Can miscarriage be accurately predicted in early pregnancy using transvaginal ultrasound parameters?

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Background

Ultrasound is often the first line of investigation when evaluating early pregnancy. Current NICE guidelines regarding confirmation of miscarriage are restrictive with only two clinically accepted ultrasound markers to definitively diagnose a miscarriage, an empty gestation sac measuring greater than 25mm mean diameter with no evidence of a yolk sac or fetal pole inside, or a fetal pole measuring 7mm or more in length with no visible heart pulsations (NICE 2023). This can often mean that the first ultrasound scan is inconclusive leading to increased stress for patients with further scans and investigations. This research aims to collate the evidence and evaluate the ultrasound parameters that can indicate a failing pregnancy from the first scan, in the hope to reduce uncertainties surrounding miscarriage in the early stages of pregnancy and help better council patients with a likely prognosis.

Method

A systematic literature search was undertaken using PubMed and Science Direct including literature published from 2012 to 2022. Inclusion criteria and exclusion criteria were applied (see table) and any literature suitable for inclusion was critically appraised using the CASP framework.

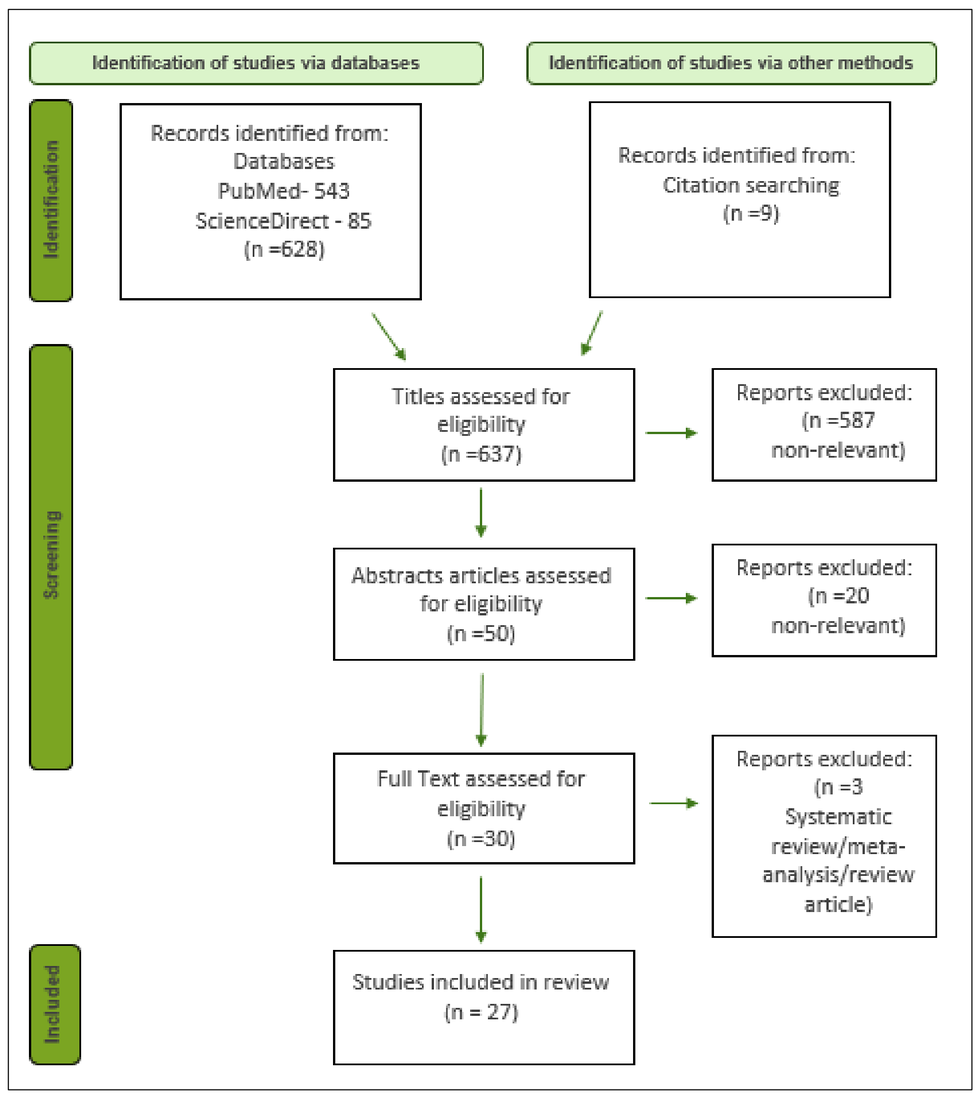
Inclusion/exclusion criteria

Inclusion criteria	Exclusion Criteria
Peer reviewed	Non-peer reviewed
Full text available online	Studies only evaluating Pregnancy of unknown Location (PUL) or ectopic pregnancies.
Prospective and retrospective cohort studies	Studies using colour Doppler
Gestational age 5-13 weeks	

Results

Parameter	Results
Mean Sac Diameter	Smaller MSD than expected for gestational age is a key predictor of pregnancy loss (Datta and Raut 2017).
Yolk sac diameter	Literature suggests a large YSD is indicative of miscarriage up to 8 weeks gestation conversely after 8 weeks a YSD >5th centile indicates a higher risk of miscarriage (Detti *et al.* 2020b).
Crown rump length	CRL is more sensitive as a predictor of miscarriage than MSD or YSD however it is highly dependent upon the accurate dating of the last menstrual period (Shaamash *et al*. 2020).
Embryonic/fetal heart rate	Heart rate is demonstrably slower in pregnancies that miscarry, if less than 5th centile for gestational age there is more than 100 times increased risk of miscarriage (Detti *et al.* 2020a).
Uterine artery pulsitility index	No statistical difference between ongoing pregnancy groups vs pregnancy loss groups however only 2 studies included UAPI within their parameters (Idelson *et al.* 2020).
Subchorionic haematoma	No statistical difference between ongoing pregnancy groups vs pregnancy loss groups- thought to be due to the difficulty in accurately measuring the volume of the haematoma due to its complex shape (Heller *et al.* 2018).
Multivariate models	By far the most accurate method to predict miscarriage - varying models working better at different gestational ages (Shaamash *et al.* 2020)

Prisma flowchart



Conclusion

No ultrasound parameter can be used in isolation to predict miscarriage with 100% accuracy, however multivariate predictive models using a combination of mean sac diameter, crown-rump length, yolk sac diameter and embryonic/fetal heart rate can predict miscarriage with a good degree of accuracy with the potential to be used in clinical practice to facilitate better counselling of patients.

References

See e-poster for reference list.

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