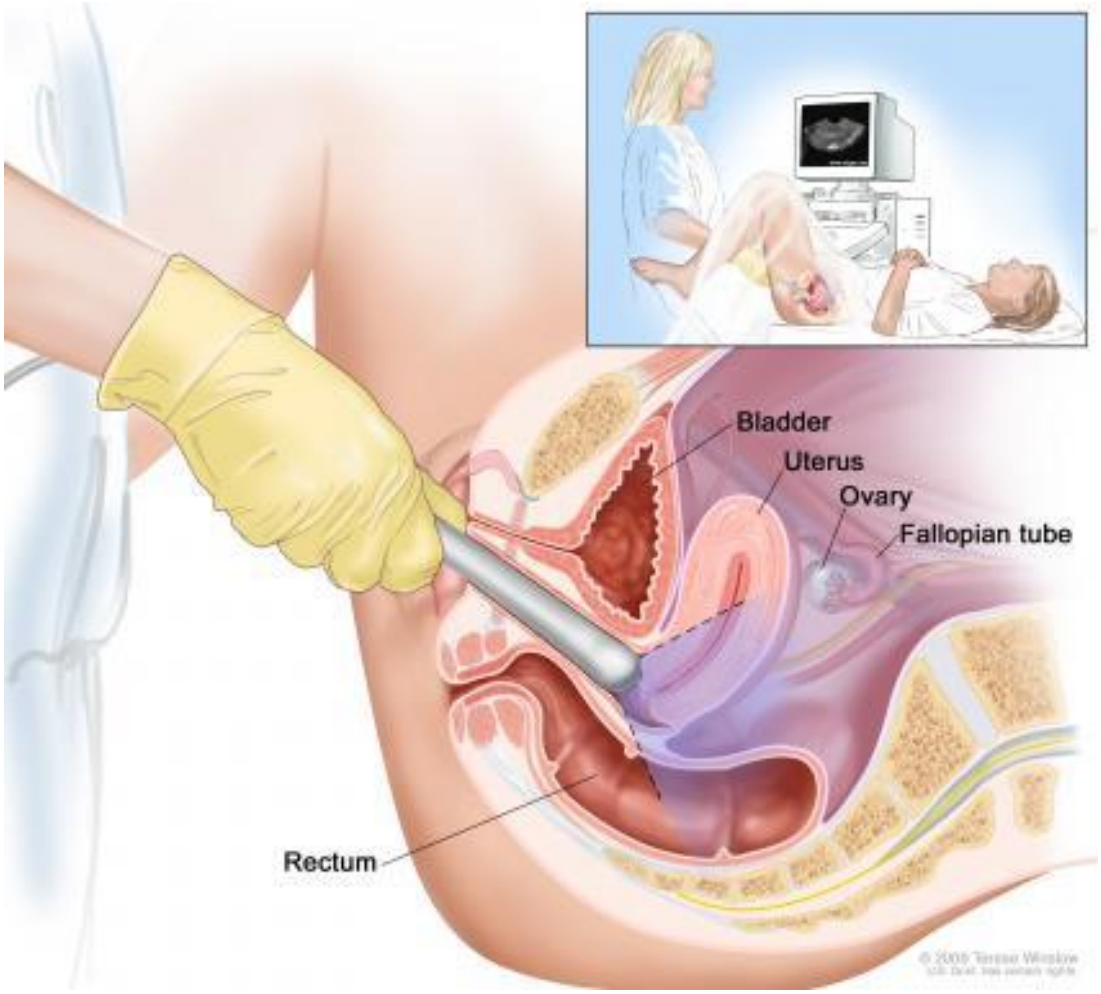
The ***majority of patients*** *with ectopic pregnancy* ***have no identifiable risk factors*** *(tubal surgery or known abnormality, previous ectopic, PID/STI, current IUD, history of infertility, IVF).*

Assuming low risk of **ruptured** ectopic pregnancy **based on normal vital signs**

Patients with ruptured ectopic ***may present with normal vitals or even with bradycardia*** *despite a litre or 2 of blood in their bellies. Normal vitals do not rule out ruptured ectopic pregnancy.*

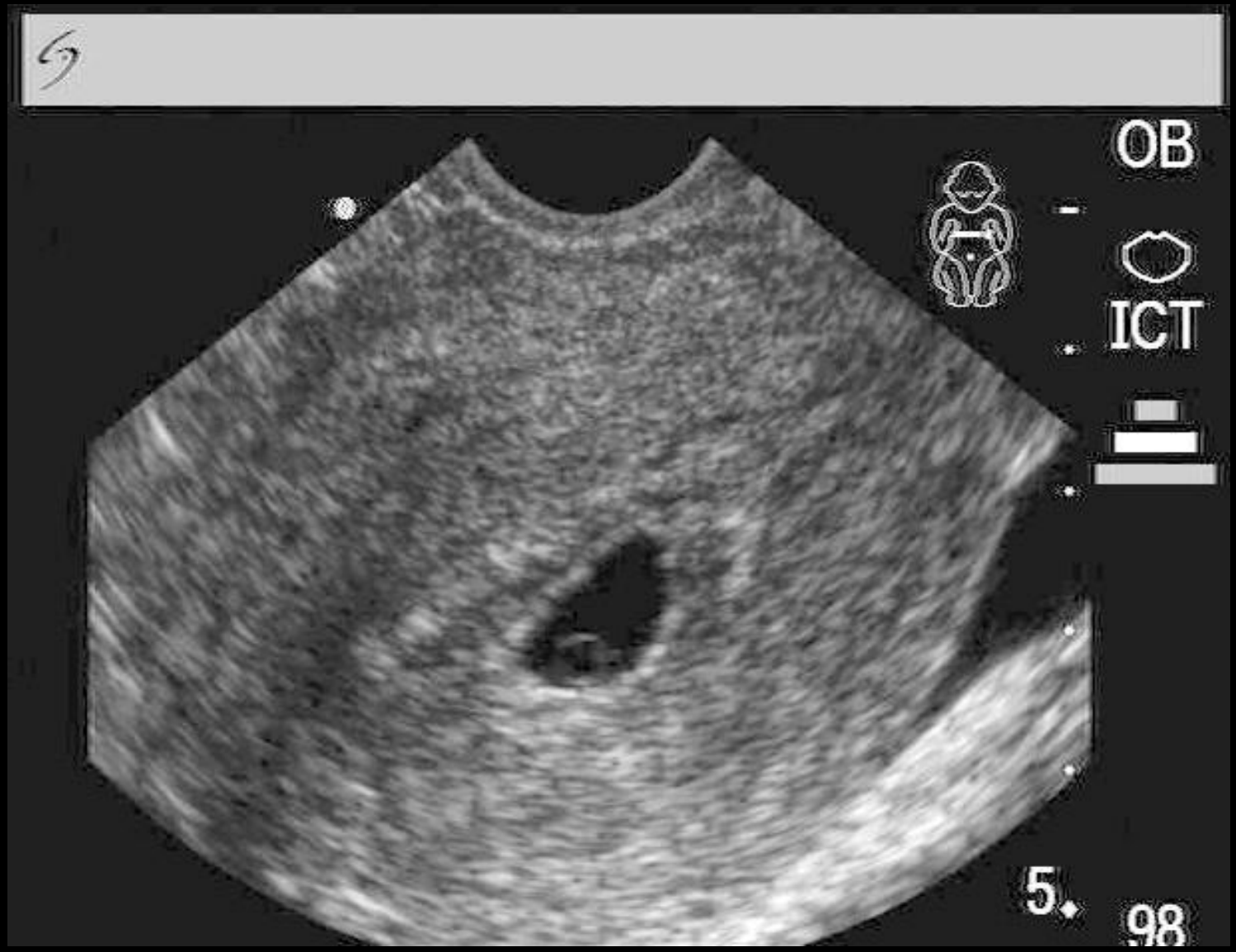



INTERSTITIAL OR CORNUAL
ECTOPIC PREGNANCY
2,5%
TUBARIC AMPULAR
ECTOPIC PREGNANCY
80%
ISTHMIC
ECTOPIC PREGNANCY
5-10%
OVARIC
ECTOPIC PREGNANCY
0,15-3%
PREGNANCY WITH
CORRECT
IMPLANTATION
INTRAMURAL, MYOMETRIAL OR PERITONEAL
ECTOPIC PREGNANCY
<1%
ABDOMINAL
ECTOPIC PREGNANCY
1,3%
CERVICAL
ECTOPIC PREGNANCY


Bladder
Uterus
Ovary
Fallopian tube
Rectum

Transvaginal Ultrasound should detect a normal intrauterine gestational sac if B-HCG is **1500 – 2000 mIU/ml**

Transabdominal Ultrasound should detect a normal intrauterine gestational sac if B-HCG is **6000 mIU/mL**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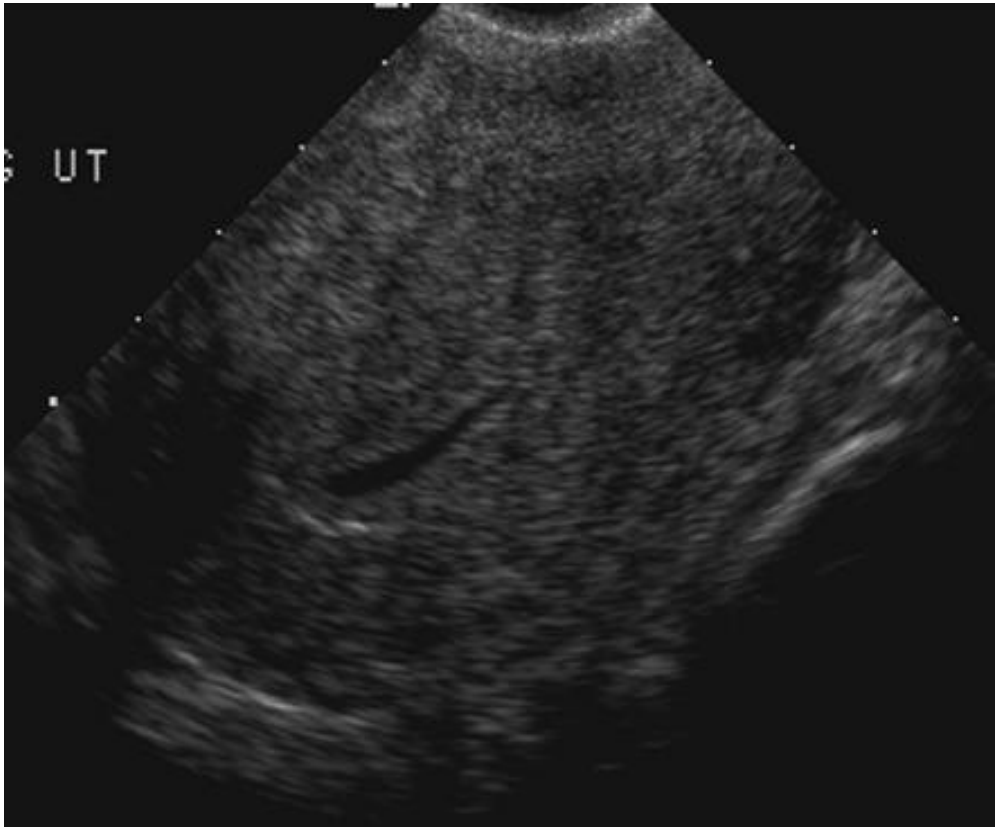
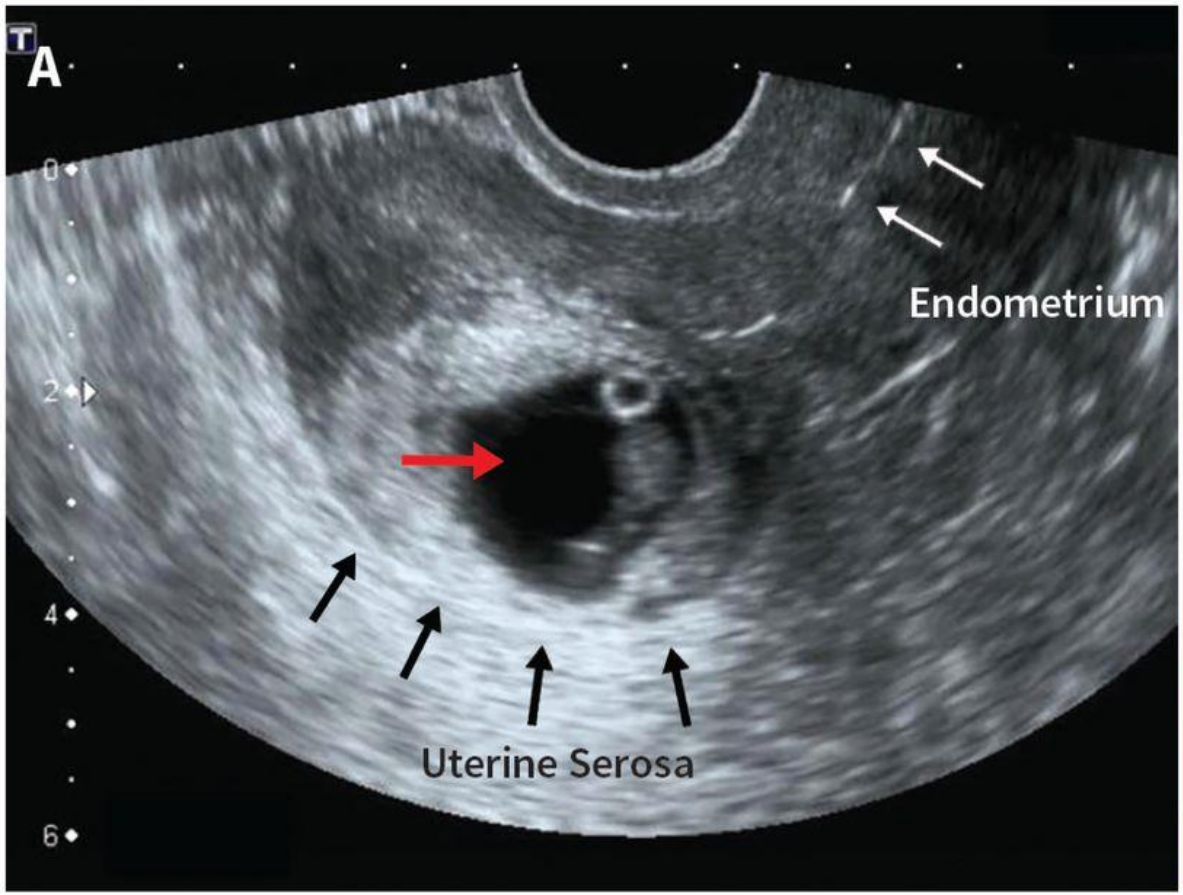
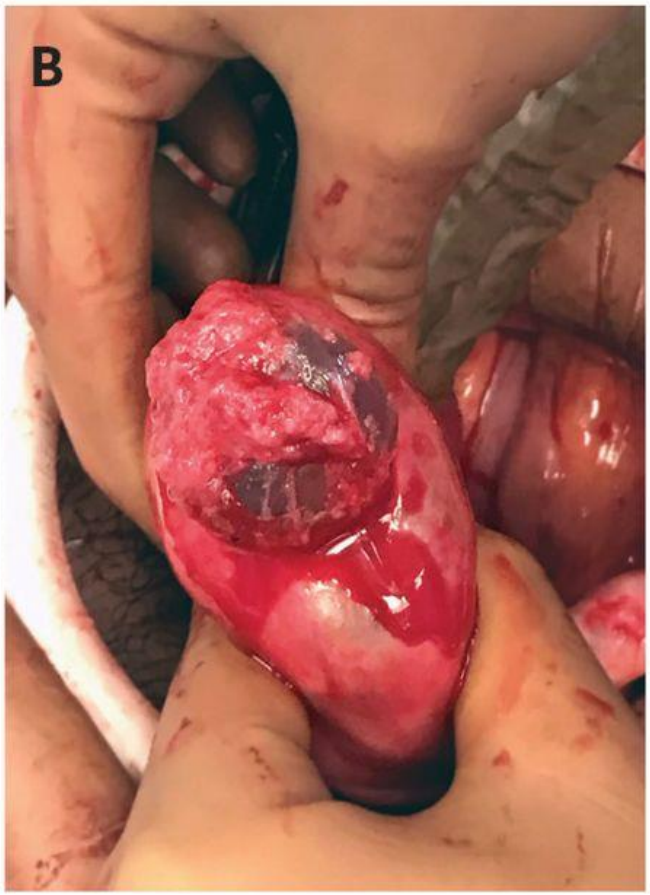
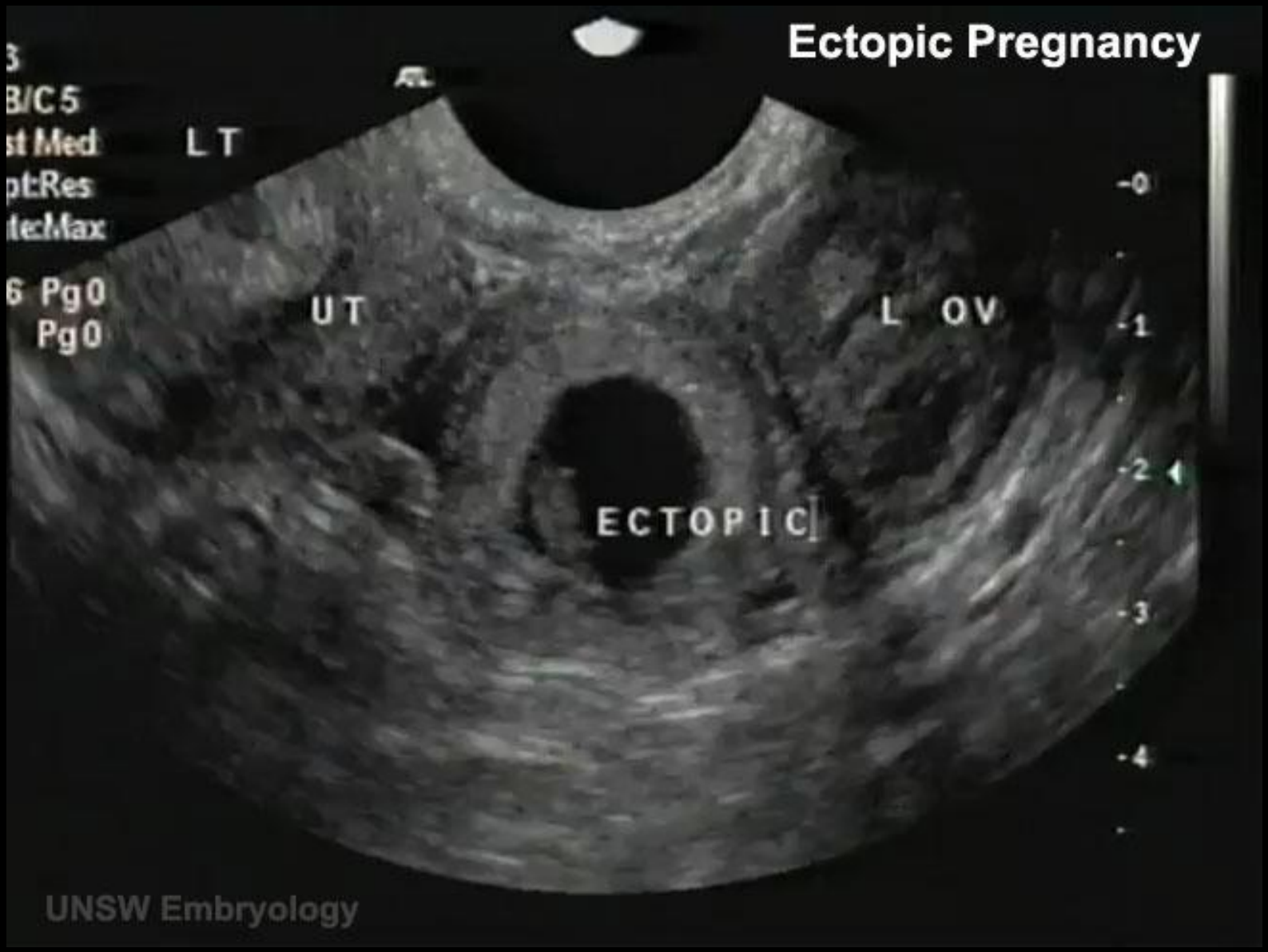
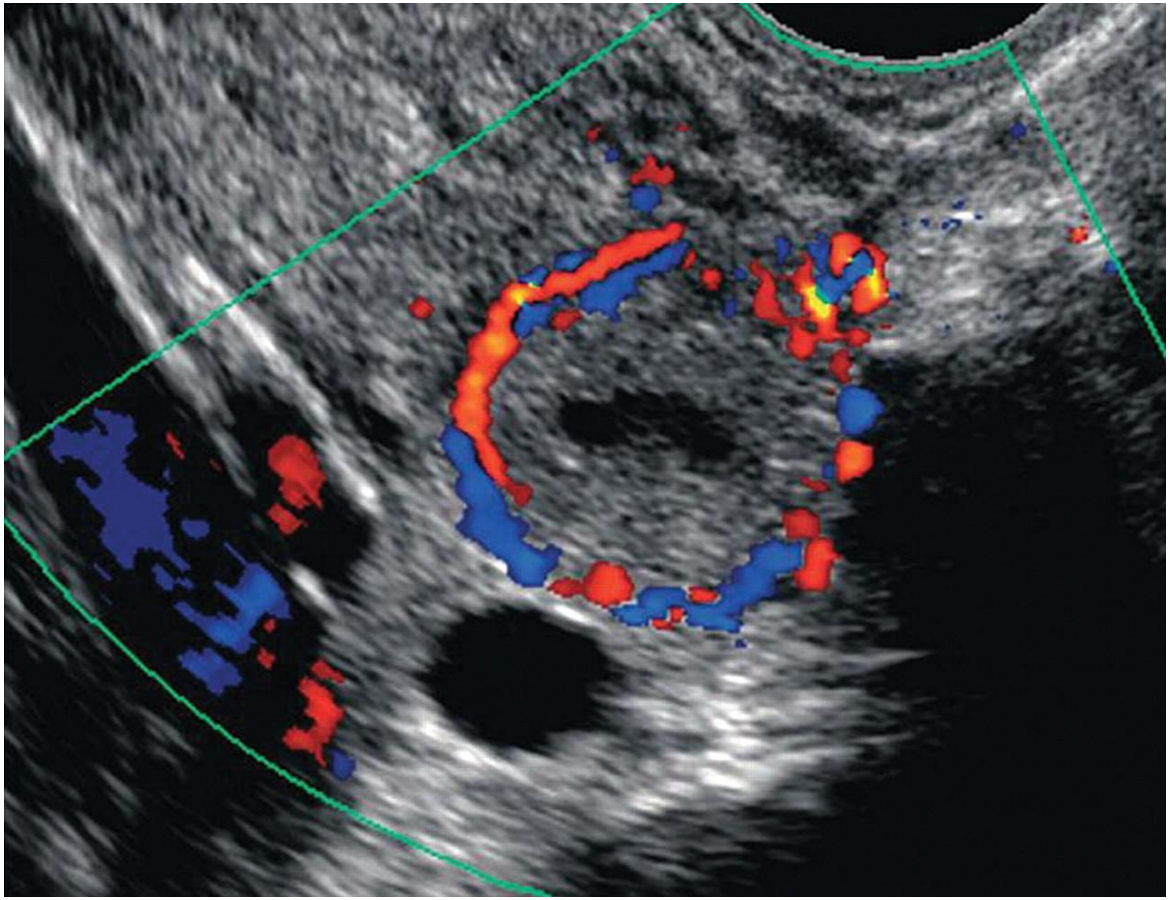


The pseudogestational sac sign is a well described entity in the literature in the setting of ectopic gestation, and represents a decidual reaction surrounding intrauterine fluid/hemorrhage without a yolk sac or fetal pole. Pseudogestational sac may be seen in 10-20% of ectopic pregnancies

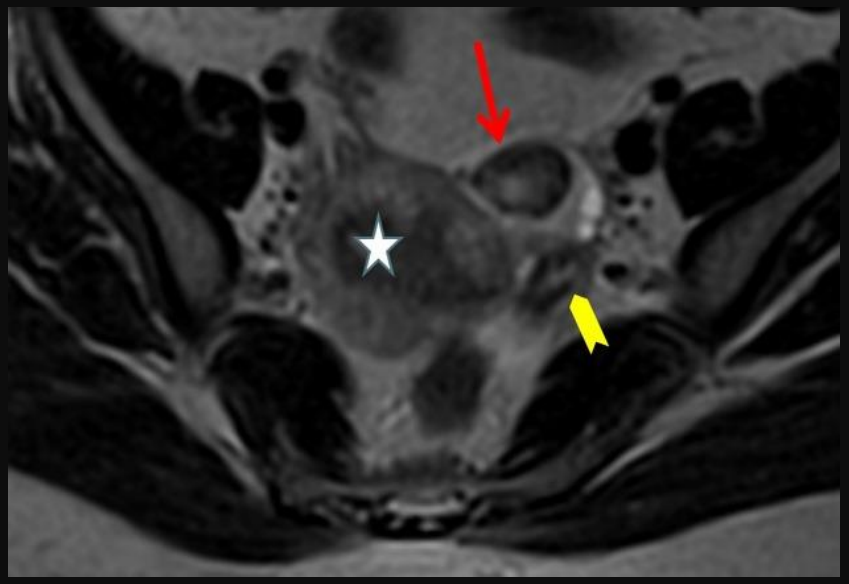


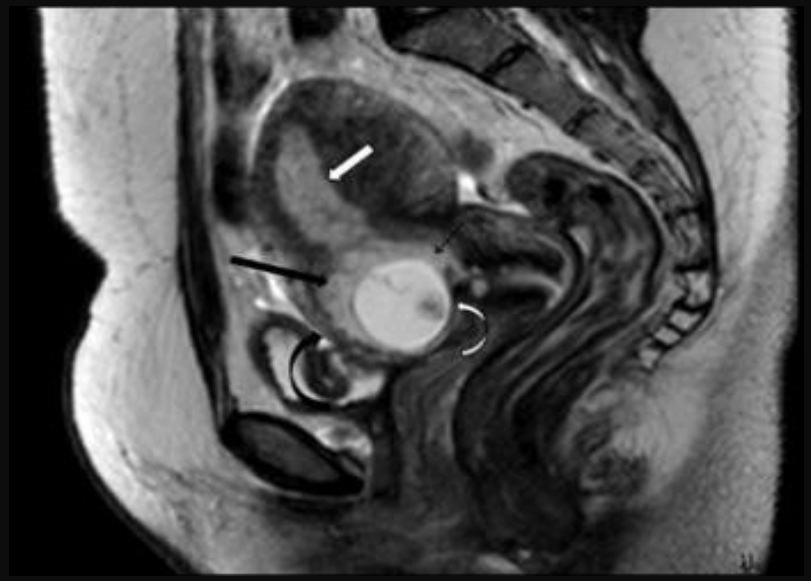


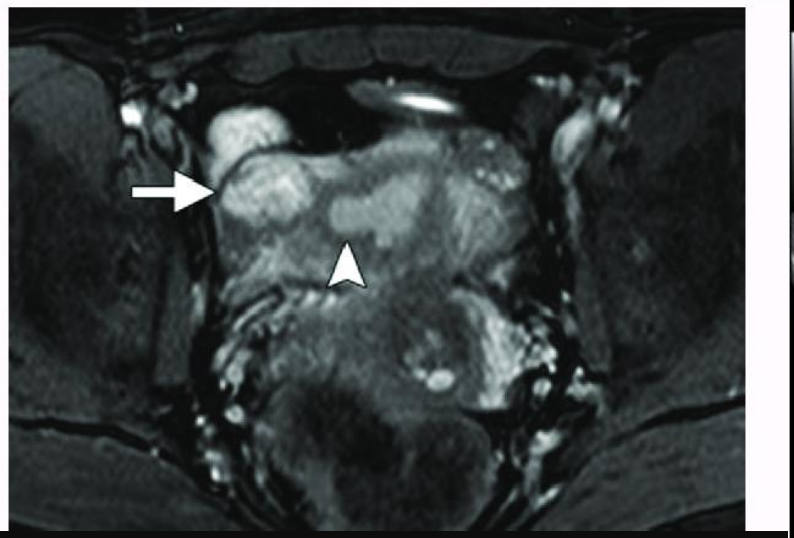

Ectopic Pregnancy
LT
UT
L OV
ECTOPIC
UNSW Embryology

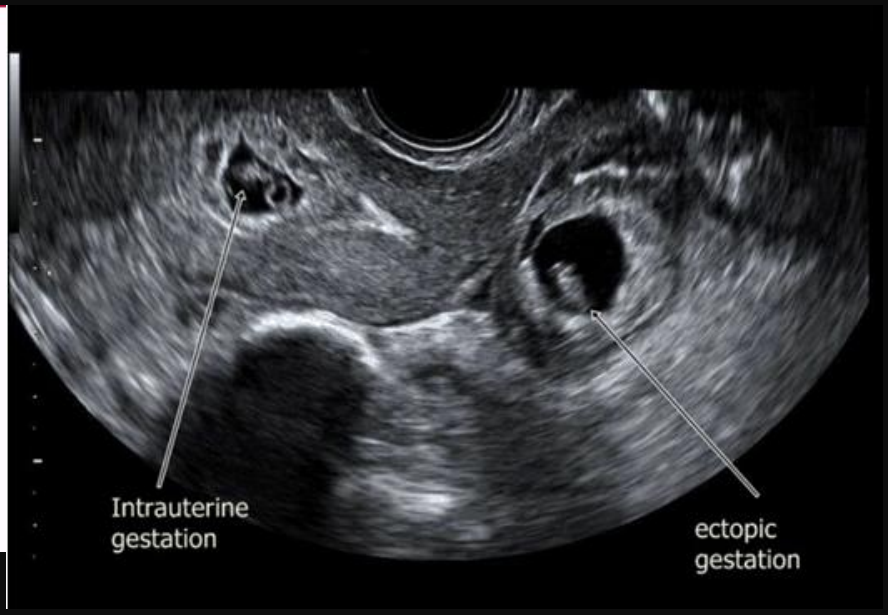


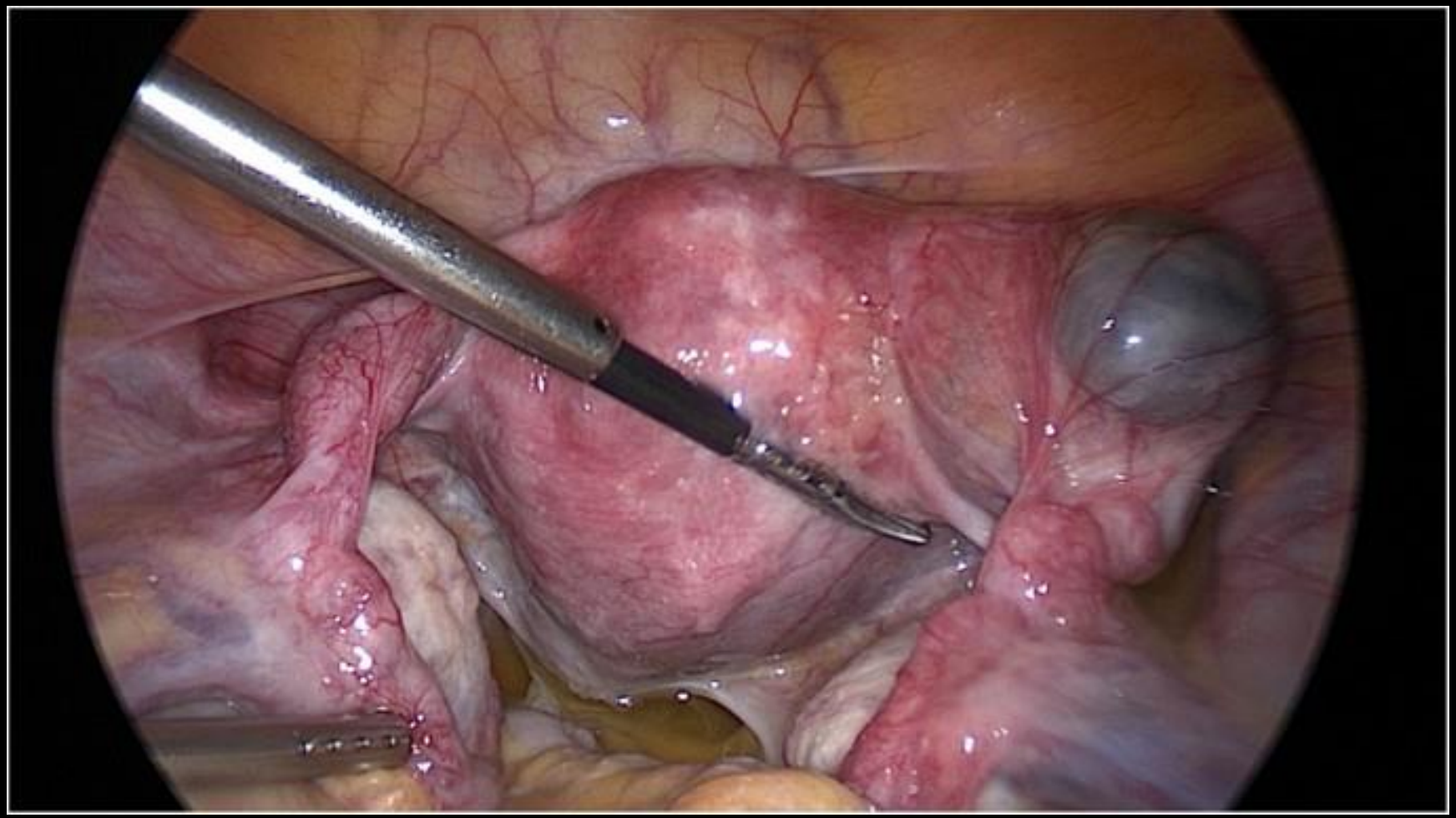
An adnexal “ring of fire” with Colour-flow Doppler representing a thick-walled fallopian tube with high velocity low-impedance flow in trophoblastic tissue
(also found in a corpus luteal cyst)

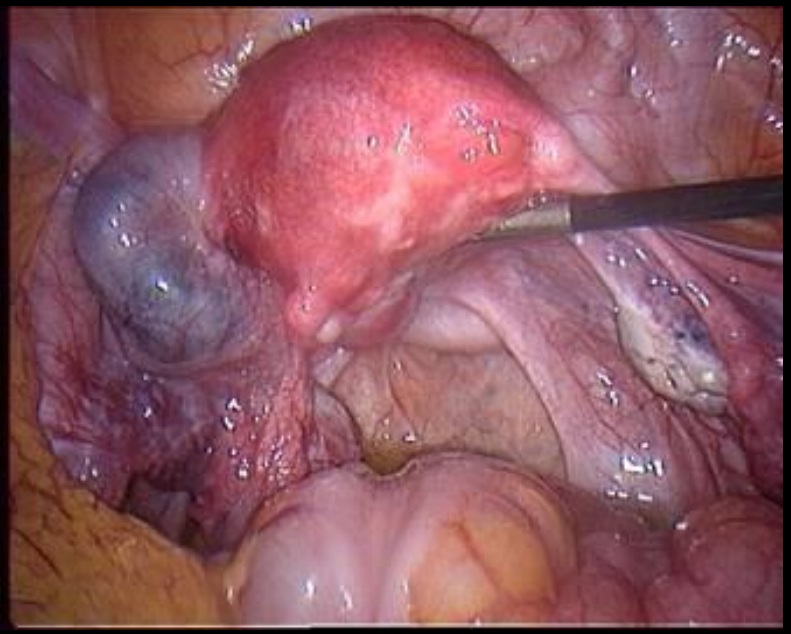


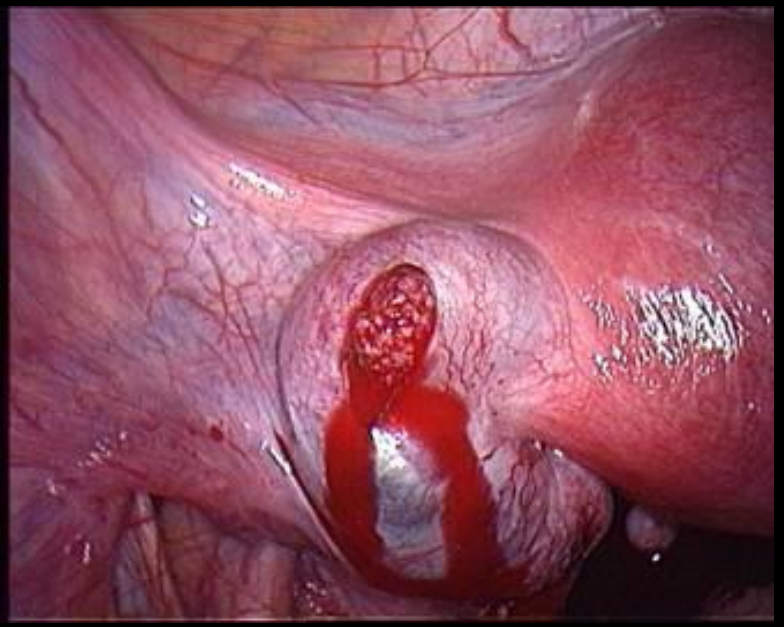


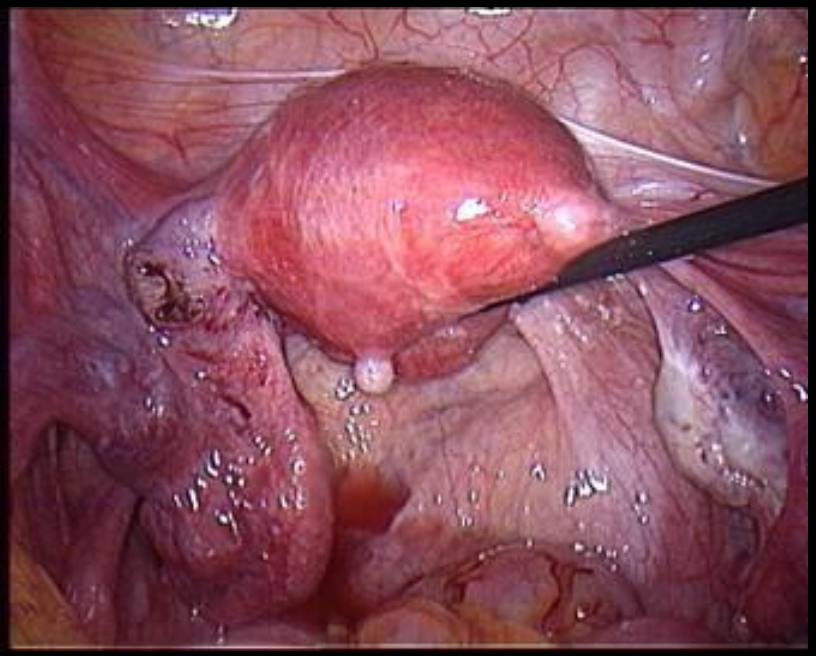



Intrauterine
gestation
ectopic
gestation







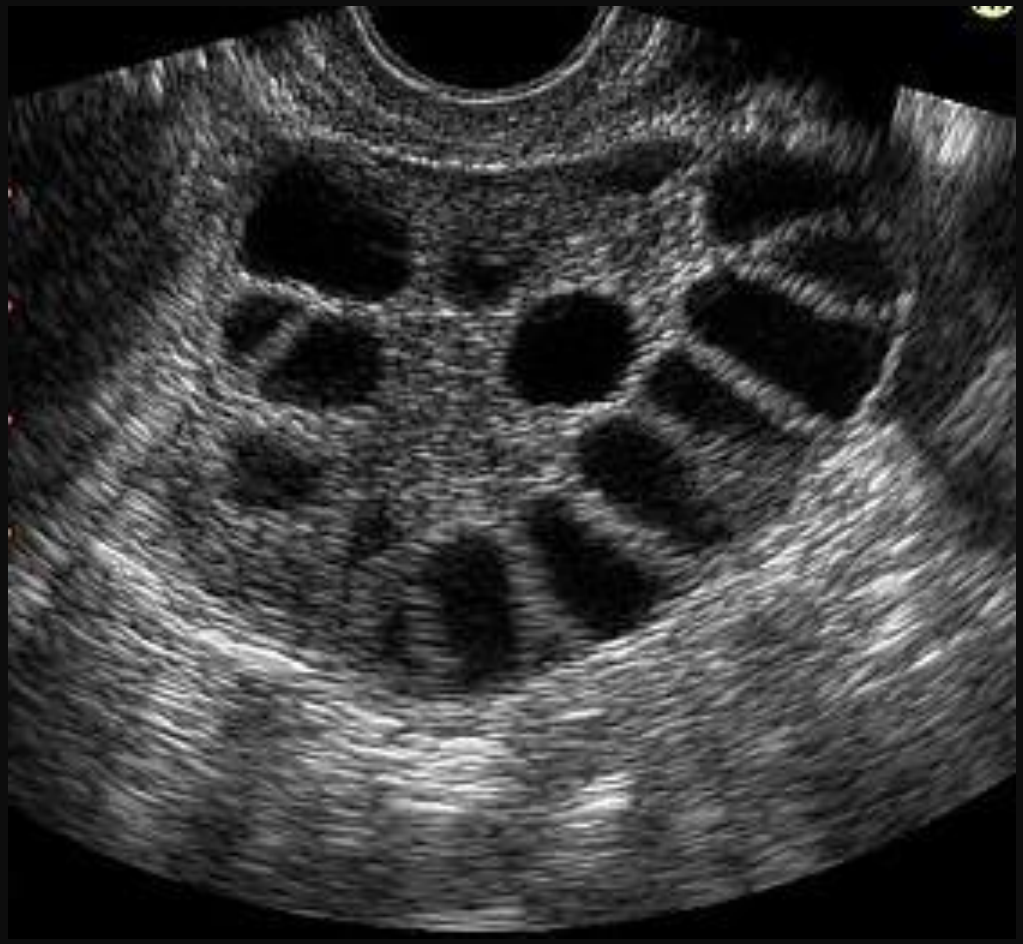



GeneraMedix
NDC 10139-062-40
Single Use Vial 40 mL
METHOTREXATE
INJECTION
Preservative
1 g/40 mL
(25 mg/mL
Sterile
CAUTION
CYTOTOXIC A
NDC 10139-062-10
Single Use Vial 10 mL
METHOTREXATE
INJECTION, USP
Preservative Free
250 mg/10 mL
(25 mg/mL)
Rx Only
CAUTION:
CYTOTOXIC AGENT
NDC 10139-062-02
Single Use Vial 2 mL
METHOTREXATE
INJECTION, USP
Preservative Free
50 mg/2 mL
(25 mg/mL)
Sterile
Rx Only


Cadbury
Eclairs
CONTAINS MILK


MPS

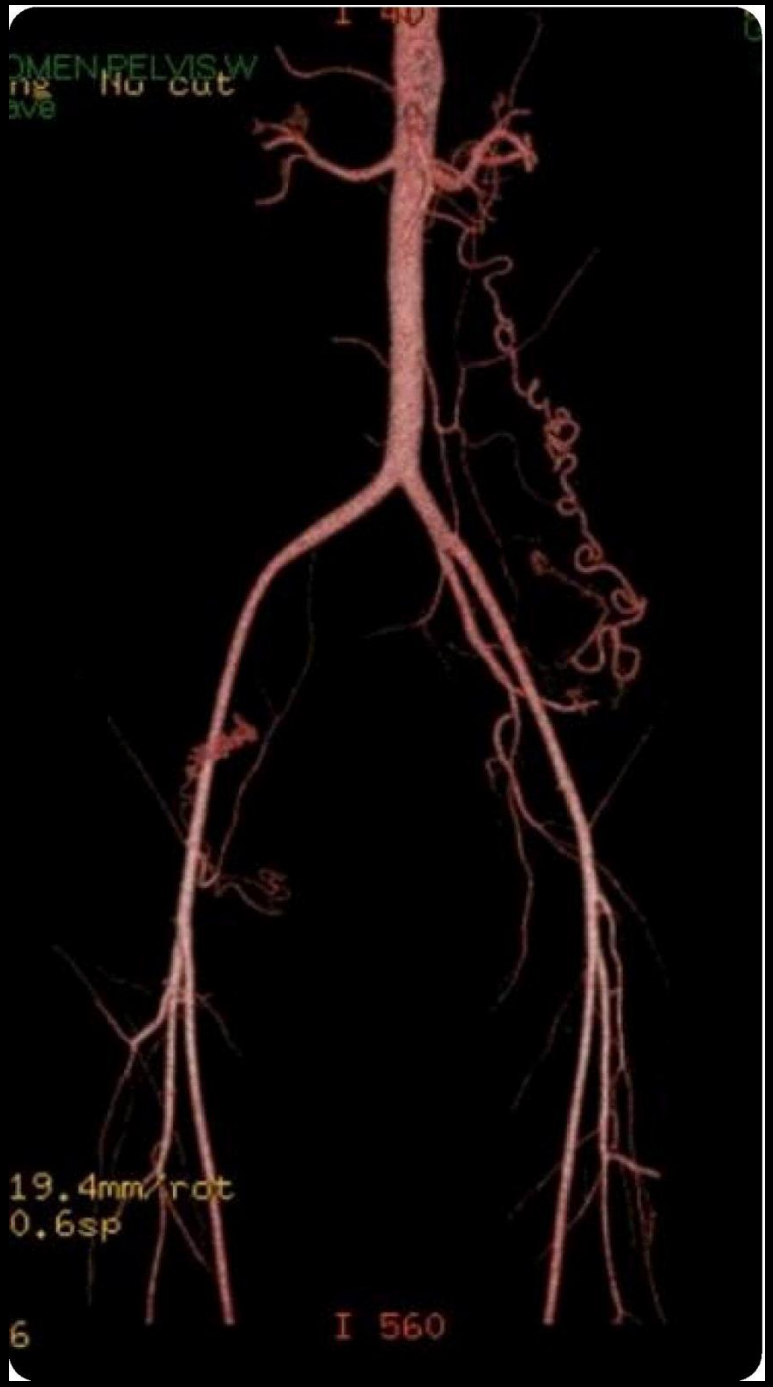

THE IRISH SOCIETY OF INTERVENTIONAL RADIOLOGY

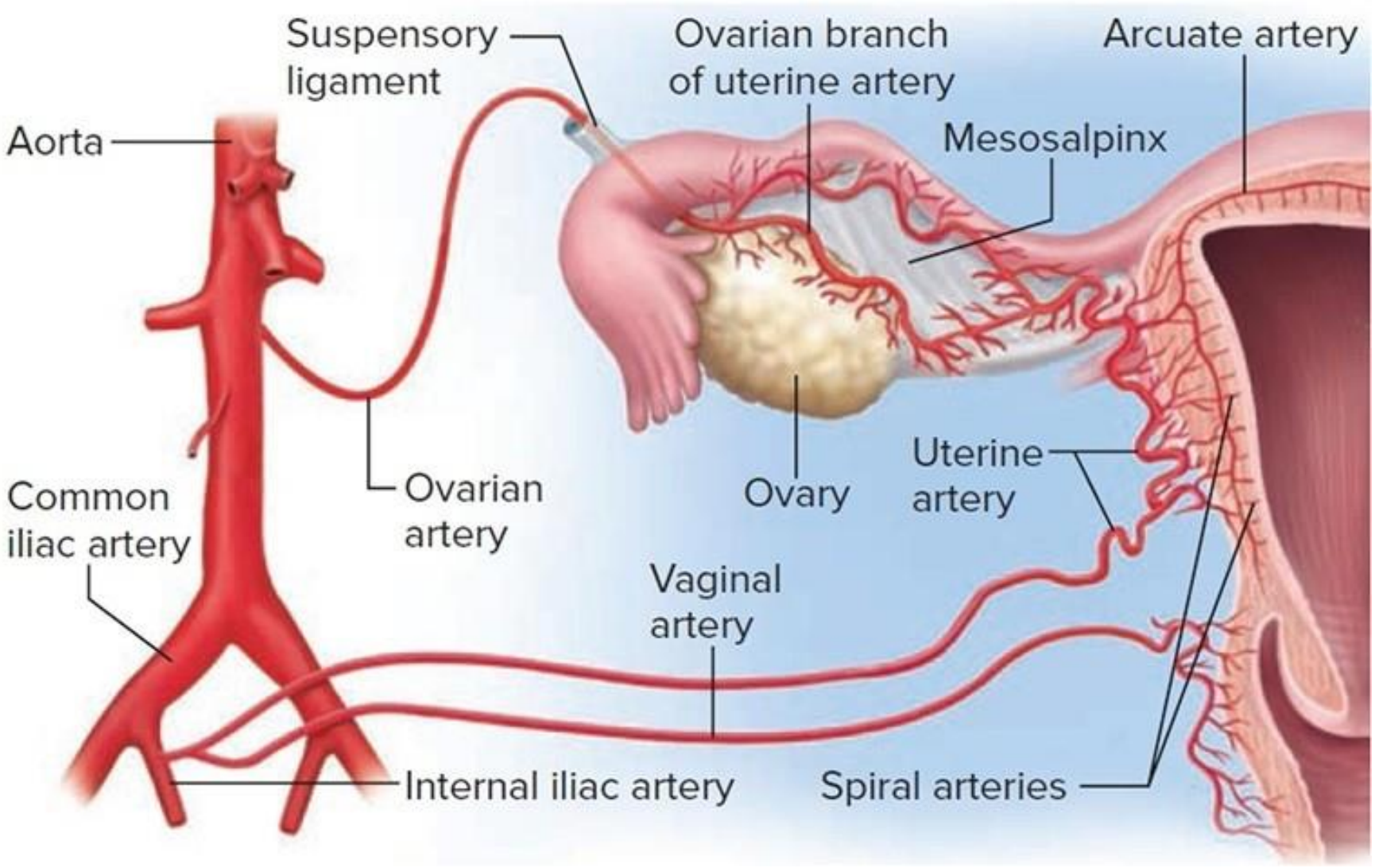


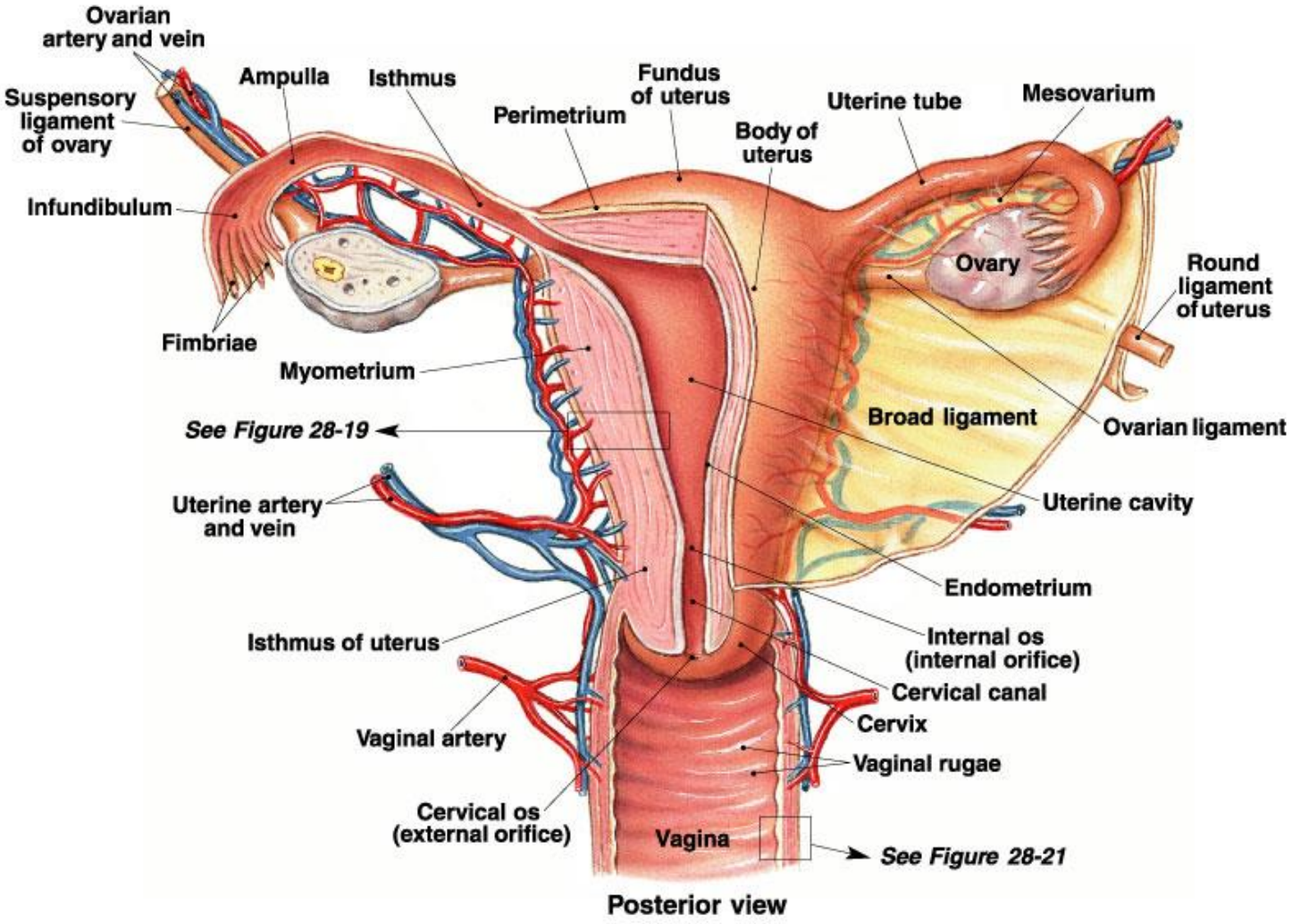
the normal ovary

volume < 5.5 cm^3 (pre-menopausal)

follicles randomly distributed in stroma
dual blood supply from the ovarian artery and an adnexal division of the uterine artery


No cut
19.4mm/rot
0.6sp
6
I 560


Suspensory ligament
Ovarian branch of uterine artery
Arcuate artery
Aorta
Mesosalpinx
Uterine artery
Ovarian artery
Ovary
Common iliac artery
Vaginal artery
Internal iliac artery
Spiral arteries



when ovarian torsion occurs, the ovary typically rotates around both the **infundibulopelvic ligament** and the **utero-ovarian ligament**

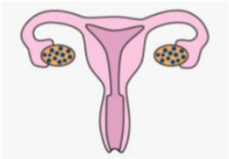
risk factor for ovarian torsion:

- ✓ adnexal mass > 5 cm (80% of all patients), the absence of an ovarian mass or cyst does not exclude torsion

- ✓ Ovarian torsion predominantly affects reproductive-aged women

- ✓ 15% of all ovarian torsion cases occur in pediatric patients> 50% have normal ovaries

- ✓ fertility therapies, history of ovarian torsion or tubal surgery, and polycystic ovarian syndrome.
- ✓ postmenopausal patients account for 15% of cases - ovarian mass



Ovarian Torsion Pearls

Just the Facts

#1: Ovarian torsion affects all ages

- Most common population is reproductive-aged women, but pediatric, elderly, and pregnant patients are also affected

#2: History and exam are not reliable

- Abdominal pain, vomiting, and tenderness are not present in all patients; pelvic exam is unreliable in detecting masses or tenderness

#3: US with normal arterial flow cannot exclude torsion

- Compromised arterial flow does not occur until later in disease course; look for mass/cyst, ovarian edema, gray scale, venous flow, pelvic free fluid

#4: CT may demonstrate findings of torsion

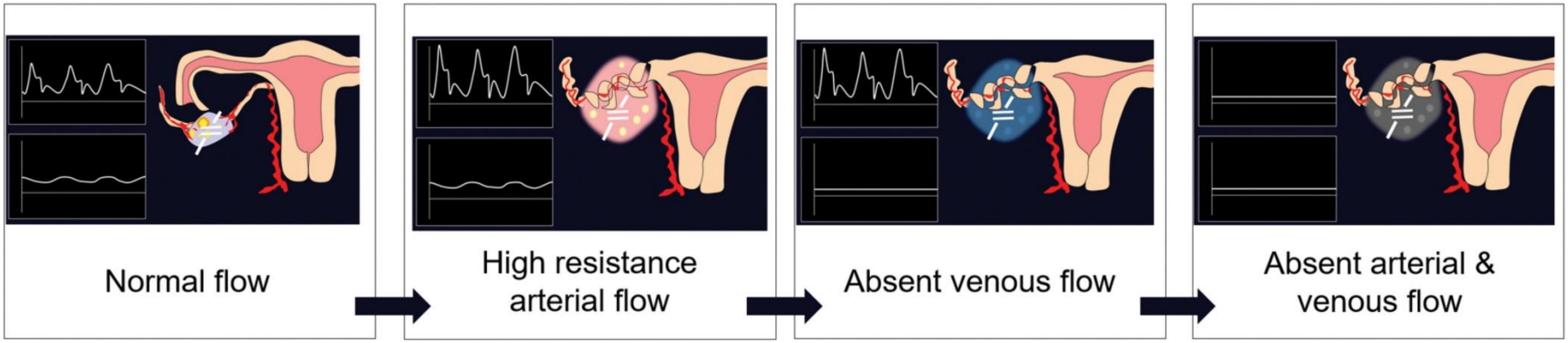
- While not the first-line modality, CT may show twisted vascular pedicle, thickened fallopian tube, abnormal enhancement, ovary with afollicular stroma/peripheral follicles

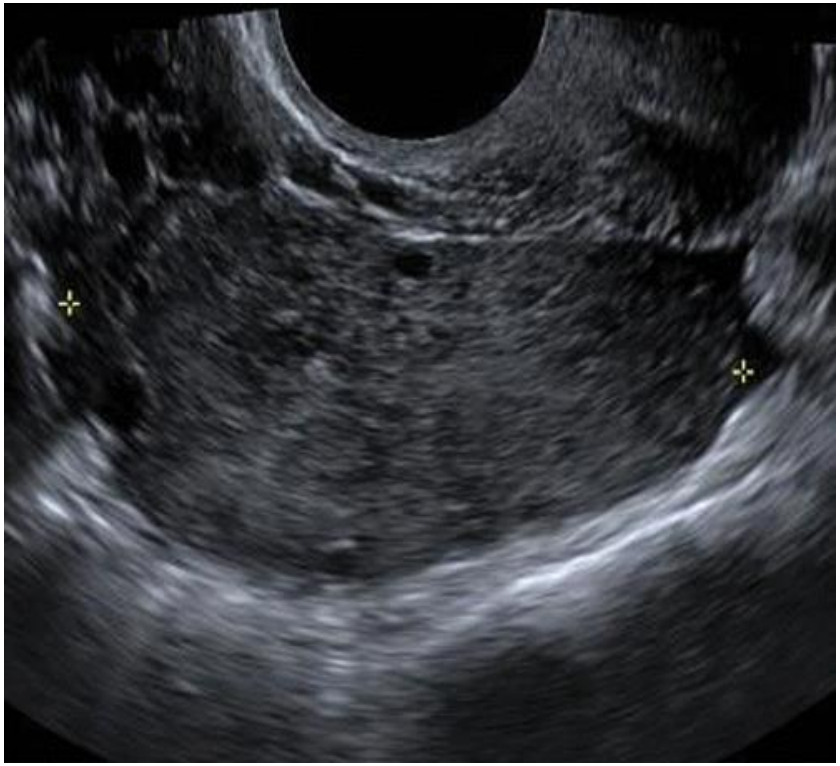
#5: There is no definitive ovarian ischemia time

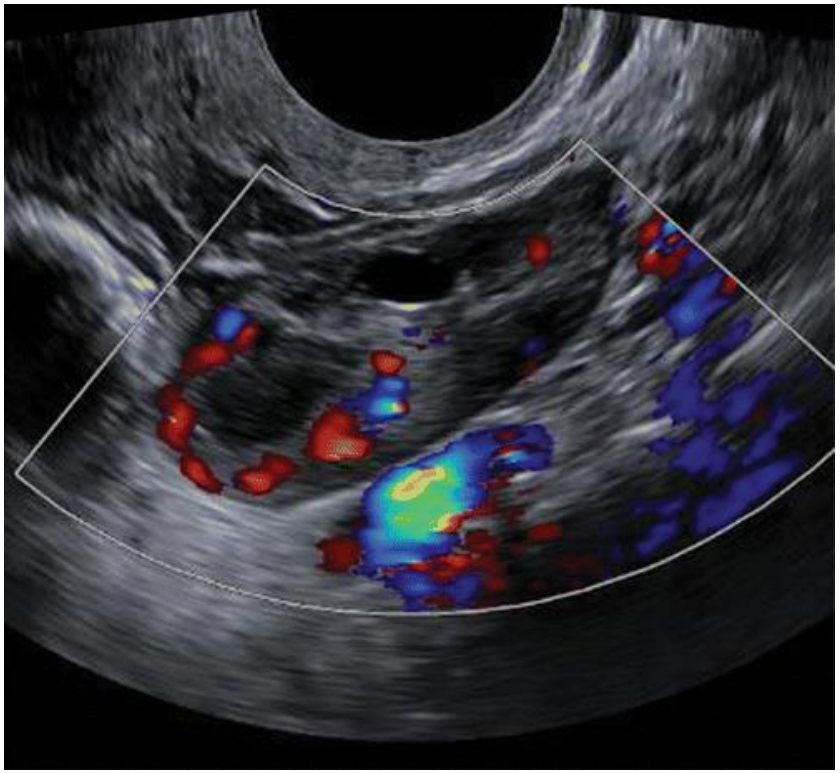
- Consult specialist regardless of symptom duration prior to imaging if history and exam suggest torsion

THE IRISH SOCIETY OF INTERVENTIONAL RADIOLOGY

“23-year-old female presents with right lower quadrant pain that has been intermittent for the past several days. The pain suddenly worsened 1 hour ago. She denies vaginal bleeding or discharge, dysuria, fever, and back pain, but she has had several episodes of nausea with vomiting. On examination, she is tender in the right lower quadrant, but her abdomen is soft”.

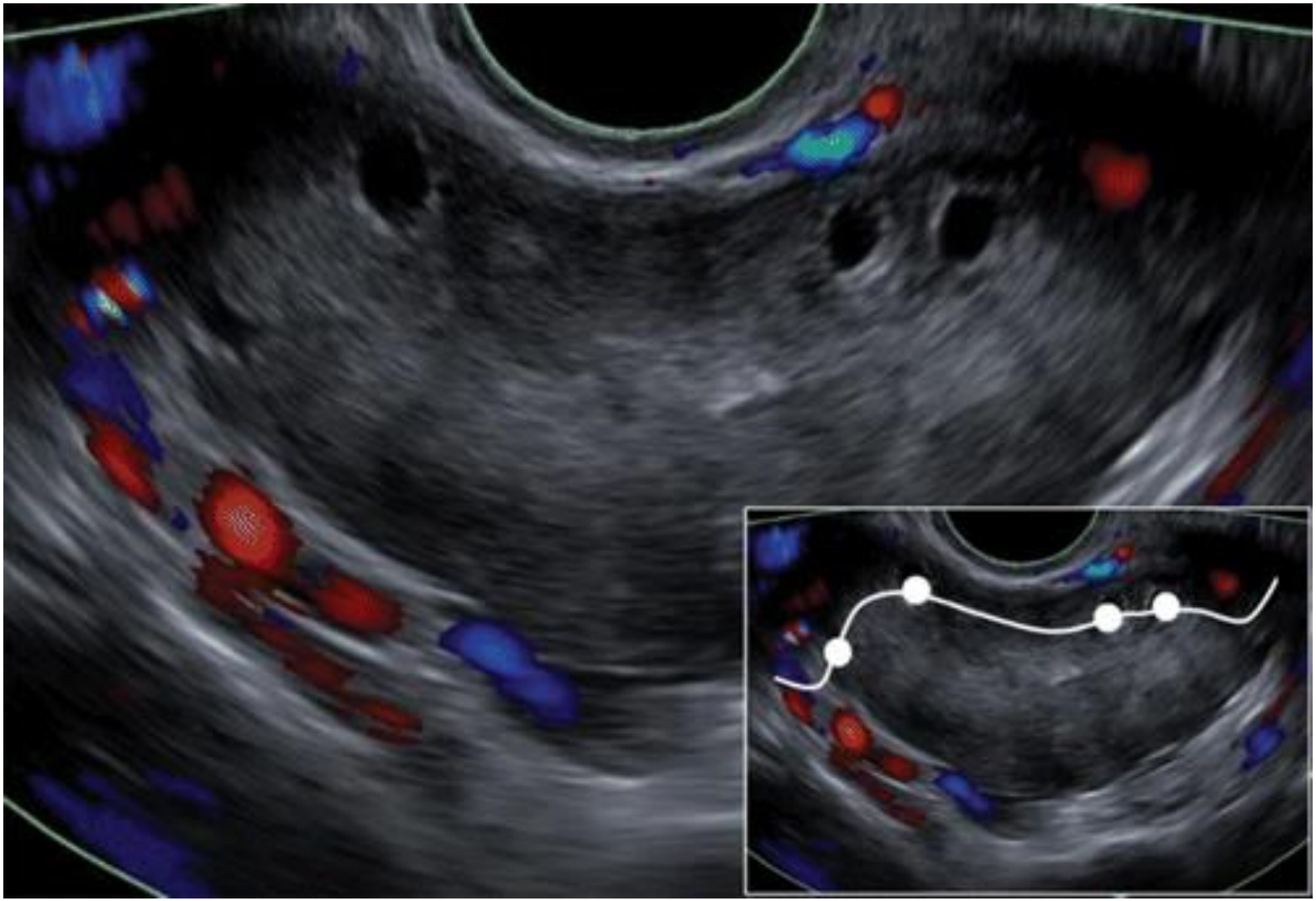

Normal flow
High resistance arterial flow
Absent venous flow
Absent arterial & venous flow

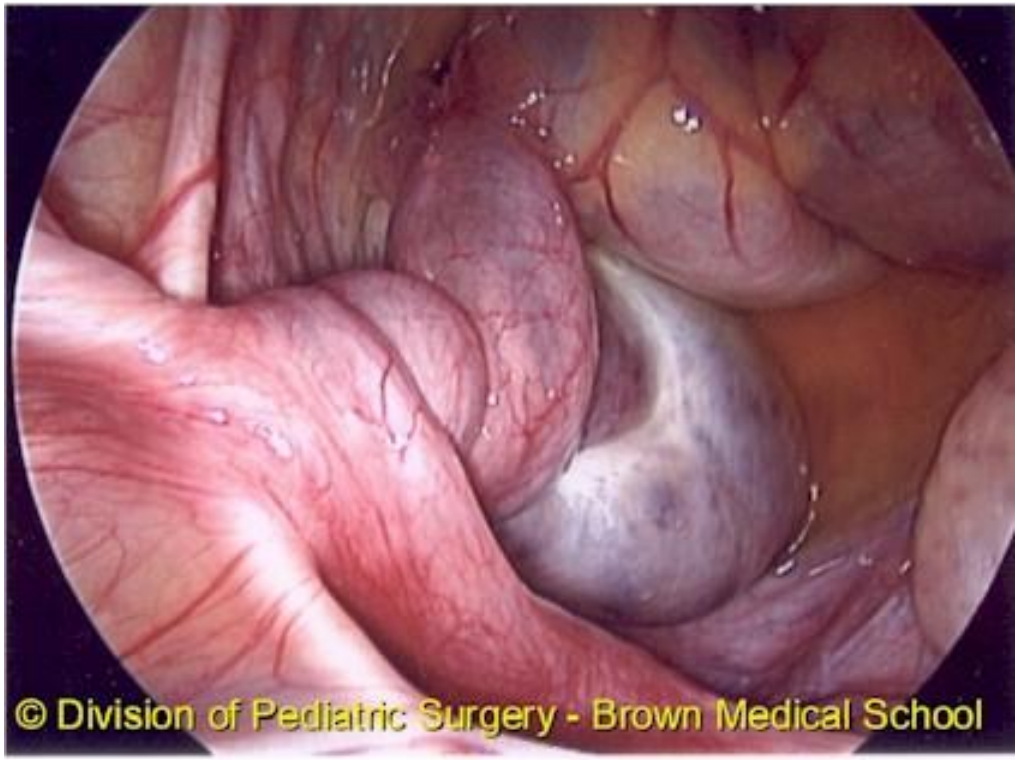


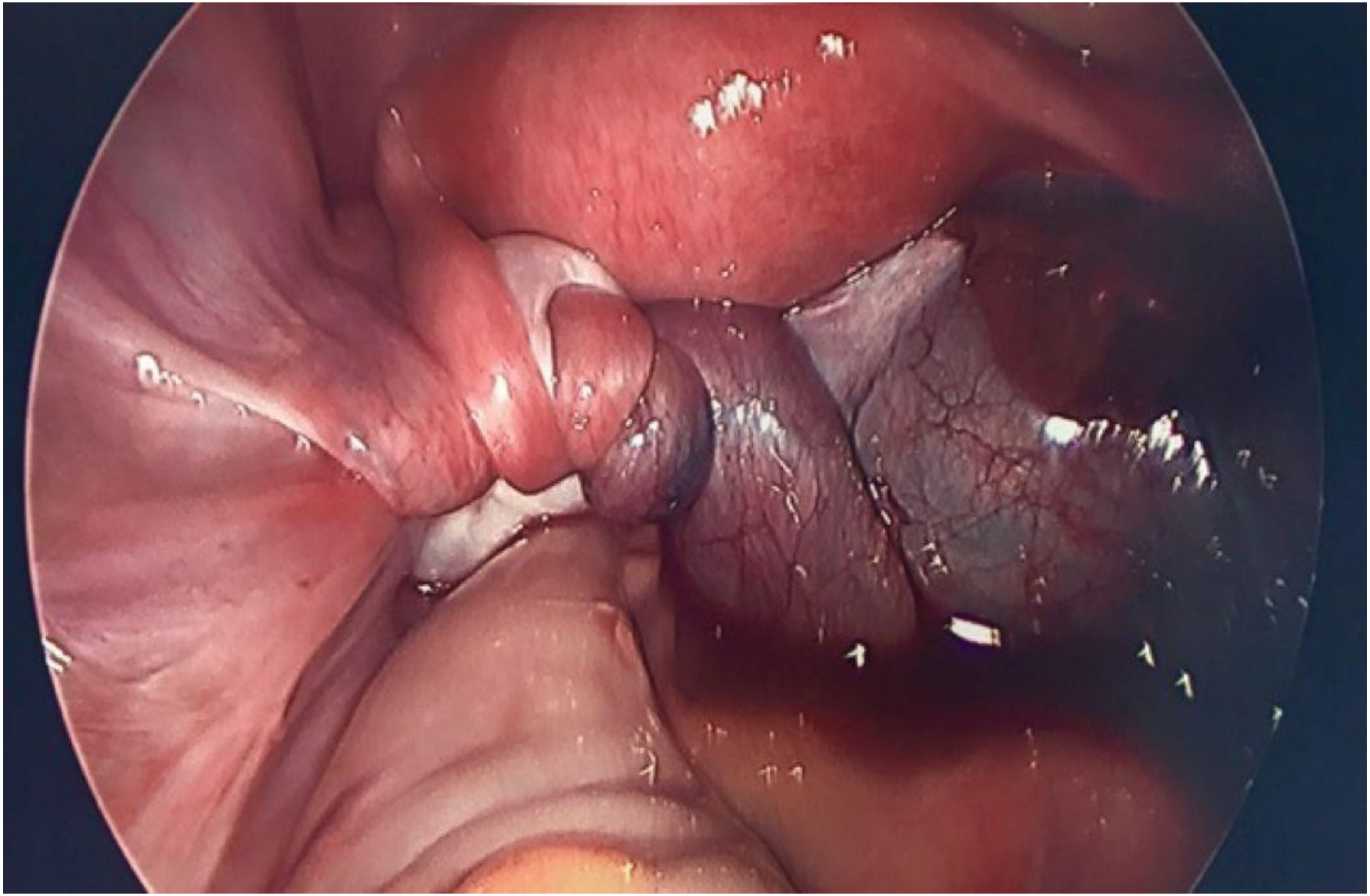


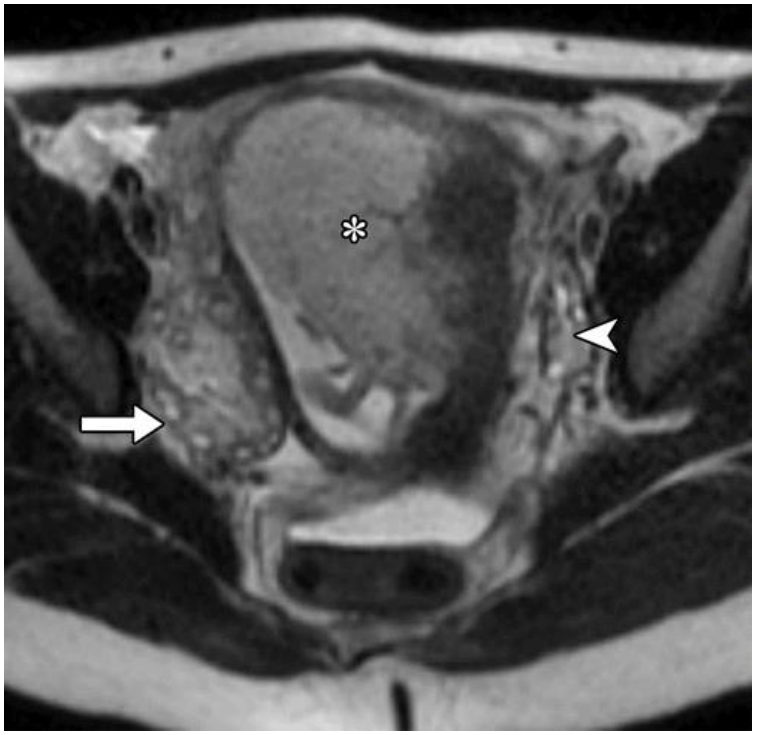
Imaging features of ovarian edema are the hallmark of torsion.

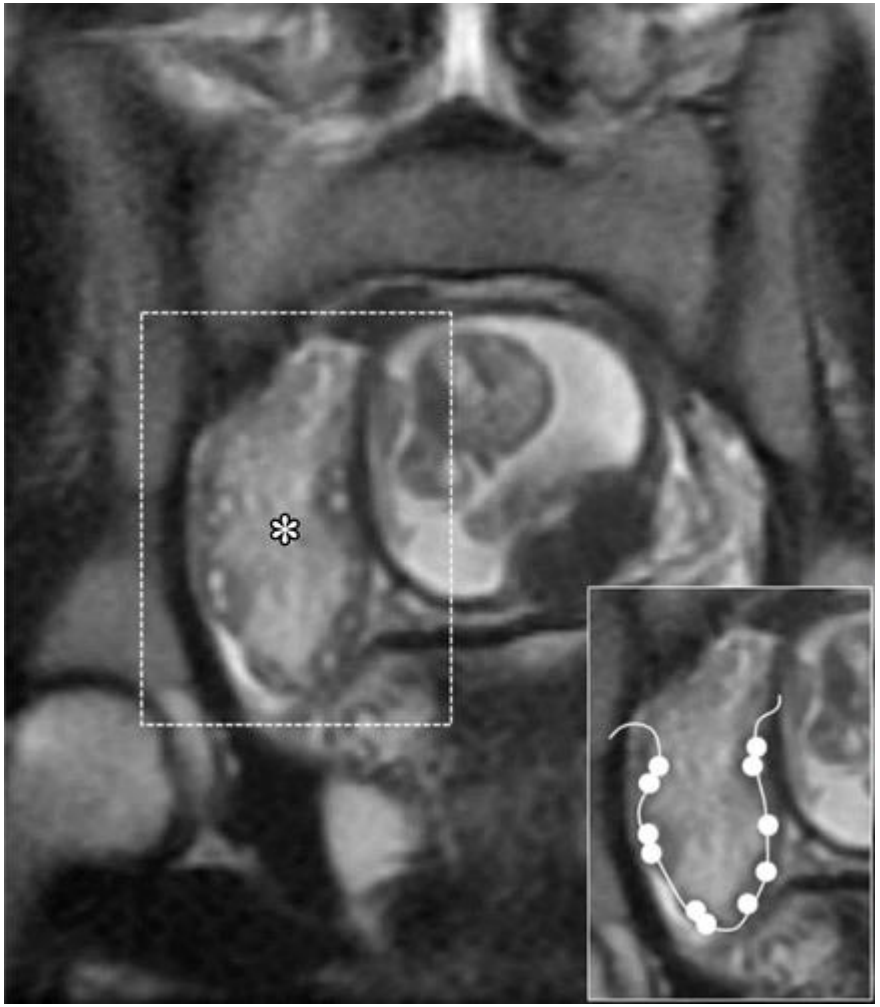
If both ovaries are normal in size and location at US, CT, or MRI, ovarian torsion is essentially excluded and additional imaging—such as Doppler US—is not necessary

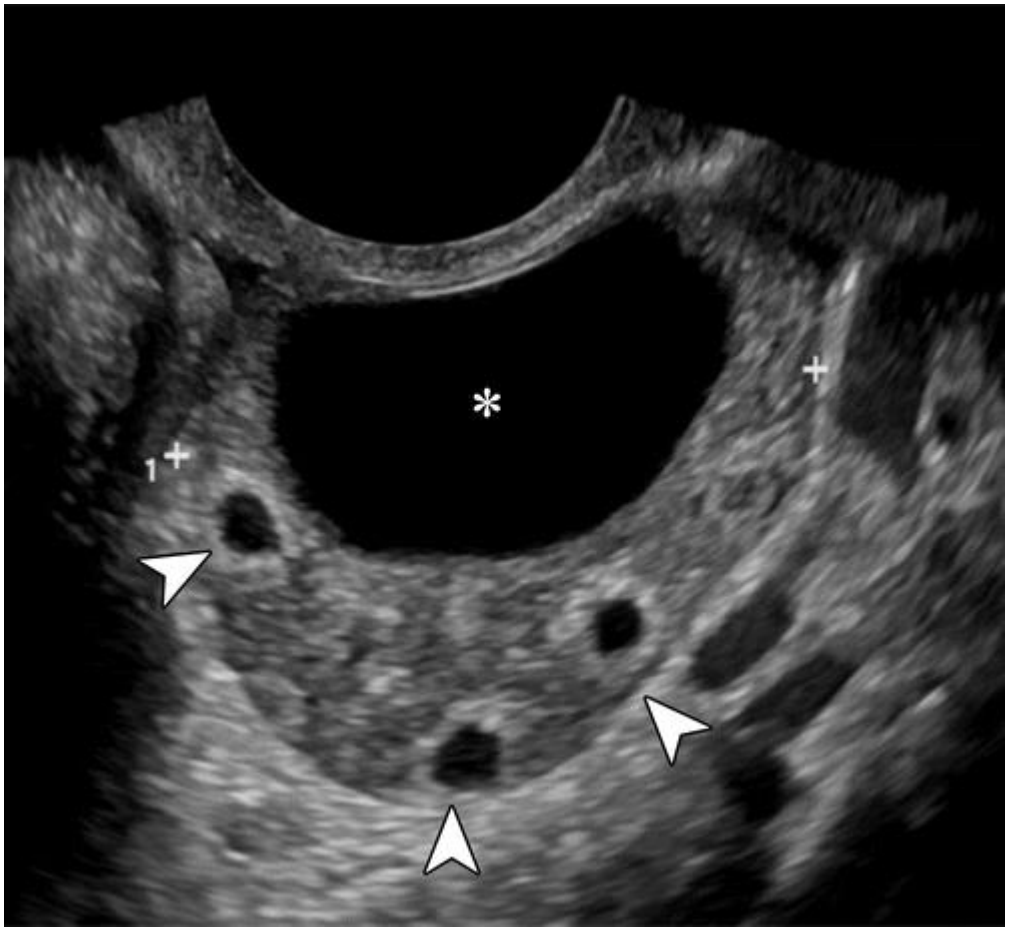




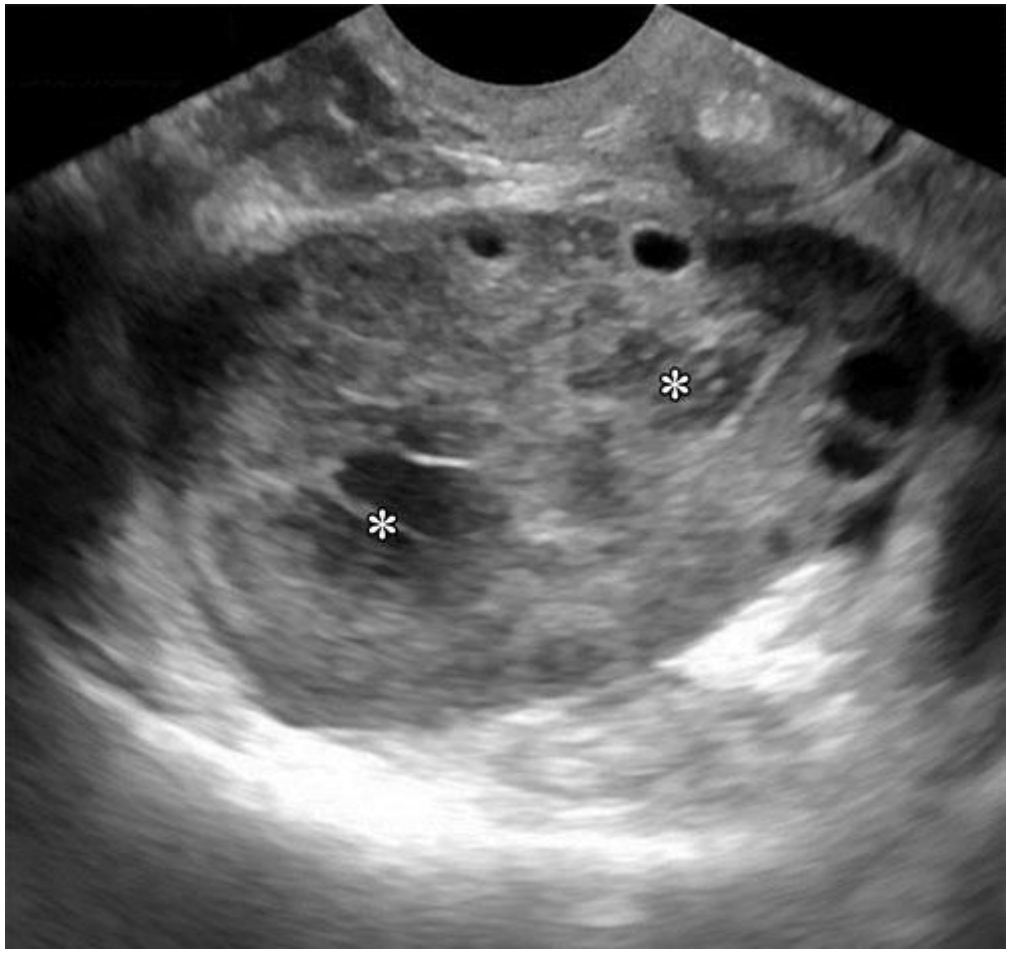








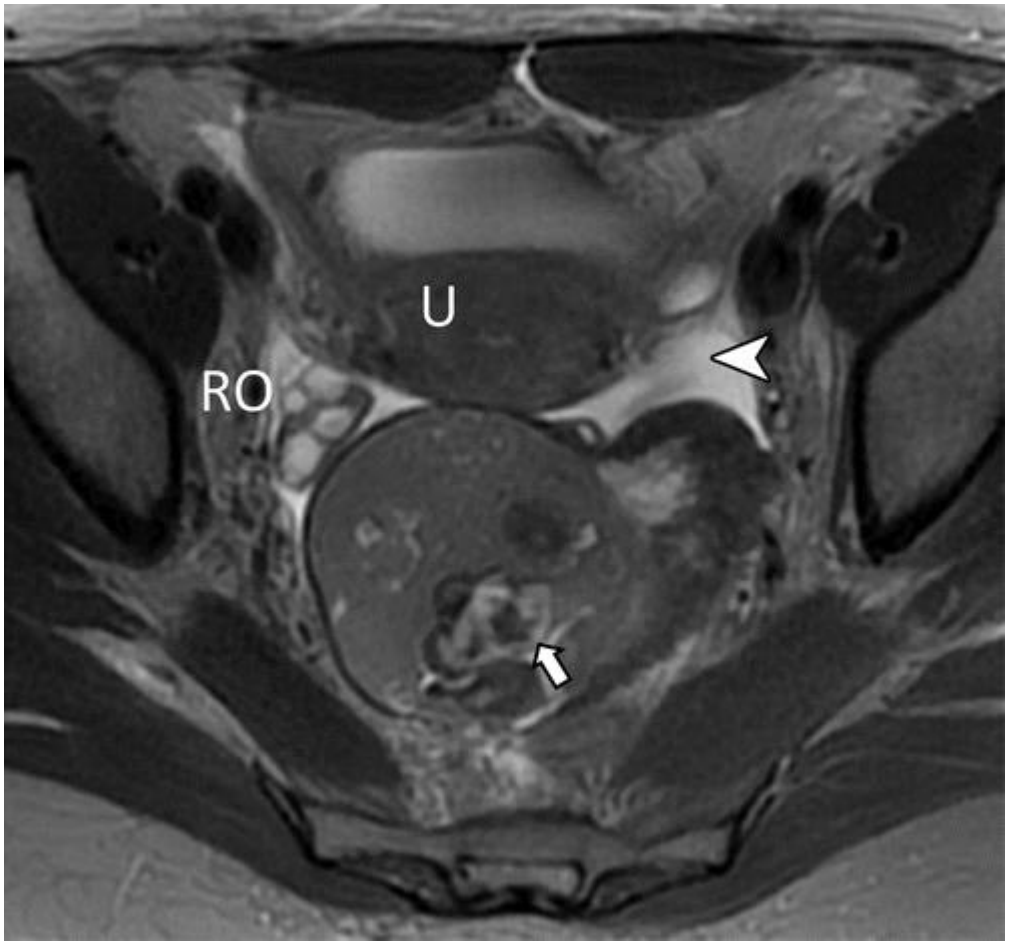
A hyperechoic rim surrounding the follicles, referred to as the “follicular ring” sign, occurs in up to 38% of adnexal torsion cases - due to engorged capillaries and hemorrhage within the thecal layer of peripheralized follicles.
adjacent free fluid that “weeps” from the strangled ovary is seen in up to 87% of cases and is yet another manifestation of edema



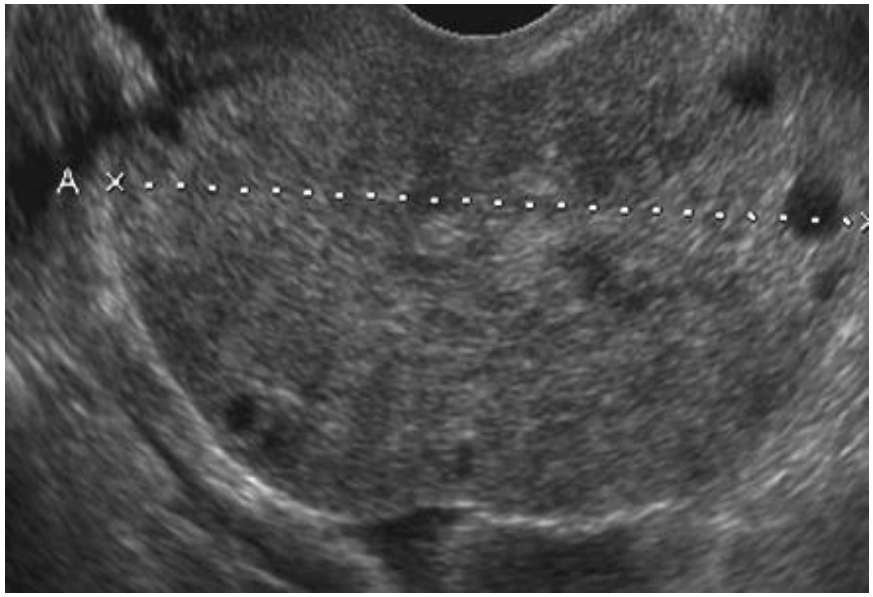
Stromal heterogeneity indicating hemorrhagic infarction due to advanced ovarian torsion

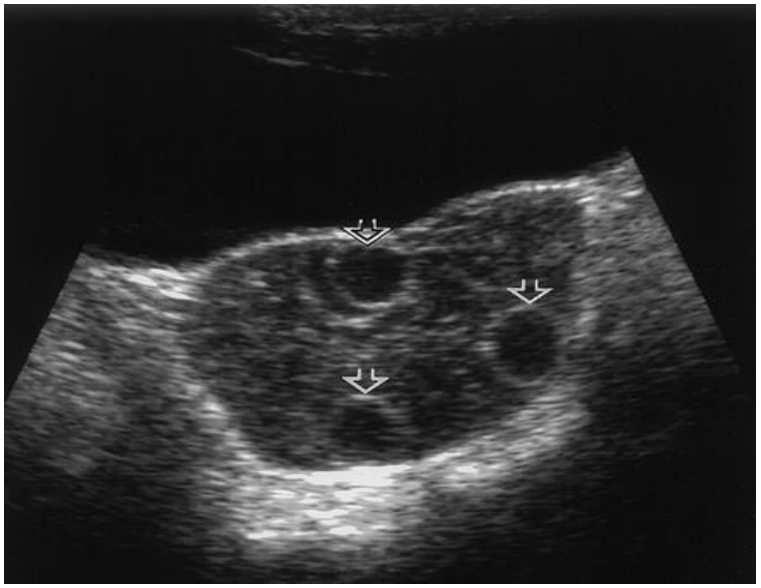
- ✓ Strange or unusual location of the ovary, uterine tilting, or change in ovarian or uterine positioning is suspicious for torsion

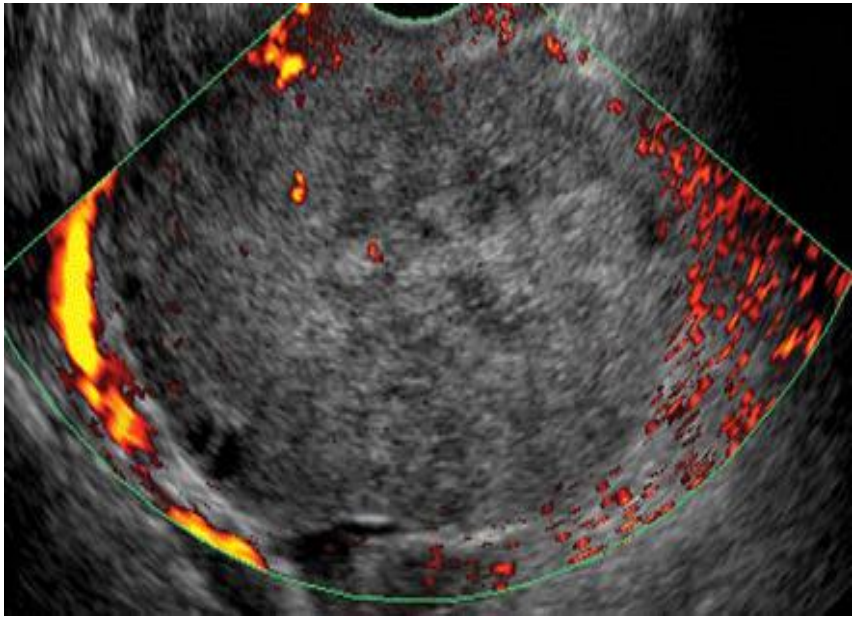
- ✓ In the setting of a known or new diagnosis of ovarian malignancy and severe acute pain, it is prudent to suspect torsion until proven otherwise

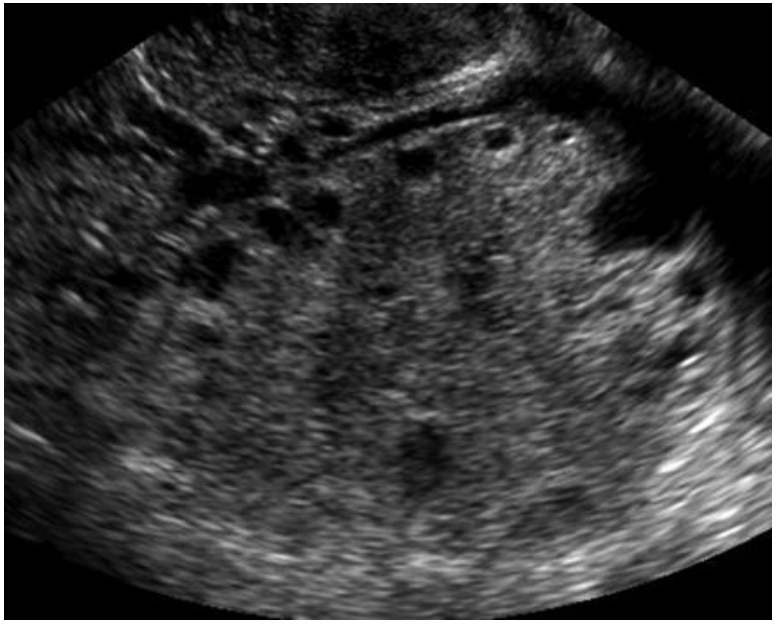


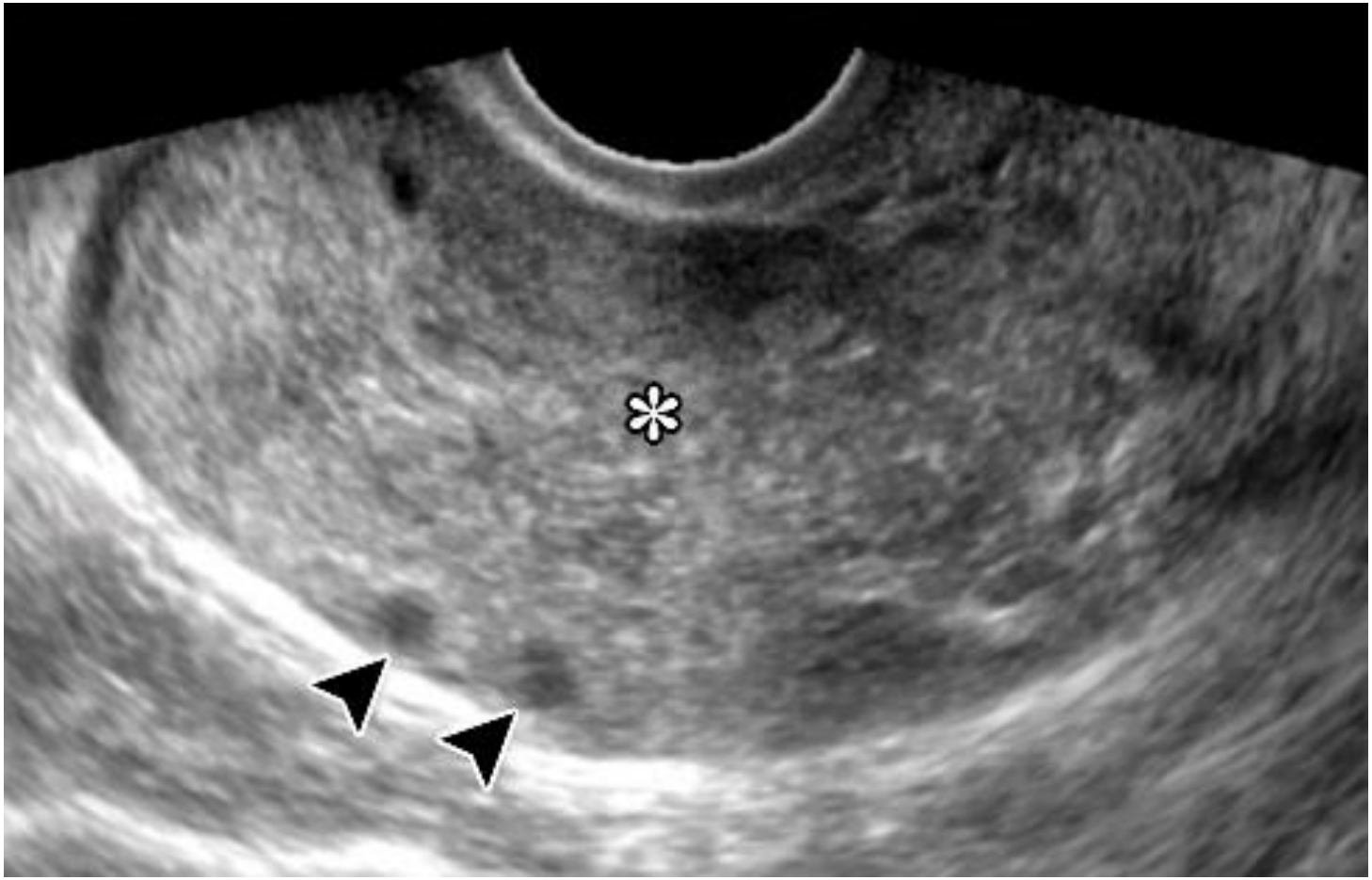
dermoid + pain = torsion

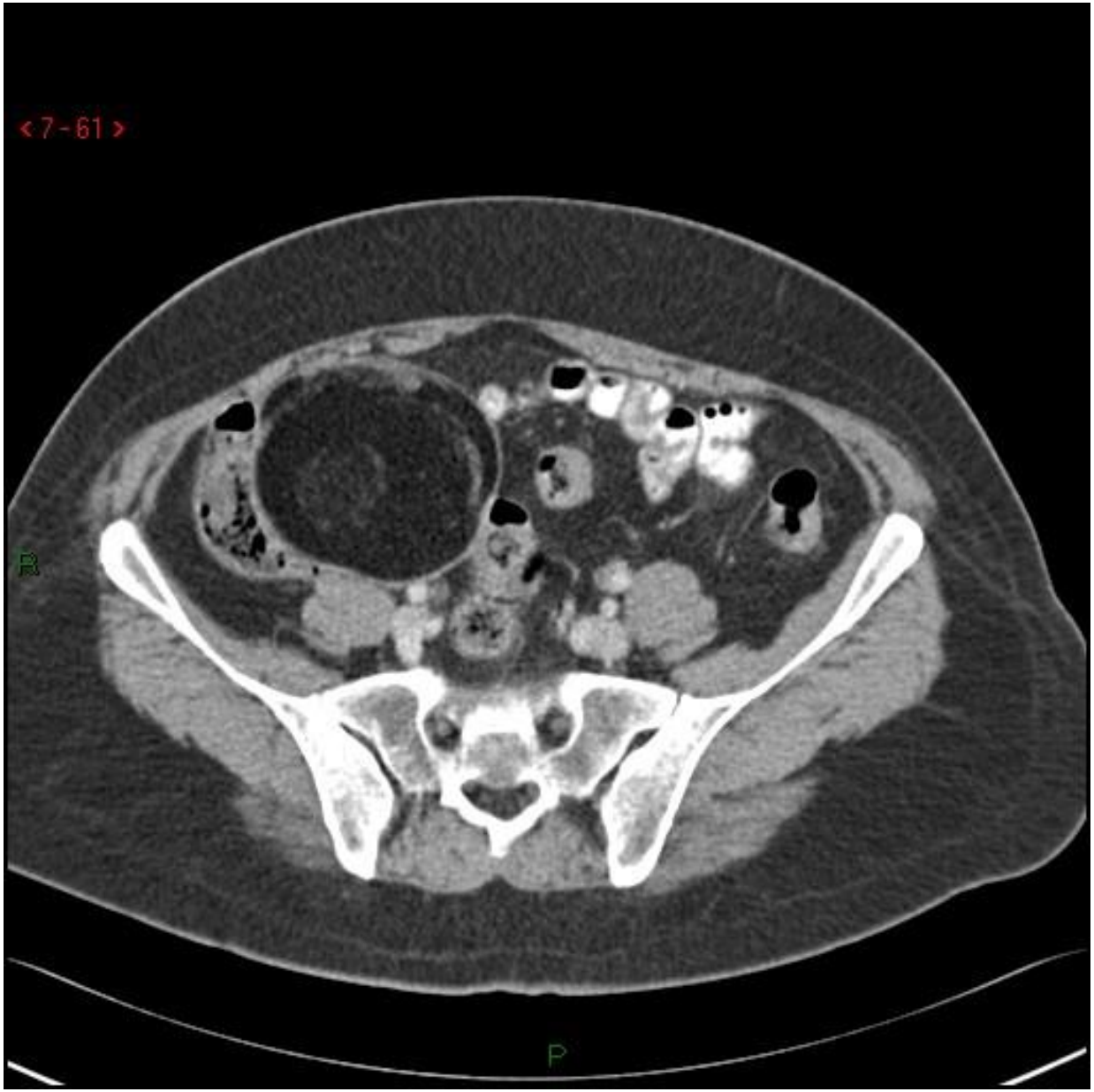

A

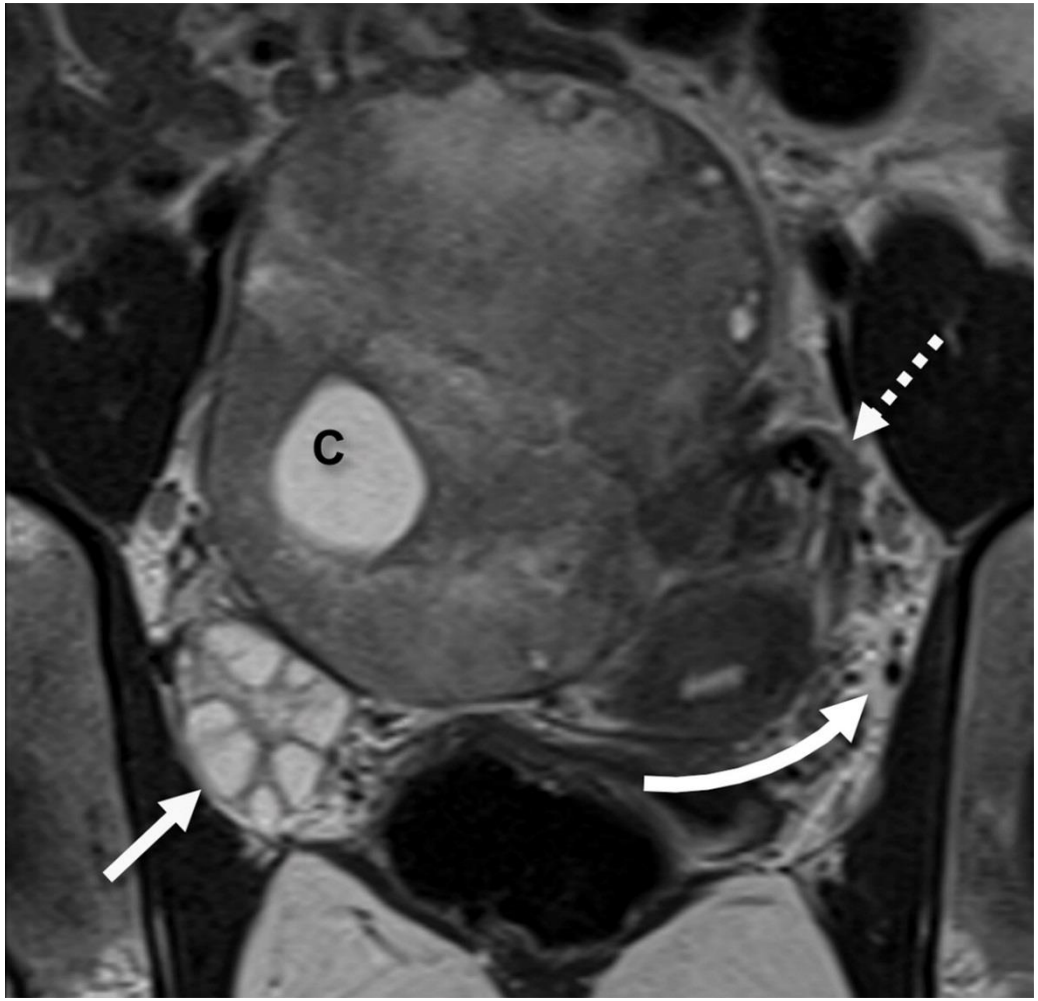




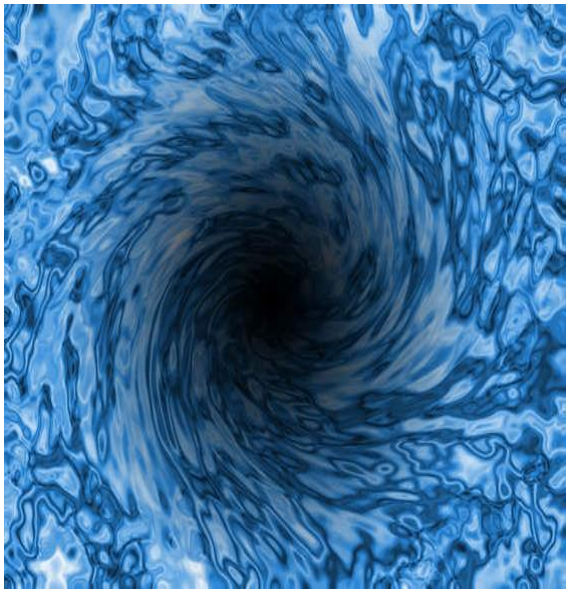


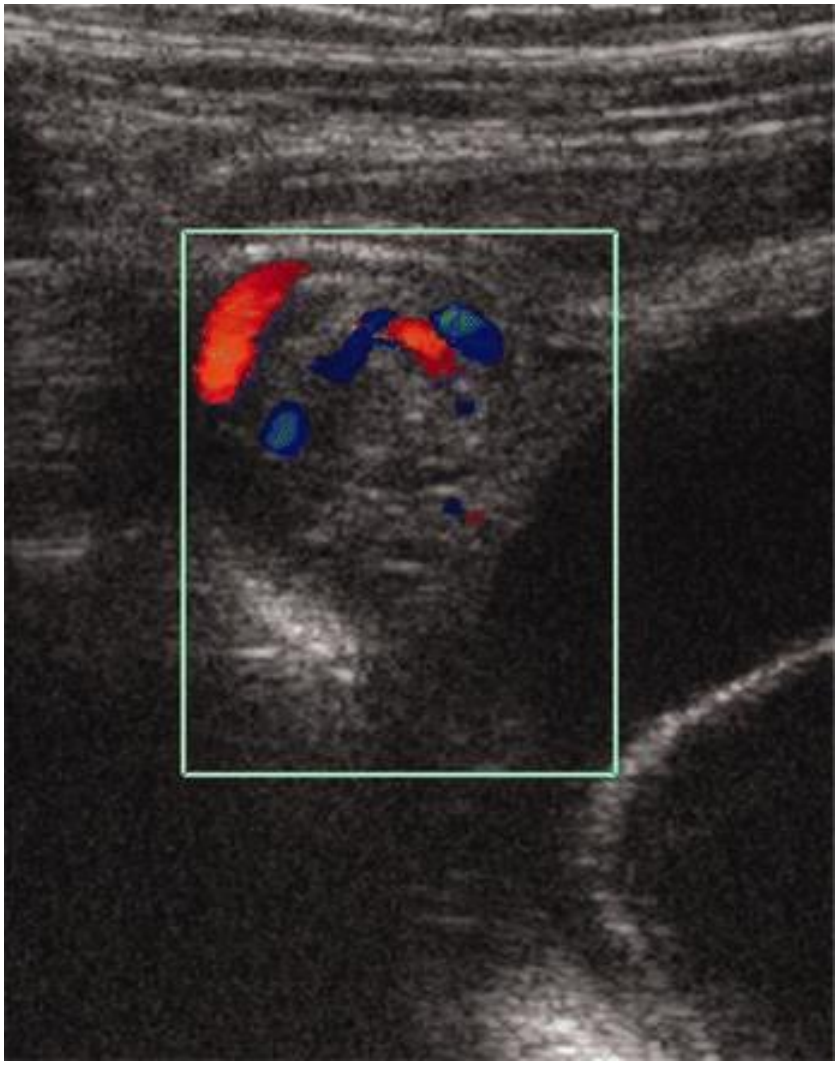


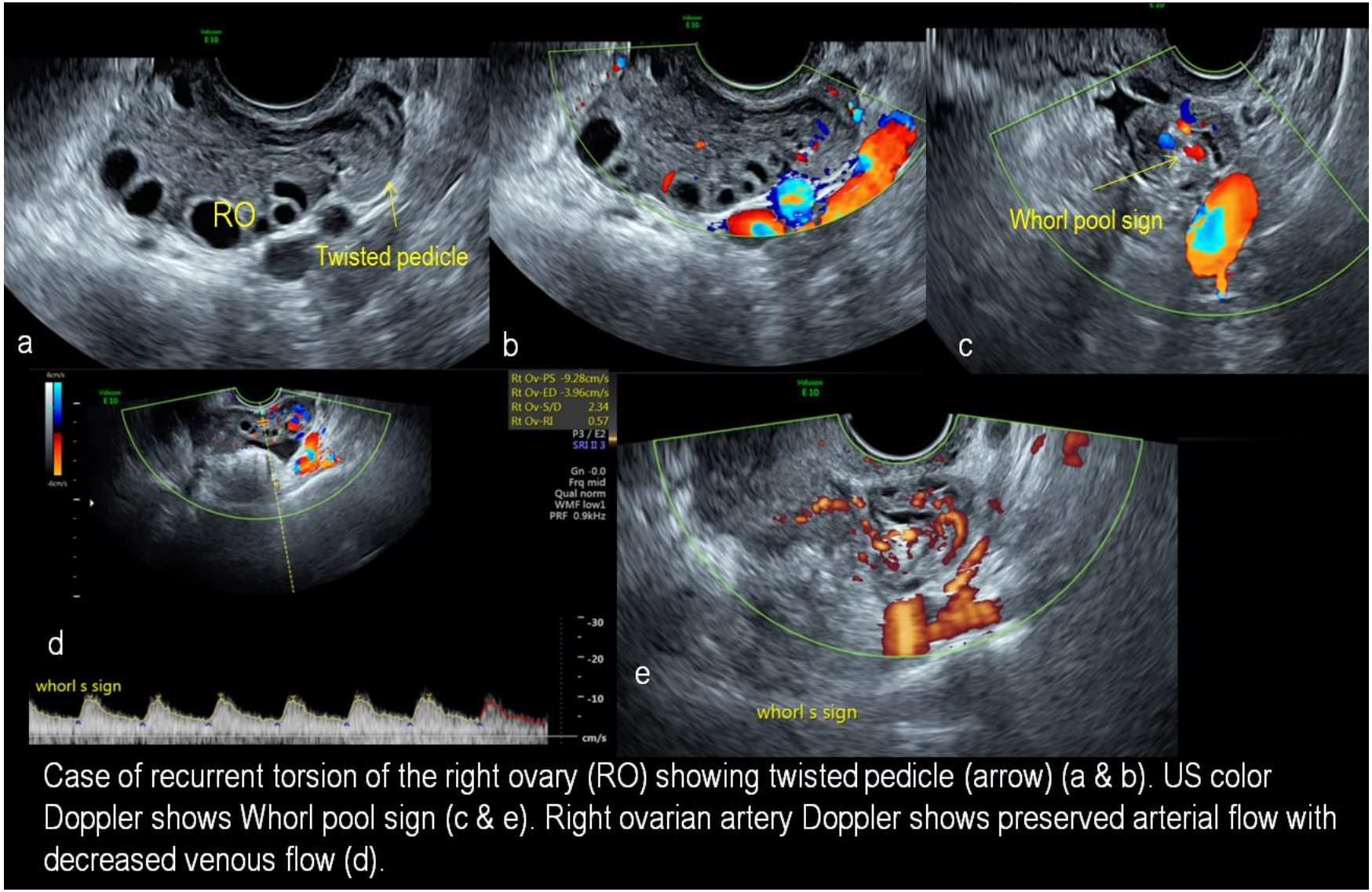

‹ 7-61 ›
R
P


C

- ✓ the whirlpool sign, consisting of a hyperechoic structure with multiple inner hypoechoic rings wrapped around a central axis, is pathognomonic for torsion



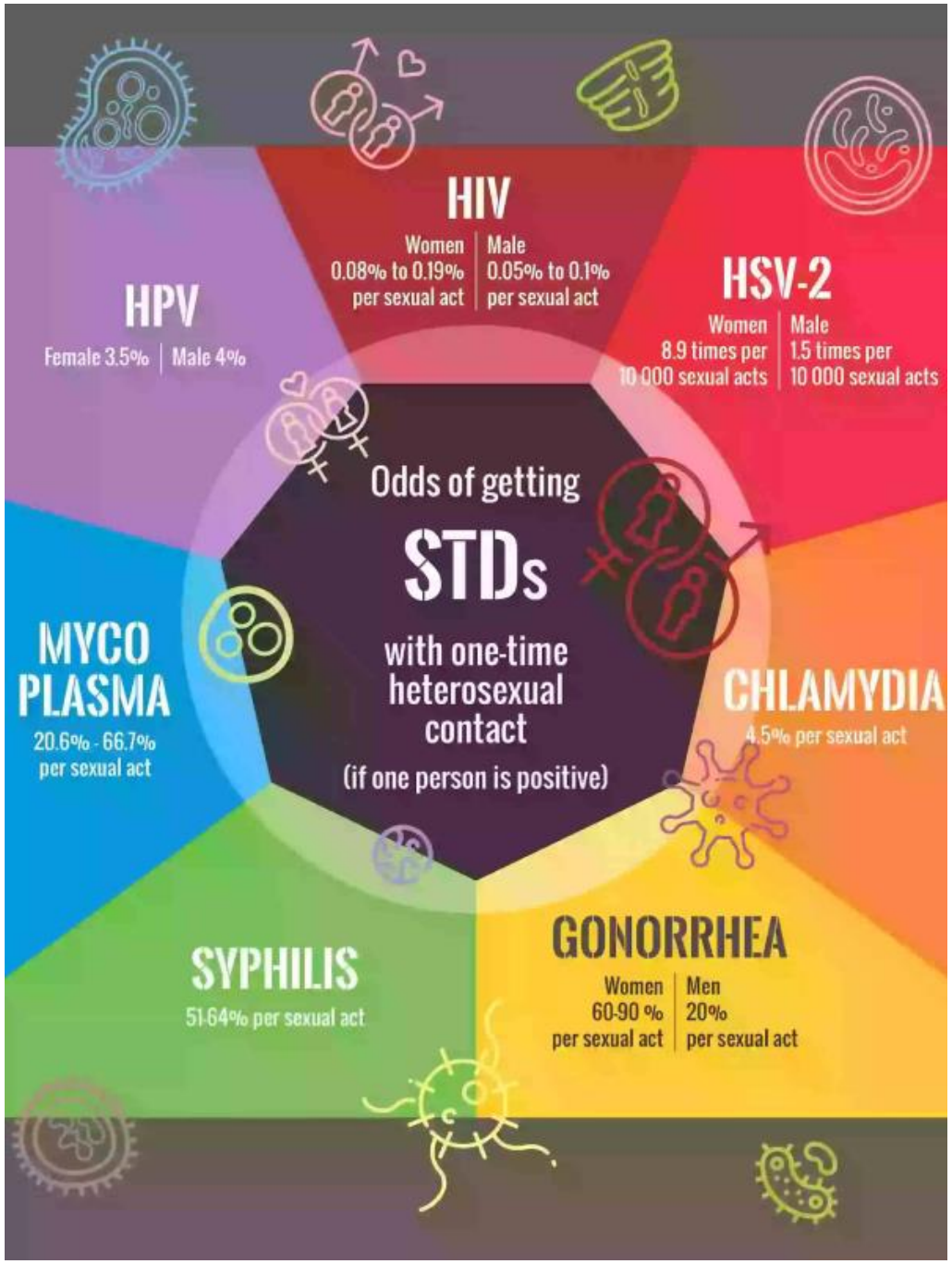




Case of recurrent torsion of the right ovary (RO) showing twisted pedicle (arrow) (a & b). US color Doppler shows Whorl pool sign (c & e). Right ovarian artery Doppler shows preserved arterial flow with decreased venous flow (d).


THE EASY GUIDE
MOVING HOME >>>

- ✓ Acute pelvic pain with nausea and vomiting
- ✓ Acute pain associated with a dermoid cyst or other ovarian neoplasm is peculiar
- ✓ Ovarian oedema, the hallmark feature of torsion: manifests as asymmetric ovarian enlargement, thicker than expected ovarian parenchyma surrounding a lesion, adjacent free fluid, and stromal changes of heterogeneity at US, high attenuation at non-contrast CT, and increased T1-weighted signal intensity at MRI
- ✓ Whirlpool sign representing a twisted pedicle
- ✓ Location, location, location: change in position of the ovary, and uterine tilting
- ✓ Diagnosis should not be delayed because color Doppler flow or contrast enhancement is still present.
- ✓ Isolated torsion of a fallopian tube or para-ovarian cyst is possible with normal-appearing ovaries


HIV
Women
0.08% to 0.19%
per sexual act
Male
0.05% to 0.1%
per sexual act
HPV
Female 3.5%
Male 4%
HSV-2
Women
8.9 times per
10 000 sexual acts
Male
1.5 times per
10 000 sexual acts
Odds of getting
STDs
with one-time
heterosexual
contact
(if one person is positive)
MYCO
PLASMA
20.6% - 66.7%
per sexual act
CHLAMYDIA
4.5% per sexual act
SYPHILIS
51-64% per sexual act
GONORRHEA
Women
60-90 %
per sexual act
Men
20%
per sexual act

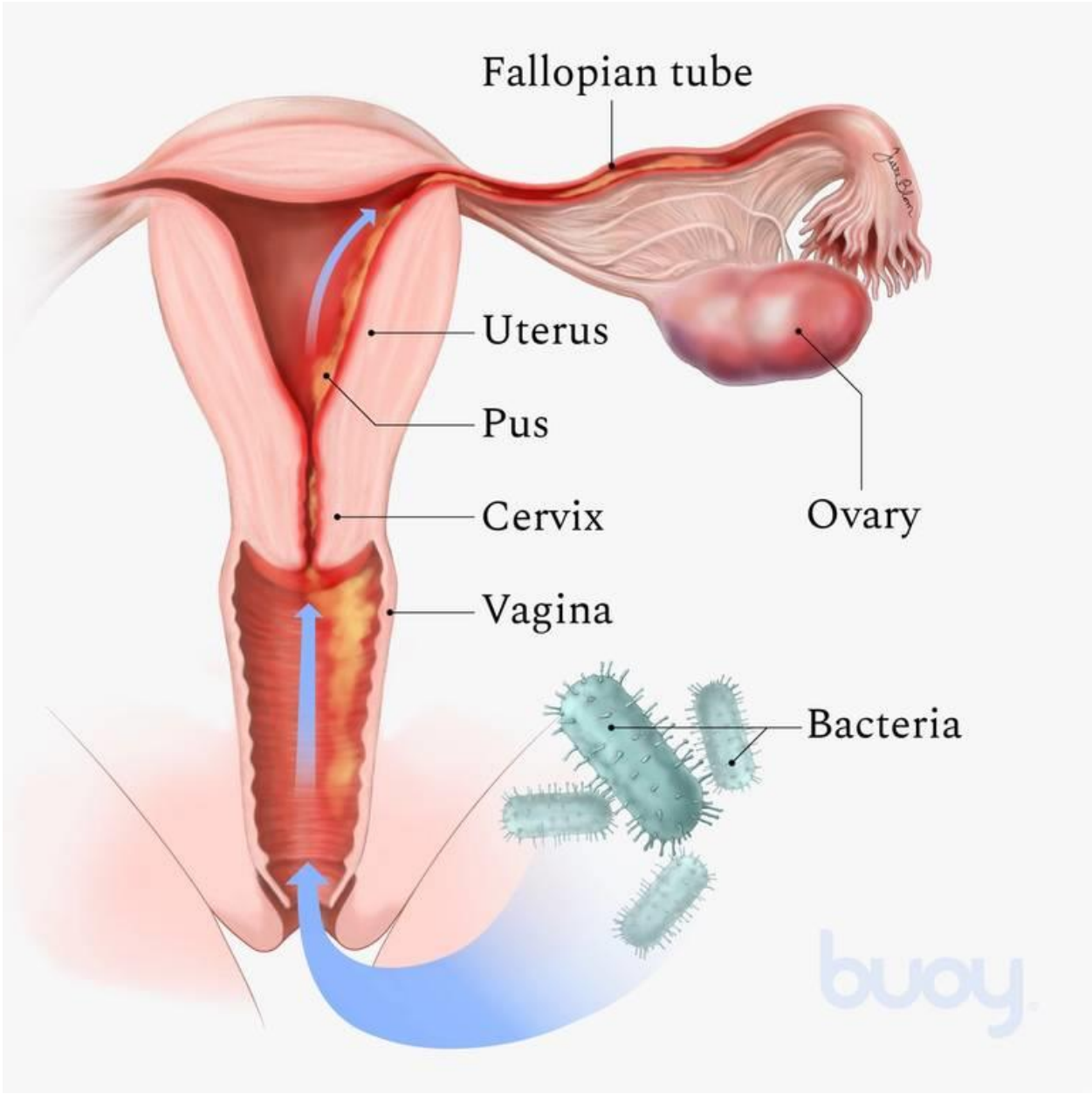
Abdominal pain

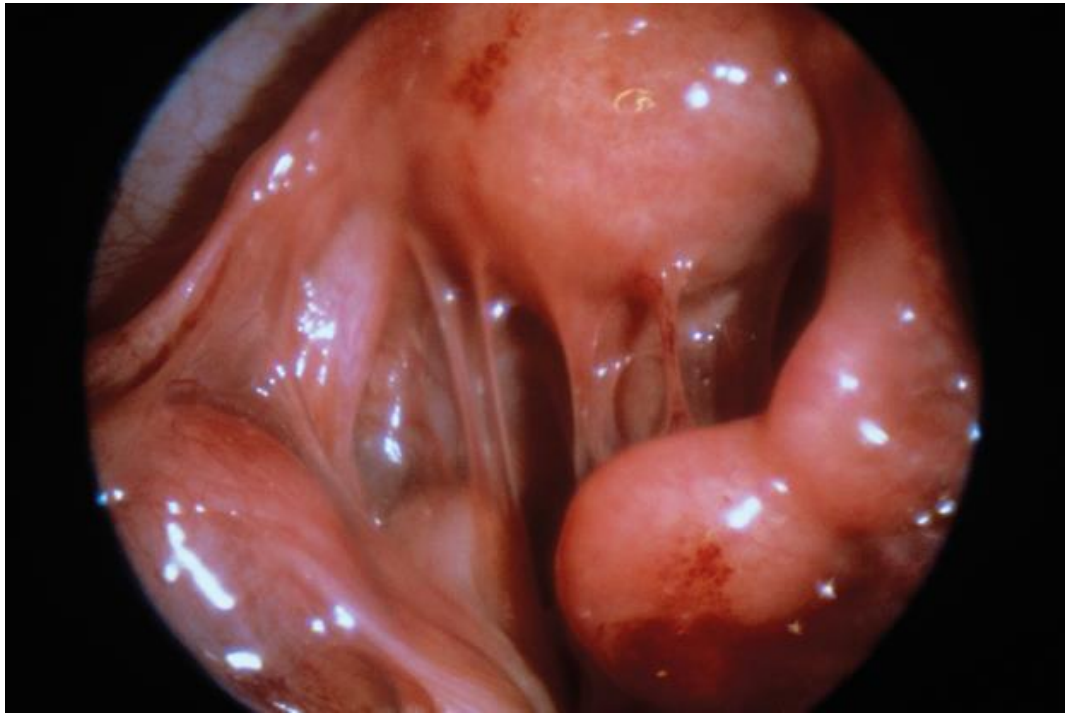
Bleedings

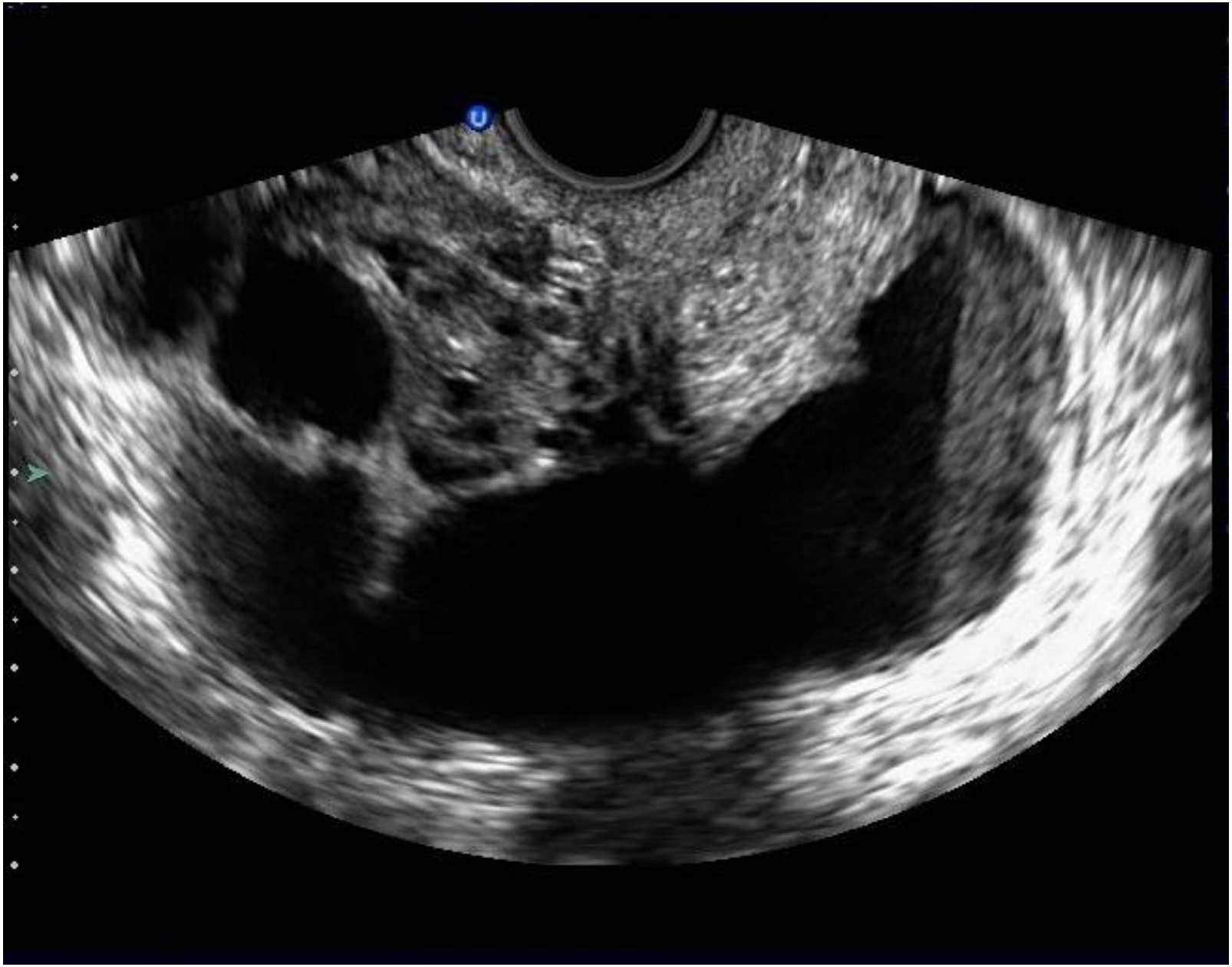
Urinary disorders

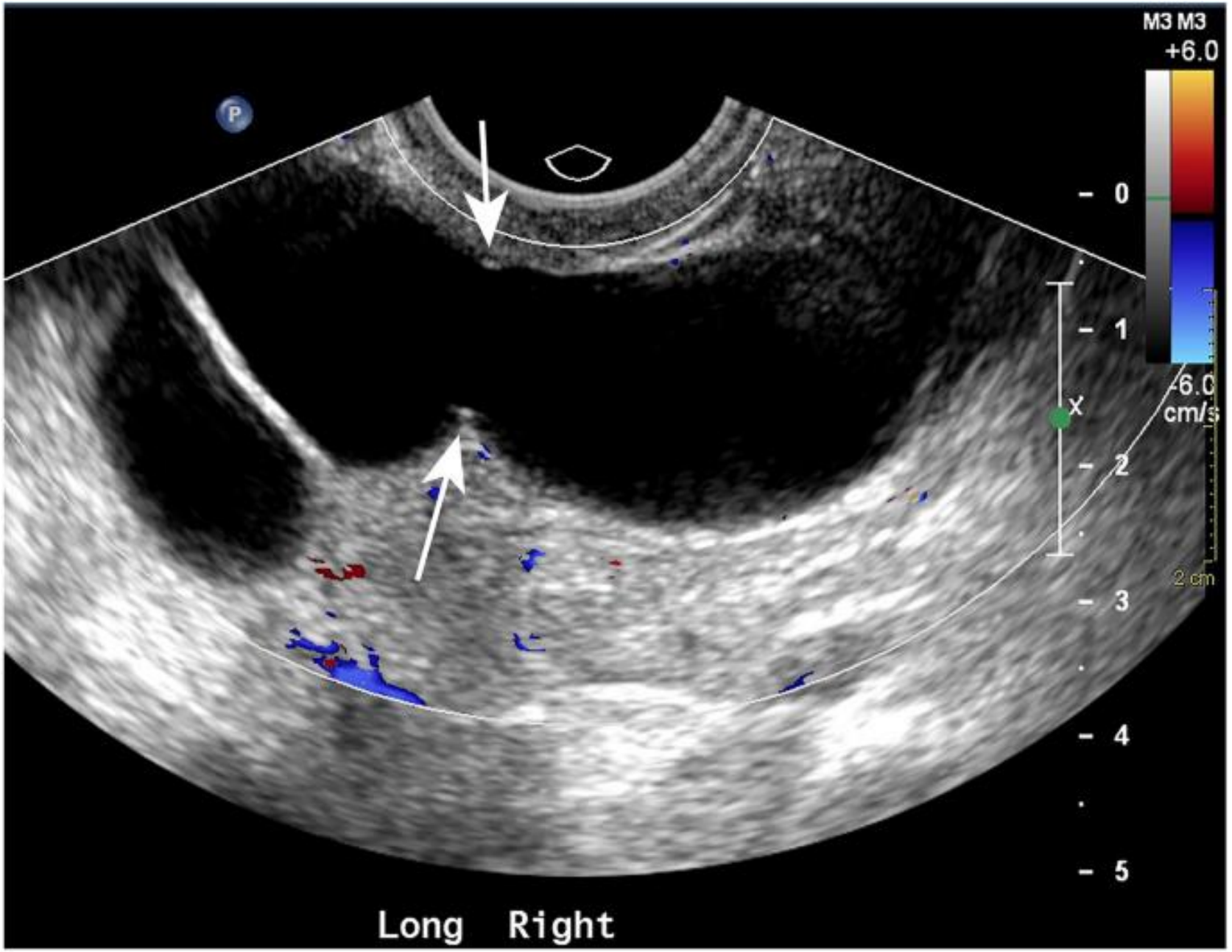
Nausea or vomiting

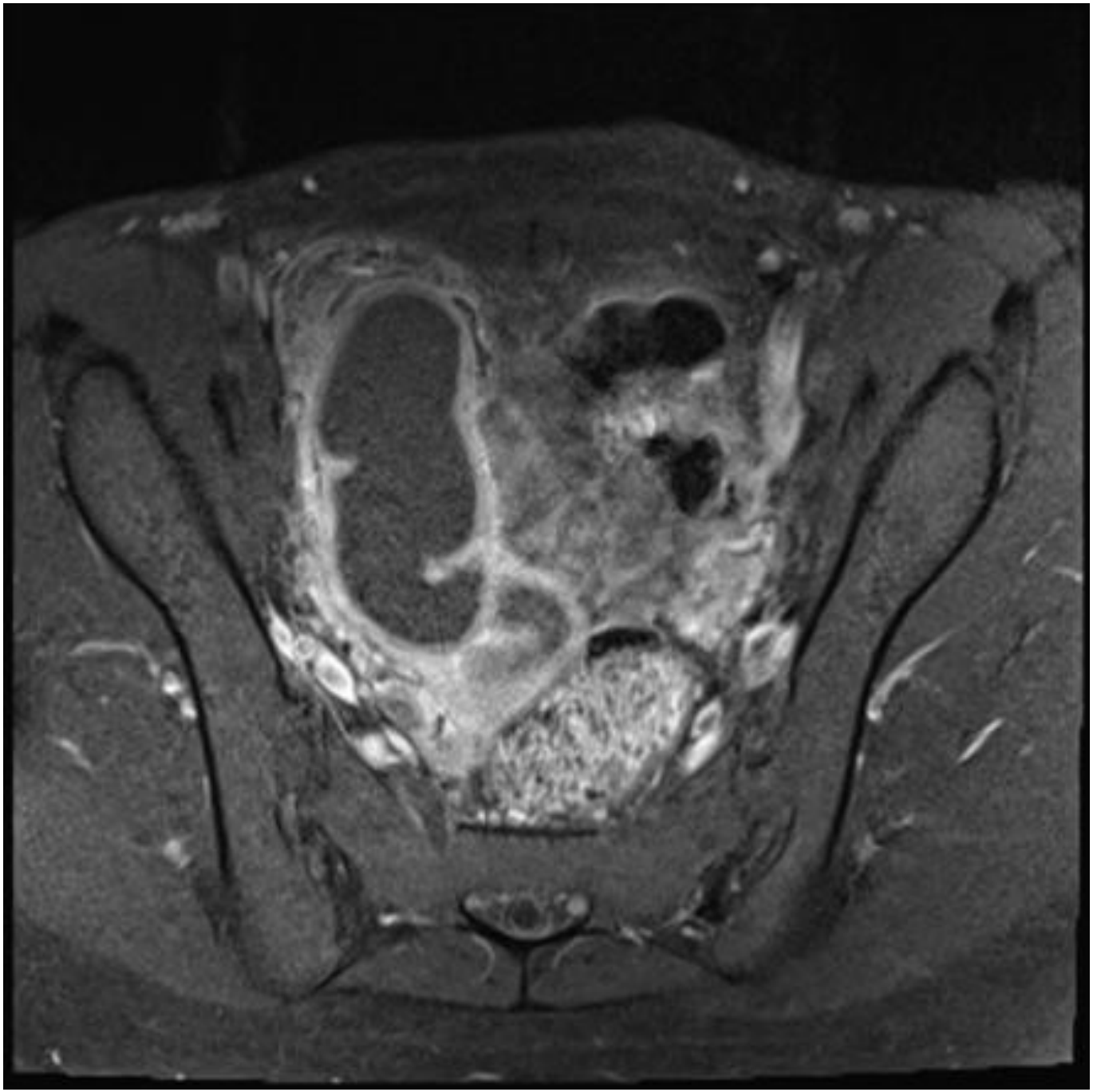
Fever

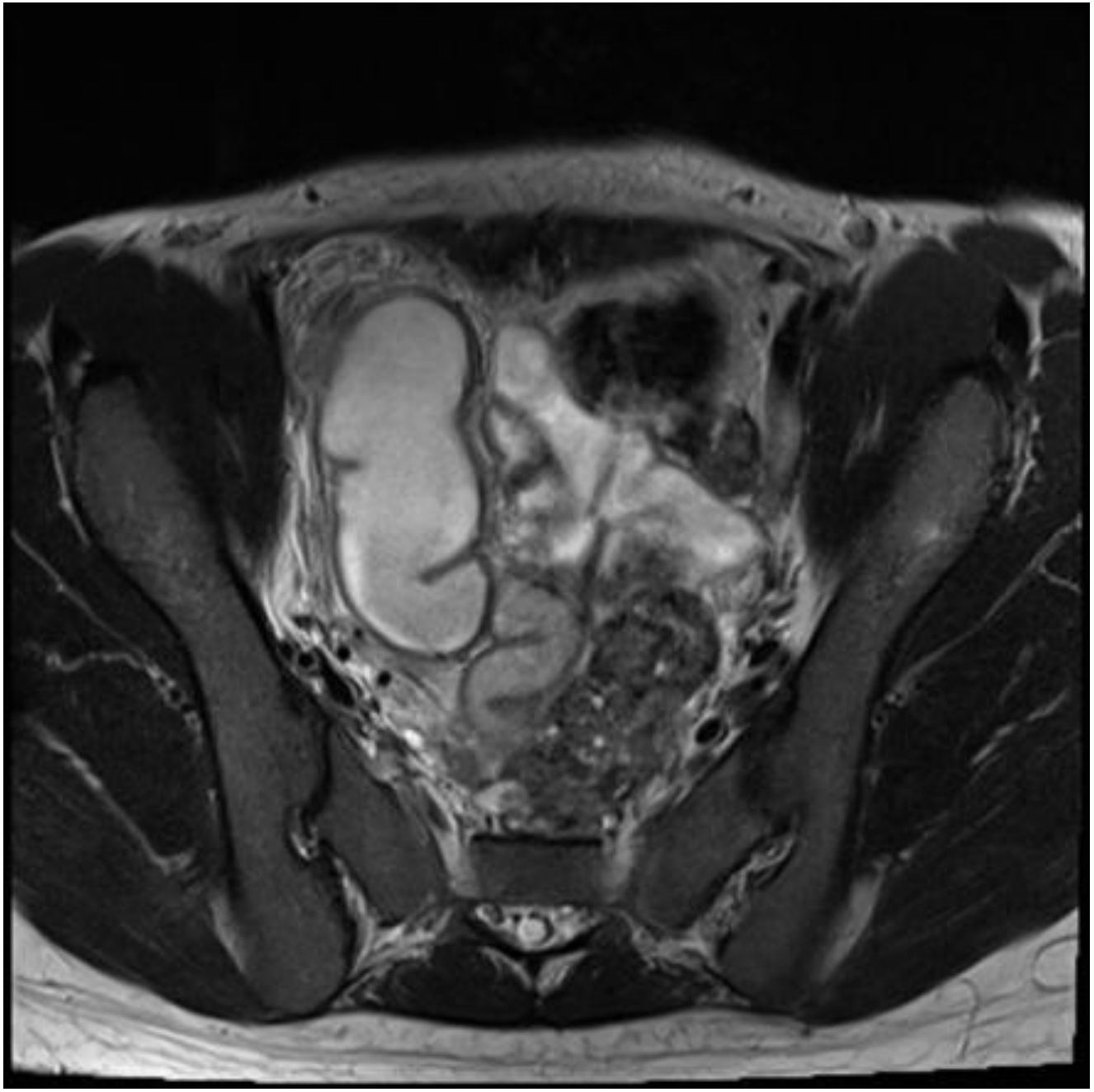

Fallopian tube
Uterus
Pus
Cervix
Vagina
Ovary
Bacteria
buoy






M3 M3
+6.0
-6.0
cm/s
0
1
2
3
4
5
2 cm
Long Right





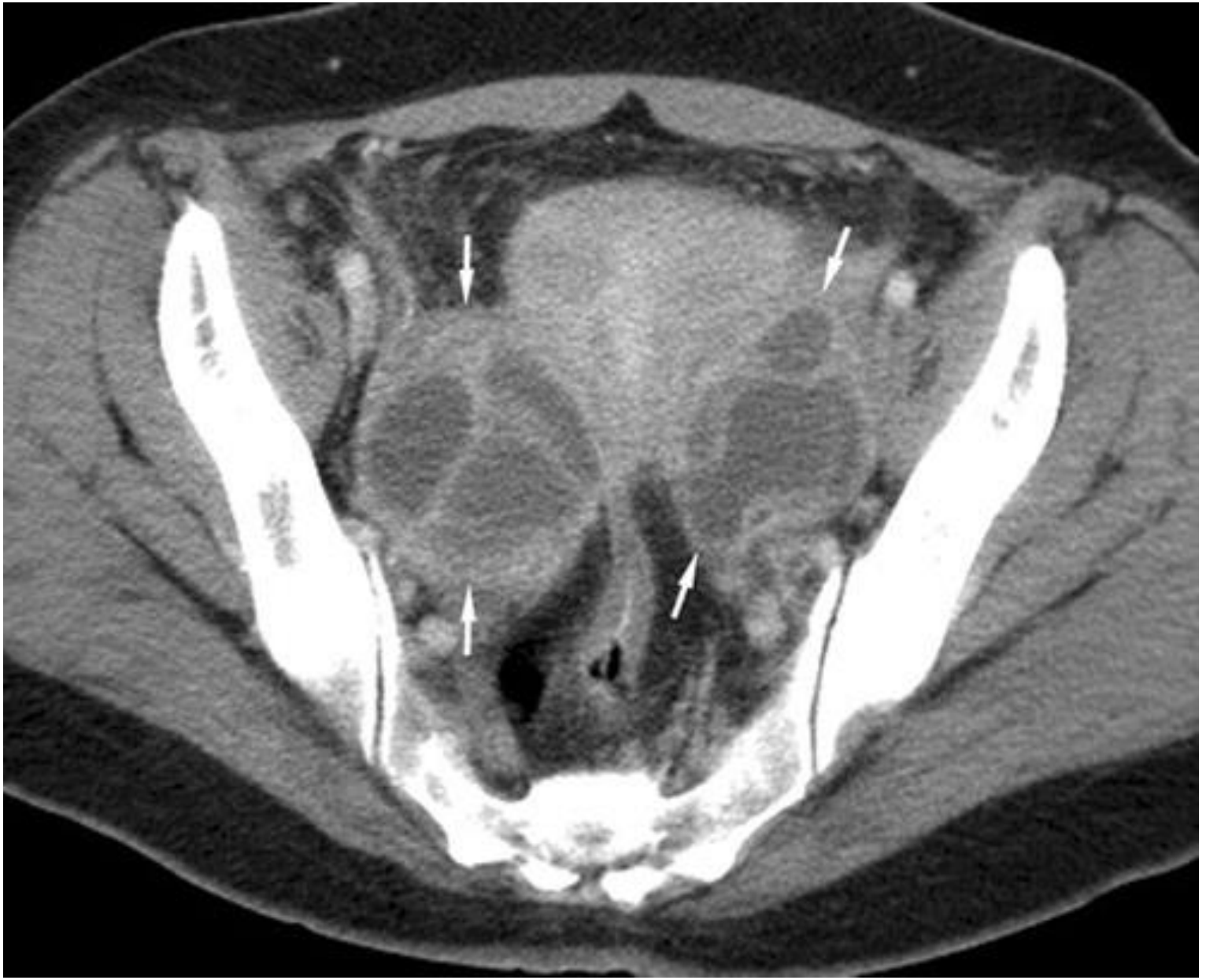


TABLE 1

Additional Diagnostic Tests for Pelvic Inflammatory Disease

	Advantages	Disadvantages
Laparoscopy	Specificity 100% Sensitivity 87%	Expensive Invasive
Serological tests	Inexpensive Readily available	Delayed results
Blood tests—WBC, ESR, and CRP	Inexpensive Readily available Rapid results	Nonspecific
Transvaginal ultrasound	Inexpensive Readily available Rapid results	Specificity 60% Sensitivity 30%
CT scan		Not useful in early PID Expensive Radiation exposure
MRI	Specificity 89% Sensitivity 95%	Expensive Not readily available

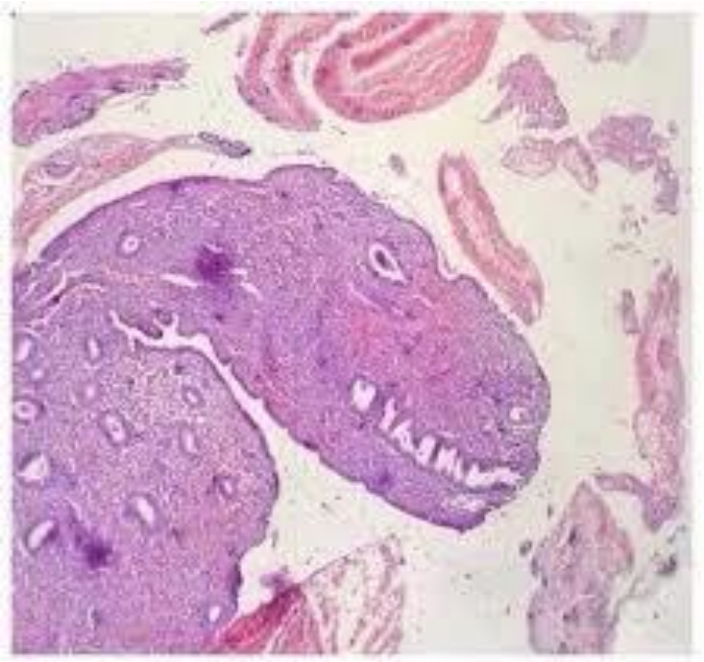
Abbreviations: CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; WBC, white blood cell.

Sources: Gaitán et al. *Infect Dis Obstet Gynecol.* 2002[17]; Łój et al. *Ann Agric Environ Med.* 2016[27]; Sam et al. *Radiographics.* 2002.[28]

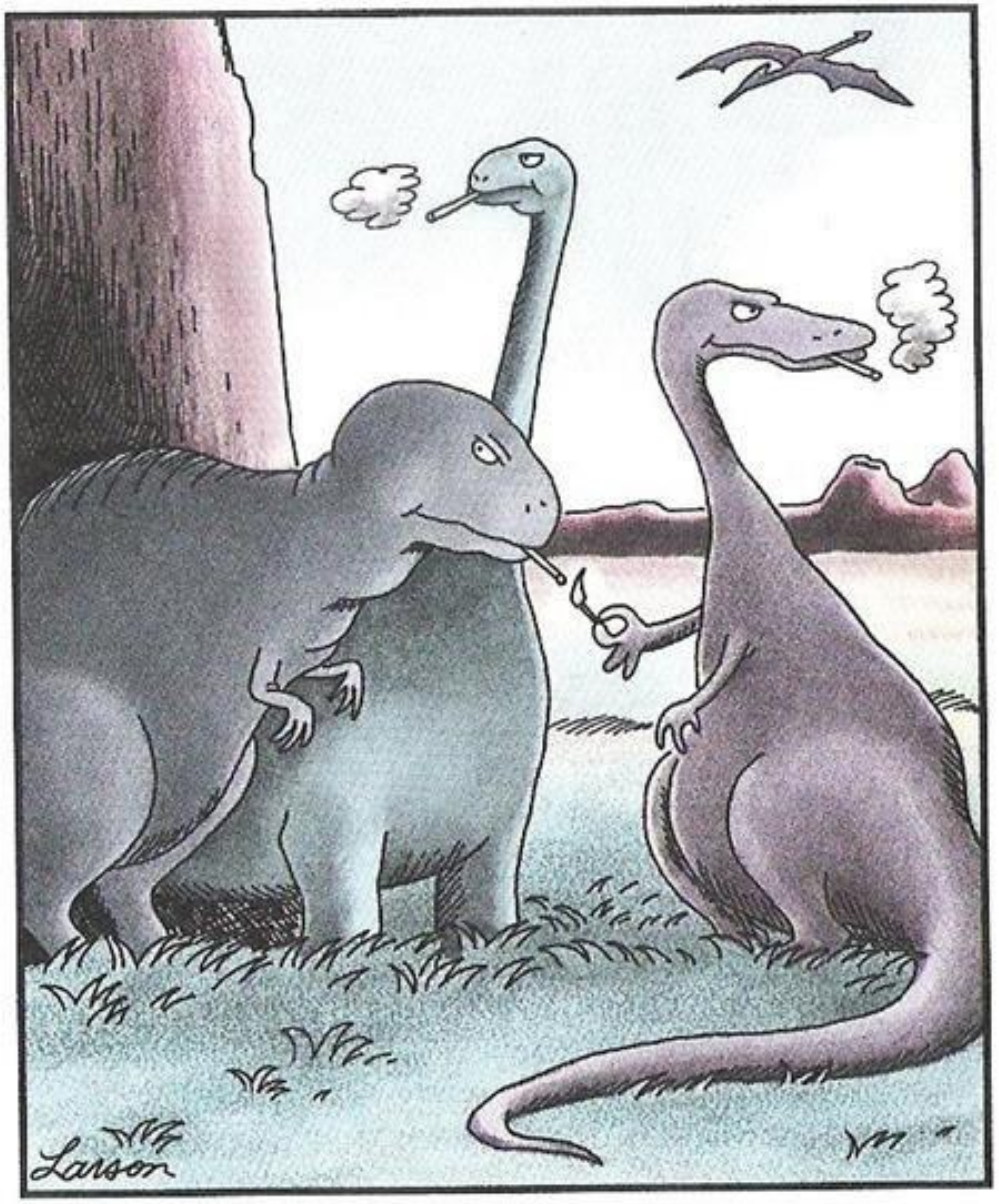
Antibiotics

Hospitalization

Surgery



endometrial biopsy



The real reason dinosaurs became extinct

arterio-venous malformation

uterine arterio-venous malformations

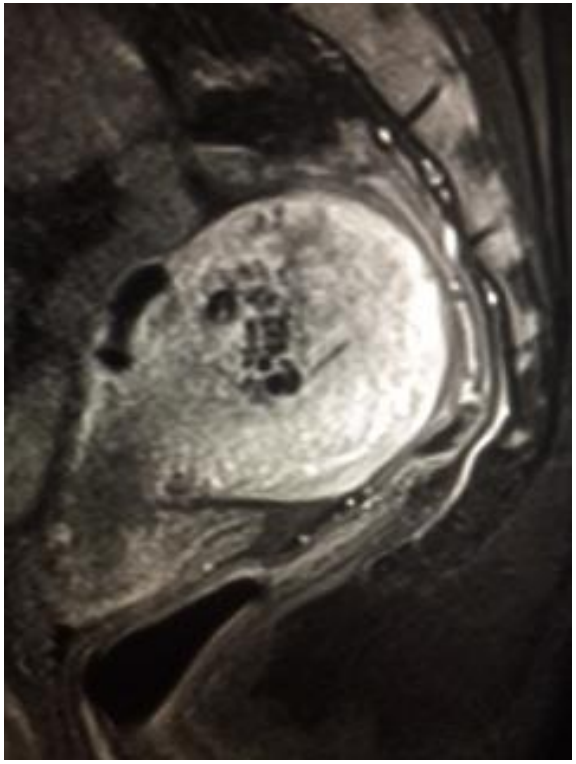
life threatening

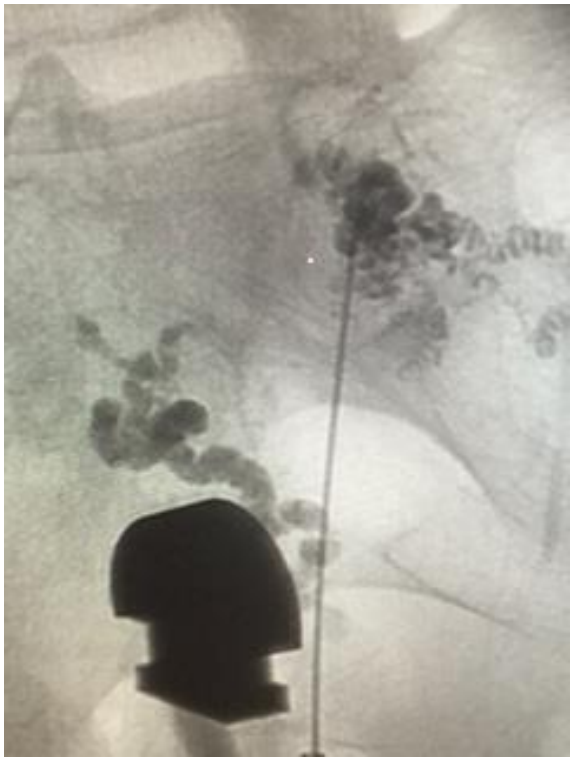
rare

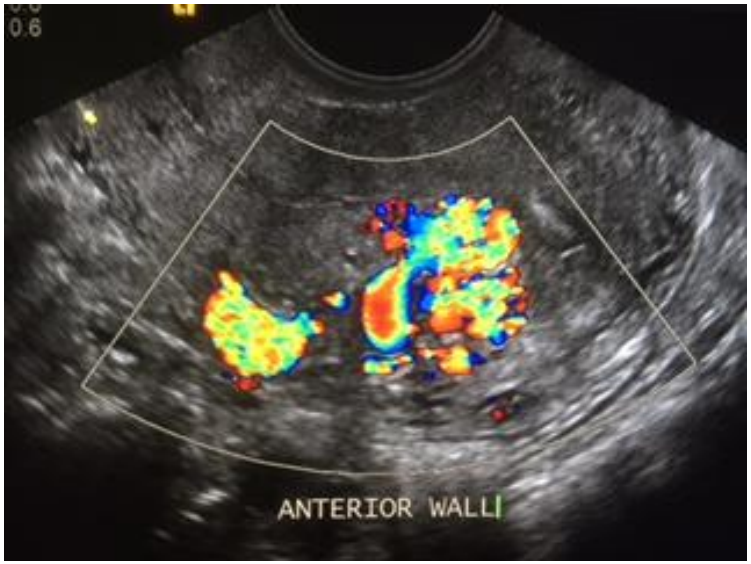
fewer than 100 cases in the literature

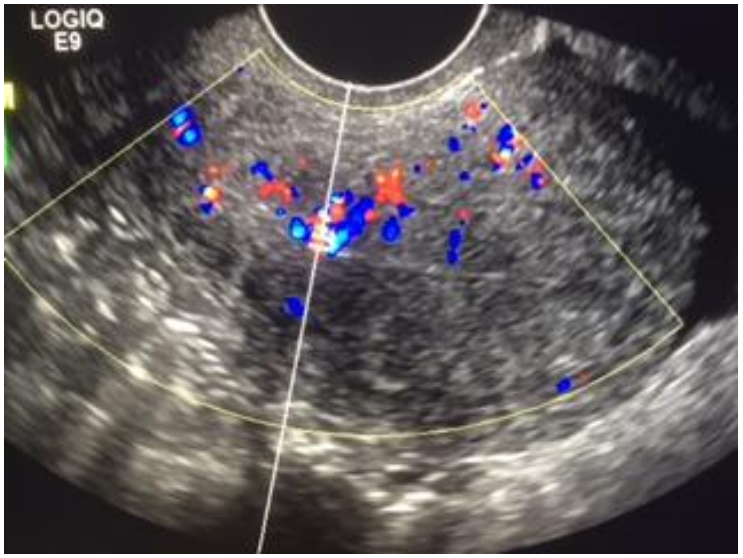
congenital or acquired

(endometrial sampling or sections)






0.6
ANTERIOR WALL


LOGIQ
E9

the mater misericordiae university hospital and the rotunda hospital

gynaecology oncology conference

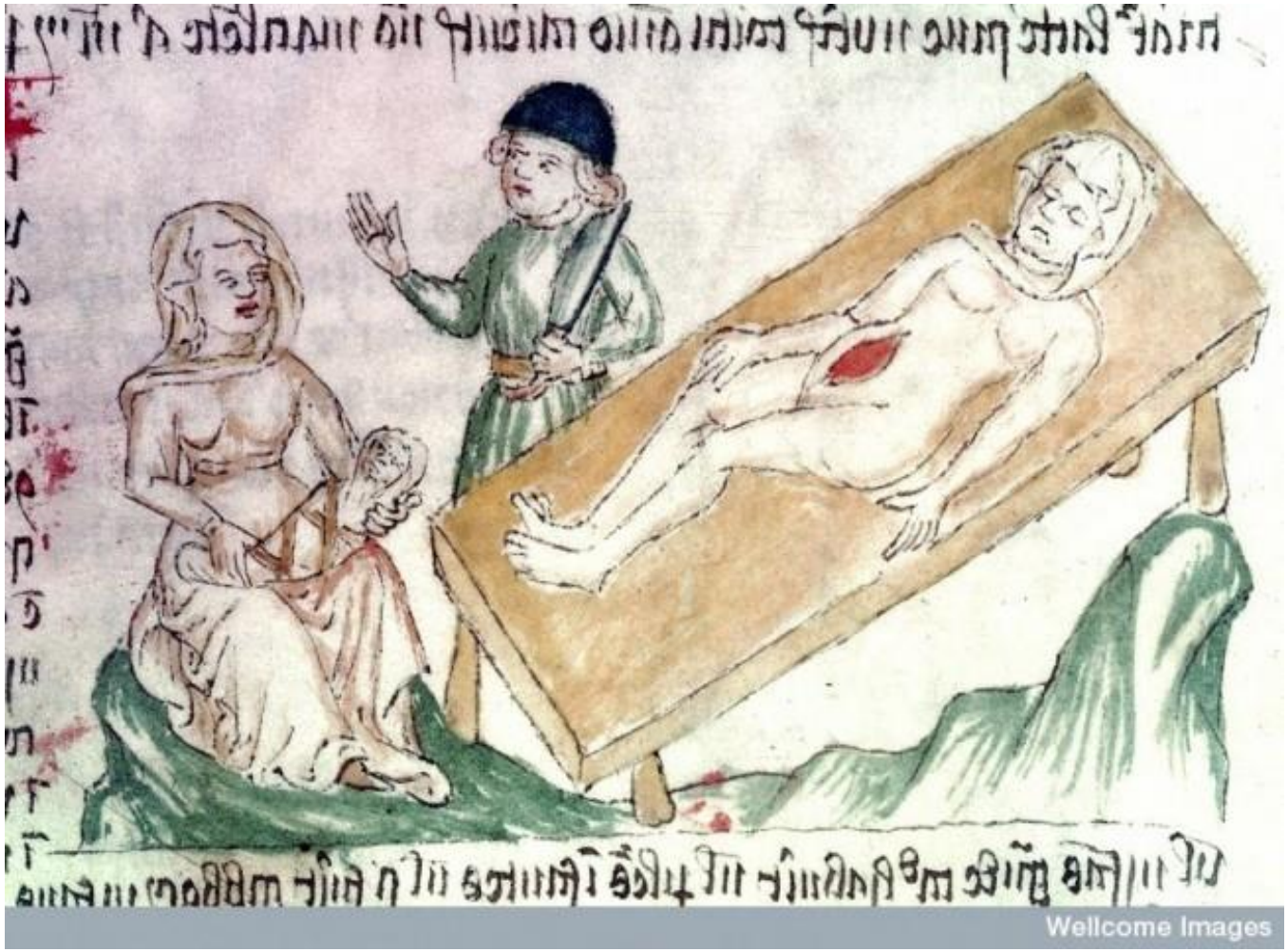
(professor of gynaecological oncology)

maternal high-risk pregnancy conference

benign gynaecology conference

interventional radiology clinic

combined appointments



10 deaths per 183,797 maternities in Ireland (2016-2018)

Maternal mortality rate = 5.4 per 100,000 maternities

maternal death

death of a woman while pregnant or within 42 days of the end of the pregnancy from any cause related to or aggravated by the pregnancy or by it's management, but not from accidental causes or incidental causes

direct (deaths from obstetric complications of the pregnancy (antenatal, intrapartum or puerperium),interventions or omissions

indirect deaths (deaths from pre-existing disease, aggravated by the physiological effects of pregnancy)

2021

Confidential reviews into maternal deaths in the ROI (2016-2018)
UK Confidential enquiry into maternal deaths (MBRRACE-UK)

New report reveals sharp rise in number of maternal deaths

Pregnancy-related mortality rate has now been found to higher than that of the UK

Sat, Feb 21, 2015, 01:00

Paul Cullen

There was a 22 per cent rise in the number of maternal deaths in 2010-2012, according to the second report of the Confidential Maternal Death Enquiry. Photograph: Andrew Matthews/PA Wire

The number of maternal deaths in Ireland has risen sharply, and the pregnancy-related death rate is now higher than in the UK, according to a new report.

There was a 22 per cent rise in the number of maternal deaths in 2010-2012, according to the second report of the Confidential Maternal Death Enquiry, based in UCC. The period coincided with a number of controversial deaths of

Release of this data brief coincides with publication in November 2021 of the annual report incorporating Irish data in the long-established UK Confidential Enquiry into Maternal Deaths (CEMD) (Knight et al, 2021). It covers the same timeframe as the latter and includes surveillance data on maternal deaths occurring in Ireland for the years 2017 to 2019.

It is recommended that this data brief is read in conjunction with the MBRRACE-UK 2021 report, which specifically discusses the care of women who died from mental health related causes, venous thromboembolism, homicide and malignancy. The report also includes a Morbidity Confidential Enquiry into the care of women who gave birth aged over 45 years.

Please note that surveillance data on maternal deaths occurring in Ireland is not included in the MBRRACE-UK report.

Dr Michael O'Hare
Chairman, Maternal Death Enquiry (MDE) Ireland

Table 1: Definitions of Maternal Deaths (World Health Organisation 2012)

Maternal Death	Deaths of women while pregnant or within 42 days of the end of the pregnancy* from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.
Direct	Deaths resulting from obstetric complications of the pregnant state (pregnancy, labour and puerperium), from interventions, omissions, incorrect treatment or from a chain of events resulting from any of the above.
Indirect	Deaths resulting from previous existing disease, or disease that developed during pregnancy and which was not the result of direct obstetric causes, but which was aggravated by the physiological effects of pregnancy.
Late	Deaths occurring between 42 days and 1 year after the pregnancy end* that are the result of Direct or Indirect maternal causes.
Coincidental‡	Deaths from unrelated causes which happen to occur in pregnancy or the puerperium.

*Includes giving birth, ectopic pregnancy, miscarriage or termination of pregnancy.
‡Termed 'Fortuitous' in the International Classification of Diseases (ICD).

MATERNAL MORTALITY IN IRELAND: 2017-2019

Definitions of maternal deaths are outlined in Table 1.

For the years 2017 to 2019, a total of 12 maternal deaths, occurring during or within 42 days of pregnancy end, were identified by MDE Ireland among 179,376 maternities. All 12 deaths were classified as direct or indirect, giving a maternal mortality rate (MMR) of 6.7 per 100,000 maternities (95% CI 3.5 – 11.7).

Of the twelve deaths, 3 were attributed to direct causes, and 9 due to indirect causes.

Two further deaths were attributed to coincidental causes.

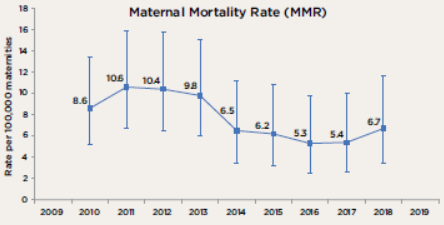
On account of small numbers and to facilitate early identification of trends, all maternal death rates (MMR) are presented as a rolling three-year average. This includes deaths due to direct and indirect causes during pregnancy and up to 42 days postpartum but not deaths due to coincidental causes or late maternal deaths. These rates are plotted in the middle year of the triennium in Figures 1 and 2.

Five (41.7%) of the twelve women who died from direct and indirect causes were still pregnant at the time of death.

The decrease in the MMR from 8.6 to 6.7 per 100,000 maternities between the triennia 2009-2011 and 2017-2019 was not statistically significant (rate ratio 0.78, p = 0.50, 95% CI 0.38-1.61).

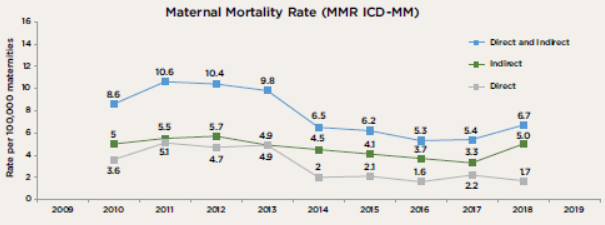
However, in respect of direct causes only, the decrease in MMR from 4.7 (CI 2.7-7.5) to 1.9 (CI 0.8-3.9) per 100,000 maternities between the early years of MDE Ireland, 2009-2013, and 2014-2019 reached statistical significance (rate ratio 0.40, p = 0.040, 95% CI 0.17-0.96). This is the first occasion since its inception that MDE Ireland has reported a statistically significant fall in any parameter relating to maternal mortality.

Figure 1: MMR per 100,000 maternities (95% CI) Ireland: rolling three year average 2009-2019



Note: Three-year moving average rates are plotted in middle year of triennium

Figure 2: Direct and Indirect MMR per 100,000 maternities in Ireland 2009-2019 using ICD-MM classification on cause of death: rolling three year average



Note: Three-year moving average rates are plotted in middle year of triennium

CAUSES OF DIRECT AND INDIRECT MATERNAL DEATHS: IRELAND

Direct and Indirect maternal deaths up to 42 days following pregnancy end by cause are categorised and detailed in Table 2 using the conventional UK CEMD categories, and Table 3 using the ICD-MM classification (WHO, 2012). On account of the small number of cases per category in Ireland and the limited power of analysis in a small cohort, rates per category are not appropriate and have not been calculated.

Based on the ICD-MM classification, the proportion of direct and indirect maternal deaths was 25% and 75% respectively for the reporting years 2017-2019 (Table 3).

As in the UK, cardiac disease remains the single most common cause of maternal death in Ireland. Although there was only one new case of thromboembolism in Ireland in 2017-19, it is the leading cause of direct maternal death in the UK. Whilst there were no late maternal deaths due to suicide in Ireland 2017- 2019, it continues to feature prominently in the UK report, both up to 42 days and one year postpartum.

Table 2: Causes of Maternal Deaths in Ireland 2009–2019 (Maternal deaths by suicide classified as direct)

Cause of Maternal Death	2017-2019	2009-2019
Direct Maternal Deaths	**3**	**24**
Thrombosis and thromboembolism	1	6
Pre-eclampsia and eclampsia	0	2
Genital Tract Sepsis	1	2
Amniotic fluid embolism	0	4
Early pregnancy deaths	0	2
Haemorrhage	0	2
Anaesthesia	0	0
Deaths due to psychiatric causes	1*	6*
Indirect Maternal Deaths	**9**	**34**
Cardiac Disease	1	15
Other Indirect causes	5	10
Indirect neurological conditions	3**	9**
Indirect malignancies	0	0
Coincidental Maternal Deaths	**2**	**12**

Note: Deaths from genital tract sepsis includes early pregnancy deaths. Deaths from sepsis not directly related to pregnancy are classified as indirect causes. *Deaths due to suicide. **One case subject to outstanding autopsy report.

KEY POINTS FROM THE 2021 UK AND IRELAND REPORT[1]

- There remains a more than four-fold difference in maternal mortality rates amongst women from Black ethnic backgrounds and an almost two-fold difference amongst women from Asian ethnic backgrounds compared to white women.
- Cardiac disease remains the largest single cause of maternal deaths.
- Neurological causes (epilepsy and stroke) are the second most common cause of maternal death.
- Thrombosis and thromboembolism remains the leading cause of direct maternal death during or up to six weeks after the end of pregnancy, and a BMI of 30kg/m^2 or greater is associated with at least a four-fold increase in the risk of venous thromboembolism.
- Maternal suicide remains the leading cause of direct deaths occurring within a year after the end of pregnancy.
- There is an almost fourfold higher maternal mortality rate amongst women aged 40 or over compared to women aged 20-24 years.

Table 3: Maternal Deaths in Ireland by cause using the ICD-MM classification, 2009–2019

Cause of Maternal Death	2017-2019	2009-2019
Direct Maternal Deaths	**3**	**24**
Group 1: Pregnancy with abortive outcome	0	2
Group 2: Hypertensive disorders	0	2
Group 3: Obstetric haemorrhage	0	2
Group 4: Pregnancy-related infection	1	2
Group 5: Other obstetric complication	2	16
Group 6: Unanticipated complication of pregnancy	0	0
Indirect Maternal Deaths	**9**	**34**
Group 7: Non obstetric complications	9	34
Group 8: Unknown/undetermined	0	0
Coincidental Maternal Deaths	**2**	**12**

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2. World Health Organisation (2012). The WHO Application of ICD-10 to deaths during pregnancy and the puerperium: ICD-MM. Available at: *www.who.int/reproductivehealth/publications/monitoring/9789241548458/en*

CITATION FOR THIS DATA BRIEF

O'Hare MF, Manning E, Corcoran P, Greene RA on behalf of MDE Ireland. Confidential Maternal Enquiry in Ireland, Data Brief No 5. Cork: MDE Ireland, November 2021.

COMPARISON OF MATERNAL MORTALITY RATE: IRELAND AND UK 2017-2019

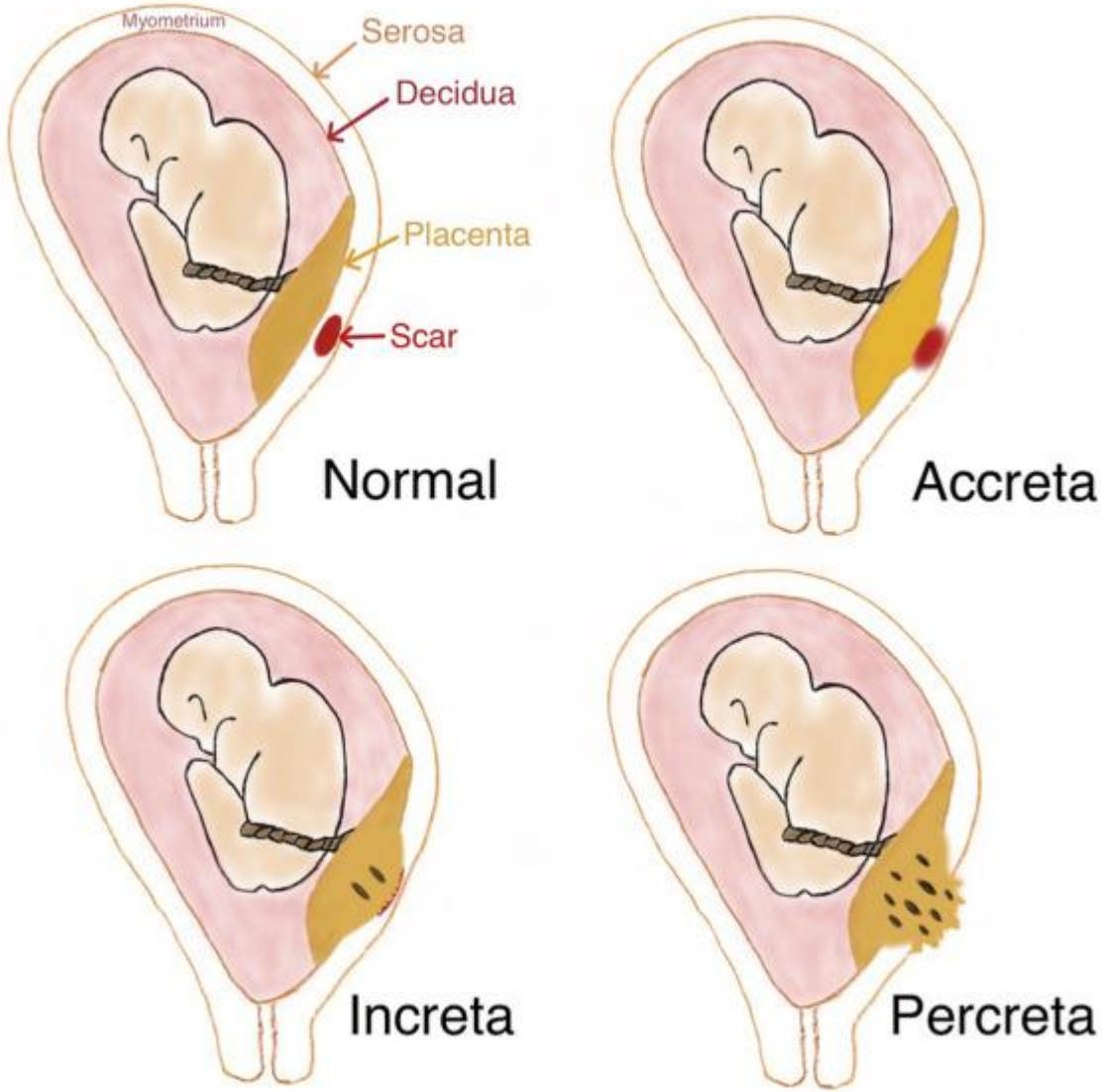
For the triennium 2017 – 2019, the Irish MMR was 6.7 per 100,000 maternities (95% CI 3.5 – 11.7) and the UK MMR was 8.79 per 100,000 maternities (95% CI 7.58 – 10.12). This does not represent a statistically significant difference in MMR between countries (rate ratio = 0.76, 95% CI = 0.42 to 1.36; p = 0.36).

LATE MATERNAL DEATHS: IRELAND 2017-2019

Five late maternal deaths were reported to MDE Ireland in the triennium 2017-2019. Three were attributed to indirect causes, thus:

- Cardiac (2) - myocardial infarction secondary to coronary artery dissection (1), and cardiac arrhythmia secondary to postpartum cardiomyopathy (1).
- Psychiatric, drug and alcohol related (1).

The remaining 2 deaths were coincidental, due to malignant disease.


Myometrium
Serosa
Decidua
Placenta
Scar
Normal
Accreta
Increta
Percreta

accreta

parallels increasing section rates

placenta sticks to the scar

placenta praevia (1%-5% risk)

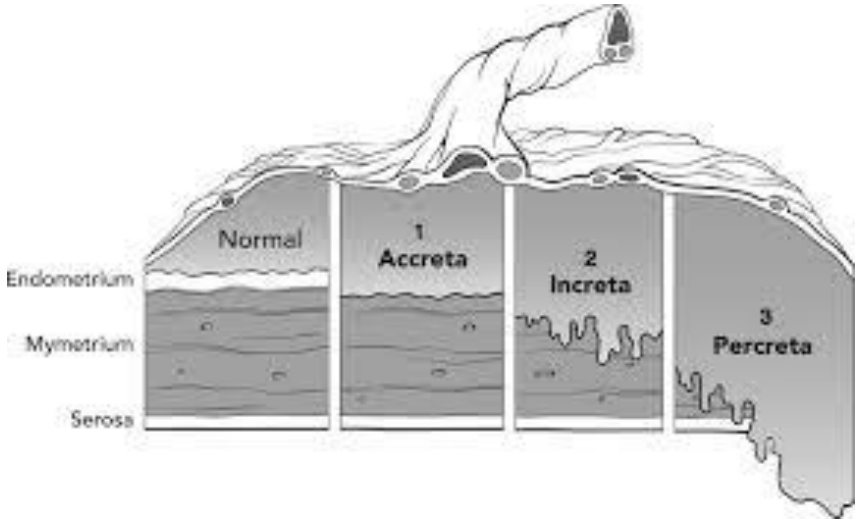
advanced maternal age

myomectomy

fibroid embolisation

Caesarean section rate at The Rotunda is 31%

PAS MDT


Normal
1
Accreta
2
Increta
3
Percreta
Endometrium
Myometrium
Serosa

incomplete separation: bleeding : massive transfusion: dic: mortality rate 7%

accreta

leave the placenta in situ – caesarean hysterectomy

accreta

placental lakes on ultrasound at 20 weeks

is the best available test

(sensitivity of 77–87%, specificity of 96–98%, a positive predictive value of 65–93%)

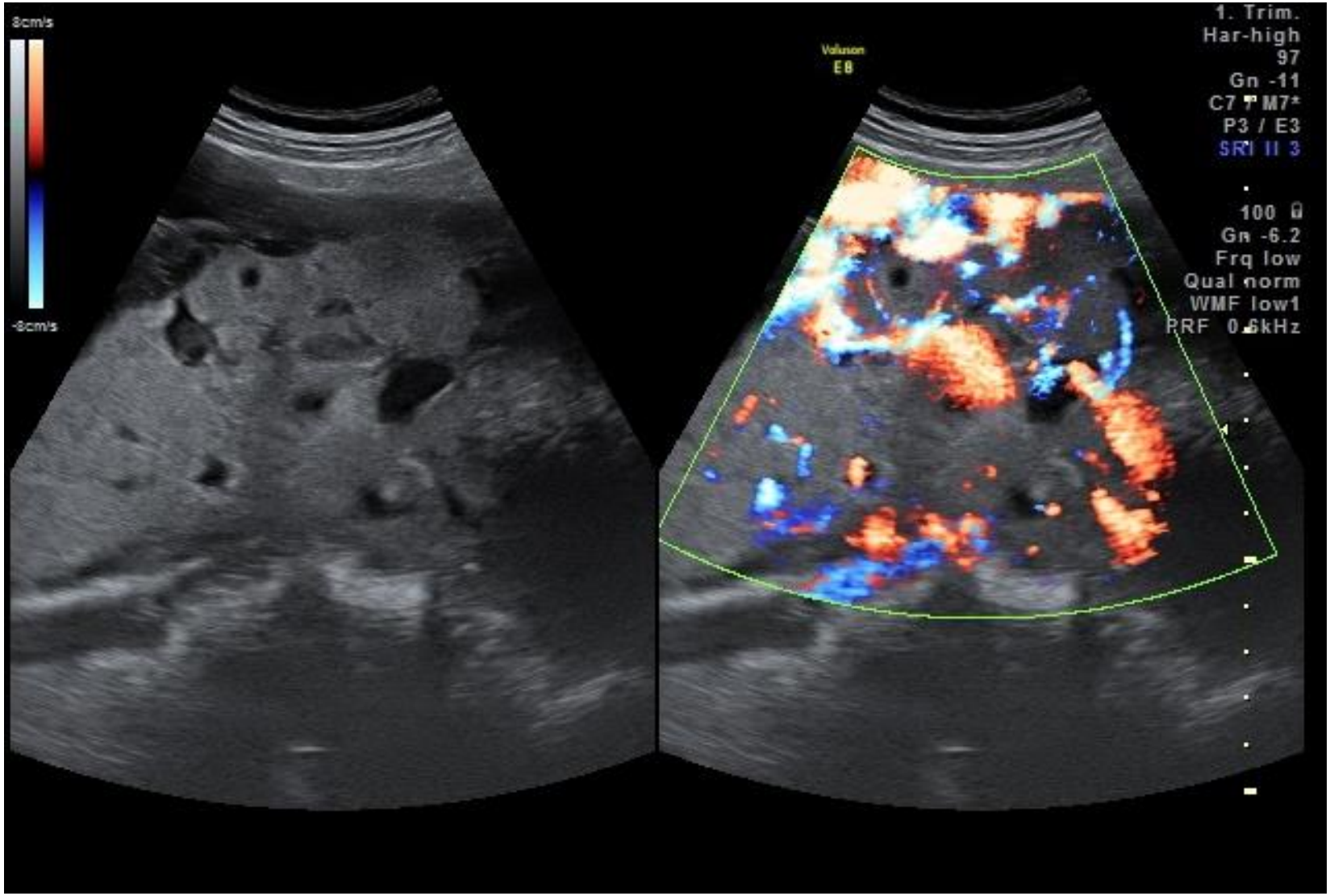
accreta

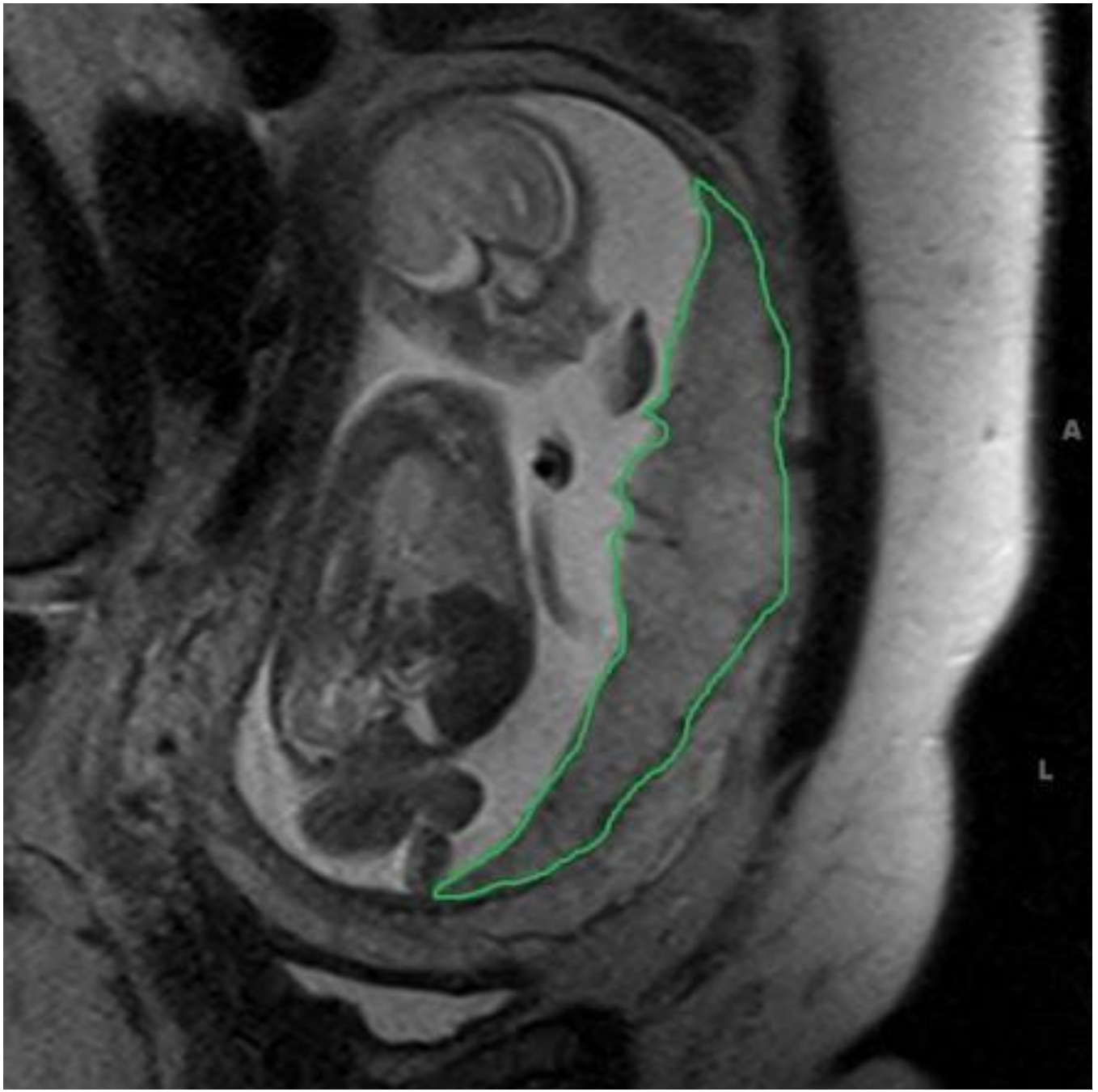
mri for placental evaluation

double read

predicting adherence is a challenge

placenta invasive / percreta


8cm/s
-8cm/s
Voluson
E8
1. Trim.
Har-high
97
Gn -11
C7 M7*
P3 / E3
100
Gn -6.2
Frq low
Qual norm
WMF low1


A
L

Previous Article

September 2009
Volume 29, Issue 5

Imaging of the Placenta: A Multimodality Pictorial Review

Khaled M. Elsayes, MD, Andrew T. Trout, MD, Aaron M. Friedkin, MD, MS, Peter S. Liu, MD, Ronald O. Bude, MD, Joel F. Platt, MD, and Christine O. Menias, MD

Address correspondence to K.M.E. (e-mail: *kelsayes@med.umich.edu*).

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Received: December 12, 2008
Accepted: May 12, 2009

Abstract | Full Text | Figures | References | Cited by | PDF

The placenta is often overlooked in the routine evaluation of a normal gestation, receiving attention only when an abnormality is detected. Although uncommon, abnormalities of the placenta are important to recognize owing to the potential for maternal and fetal morbidity and mortality. Pathologic conditions of the placenta include placental causes of hemorrhage, gestational trophoblastic disease, retained products of conception, nontrophoblastic placental tumors, metastases, and cystic lesions. Sonography remains the imaging modality of choice for evaluation of the placenta. Magnetic resonance (MR) imaging can be of added diagnostic value when further characterization is required, particularly in the setting of invasive placental processes such as placenta accreta and gestational trophoblastic disease. Computed tomography (CT) has a limited role in the evaluation of placental disease owing to limited tissue characterization, compared with that of MR imaging, and the radiation risk to the fetus; this risk often outweighs the benefit. The primary role for CT is in the evaluation of trauma and gestational trophoblastic disease, for which it allows characterization of the primary lesion and distant metastases.

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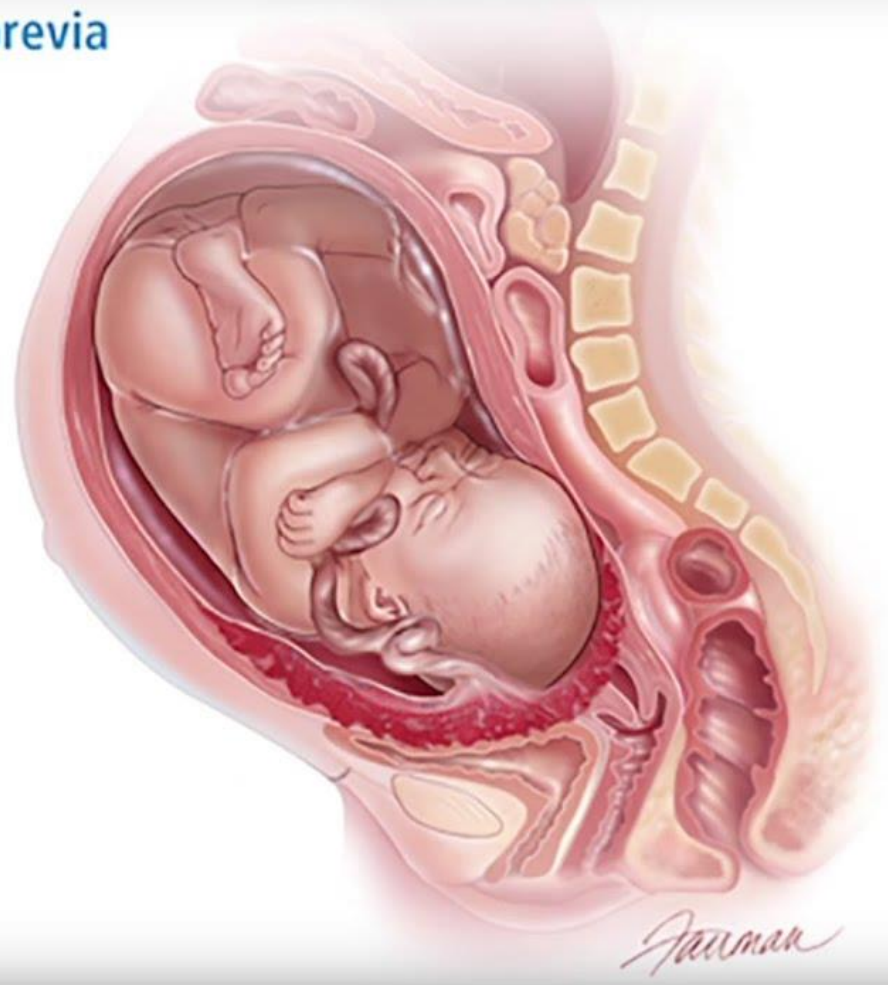
Imaging after Cesarean Delivery: Acute and Chronic Complications
Rodgers et al. *RadioGraphics.* (2012)

The History of Imaging in Obstetrics
Benson et al. *Radiology.* (2014)

Severe accreta and previa

Placenta grows all the way through the wall of the uterus. No separation between placenta and bladder (Percreta).



Royal College of Obstetricians and Gynaecologists
Royal College of Radiologists
British Society of Interventional Radiology

Good Practice No. 6
June 2007

THE ROLE OF EMERGENCY AND ELECTIVE INTERVENTIONAL RADIOLOGY IN POSTPARTUM HAEMORRHAGE

1. Purpose

The purpose of this guidance is to urge all obstetric units to consider early or prophylactic interventional radiology as an important tool in the prevention and management of postpartum haemorrhage. Arterial balloon occlusion and embolisation can prevent major blood loss, obviating the need for blood transfusion and hysterectomy. Potentially, this may reduce the need for intensive care and decrease maternal morbidity and mortality.[1–4]

2. Aetiology of postpartum haemorrhage

Postpartum haemorrhage remains a significant cause of maternal morbidity and mortality. Confidential enquiries and near-miss reports indicate that large numbers of women suffer severe morbidity requiring blood transfusions, hysterectomy and intensive care facilities, because of excessive blood loss. This may be predictable where there is known placenta accreta or placenta praevia. However, the majority of postpartum haemorrhage is unpredictable and is typically secondary to:

- atonic uterus following a normal or prolonged labour resulting in normal delivery or caesarean section
- uterine and cervical injury (this occurs most commonly as a result of instrumental delivery or at the time of caesarean section secondary to surgical complications; it is more common in association with placenta praevia and placenta accreta)
- delayed bleeding in the recovery unit or on the postnatal ward in women who have delivered normally or undergone a caesarean section; rarely, secondary haemorrhage can present after 24 hours
- uncontrolled bleeding after emergency hysterectomy for postpartum haemorrhage because of coagulopathy or surgical complications.

3. Indications for using interventional radiology in postpartum haemorrhage

3.1 Emergency intervention

Interventional radiology should be considered in the management of postpartum haemorrhage secondary to:

- atonic uterus following normal or prolonged labour, with or without caesarean section
- surgical complications or uterine tears at the time of caesarean section
- bleeding while on the recovery unit or in the postnatal ward following a normal delivery or a caesarean section
- bleeding following hysterectomy

placement of internal iliac balloons

epidural in IR

bi-lateral common femoral artery puncture

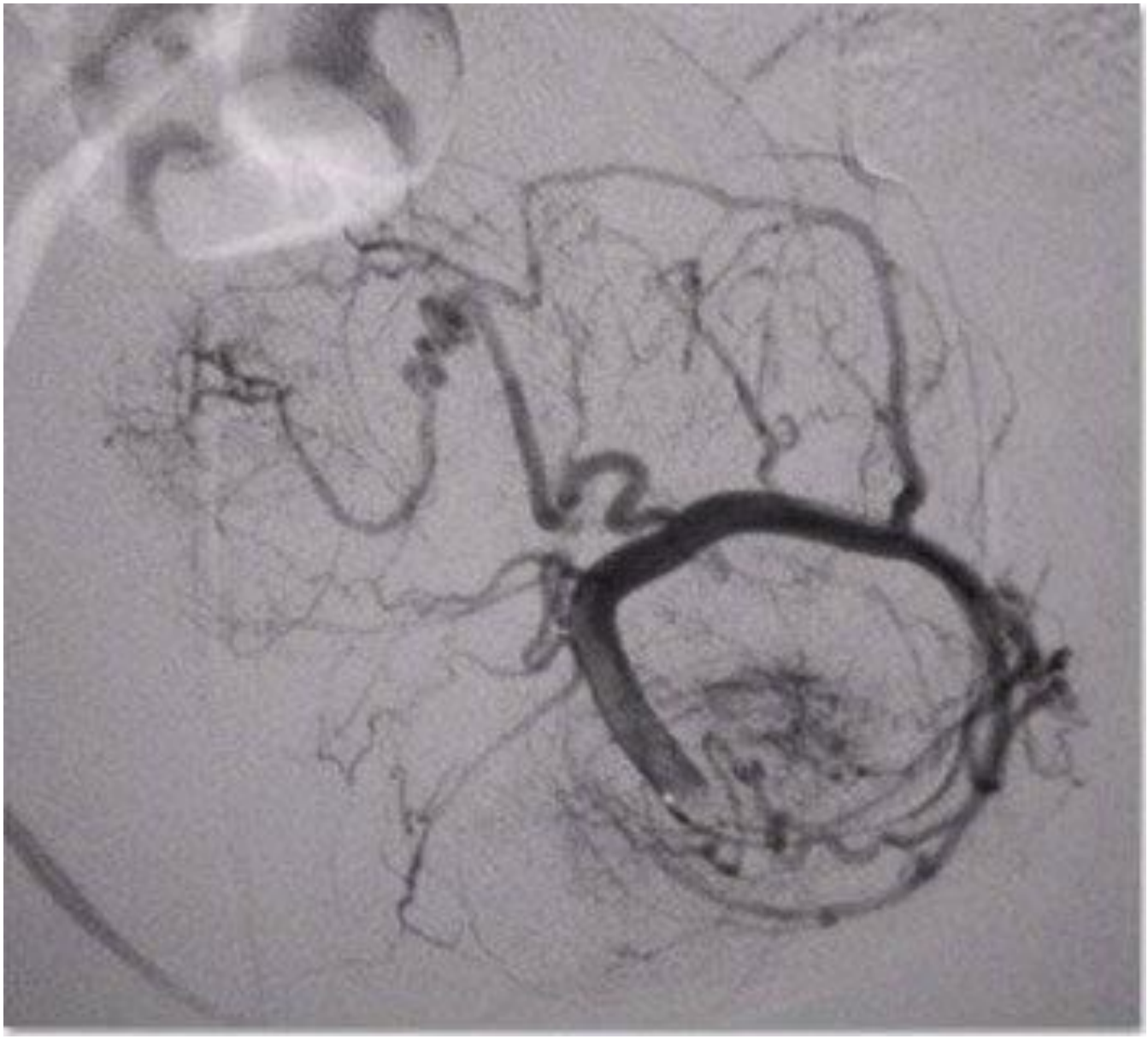
inflation and / or embolisation

no proven benefit

may reduce transfusion requirements

seems a reasonable thing to consider

(especially in increta / percreta)



Prophylactic use of intravascular balloon catheters in women with placenta accreta, increta and percreta

Giuseppe Cali [a], Francesco Forlani [b] *, Laura Giambanco [a], Maria Luisa Amico [a], Mario Vallone [c], Giuseppe Puccio [d] and Luigi Alio [a]

European Journal of Obstetrics & Gynecology and Reproductive Biology 179 (2014) 36–41

Abstract

Objective

To evaluate outcomes of women undergoing cesarean hysterectomy for abnormal invasive placenta (AIP) with and without preoperative balloon catheter placement in internal iliac arteries.

Study design

A prospective observational study of women with ultrasound diagnosis of AIP and a planned delivery at our institution. From January 2004 to June 2009, all AIP cases were treated with planned multidisciplinary cesarean hysterectomy alone (CHa group). From July 2009 to September 2013 a pre-operative balloon catheter protocol was introduced (BC group). Statistical analysis considered the entire sample (placenta accreta/increta and percreta) and the individual subgroups (accreta/increta vs percreta).

Results

Twenty-three cases of AIP (10 accreta/increta and 13 percreta) were treated with cesarean hysterectomy alone, and 30 cases of AIP (12 accreta/increta and 18 percreta) were treated with cesarean hysterectomy and pre-operative balloon catheters. For the entire sample, a significant difference in estimated blood loss and transfused blood products units was observed between CHa group and BC group. When women with placenta accreta/increta and women with placenta percreta were analysed separately, no difference in estimated blood loss and transfused blood products units was found between the BC and the CHa groups in women with placenta accreta/increta. However, in women with placenta percreta, mean estimated blood loss and transfused blood products units were higher in the CHa group compared with BC group (1507 ml vs 933.33 ml; 3.31 units vs 0.67 units). Postoperative recovery differed between the two groups, but no differences were observed in any other outcomes.

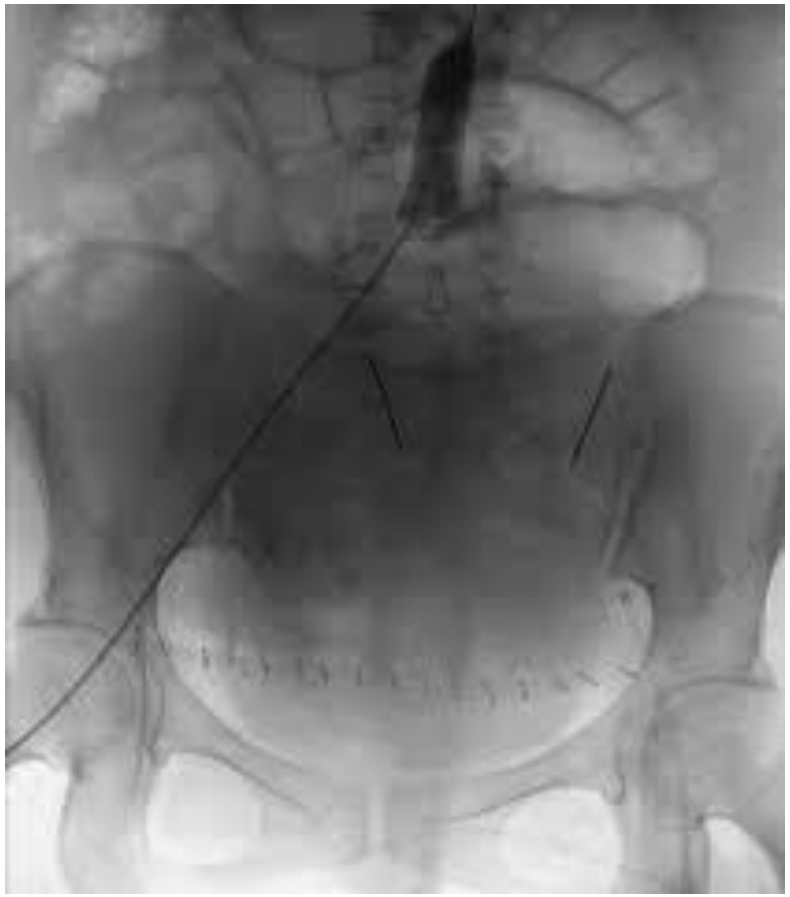
Conclusions

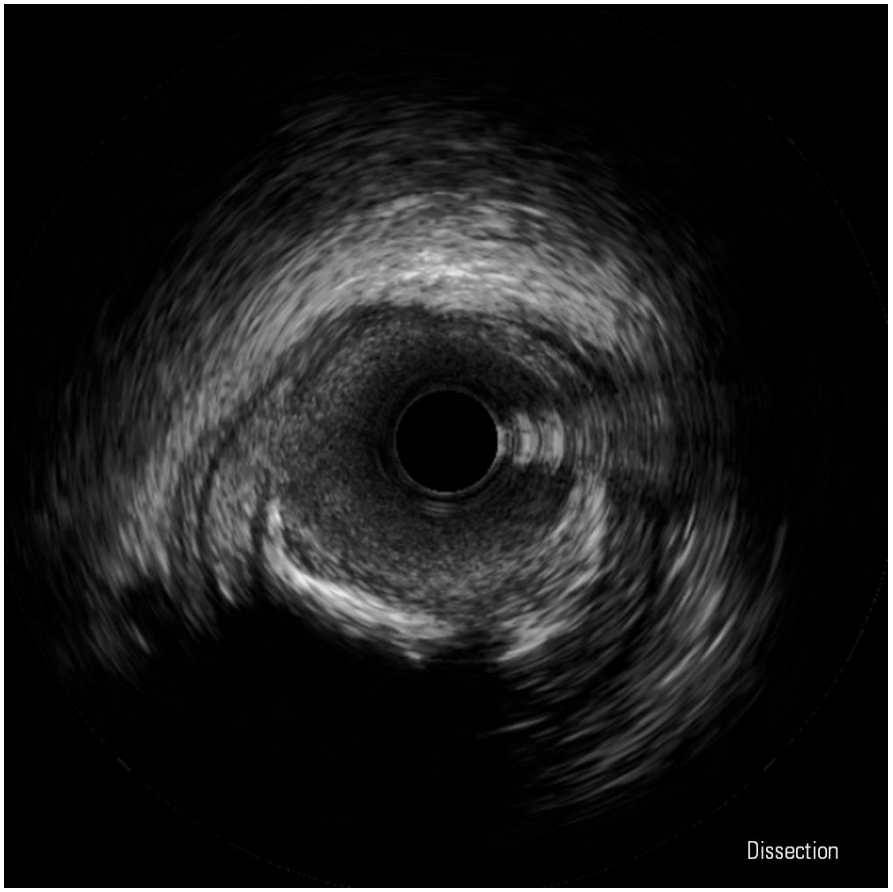
placement of internal iliac balloons

multiple complications following the use of prophylactic internal iliac artery catheterisation in a patient with placenta percreta

bilateral pseudoaneurysms, unilateral iliac rupture, compromised vascular supply to her right leg and massive obstetric haemorrhage

international journal of obstetric anaesthesia
(volume 20,issue 1,january 2011,70-73)




Dissection


THE IRISH SOCIETY OF INTERVENTIONAL RADIOLOGY