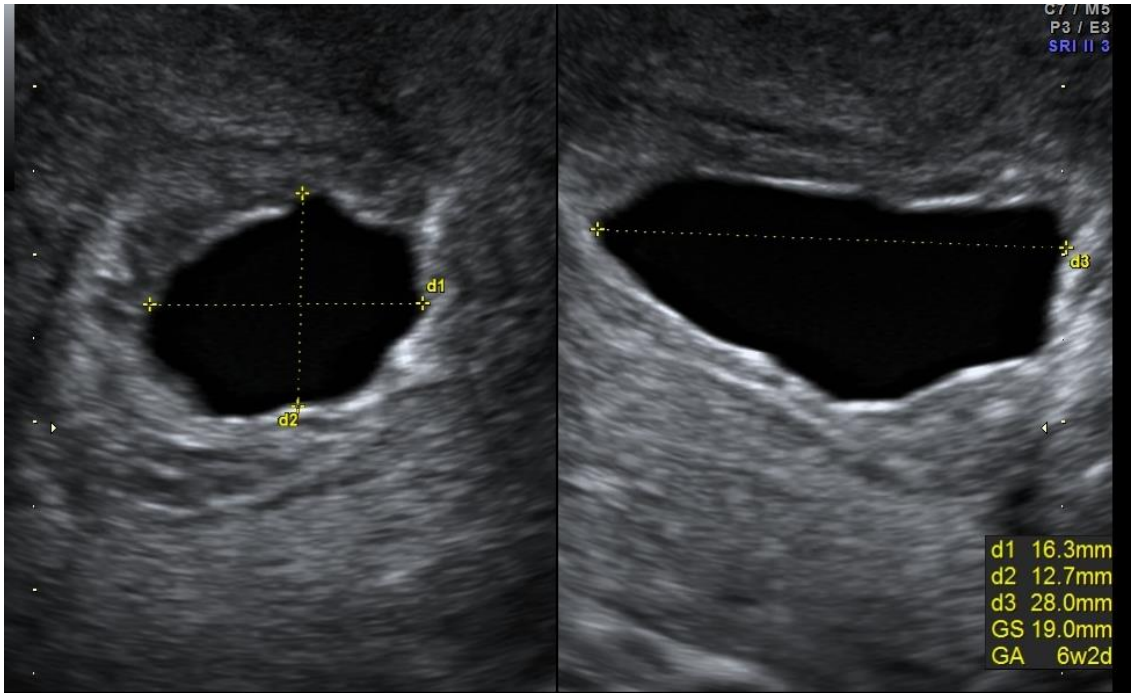
Miscarriage and PUV Definition

Miscarriage: Spontaneous loss of a pregnancy before it would be able to survive independently (before the 23rd week gestation, or a weight of 500g)

Recurrent miscarriage: The loss of three or more consecutive pregnancies

Pregnancy of uncertain viability (PUV): Transvaginal ultrasonography showing an intrauterine gestation sac with no embryonic heartbeat (and no findings of definite pregnancy failure)



Miscarriage and PUV
Incidence of miscarriage

Miscarriage affects approximately 25% of women who have been pregnant by the age of 39 years

12-20% of all pregnancies [1]

Majority take place in the 1st trimester

1% of women experience recurrent miscarriage [2]

Risk factors: age, smoking, excess alcohol intake, illicit drug use, uterine surgery or abnormalities, systemic disease (SLE, uncontrolled diabetes, antiphospholipid syndrome)

Miscarriage and PUV
Clinical symptoms of miscarriage

- Pelvic pain
- Vaginal bleeding
- Passage of pregnancy tissue
- Loss of pregnancy symptoms
- Asymptomatic: diagnosed first at dating or combined screening ultrasound

Ultrasound features:
normal early intra-uterine pregnancy

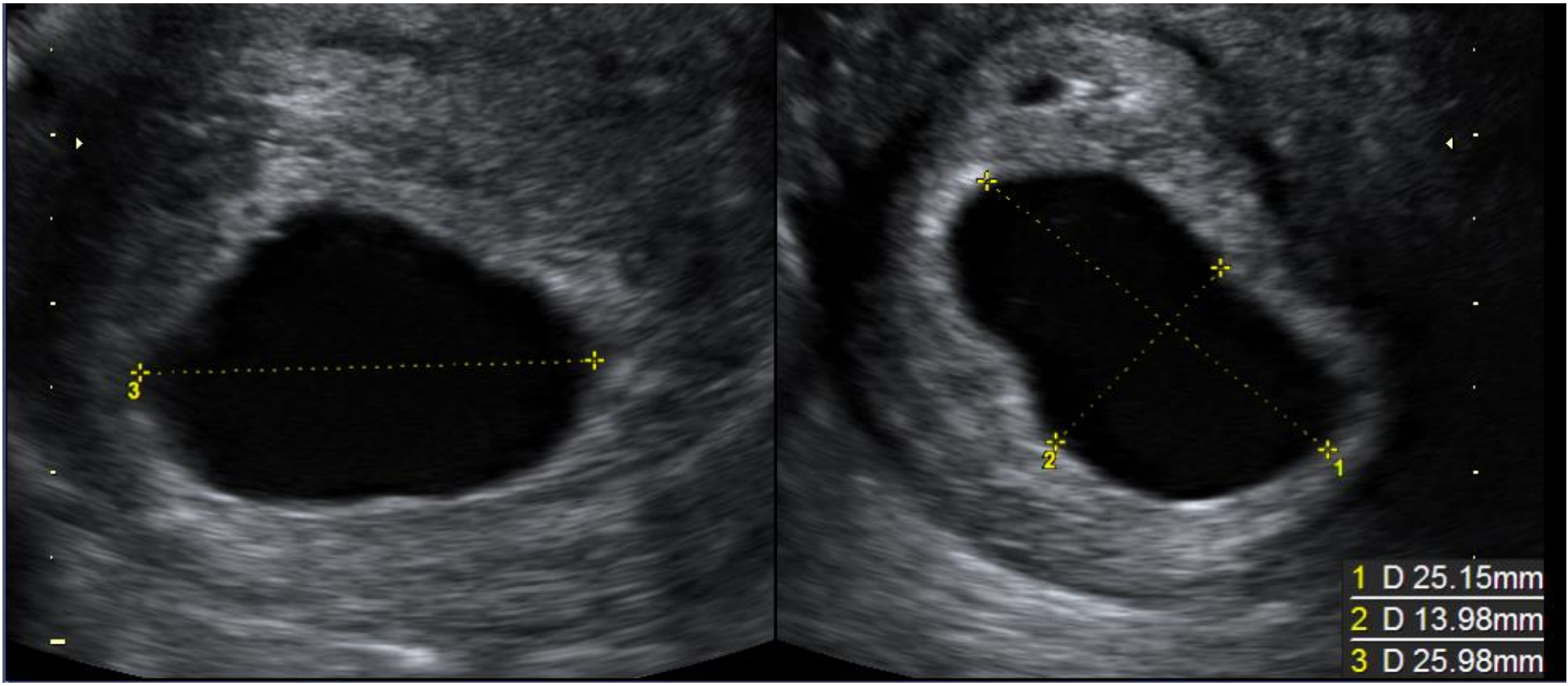
Ultrasound characteristics

Normal early pregnancy [3, 4]

	Typical appearance	First visible on TVS (days from LMP)	Growth
Gestation Sac (GS) 	Uniformly round/oval Hypoechoic Asymmetrically within decidua At or near fundus	29-32 days	1mm/day
Yolk Sac (YS)	Spherical hyperechoic ring Eccentrically situated in GS	35 days	Max at 10/40
Embryo 	Initially as ‘signet’ ring on YS Typically, fetal heart activity visible as soon as embryo pole visualised Becomes kidney bean shaped & moves away from YS	37 days	1mm/day
Amnion	Thin hyperechoic ring surrounding embryo Fuses with chorionic membrane at 12 weeks	49 days	

Ultrasound characteristics

Gestation Sac



Measuring a gestation sac (GS):

- Three orthogonal planes, from which Mean Sac Diameter (MSD) is calculated
- Generally two measurements taken in sagittal plane (longest and its orthogonal, from inner borders), & one horizontal measurement in transverse plane

Ultrasound characteristics
Embryo

Measuring crown rump length (CRL):

Image a: when caudal and cephalic ends cannot be clearly distinguished, measure the greatest straight-line length

Image b: once sufficiently deflexed, and lower limbs become distinguishable (from 8 weeks), a true ‘crown-rump’ measurement can be taken

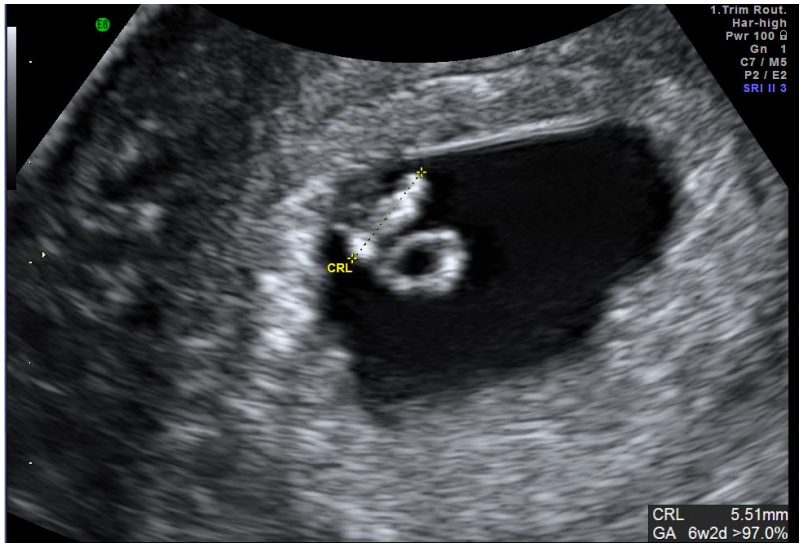


Image (a)

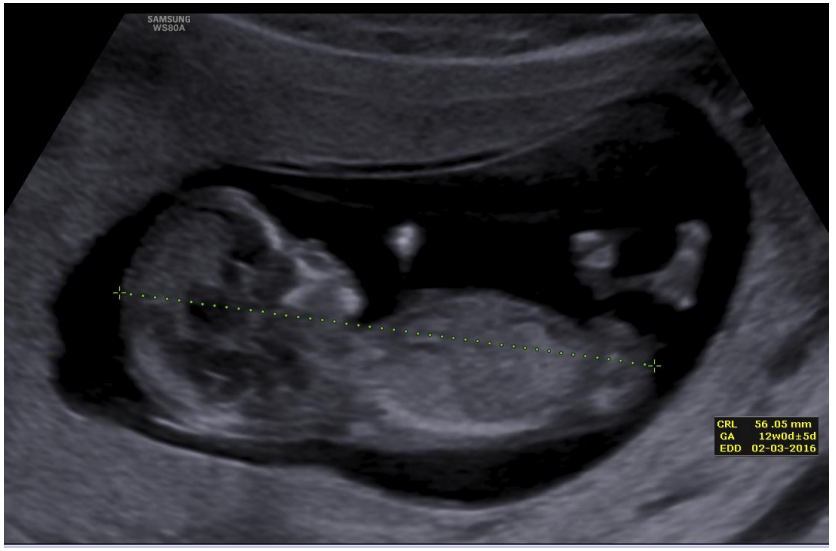
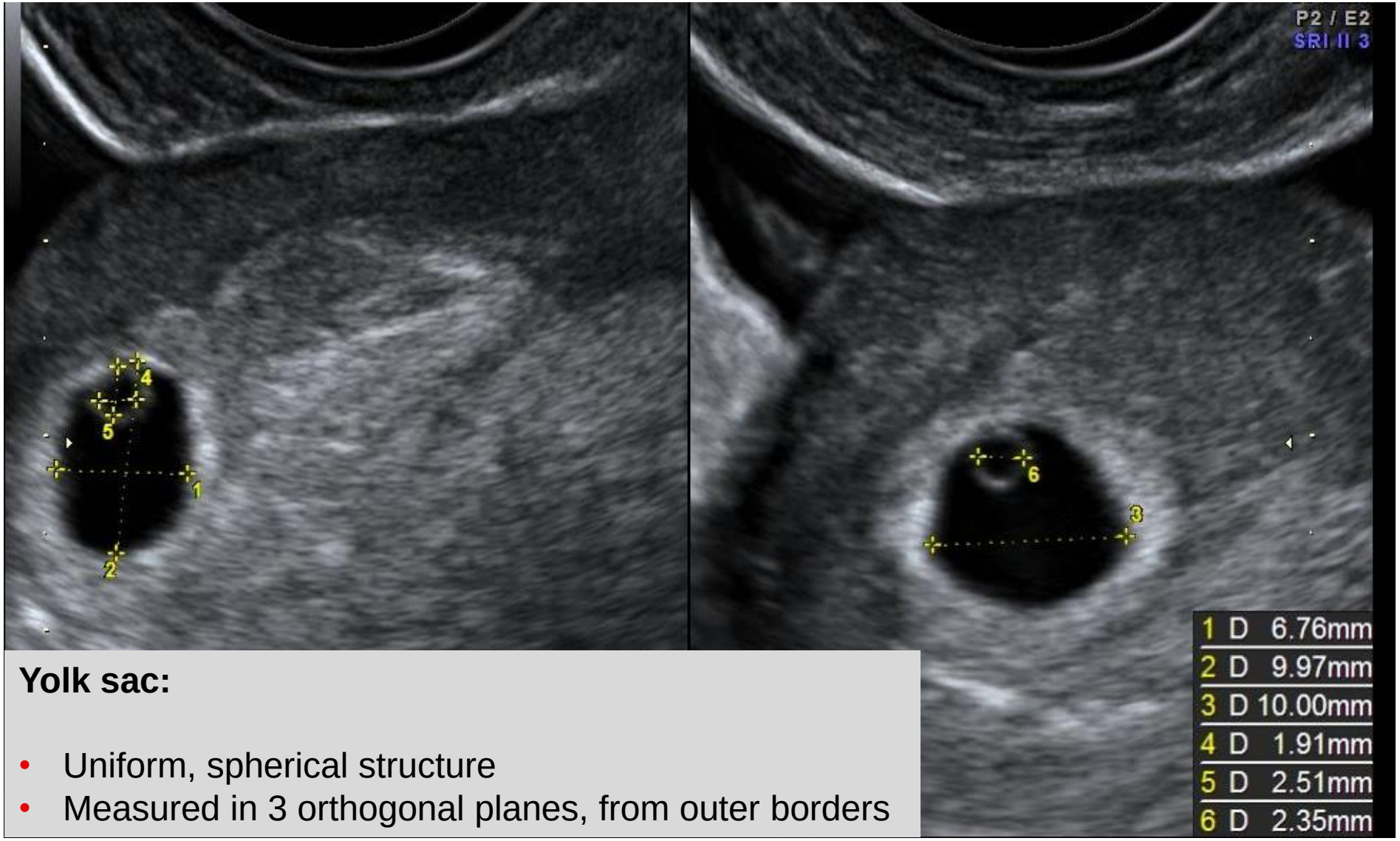


Image (b)

Ultrasound characteristics

Yolk Sac



Yolk sac:

- Uniform, spherical structure
- Measured in 3 orthogonal planes, from outer borders

Ultrasound features:
the diagnosis of miscarriage

Miscarriage
Ultrasound characteristics

Fundamental principle: First do no harm

Misdiagnosis of miscarriage is **unacceptable** as it may lead to inadvertent termination of a viable pregnancy

Thus:

- Strict cut-offs for diagnosis; allow for inter and intra-observer variability
- Strict time intervals before repeating scans when initial scan inconclusive

Miscarriage
Ultrasound characteristics [5,6,7]

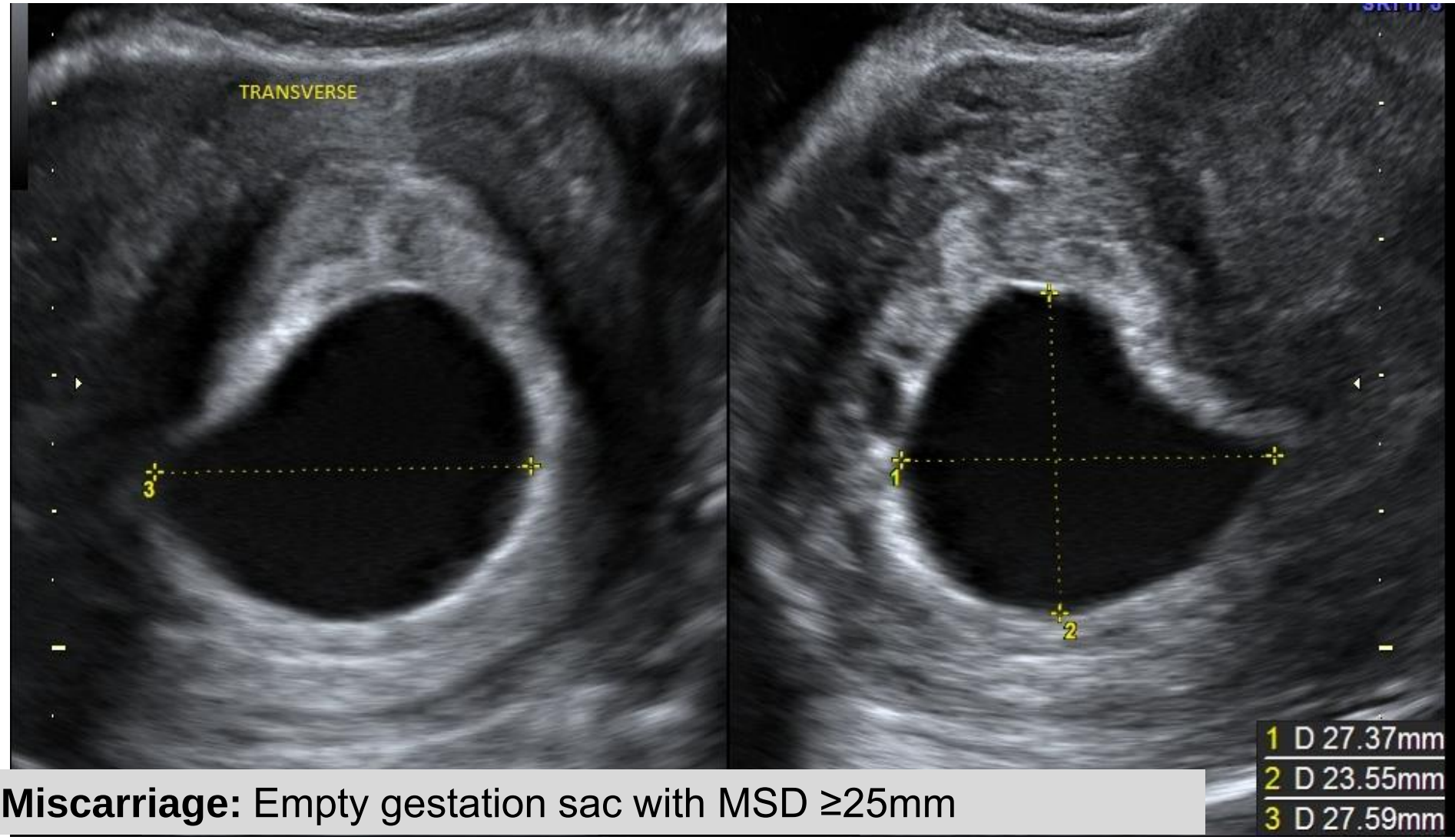
Features diagnostic of a miscarriage on trans-vaginal* scanning:	
One-off scan	- MSD ≥25mm (with no obvious yolk sac or fetal pole) - Embryo with CRL ≥7mm without evidence of fetal heart activity *A second operator should check the findings or repeat the scan 7 days later* ** A scan performed trans-abdominally should be repeated after a minimum of 14 days*
Scan repeated at interval	- No embryo with fetal heart activity ≥**14 days** after a scan that showed a gestational sac without a yolk sac - No embryo with fetal heart activity **≥11 days** after a scan that showed a gestational sac with a yolk sac

Miscarriage

Suggested new criteria for diagnosis of miscarriage [8]

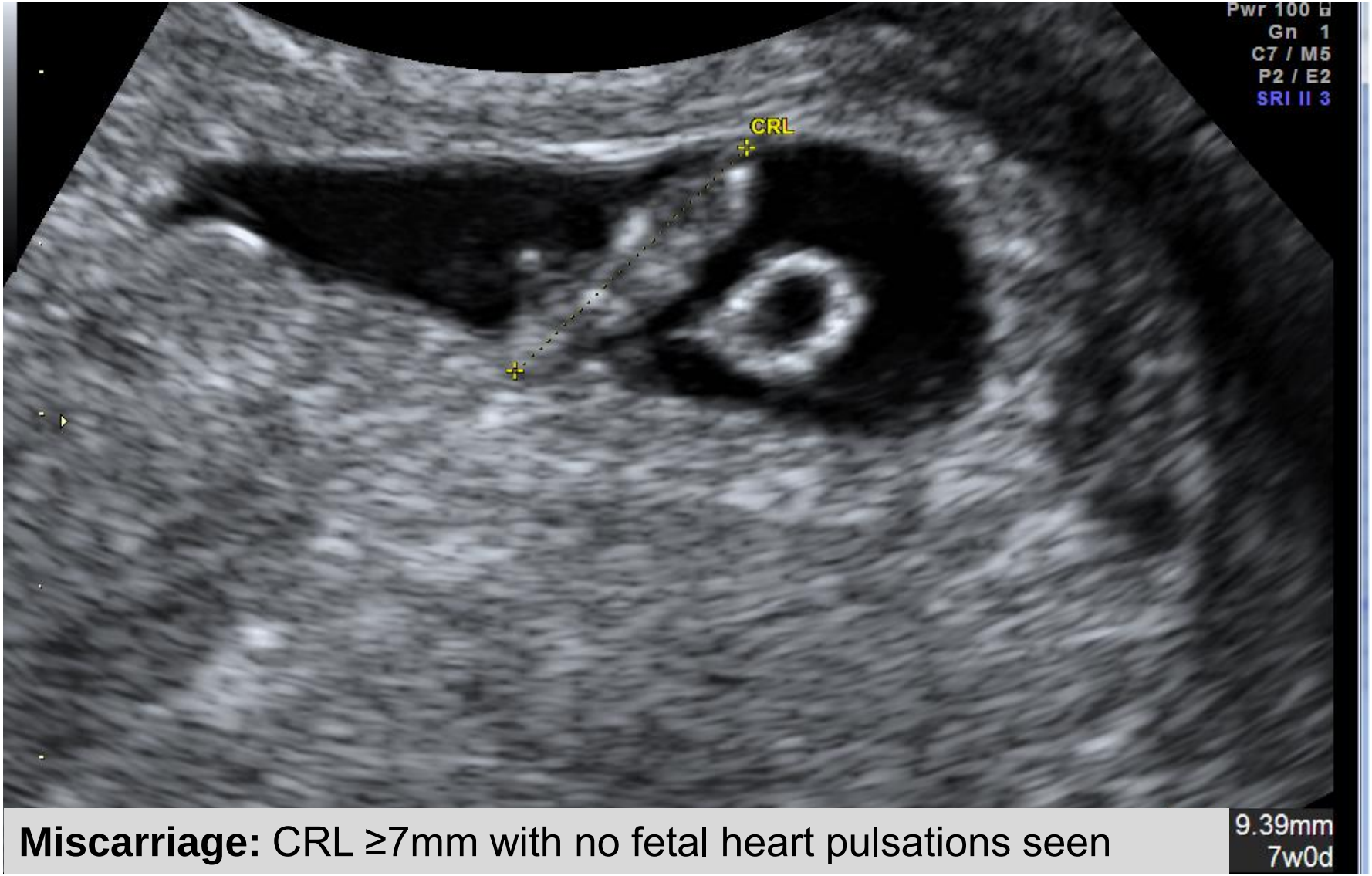
Features diagnostic of a miscarriage on trans-vaginal scanning:	
One-off scan	- MSD ≥25mm (with no obvious yolk sac or fetal pole) - Embryo with CRL ≥7mm without evidence of fetal heart activity -MSD ≥18mm without embryo, more than 70 days after LMP* -Embryo ≥3mm without fetal heart activity, more than 70 days after LMP* *Close to decision boundaries, a second operator should check the findings or repeat the scan 7 days later*
Scan repeated at interval	- No embryo with fetal heart activity **7 days** after a scan: - in which embryo was visualised* - in which a gestation sac ≥12mm MSD (with or without yolk sac) was visualised* -MSD less than doubled **14 days** after scan in which empty sac with MSD <12mm was seen* * Suggested new additions

Miscarriage
Ultrasound characteristics



Miscarriage: Empty gestation sac with MSD ≥25mm

Miscarriage
Ultrasound characteristics



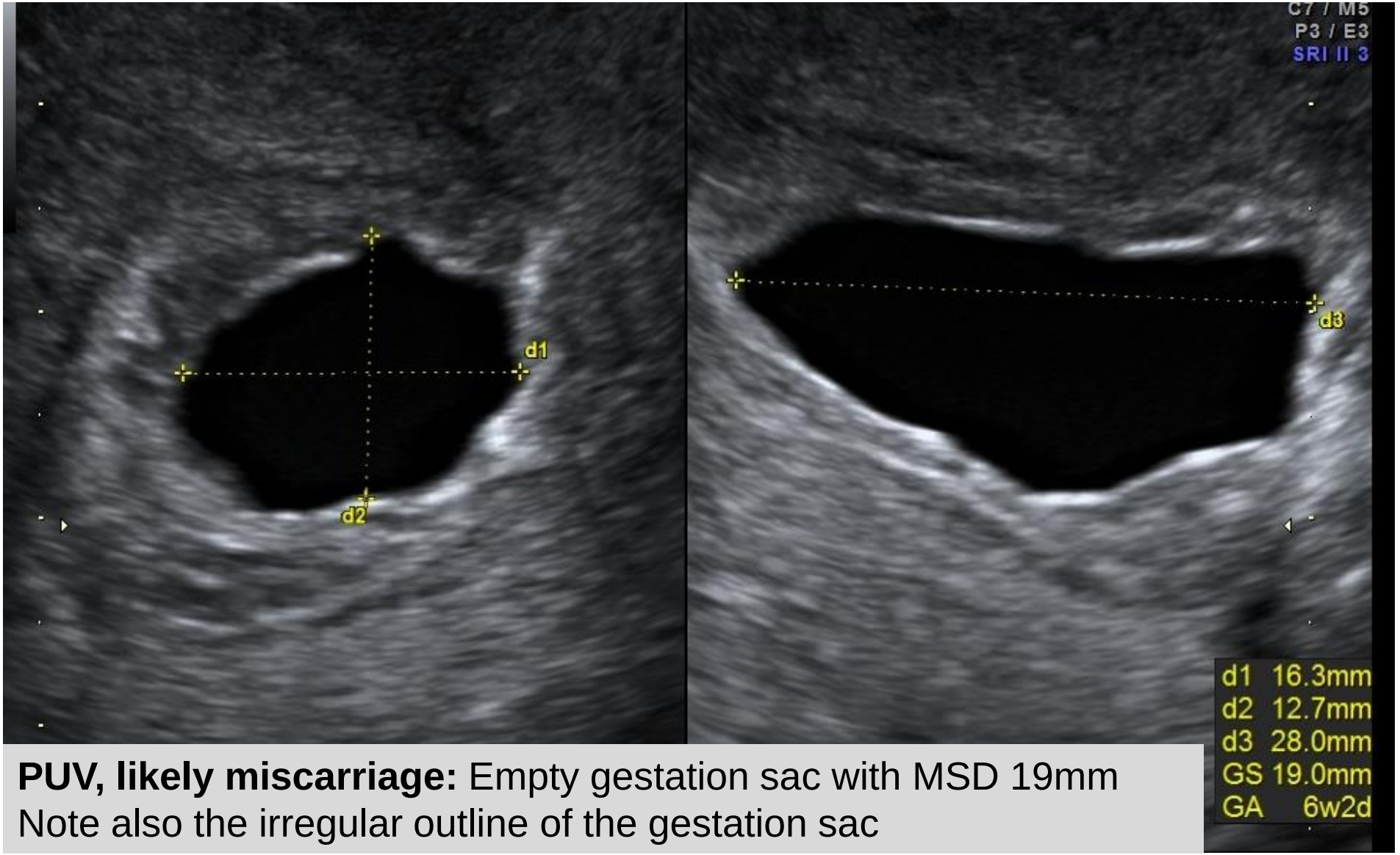
Miscarriage: CRL ≥7mm with no fetal heart pulsations seen

Miscarriage

Ultrasound characteristics suggestive of miscarriage

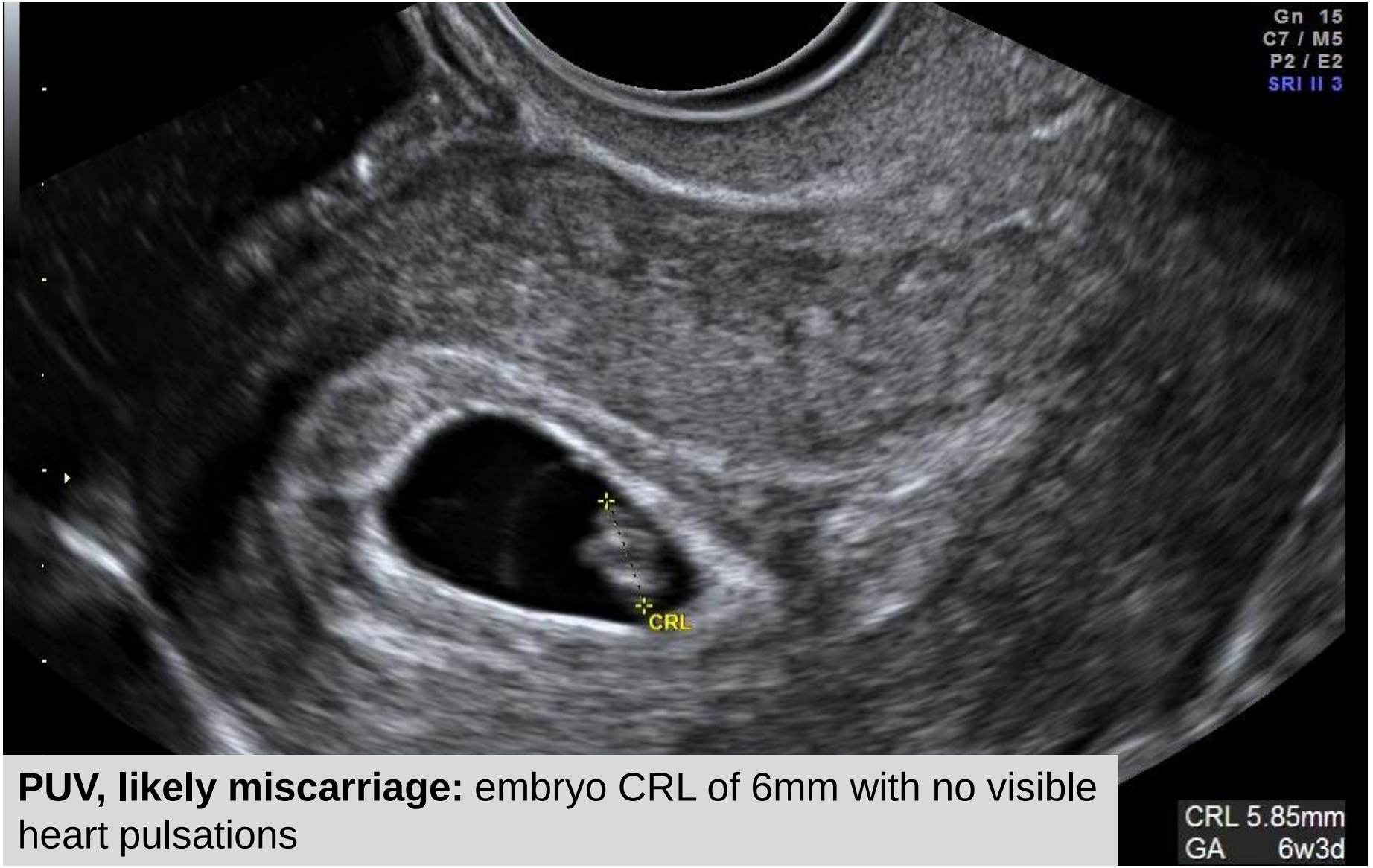
Features suggestive of a miscarriage [7]	
Findings close to decision boundaries	Crown-rump length of <7mm and no heartbeat Mean sac diameter of 16-24mm and no embryo Absence of an embryo >=6 weeks after last menstrual period
Discordant growth	Enlarged yolk sac >7mm Empty amnion sign <5mm difference between MSD and CRL
Other concerning features	Sac low in cavity (NB care to exclude cervical or C/S scar ectopic) Irregular outline Subchorionic haematoma

PUV
Ultrasound characteristics



PUV, likely miscarriage: Empty gestation sac with MSD 19mm
Note also the irregular outline of the gestation sac

PUV
Ultrasound characteristics

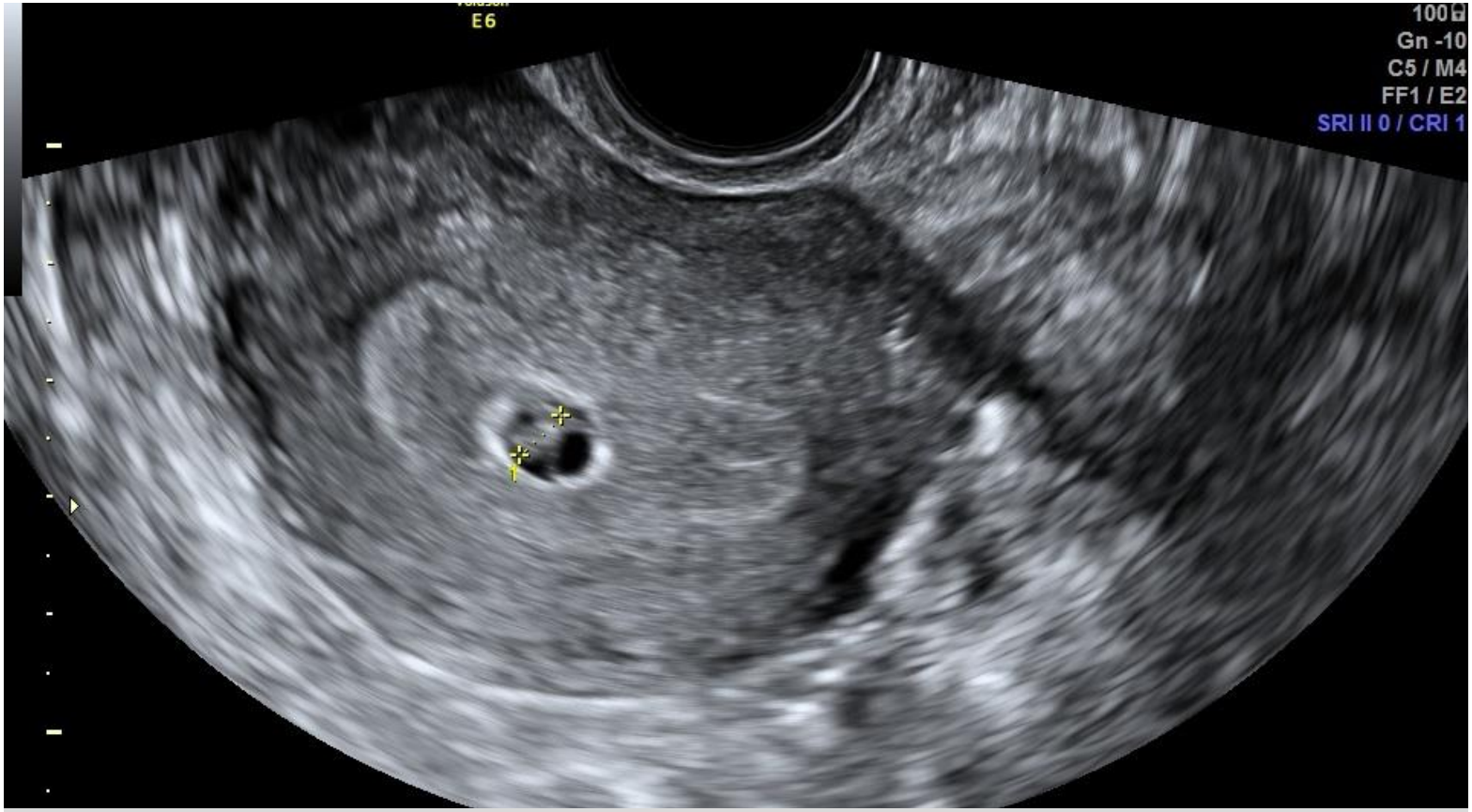


PUV, likely miscarriage: embryo CRL of 6mm with no visible heart pulsations

PUV
Ultrasound characteristics

PUV, likely miscarriage: Empty Amnion Sign
An amnion is usually visible at 7 weeks; thus the appearance of an amnion without an obvious visible embryo is highly suggestive of miscarriage

PUV
Ultrasound characteristics



PUV, likely miscarriage: Small gestation sac in relation to embryo - <5mm difference between CRL and MSD

Miscarriage and PUV Management

	Expectant	Medical	Surgical
Procedure	(None)	Misoprostol 600mcg or 800mcg PV [8]	Suction evacuation (under general anaesthetic) or manual vacuum aspiration (MVA)
Success rates	70% after 2 weeks[9]	84% after 8 days [10]	97% [10]
Advantages	Cheapest	More predictable than expectant management	Most predictable Shortest duration of bleeding and pain
Equal	No difference in infection, future fertility or patient satisfaction [11]		
Disadvantages	Unpredictability	Gastrointestinal side effects	Potential surgical complications – including perforation or adhesions
	Higher risk of unplanned admission and intervention as compared to surgical [11]		