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Robert Peter J, Ho JJ, Valliapan J, Sivasangari S

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[Intervention Review]

Symphysial fundal height (SFH) measurement in pregnancy for detecting abnormal fetal growth

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ABSTRACT

Background

Symphysis fundal height (SFH) measurement is commonly practiced primarily to detect fetal intrauterine growth restriction (IUGR). Undiagnosed IUGR may lead to fetal death as well as increase perinatal mortality and morbidity.

Objectives

The objective of this review is to compare SFH measurement with serial ultrasound measurement of fetal parameters or clinical palpation to detect abnormal fetal growth (IUGR and large-for-gestational age), and improving perinatal outcome.

Search methods

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register (14 July 2015) and reference lists of retrieved articles.

Selection criteria

Randomised controlled trials including quasi-randomised and cluster-randomised trials involving pregnant women with singleton fetuses at 20 weeks' gestation and above comparing tape measurement of SFH with serial ultrasound measurement of fetal parameters or clinical palpation using anatomical landmarks.

Data collection and analysis

Two review authors independently assessed trials for inclusion and risk of bias, extracted data and checked them for accuracy.

Main results

One trial involving 1639 women was included. It compared SFH measurement with clinical abdominal palpation.

There was no difference in the two reported primary outcomes of incidence of small-for-gestational age (risk ratio (RR) 1.32; 95% confidence interval (CI) 0.92 to 1.90, *low quality evidence*) or perinatal death (RR 1.25, 95% CI 0.38 to 4.07; participants = 1639, *low quality evidence*). There were no data on the neonatal detection of large-for-gestational age (variously defined by authors). There was no difference in the reported secondary outcomes of neonatal hypoglycaemia, admission to neonatal nursery, admission to the neonatal nursery for IUGR (*low quality evidence*), induction of labour and caesarean section (*very low quality evidence*). The trial did not address the other outcomes specified in the 'Summary of findings' table (intrauterine death; neurodevelopmental outcome in childhood). GRADEpro software was used

to assess the quality of evidence, downgrading of evidence was based on including a small single study with unclear risk of bias and a wide confidence interval crossing the line of no effect.

Authors' conclusions

There is insufficient evidence to determine whether SFH measurement is effective in detecting IUGR. We cannot therefore recommend any change of current practice. Further trials are needed.

PLAIN LANGUAGE SUMMARY

Measuring the height of the uterus from the symphysis pubis (SFH) in pregnancy for detecting problems with fetal growth

Monitoring the baby's growth is important during pregnancy. If growth is poor then this should be identified as soon as possible, because delay might result in the baby's death. The simplest way to determine growth is to examine the baby by palpating the mother's by abdomen and estimate the size of her womb compared with a landmark such as the navel (umbilicus). An alternative method is to use a tape measure to take a measurement, known as the symphysial fundal height (SFH) measurement, from the mother's pubic bone (symphysis pubis) to the top of the womb. The measurement is then applied to the gestation by a simple rule of thumb and compared with normal growth.

We wanted to know which of these two methods is more likely to detect poor growth. Ultrasound assessment can also be used to detect growth restriction but this is costly and not always available, and there are concerns about its unnecessary use. We found only one randomised trial (involving 1639 women at 20 weeks' gestation and above) comparing repeated measures of SFH with abdominal palpation. The trial found no difference between the two approaches in detecting poor growth. With such limited evidence, it is still not known whether one method is more effective than the other, and how these methods compare with ultrasound measurement. The main findings from this review were assessed for quality using software called GRADEpro. The overall evidence was of low/very low quality.

SUMMARY OF FINDINGS

Summary of findings for the main comparison. Tape measurement compared with clinical palpation for pregnancy for detecting abnormal fetal growth

Tape measurement compared with clinical palpation for pregnancy for detecting abnormal fetal growth

Patient or population: Pregnant women with singleton fetuses who were of 20 weeks' gestation and above.

Settings: Denmark

Intervention: Tape measurement

Comparison: Clinical palpation

Outcomes	Illustrative comparative risks* (95% CI)		Relative effect (95% CI)	No of Participants (studies)	Quality of the evidence (GRADE)	Comments
	Assumed risk	Corresponding risk				
	clinical palpation	Tape measurement				
Neonatal detection of small-for-dates	Study population		RR 1.32 (0.92 to 1.90)	1639 (1 RCT)	⊕⊕⊕⊕ LOW 1,2	
	57 per 1000	76 per 1000 (53 to 109)				
	Moderate					
	58 per 1000	76 per 1000 (53 to 109)				
Neonatal detection of large-for-gestational age	The study did not have data on this outcome.					
Perinatal mortality	Study population		RR 1.25 (0.38 to 4.07)	1639 (1 RCT)	⊕⊕⊕⊕ LOW 4	
	6 per 1000	7 per 1000 (2 to 24)				
	Moderate					
	6 per 1000	8 per 1000 (2 to 24)				
Intrauterine death	The study did not have data on this outcome.					

Caesarean section	Study population		RR 0.72 (0.31 to 1.67)	1639 (1 RCT)	⊕⊕⊕⊕ VERY LOW 1,3
	16 per 1000	11 per 1000 (5 to 26)			
	Moderate				
	16 per 1000	11 per 1000 (5 to 26)			
Neurodevelopmental outcome in childhood	The study did not have address this outcome.				
Admission to neonatal nursery	Study population		RR 1.06 (0.70 to 1.61)	1639 (1 RCT)	⊕⊕⊕⊖ LOW 1,2
	50 per 1000	53 per 1000 (35 to 81)			
	Moderate				
	50 per 1000	53 per 1000 (35 to 81)			

*The basis for the **assumed risk** (e.g. the median control group risk across studies) is provided in footnotes. The **corresponding risk** (and its 95% confidence interval) is based on the assumed risk in the comparison group and the **relative effect** of the intervention (and its 95% CI).

CI: Confidence interval; **RR:** risk ratio

GRADE Working Group grades of evidence

High quality: Further research is very unlikely to change our confidence in the estimate of effect.

Moderate quality: Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.

Low quality: Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.

Very low quality: We are very uncertain about the estimate.

¹One study with unclear risk of bias

²Wide CI crossing the line of no effect

³One small study with few events and wide CI crossing the line of no effect

⁴Only one small study

BACKGROUND

Description of the condition

Fetal growth assessment is an important part of antenatal care. Methods used in the past include clinical palpation of fundal height in relation to anatomical landmarks such as the umbilicus and xiphisternum, abdominal girth measurement and serial ultrasound measurement of the fetal parameters. Clinical palpation using anatomical landmarks is subjective and has a wide interobserver difference (Bais 2004), but is the only alternative in settings without ultrasound machines. Abdominal girth measurement rarely correlates with fetal outcomes (Rosenberg 1982). Serial ultrasound is thought to be an accurate tool to detect intrauterine growth restriction (IUGR) and macrosomia (large baby). The sensitivity for detection of IUGR is quoted as high as 93% and 90% for macrosomia (De Reu 2008). Though accurate, ultrasound is expensive when used as a screening tool for abnormal growth detection. The American College of Obstetricians and Gynecologists recommend symphysis fundal height (SFH) with ultrasound measurement where discrepancies of failure of fundal growth arise (ACOG 2000).

Description of the intervention

SFH measurement of the distance from the pubic symphysis to the uterine fundus is a simple, inexpensive and widely used method of detecting abnormal fetal growth. For fetuses after 24 weeks' gestation, the measurement is made by identifying the upper border of the symphysis pubis and the uterine fundus and measuring the distance between with a tape measure. The measurement in centimetres is then applied to the gestation by a simple rule of thumb (Belizan 1978). In a fetus which is growing normally, the SFH measurement in centimetres should correspond to the gestation (i.e., the SFH measurement should be 28 centimetres for a 28 weeks' gestation singleton pregnancy, with a allowance of +/- 2 centimetres difference).

How the intervention might work

SFH measurement is aimed at detecting small-for-dates fetuses but among these, the group that is important is those with IUGR. Many workers have found SFH measurement to be more scientific, objective, and reproducible to assess fetal growth (Belizan 1978; Challis 2002; Grover 1991; Lu 2003; Westin 1997). The primary and most important aim of the SFH measurement is the detection of fetuses that are poorly grown as delay in the diagnosis of this fetal condition may lead to intrauterine death (Challis 2002). It also has the potential to detect multiple pregnancies, large-for-gestational-age fetuses, polyhydramnios and oligohydramnios. The assumption is that these conditions, if not picked up early enough during the course of routine antenatal care, will lead to an increased perinatal morbidity and perinatal mortality.

Use of SFH measurement reported detection rates of small-for-dates babies from observational studies of SFH, ranges between 56% (Rosenberg 1982) and 86% (Belizan 1978). Studies showing a reduced mortality have not been reported. SFH measurement appears to be in use in developing countries in most regions of the world (Goto 2013).

In addition, there is disagreement in SFH measurement between observers regarding the ability to separate small fundal heights from those that are not small (Bailey 1989). This becomes an issue

especially in a clinical setting where the pregnant woman sees more than one clinician during the course of her pregnancy. There is also the issue of clinicians being biased in the measurement of the SFH after knowing the gestational age (Jelks 2007). Despite this, SFH measurement continues to be used in many countries on a large scale simply because of its low cost, ease of use, and need for very little training. Another issue is the effect of body mass index on the accuracy of SFH measurement which is important in view of the emerging epidemic of obesity.

IUGR using ultrasound is detected by estimating fetal weight or fetal abdominal circumference that is less than the specified centile (usually 10th, 5th or 3rd) for gestation and sex, and detection of large-for-gestational age more than the specified centile (usually 90th, 95th, or 97th) fetuses is estimated by fetal weight or fetal abdominal circumference that is more than the 90th centile for its gestation and sex (Jelks 2007).

Why it is important to do this review

The evidence for the use of SFH measurement has great implications for low-income countries with limited access to serial ultrasound assessment of the fetus. It is also important in high-income countries as SFH measurement is still used as a screening tool to detect IUGR in many countries. Customised SFH measurement may also be used (see <http://www.perinatal.nhs.uk>).

OBJECTIVES

The objective of this review is to compare symphysis fundal height measurement with serial ultrasound measurement of fetal parameters or clinical palpation to detect abnormal fetal growth (intrauterine growth restriction and large-for-gestational age), and improving perinatal outcome.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials including quasi-randomised and cluster-randomised trials. Trials using a cross-over design were not eligible for inclusion.

Types of participants

Pregnant women with singleton fetuses who were of 20 weeks' gestation and above.

Types of interventions

Intervention

Tape measurement of symphysis fundal height.

Comparison

Serial ultrasound measurement of fetal parameters or clinical palpation using anatomical landmarks.

Types of outcome measures

Primary outcomes

1. Neonatal detection of small-for-dates (variously defined by authors).

2. Neonatal detection of large-for-gestational age (variously defined by authors).
3. Perinatal mortality (variously defined by authors).

Secondary outcomes

1. Complications associated with intrauterine growth restriction (IUGR) (fetal distress in labour, neonatal hypoglycaemia, admission to neonatal nursery because of IUGR).
2. Complications associated with large-for-gestational-age fetuses (fetal macrosomia, shoulder dystocia, prolonged labour, fetal distress).
3. Intrauterine death.
4. Intrapartum asphyxia (however defined by trialists).
5. Detection of oligohydramnios (however detected by trialists).
6. Induction of labour.
7. Caesarean section and reasons for caesarean section.
8. Health service outcomes (admission to neonatal nursery, antenatal admission of women).
9. Detection of polyhydramnios (however detected by trialists).
10. Neurodevelopmental outcome in childhood.

Search methods for identification of studies

The following methods section of this review is based on a standard template used by the Cochrane Pregnancy and Childbirth Group.

Electronic searches

We searched the Cochrane Pregnancy and Childbirth Group's Trials Register by contacting the Trials Search Co-ordinator (14 July 2015).

The Cochrane Pregnancy and Childbirth Group's Trials Register is maintained by the Trials Search Co-ordinator and contains trials identified from:

1. monthly searches of the Cochrane Central Register of Controlled Trials (CENTRAL);
2. weekly searches of MEDLINE (Ovid);
3. weekly searches of Embase (Ovid);
4. monthly searches of CINAHL (EBSCO);
5. handsearches of 30 journals and the proceedings of major conferences;
6. weekly current awareness alerts for a further 44 journals plus monthly BioMed Central email alerts.

Details of the search strategies for CENTRAL, MEDLINE, Embase and CINAHL, the list of handsearched journals and conference proceedings, and the list of journals reviewed via the current awareness service can be found in the 'Specialized Register' section within the editorial information about the [Cochrane Pregnancy and Childbirth Group](#).

Trials identified through the searching activities described above are each assigned to a review topic (or topics). The Trials Search Co-ordinator searches the register for each review using the topic list rather than keywords.

Searching other resources

We searched the reference lists of retrieved articles to look for further studies and any possible sources of unpublished data and contact known experts.

We did not apply any language or date restrictions.

Data collection and analysis

For methods used in the previous version of this review, see [Robert Peter 2012](#).

For this update, no new reports were identified as a result of the updated search.

Two review authors independently assessed risk of bias for each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2011](#)). Any disagreement was resolved by discussion or by involving a third assessor.

Assessment of the quality of evidence

For this update the quality of the evidence was assessed using the GRADE approach ([Schunemann 2009](#)) in order to assess the quality of the body of evidence relating to the following outcomes for the main comparisons 'tape measurement versus clinical palpation':

1. Neonatal detection of small-for-dates (variously defined by authors).
2. Neonatal detection of large-for-gestational age (variously defined by authors).
3. Perinatal mortality (variously defined by authors)
4. Intrauterine death
5. Caesarean section and reasons for caesarean section.
6. Admission to neonatal nursery.
7. Neurodevelopmental outcome in childhood.

We used GRADE profiler ([GRADEpro 2014](#)) to import data from Review Manager 5.3 ([RevMan 2014](#)) in order to create a 'Summary of findings' table. A summary of the intervention effect and a measure of quality for each of the above outcomes has been produced using the GRADE approach. The GRADE approach uses five considerations (study limitations, consistency of effect, imprecision, indirectness and publication bias) to assess the quality of the body of evidence for each outcome. The evidence can be downgraded from 'high quality' by one level for serious (or by two levels for very serious) limitations, depending on assessments for risk of bias, indirectness of evidence, serious inconsistency, imprecision of effect estimates or potential publication bias.

In future updates, if new reports are identified, we will use the methods described in [Appendix 1](#).

RESULTS

Description of studies

Results of the search

The original search of the Pregnancy and Childbirth Group's Trials Register found one report ([Lindhard 1990](#)). No new reports were identified for this update.

Included studies

The included study involved 1639 women (804 in the SFM group and 835 in the control group). The intervention group had serial measurements of symphysis fundal height (SFH) using a metric non-elastic tape measure. The controls were assessed using abdominal palpation and were measured with an unmarked tape which was cut off and measured after the birth. The primary outcomes was detection of intrauterine growth restriction (IUGR).

The characteristics of the study are included in the [Characteristics of included studies](#).

Excluded studies

None identified.

Risk of bias in included studies

See [Figure 1](#) and [Figure 2](#) for a summary of 'Risk of bias' assessments.

Figure 1. 'Risk of bias' graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.

Figure 2. 'Risk of bias' summary: review authors' judgements about each risk of bias item for each included study.

Allocation

In the one included study (Lindhard 1990), the method of sequence generation was not described but the trialists used sealed opaque envelopes for group allocation.

Blinding

Blinding of participants and personnel was unlikely because of the nature of procedure. For the primary outcome there was no blinding of outcome assessment because the primary outcome (detection of small-for-gestational age (SGA)) in the SFM group was used to determine further management of the pregnancy. It is not mentioned whether the care-giver carrying out the measurement was blinded for gestation prior to carrying out the measurement. For the neonatal outcome measures (perinatal death, neonatal hypoglycaemia, admission to the neonatal nursery), blinding of the outcome assessors would have been possible but it is not mentioned whether this was done.

Incomplete outcome data

All the patients who were randomised were accounted for and follow-up was greater than 95%. It is not clear whether they used an intention-to-treat analysis.

Selective reporting

The protocol was not available. Methods section and the results were consistent.

Other potential sources of bias

None identified.

Effects of interventions

See: [Summary of findings for the main comparison Tape measurement compared with clinical palpation for pregnancy for detecting abnormal fetal growth](#)

Tape measurement versus clinical palpation

There was only one included study (Lindhard 1990) involving 1639 women.

Primary outcomes

The incidence of small-for-gestational age (SGA) was not significantly different between the two groups; 7.6% in SFH group and 5.7% in control group (risk ratio (RR) 1.32, 95% confidence interval (CI) 0.92 to 1.90; participants = 1639;; [Analysis 1.1](#)). The numbers of perinatal deaths were not different between groups

(RR 1.25, 95% CI 0.38 to 4.07; participants = 1639 ; [Analysis 1.2](#)). There were no data for the outcome neonatal detection of large-for-gestational age (LGA).

Secondary outcomes

The other reported outcomes were also not significant: neonatal hypoglycaemia (RR 1.10; 95% CI 0.47 to 2.58; [Analysis 1.3](#)), admission to neonatal nursery (RR 1.06; 95% CI 0.70 to 1.61; [Analysis 1.4](#)), admission to neonatal nursery for IUGR (RR 0.95; 95% CI 0.42 to 2.15; [Analysis 1.5](#)), induction of labour (RR 0.84; 95% CI 0.45 to 1.58; [Analysis 1.6](#)), caesarean section (RR 0.72; 95% CI 0.31 to 1.67; [Analysis 1.7](#)).

None of the other review prespecified secondary outcomes were mentioned in the study.

DISCUSSION

Summary of main results

From the one included study we were unable to determine the effect of symphysis fundal height (SFH) measurement compared with abdominal palpation for detecting intrauterine growth restriction (IUGR). Neither were there any significant differences in fetal outcomes. The number of small-for-gestational age (SGA) infants, perinatal deaths and infants transferred to neonatal ward were similar in the two groups. The sample size was substantial compared with the calculated minimum sample required to answer this question. There were minor differences between the two groups in characteristics before pregnancy that would not have influenced the final outcome.

Overall completeness and applicability of evidence

This is an important question for women in most countries in the world and further trials should be performed. There is established technology for the detection of IUGR using ultrasound measurement of fetal parameters and Doppler velocimetry assists in clinical management. However, we could not identify any trials comparing SFH with serial ultrasound. It would be important to know how SFH measurement compares with that for the detection of IUGR as well as the palpation method.

Quality of the evidence

GRADEpro software was used to assess the quality of evidence for the seven outcomes stated above ([Summary of findings for the main comparison](#)). We were able to provide quality assessment for four out of the seven prespecified outcomes. The evidence was of low quality for the outcome of neonatal detection of small-for-dates, perinatal mortality and admission to neonatal nursery, and of very low quality for the outcomes caesarean section and admission to neonatal nursery. Downgrading of evidence was based on the inclusion of only one study with unclear risk of bias and a wide confidence interval crossing the line of no effect. For the rare outcome, perinatal mortality, which we also judged to be

less susceptible to the lack of blinding, we did not downgrade for imprecision.

Potential biases in the review process

The findings of this review are severely limited by the fact there is only one included study. Our search was very comprehensive and we do not have reasons to believe that we have missed studies due to publication bias. We attempted to minimise bias by having two review authors assessing studies and extracting data.

Agreements and disagreements with other studies or reviews

A systematic review examining interventions, including SFH measurement, for reducing IUGR-related stillbirths ([Imdad 2011](#)) also found only one randomised controlled trial. However based on observational studies and a Delphi procedure performed among experts, the authors recommended its use for this purpose.

AUTHORS' CONCLUSIONS

Implications for practice

There is insufficient evidence to determine whether symphysis fundal height (SFH) measurement is effective in detecting intrauterine growth restriction. For those who are currently practising SFH measurement, this review does not provide any evidence for stopping this practice. SFH measurement is not resource intensive so it could not be considered a costly unnecessary practice.

Implications for research

Further trials are needed and these should address long-term outcomes. In particular, there is a need for trials comparing SFH with ultrasound measurement.

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CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Lindhard 1990

Methods	Randomised controlled trial.
Participants	1639 (804 in the SFH group and 835 in the control group) women attending a hospital antenatal clinic during 1986 to 1987.
Interventions	Women were randomised at about 14 weeks to either SFH measurement from 28 weeks' gestation using a metric non-elastic tape or abdominal palpation plus measurement with a fabric tape with no marks (cut off and measured after delivery). 79% of them had at least 3 measurements. The measurements were plotted against SFH chart.
Outcomes	Detection of SGA-fetuses antenatally and fetal outcomes (perinatal death, neonatal hypoglycaemia, admission to neonatal nursery because of IUGR, induction of labour, caesarean section).
Notes	Estimated sample size was 1000 for $\alpha < 0.05$ and $\beta = 0.2$.

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Not mentioned.
Allocation concealment (selection bias)	Low risk	Sealed opaque envelope containing a project number, which ranged from 1 to 1800.
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	The study did not state this. Blinding of participants and personnel was unlikely because of the nature of procedure.
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	Blinding for outcome assessed by clinician is not mentioned.
Incomplete outcome data (attrition bias) All outcomes	Low risk	All the patients who were randomised were accounted for and follow-up was greater than 95%.
Selective reporting (reporting bias)	Unclear risk	Protocol was not available. Methods section and the results were consistent
Other bias	Low risk	None detected

IUGR: intrauterine growth restriction
SFH: symphysis fundal height
SGA: small-for-gestational age

DATA AND ANALYSES

Comparison 1. Tape measurement versus clinical palpation

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Neonatal detection of small-for-dates	1	1639	Risk Ratio (M-H, Fixed, 95% CI)	1.32 [0.92, 1.90]
2 Perinatal death	1	1639	Risk Ratio (M-H, Fixed, 95% CI)	1.25 [0.38, 4.07]
3 Neonatal hypoglycaemia	1	85	Risk Ratio (M-H, Fixed, 95% CI)	1.10 [0.47, 2.58]
4 Admission to neonatal nursery	1	1639	Risk Ratio (M-H, Fixed, 95% CI)	1.06 [0.70, 1.61]
5 Admission to neonatal nursery because of intrauterine growth restriction	1	1639	Risk Ratio (M-H, Fixed, 95% CI)	0.95 [0.42, 2.15]
6 Induction of labour	1	1639	Risk Ratio (M-H, Fixed, 95% CI)	0.84 [0.45, 1.58]
7 Caesarean section	1	1639	Risk Ratio (M-H, Fixed, 95% CI)	0.72 [0.31, 1.67]

Analysis 1.1. Comparison 1 Tape measurement versus clinical palpation, Outcome 1 Neonatal detection of small-for-dates.

Analysis 1.2. Comparison 1 Tape measurement versus clinical palpation, Outcome 2 Perinatal death.

Analysis 1.3. Comparison 1 Tape measurement versus clinical palpation, Outcome 3 Neonatal hypoglycaemia.

Analysis 1.4. Comparison 1 Tape measurement versus clinical palpation, Outcome 4 Admission to neonatal nursery.

Analysis 1.5. Comparison 1 Tape measurement versus clinical palpation, Outcome 5 Admission to neonatal nursery because of intrauterine growth restriction.

Analysis 1.6. Comparison 1 Tape measurement versus clinical palpation, Outcome 6 Induction of labour.

Analysis 1.7. Comparison 1 Tape measurement versus clinical palpation, Outcome 7 Caesarean section.

APPENDICES

Appendix 1. Methods to be used in future update

The following methods section of this review is based on a standard template used by the Cochrane Pregnancy and Childbirth Group.

Selection of studies

Two review authors will independently assess for inclusion all the potential studies we identify as a result of the search strategy. We will resolve any disagreement through discussion or, if required, we will consult a third person.

We will create a Study flow diagram to map out the number of records identified, included and excluded.

Data extraction and management

We will design a form to extract data. For eligible studies, two review authors will extract the data using the agreed form. We will resolve discrepancies through discussion or, if required, we will consult a third person. We will enter data into Review Manager software ([RevMan 2014](#)) and check for accuracy.

When information regarding any of the above is unclear, we will attempt to contact authors of the original reports to provide further details.

Assessment of risk of bias in included studies

Two review authors will independently assess risk of bias for each study using the criteria outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2011](#)). We will resolve any disagreement by discussion or by involving a [third] assessor.

(1) Random sequence generation (checking for possible selection bias)

We will describe for each included study the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.

We will assess the method as:

- low risk of bias (any truly random process, e.g. random number table; computer random number generator);

- high risk of bias (any non-random process, e.g. odd or even date of birth; hospital or clinic record number);
- unclear risk of bias.

(2) Allocation concealment (checking for possible selection bias)

We will describe for each included study the method used to conceal allocation to interventions prior to assignment and will assess whether intervention allocation could have been foreseen in advance of, or during recruitment, or changed after assignment.

We will assess the methods as:

- low risk of bias (e.g. telephone or central randomisation; consecutively numbered sealed opaque envelopes);
- high risk of bias (open random allocation; unsealed or non-opaque envelopes, alternation; date of birth);
- unclear risk of bias.

(3.1) Blinding of participants and personnel (checking for possible performance bias)

We will describe for each included study the methods used, if any, to blind study participants and personnel from knowledge of which intervention a participant received. We will consider that studies are at low risk of bias if they were blinded, or if we judge that the lack of blinding would be unlikely to affect results. We will assess blinding separately for different outcomes or classes of outcomes.

We will assess the methods as:

- low, high or unclear risk of bias for participants;
- low, high or unclear risk of bias for personnel.

(3.2) Blinding of outcome assessment (checking for possible detection bias)

We will describe for each included study the methods used, if any, to blind outcome assessors from knowledge of which intervention a participant received. We will assess blinding separately for different outcomes or classes of outcomes.

We will assess methods used to blind outcome assessment as:

- low, high or unclear risk of bias.

(4) Incomplete outcome data (checking for possible attrition bias due to the amount, nature and handling of incomplete outcome data)

We will describe for each included study, and for each outcome or class of outcomes, the completeness of data including attrition and exclusions from the analysis. We will state whether attrition and exclusions were reported and the numbers included in the analysis at each stage (compared with the total randomised participants), reasons for attrition or exclusion where reported, and whether missing data were balanced across groups or were related to outcomes. Where sufficient information is reported, or can be supplied by the trial authors, we will re-include missing data in the analyses which we undertake.

We will assess methods as:

- low risk of bias (e.g. no missing outcome data; missing outcome data balanced across groups);
- high risk of bias (e.g. numbers or reasons for missing data imbalanced across groups; 'as treated' analysis done with substantial departure of intervention received from that assigned at randomisation);
- unclear risk of bias.

(5) Selective reporting (checking for reporting bias)

We will describe for each included study how we investigated the possibility of selective outcome reporting bias and what we found.

We will assess the methods as:

- low risk of bias (where it is clear that all of the study's pre-specified outcomes and all expected outcomes of interest to the review have been reported);
- high risk of bias (where not all the study's pre-specified outcomes have been reported; one or more reported primary outcomes were not pre-specified; outcomes of interest are reported incompletely and so cannot be used; study fails to include results of a key outcome that would have been expected to have been reported);
- unclear risk of bias.

(6) Other bias (checking for bias due to problems not covered by (1) to (5) above)

We will describe for each included study any important concerns we have about other possible sources of bias.

We will assess whether each study was free of other problems that could put it at risk of bias:

- low risk of other bias;
- high risk of other bias;
- unclear whether there is risk of other bias.

(7) Overall risk of bias [See table 8.5c in the Handbook]

We will make explicit judgements about whether studies are at high risk of bias, according to the criteria given in the *Handbook* (Higgins 2011). With reference to (1) to (6) above, we will assess the likely magnitude and direction of the bias and whether we consider it is likely to impact on the findings. We will explore the impact of the level of bias through undertaking sensitivity analyses - see Sensitivity analysis.

Measures of treatment effect

Dichotomous data

For dichotomous data, we will present results as summary risk ratio with 95% confidence intervals.

Continuous data

For continuous data, we will use the mean difference if outcomes are measured in the same way between trials. We will use the standardised mean difference to combine trials that measure the same outcome, but use different methods.

Unit of analysis issues

Cluster-randomised trials

We will include cluster-randomised trials in the analyses along with individually-randomised trials. We will adjust either their sample sizes or standard errors using the methods described in the *Handbook* [Section 16.3.4 or 16.3.6] using an estimate of the intracluster correlation co-efficient (ICC) derived from the trial (if possible), from a similar trial or from a study of a similar population. If we use ICCs from other sources, we will report this and conduct sensitivity analyses to investigate the effect of variation in the ICC. If we identify both cluster-randomised trials and individually-randomised trials, we plan to synthesise the relevant information. We will consider it reasonable to combine the results from both if there is little heterogeneity between the study designs and the interaction between the effect of intervention and the choice of randomisation unit is considered to be unlikely.

We will also acknowledge heterogeneity in the randomisation unit and perform a sensitivity analysis to investigate the effects of the randomisation unit.

Cross-over trials

We will not include cross-over trials.

Dealing with missing data

For included studies, we will note levels of attrition. We will explore the impact of including studies with high levels of missing data in the overall assessment of treatment effect by using sensitivity analysis.

For all outcomes, we will carry out analyses, as far as possible, on an intention-to-treat basis, i.e. we will attempt to include all participants randomised to each group in the analyses, and all participants will be analysed in the group to which they were allocated, regardless of whether or not they received the allocated intervention. The denominator for each outcome in each trial will be the number randomised minus any participants whose outcomes are known to be missing.

Assessment of heterogeneity

We will assess statistical heterogeneity in each meta-analysis using the τ^2 , I^2 and χ^2 statistics. We will regard heterogeneity as substantial if an I^2 is greater than 30% and either a τ^2 is greater than zero, or there is a low P value (less than 0.10) in the χ^2 test for heterogeneity.

Assessment of reporting biases

If there are 10 or more studies in the meta-analysis, we will investigate reporting biases (such as publication bias) using funnel plots. We will assess funnel plot asymmetry visually. If asymmetry is suggested by a visual assessment, we will perform exploratory analyses to investigate it.

Data synthesis

We will carry out statistical analysis using the Review Manager software (RevMan 2014). We will use fixed-effect meta-analysis for combining data where it is reasonable to assume that studies are estimating the same underlying treatment effect: i.e. where trials are examining the same intervention, and the trials' populations and methods are judged sufficiently similar. If there is clinical heterogeneity sufficient to

expect that the underlying treatment effects differ between trials, or if substantial statistical heterogeneity is detected, we will use random-effects meta-analysis to produce an overall summary, if an average treatment effect across trials is considered clinically meaningful. The random-effects summary will be treated as the average of the range of possible treatment effects and we will discuss the clinical implications of treatment effects differing between trials. If the average treatment effect is not clinically meaningful, we will not combine trials.

If we use random-effects analyses, the results will be presented as the average treatment effect with 95% confidence intervals, and the estimates of τ^2 and I^2 .

Subgroup analysis and investigation of heterogeneity

If we identify substantial heterogeneity, we will investigate it using subgroup analyses and sensitivity analyses. We will consider whether an overall summary is meaningful, and if it is, use random-effects analysis to produce it.

We plan to carry out the following subgroup analyses:

1. Body mass index
2. Health practitioner (traditional birth attendant, midwife, medical officer/trainee, obstetrician, general practitioner)

Subgroup analysis will be restricted to the review's primary outcomes.

We will assess subgroup differences by interaction tests available within RevMan (RevMan 2014). We will report the results of subgroup analyses quoting the χ^2 statistic and P value, and the interaction test I^2 value.

Sensitivity analysis

We will carry out sensitivity analyses to explore the effect of trial quality assessed by concealment of allocation, high attrition rates, or both, with poor quality studies being excluded from the analyses in order to assess whether this makes any difference to the overall result.

WHAT'S NEW

Date	Event	Description
14 July 2015	New search has been performed	Search updated. No new reports identified. A 'Summary of findings' table has been incorporated.
14 July 2015	New citation required but conclusions have not changed	Review updated.

CONTRIBUTIONS OF AUTHORS

The updated review was prepared by Jacqueline J Ho and J Robert Peter with input from V Jayabalan and help from S Sivasangari.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Hospital Raja Permaisuri Bainun Ipoh, Malaysia.
- Penang Medical College, Penang, Malaysia.

External sources

- South East Asia-Optimising Reproductive and Child Health In Developing Countries (SEA ORCHID Project), Malaysia.
See <http://www.seaorchid.org/>
- UNDP/UNFPA/UNICEF/WHO/World Bank Special Programme of Research, Development and Research Training in Human Reproduction (HRP), Department of Reproductive Health and Research (RHR), World Health Organization, Switzerland.

DIFFERENCES BETWEEN PROTOCOL AND REVIEW

The methods have been updated in accordance with the latest version of the *Cochrane Handbook for Systematic Reviews of Interventions* ([Higgins 2011](#)) and Pregnancy and Childbirth standard methods text. We added the words 'or clinical palpation' to the objectives to broaden it so that it matched the description given in the section on the types of interventions. A 'Summary of findings' table has been incorporated for the 2015 update.

INDEX TERMS

Medical Subject Headings (MeSH)

Abdomen; Fetal Growth Retardation [*diagnosis] [diagnostic imaging]; Palpation [*methods]; Pubic Symphysis [*anatomy & histology]; Randomized Controlled Trials as Topic; Ultrasonography, Prenatal; Uterus [*anatomy & histology]

MeSH check words

Female; Humans; Pregnancy