

# Ultrasound follow up, prediction of pregnancy loss and ectopic pregnancy

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## Summary

- 1. How to get the diagnosis RIGHT
    - Miscarriage
    - Ectopic
  - 2. How to manage expectations
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# US measurements and diagnosis of miscarriage

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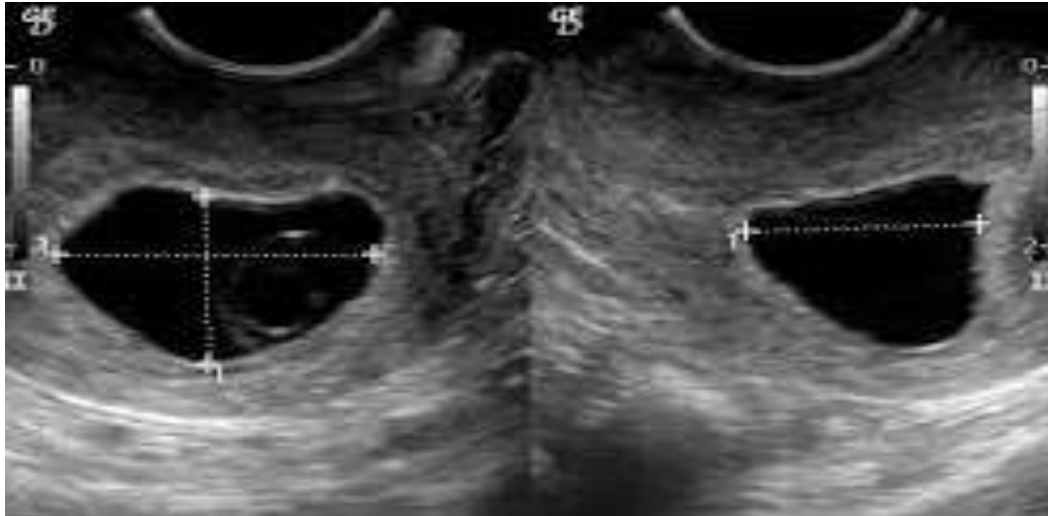
## Ultrasound scanning in early pregnancy

- Localisation
  - Accurate measurement of pregnancy structures
  - Assessment of viability
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# How to measure an early pregnancy

## Gestation sac

- MSD: Three orthogonal planes; two in sagittal plane, one in transverse. Largest sac diameters from inner borders of the sac.
- Location
- Regularity
- Sub-chorionic haematoma







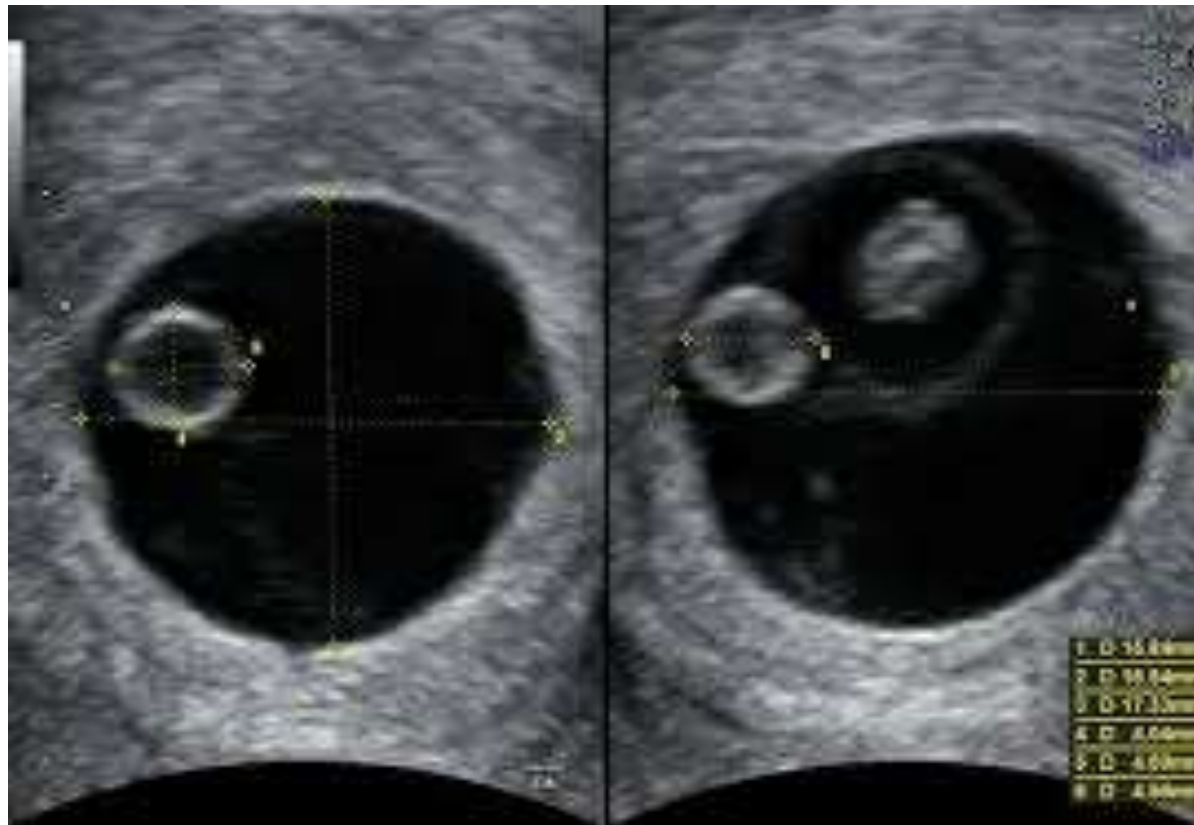
Gestation sac

Fluid in cavity - pseudosac



## Yolk sac

- Three orthogonal planes, from outer borders





## CRL

- Greatest straight line length while caudal and cephalic cannot be distinguished
- CRL once sufficiently deflexed (9 weeks)



(a)



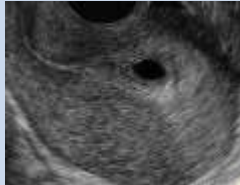



(b)

Fundamental issue:

**A normal early pregnancy  
may be indistinguishable from  
an abnormal early pregnancy that has  
arrested its development**



# Pregnancy of unknown viability

	First visible on TVS (days from LMP)	Growth
Gestation Sac 	31days (4+3 weeks)	1mm/day
YS 	35 days (5 weeks)	Max at 10/40
Embryo 	37 days (5+2 week)	0.7mm/day
Amnion 	49 days (7 weeks)	

## Why you might not see what you expect to...

### Patient

- Incorrect dates
  - Erratic cycles (PCO)
  - Recent pregnancy/ breastfeeding
  - Contraception
  - Ovulation to implantation interval`
- Sonographic view
  - TA vs TV scan
  - BMI
  - Fibroids
  - Axial uterus

### External factors

- Experience of sonographer
- Quality of machine
- Inter/Intra-observer variation
  - 14-18% 6-9 weeks

### Pregnancy

- Miscarriage
- Genetic abnormality
- Location

## Aim for 100% specificity

- Key question: **“Is there a chance of viable pregnancy?”**
  - A false positive diagnosis of miscarriage is much worse than a false negative diagnosis
    - False positive: Inadvertent ToP
    - False negative: raised hopes, delay in intervention

**First do no harm**

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# Evolution of criteria for the diagnosis of miscarriage

2006:

ACR – empty GS MSD >16mm, CRL >5mm and no FH

RCOG – empty GS MSD >20mm, CRL >6mm and no FH

2011 (Abdallah et al):

4.4% false positive rate if cut-off MSD  $\geq$ 16mm

0.5% false positive rate if cut off MSD  $\geq$ 20mm

8.3% false positive rate for cut-off CRL 5mm

MSD >25mm, CRL >7mm

RCOG 2011

2015 (Priesler et al):

Verified cut-offs proposed in 2011

Intervals between scans

## **Defining safe criteria to diagnose miscarriage: prospective observational multicentre study**

Jessica Preisler,<sup>1</sup> Julia Kopeika,<sup>2</sup> Laure Ismail,<sup>1,3</sup> Veluppillai Vathanan,<sup>4</sup> Jessica Farren,<sup>1</sup> Yazan Abdallah,<sup>1</sup> Parijat Battacharjee,<sup>5</sup> Caroline Van Holsbeke,<sup>6</sup> Cecilia Bottomley,<sup>4</sup> Deborah Gould,<sup>3</sup> Susanne Johnson,<sup>7</sup> Catriona Stalder,<sup>1</sup> Ben Van Calster,<sup>8</sup> Judith Hamilton,<sup>2</sup>, Dirk Timmerman,<sup>6,8</sup> Tom Bourne<sup>1,6,8</sup>

### To validate change in guidelines

Prospective multicentre study; 2845 women presenting with bleeding, pain, hyperemesis

Validated guidance on miscarriage diagnosis

Added evidence based guidance on repeat scans



## Criteria that are specific for miscarriage

### Initial scan

- Empty GS MSD >25mm.
- Embryo CRL 7mm with no FH

### Initial scan beyond 70 days (10w from LMP)

- MSD >18mm with no embryo
- Embryo CRL 3mm with no FH

### Repeat scan

- CRL < 7mm: rescan in 7 days shows no FH
- MSD <12mm and no embryo with or without a yolk sac: rescan 14 days shows no doubling of MSD
- MSD >12mm, no embryo with or without a yolk sac: rescan in 7 days shows no CRL with FH

**Priesler et al BMJ 2015**

If you or patient have any doubts....

**RE-SCAN**

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## Findings suspicious for pregnancy failure

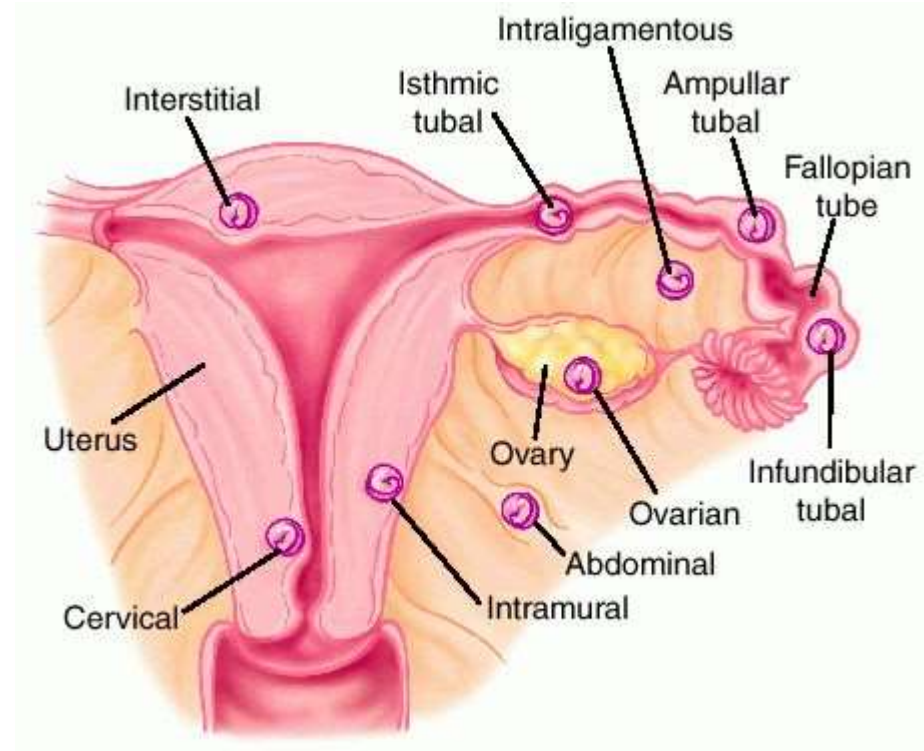
Findings close to decision boundaries	CRL <7mm but no FH MSD 16-24 mm but no embryo
Size smaller or structures less developed, than expected by dates	No embryo at 6 weeks
Discordant growth	Empty amnion – amnion and YS but no embryo Enlarged YS >7mm Small GS wrt embryo (<5mm difference between MSD and CRL) Discordant twins
Growth slower than expected	GS < 1mm/day, CRL < 0.7mm/day
Other features	Irregular sac Sac low in cavity Sub-chorionic haematoma (Fetal bradycardia)

# Ectopic pregnancy

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## Ectopic pregnancy

- Tubal 90%
- Scar ectopic 6%
- Interstitial 2-4%
- Ovarian 1%
- Cervix 0.15%
- Broad ligament
- Cornual
- Abdominal 0.1-0.7%



**Non tubal EP account for 20% of mortalities connected to all ectopic pregnancies**

**Heterotopic pregnancy 1/7000 pregnancies (1/100 post IVF)**

## Sonographic criteria for different types of tubal ectopic pregnancy

Sonographic criteria	% of ectopics seen on US
Inhomogenous adnexal mass ('blob' sign)	60%
Empty extrauterine gestation sac ('bagel sign')	20%
Extrauterine gestation sac +/- yolk sac +/- fetal pole +/- fetal cardiac activity	20%

Brown DL, Doubilet PM. J Ultrasound Med. 1994;13:259–266.

## Interstitial pregnancy



## Interstitial pregnancy

- Pregnancy high in fundus, towards edge of uterus
  - Endometrial stripe connecting to pregnancy site
  - Thin myometrial mantle of < 5mm around the GS
  
  - Interstitial pregnancy and cornual pregnancy are 2 separate entities:
  - **Interstitial pregnancy** – GS in the muscular part of the tube that penetrates the uterine wall
  - **Cornual pregnancy** – GS in a rudimentary horn of a unicornuate uterus, cornu of a bicornuate or septate uterus
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## Caesarean scar ectopic



- Incidence increasing. 1:2000 of all pregnancies, 6% of EP
- Prompt diagnosis is crucial – uterine rupture, haemorrhage, bladder invasion
- **Sonographic criteria**
- Empty uterus, empty cervix
- GS in the anterior wall of the lower segment of the uterus
- Thin or no myometrium between bladder and gestation sac
- Doppler flow
- Discontinuity in uterine wall on sagittal view

# Cervical ectopic

## Sonographic criteria

- GS in the cervical tissue not the cervical canal
- Decidual ring, vascularity
- To differentiate from a GS in the cervical canal (inevitable miscarriage):  
Sliding sign – when pressure is applied to cervix with TV probe, a GS in the cervical canal will slide but a cervical EP does not move



## Heterotopic pregnancy

- Incidence:
- 1:7 000 natural conceptions
- 1- 3:100 assisted conception
- Laparoscopy and salpingectomy



## Ectopic pregnancy: Diagnostic pitfalls

- Intrauterine fluid collection – pseudosac
- “Incomplete miscarriage” with blood in uterus may not be a miscarriage - exclude an EP (unless IUP seen previously)
- “Complete miscarriage” is a PUL and possible EP (unless IUP seen previously)
- IUP does not exclude EP (heterotopic)
- Low GS may be scar EP
- Sac in the cervix may be a cervical EP rather than an inevitable miscarriage

Imperial College  
London

**A triple layer endometrium with a positive PT is likely to be an ectopic pregnancy - beware**



# Managing expectations and psychological considerations

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## The issue of early testing...

- Very early presentations due to ovulation apps, home ovulation tests, sensitive home pregnancy tests - Inconclusive scans and uncertainty
  - PUV and PUL

When should we do the first scan?

- Day 35 (5 weeks) – PUV rate 60%
  - Day 42 (6 weeks) – PUV rate 29%
  - If no clinical symptoms, USS to look for viability on Day 49 (7 weeks)
-

## Managing patient expectations

- **.Accurate prediction of pregnancy viability by means of a simple scoring system.**
- [Bottomley C<sup>1</sup>](#), [Van Belle V](#), [Kirk E](#), [Van Huffel S](#), [Timmerman D](#), [Bourne T](#).
- [Hum Reprod](#). 2013 Jan;28(1):68-76. doi: 10.1093/humrep/des352. Epub 2012 Oct 30
- **The psychological effects and patient acceptability of a test to predict viability in early pregnancy: a prospective randomised study.** / Davison, A. Z.; Appiah, A.; Sana, Y.; Johns, J.; Ross, Jackie.
- In: European Journal of Obstetrics Gynecology and Reproductive Biology, Vol. 178, 07.2014, p. 95-99



## Managing patient expectations: Scoring systems (Bottomley et al)

- Maternal age
- Bleeding score
- Mean gestational sac size
- Fetal heart beat
- Mean yolk sac diameter
- Mean gestational sac size +/- fetal heart beat
  - **Estimated chance of a viable pregnancy**
  
- *Human Reproduction*, Bottomley et al, Volume 28, Issue 1, 1 January 2013, Pages 68–76,

- Women offered information of potential pregnancy outcome based on a predictive model found it useful to manage their expectation and anxiety
  - Reassurance is difficult
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# The psychological impact....

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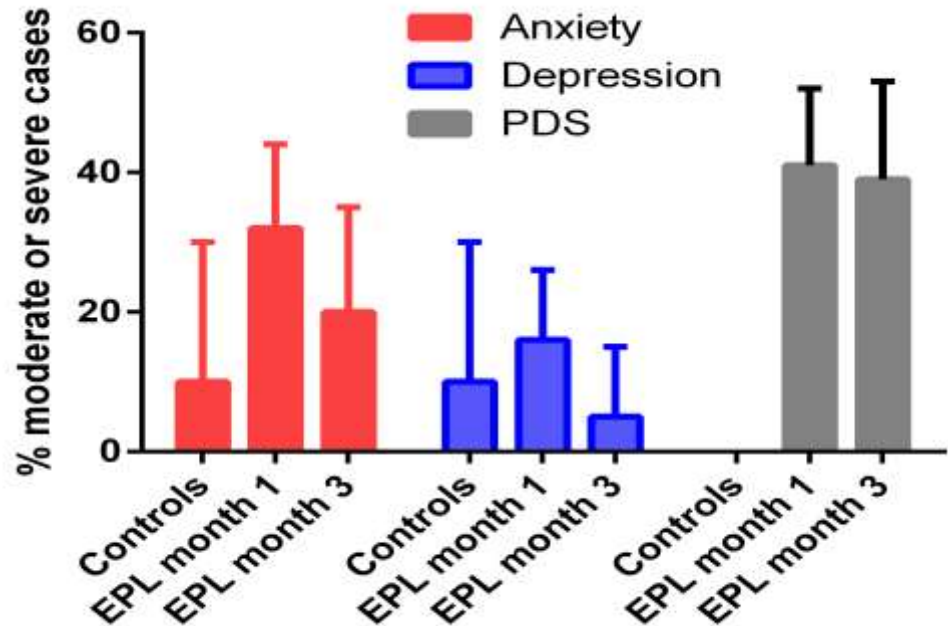
*BMJ Open* 2016;**6**:e011864 doi:10.1136/bmjopen-2016-011864

## Mental health

### Post-traumatic stress, anxiety and depression following miscarriage or ectopic pregnancy: a prospective cohort study

Jessica Farren<sup>1</sup>, Maria Jalbrant<sup>2</sup>, Lieveke Ameye<sup>3</sup>, Karen Joash<sup>1</sup>, Nicola Mitchell-Jones<sup>4</sup>, Sophie Tapp<sup>1</sup>, Dirk Timmerman<sup>3,5</sup>, Tom Bourne<sup>1,3,5</sup>

[Author Affiliations](#)



## In the future

- Criteria for IVF
  - Criteria for 3-D USS
  - AI
  - Non-USS markers to predict miscarriage
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## Conclusion

- Always err on side of caution in diagnosis of miscarriage: if in doubt, re-scan
  - Manage expectations – informally or formally (predictive models)
  - High index of suspicion in the dx of EP
  - Consider the psychological sequelae of pregnancy loss
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- My thanks to
  - Jessica Farren
  - Shabnam Bobdiwalla
-