



# Common modalities for routine antepartum foetal monitoring: are they evidence-based?

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## ABSTRACT

**Antepartum foetal monitoring is crucial for the detection of foetuses at risk so that timely intervention can improve the perinatal outcome. The evidence underlying the most common modalities of antepartum foetal monitoring used are appraised and presented in this article. Foetal movement chart should be used in high-risk pregnancies but not recommended routinely in low-risk pregnancies. Symphysis-fundal height measurement, being associated with low cost and ease of use, is a reasonable screening tool for foetal well-being. Third trimester ultrasonography is, thus far, the best modality available for the assessment of foetal growth, and can be used until a better modality for foetal growth assessment becomes available. Antepartum cardiotocography can be used to monitor foetal well-being in normal pregnancies beyond the estimated date of delivery but it probably serves little purpose prior to that. Well-designed controlled studies evaluating modalities for antepartum foetal monitoring are generally lacking. With the advance of medical science, more research should be focused on this aspect of obstetric care so that our practice can become more evidence-based.**

**Keywords: antepartum foetal monitoring, cardiotocography, foetal movement chart, high-risk pregnancy, symphysis-fundal height, ultrasonography**

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## INTRODUCTION

The aim of antenatal care is to ensure that every pregnancy is given the maximum chance to culminate in the delivery of a healthy baby without impairing the health of the mother. One can argue that in the light of increasing obstetric litigation, all pregnancies

are considered “high-risk” as parental expectations of a good outcome are extremely high. Beyond foetal viability and prenatal diagnosis, various tools for antepartum foetal monitoring are routinely used by the majority of the obstetricians and practitioners looking after pregnant women. We discuss the most common methods used in Singapore practice.

## FOETAL MOVEMENT CHART

Foetal movement counting is the only method that can be used by the mother without the need for a clinician or equipment. In a randomised study, of three different methods of foetal movement counting, participants found the Cardiff “count to 10” method most user-friendly<sup>(1)</sup>. In the Cardiff “count to ten” method of recording foetal movements (Fig. 1), the woman counts ten movements from a specific time each day. She is advised to report if the foetus takes longer than usual to achieve the ten movements, or if there are fewer than ten movements in 12 hours. If so, this is a warning sign that the foetus may be compromised. Timely intervention may potentially prevent foetal death and asphyxia. However, the period between decreased foetal movements and foetal death can be too short for any reporting or intervention to take place<sup>(2)</sup>.

## Who should be given the foetal movement chart?

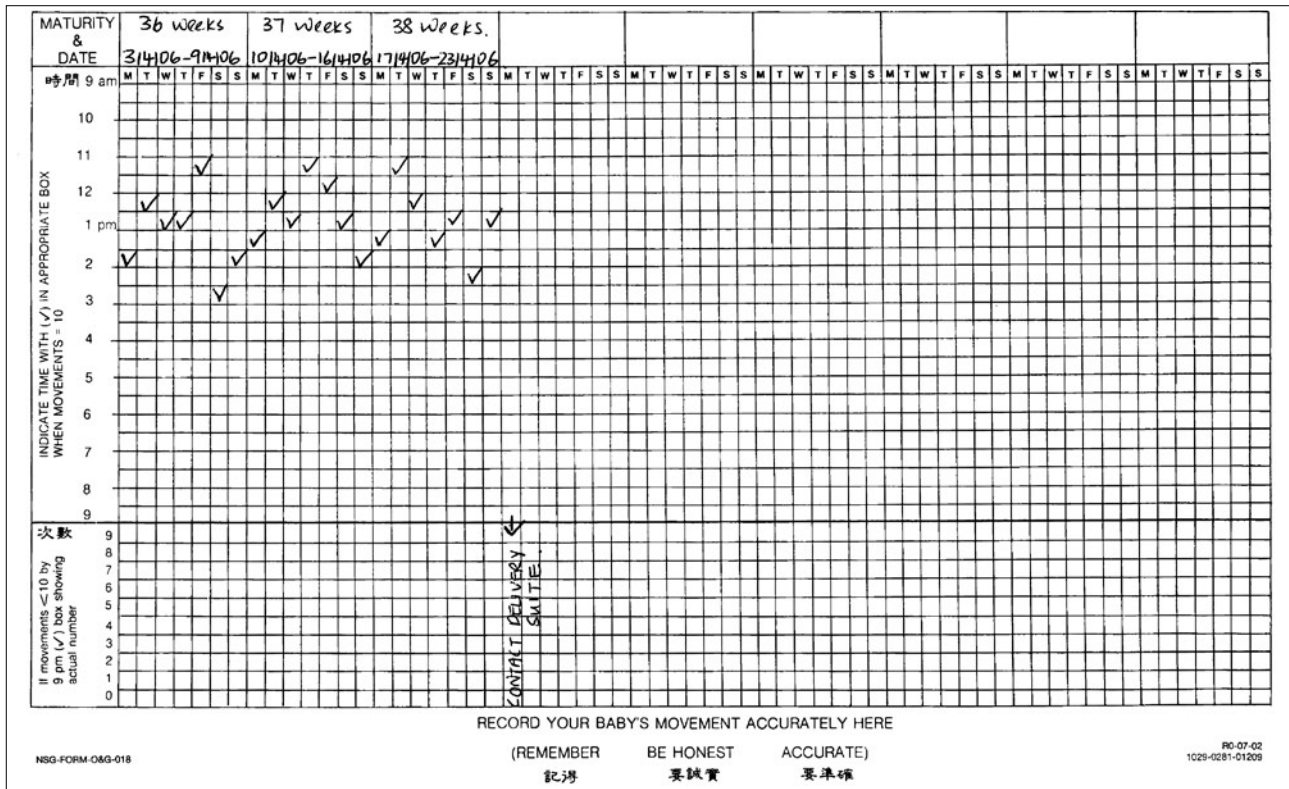
Foetal movement counting is recommended for women with high-risk pregnancies where foetal well-being is a concern. However, routine formal foetal movement counting in women without known risk factors should not be offered, according to the national guidelines in the United Kingdom as the evidence does not support the routine use of foetal movement counting to prevent late foetal death<sup>(3)</sup>. In the largest trial on foetal movement counting, 68,654 women were randomised to routine formal foetal-movement counting or to standard care<sup>(4)</sup>. There was no decrease in perinatal mortality in the test group, despite the increase in intervention such as cardiotocography. The level of anxiety that may be induced in the individual woman should also be weighed against any potential benefit from

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**Fig. 1** “Count to ten” foetal movement chart. Starting at 9 am, count the number of movements until the total equals ten. Then tick (✓) the time taken to count-to-ten in the appropriate box on the graph, for example, 2 pm.

the intervention. We believe that foetal movement counting should be performed on all high-risk women, and the routine use of formal foetal movement counting on low-risk pregnant women is not recommended.

**What to do if a woman experiences reduced foetal movement?**

A woman should report to her doctor or the hospital immediately should she experience reduced foetal movement or a change in the patterns of foetal movement. Foetal well-being should be assessed with cardiotocography. If the foetal heart rate tracing is normal and there is normal foetal activity in an uncomplicated pregnancy, the likelihood of imminent foetal hypoxia is very low. Assessment of the amniotic fluid volume and umbilical artery Doppler velocimetry may give additional information about the foetal well-being and have been recommended, although the cost-effectiveness of these additional investigations is not known.

**SYMPHYSIS-FUNDAL HEIGHT MEASUREMENT**

Tape measurement of the distance from the pubic symphysis to the uterine fundus is simple, inexpensive and widely-used during antenatal care (Fig. 2). This measurement (in centimetres) corresponds to the gestational age (in weeks +/- two weeks) of the



**Fig. 2** Measurement of the symphysis-fundal height.

pregnancy after 24 weeks, and has largely replaced clinical assessment of foetal size by abdominal palpation. In abdominal palpation, the caregivers feel and gently press the outside of the woman’s pregnant uterus to assess the foetal size. The primary aim of these measurements is the detection of intrauterine growth-restricted foetuses, of which appropriate monitoring and intervention can be taken to reduce perinatal morbidity and mortality. Excessive symphysis-fundal height may also allow detection of multiple pregnancies, foetal macrosomia and polyhydramnios.

**What is the evidence?**

The detection rate of abdominal palpation for small-for-dates foetuses, which ranges from 30% to 50%, has been found to be poor in observational studies<sup>(5,6)</sup>.

Although the reported detection rates of small-for-gestates babies from observational studies of symphysis-fundal height measurement appear to be superior, great variations in the results exist, from 56%<sup>(6)</sup> to 86%<sup>(7)</sup>. Serial measurements may improve sensitivity and specificity<sup>(8)</sup>. In a Cochrane review involving only a very small randomised controlled trial<sup>(9)</sup>, there was no evidence of improved outcome from symphysis-fundal height measurement. Due to the small size of the trial, it would seem unwise to abandon the use of symphysis-fundal height measurement, unless a much larger trial likewise suggests that it is unhelpful<sup>(10)</sup>.

#### What to do if the symphysis-fundal height is inconsistent with gestational age?

As symphysis-fundal height is only a screening modality, inconsistencies with gestational age should not lead to immediate excessive alarm to the practitioner and undue worries for the patient. Follow-up with ultrasonography to assess the growth biometry should allow a better evaluation of the foetal size, and allow an appropriate plan of monitoring or intervention to be made.

#### THIRD TRIMESTER ULTRASONOGRAPHY

Obstetric ultrasonography in the third trimester

can be performed for growth and amniotic fluid volume assessment, as well as Doppler assessment of circulation in the umbilical artery, middle cerebral artery and ductus venosus. Growth of the foetus can also be compared to the growth parameters from the second trimester. Ultrasonography plays an important role in the monitoring of foetuses at risk of asphyxia. Doppler velocimetry has been consistently shown to reduce perinatal morbidity and mortality in high-risk pregnancies<sup>(11)</sup>. Illustrations of normal and abnormal umbilical artery Doppler velocimetry are shown in Figs. 3 and 4.

Biophysical profile, which consists of foetal tone, gross body/limb movement, foetal breathing movement, amniotic fluid volume evaluation and foetal heart rate tracing, is used by some obstetricians in the evaluation of at-risk foetuses. However, no convincing evidence is available for evaluating the use of biophysical profile as a test of foetal well-being<sup>(12)</sup>, except in selected cases. However, routine use of third trimester ultrasonography screening in unselected populations is controversial. The rationale for such screening is the detection of growth-restricted or macrosomic foetuses, for which subsequent intervention would improve perinatal outcome.

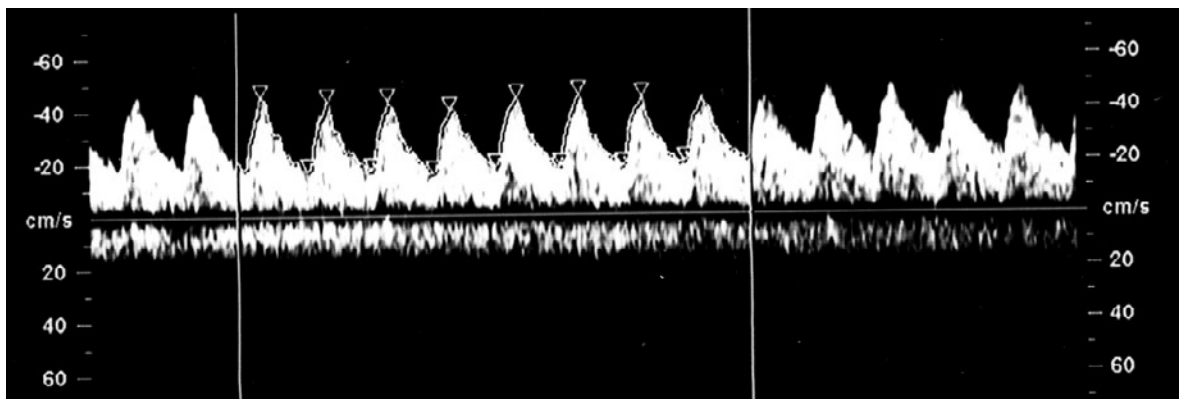


Fig. 3 Normal umbilical artery Doppler velocimetry.

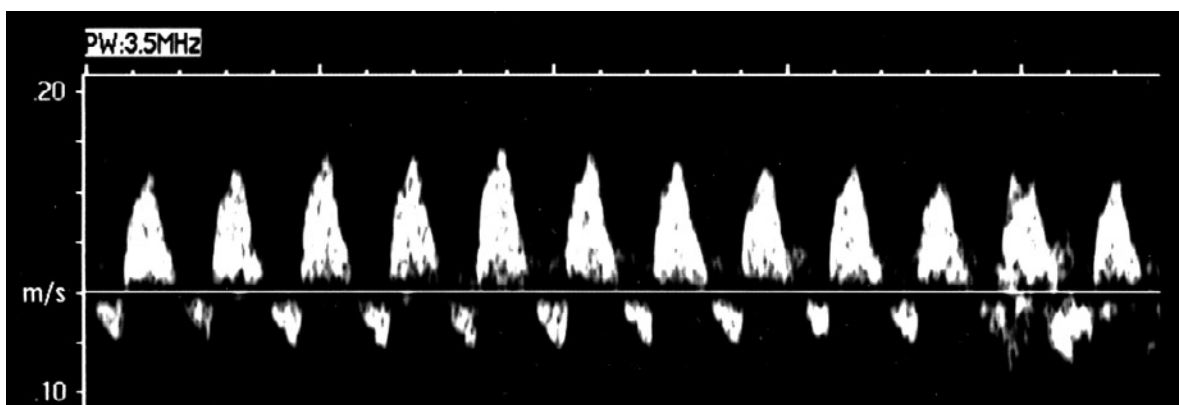


Fig. 4 Abnormal umbilical artery Doppler velocimetry with reversed end-diastolic flow.



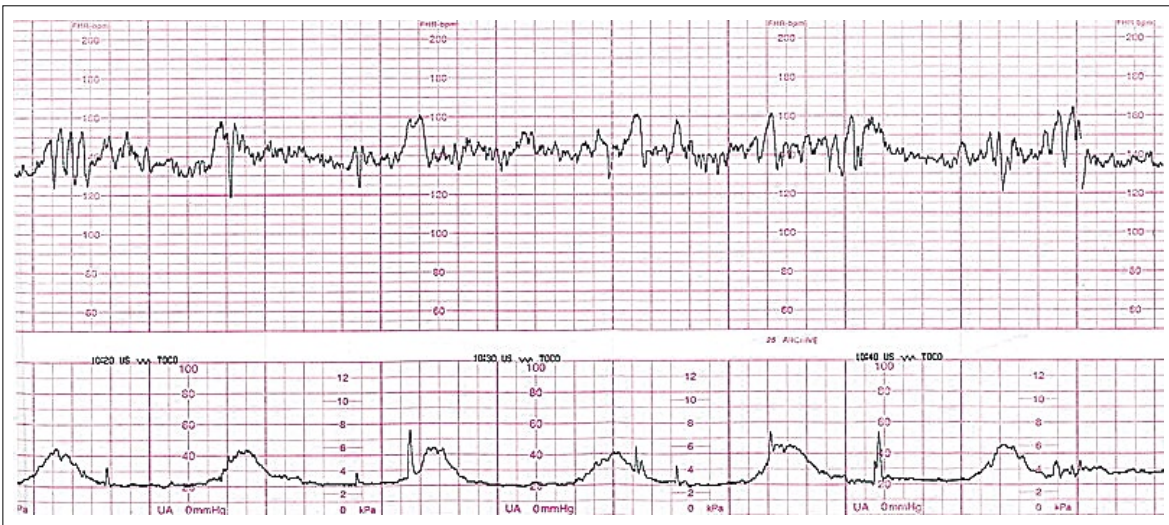
**Fig. 5** Abdominal circumference on third trimester growth US scan.

measurements<sup>(13)</sup>. Third trimester ultrasonographical biometry using foetal abdominal circumferences (Fig. 5) appears to be a more consistent test, with a sensitivity of around 85% for predicting the infant with birth weight below the tenth percentile<sup>(8,14)</sup>. McKenna reported that the introduction of an ultrasonography scan at 30-32 weeks, and 36-37 weeks, gestation may reduce the risk of growth-restricted infants and increase antenatal interventions<sup>(15)</sup>.

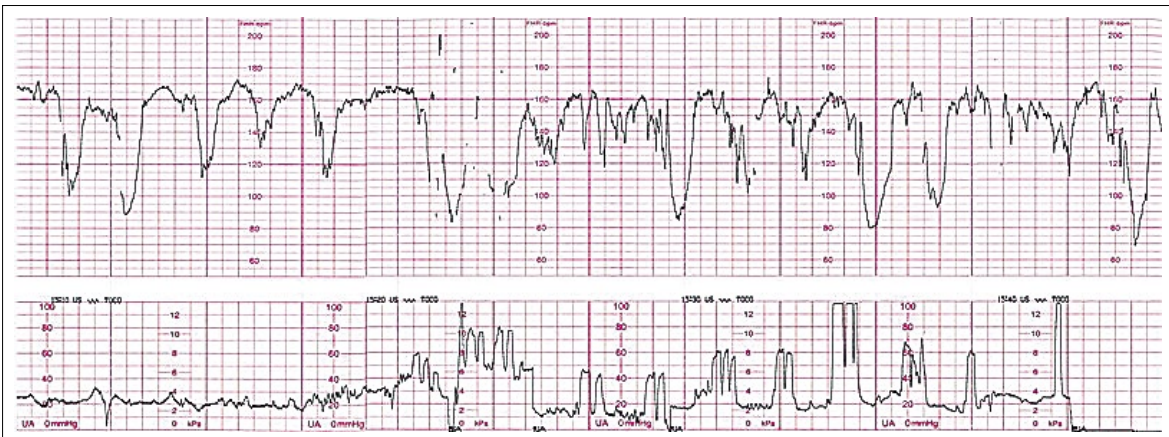
However, a Cochrane review concluded that routine late pregnancy ultrasonography in low-risk or unselected populations do not confer benefit to mother or baby. There was no difference in antenatal, obstetrical and neonatal interventions or morbidities in screened versus control groups<sup>(16)</sup>. The authors felt that third trimester ultrasonography may improve detection of small babies resulting in improved outcome mainly among high-risk pregnancies. Even though there is no strong evidence for the use of routine third trimester ultrasonography for low-risk pregnancies, it remains the best modality for assessment of growth for this category.

**What is the evidence?**

Harding et al demonstrated that symphysis-fundal height measurements perform relatively poorly, compared with ultrasound abdominal circumference



**Fig. 6** Normal cardiocotography.



**Fig. 7** Abnormal cardiocotography with baseline tachycardia and decelerations.

**What to do if ultrasonography is abnormal?**

In Singapore, routine ultrasonography to assess foetal growth is increasingly performed for pregnant women around 30-32 weeks' gestation. Further monitoring would depend on the type and degree of abnormality detected on the ultrasonography. Assessment of growth should only be done at an interval of at least two to three weeks. However, more vigilant monitoring, such as Doppler velocimetry of umbilical artery or foetal circulations, amniotic fluid indices and cardiotocography, may need to be instituted in the presence of foetal growth restriction.

**ANTEPARTUM CARDIOTOCOGRAPHY (CTG)**

Antenatal cardiotocography is a continuous record of the foetal heart rate for a period of time, usually lasting 30 minutes, obtained via an ultrasound transducer placed on the maternal abdomen. In a foetal heart rate trace, baseline foetal heart rate, variability, accelerations and decelerations, if any occur, are recorded electronically on a paper trace (Figs. 6 and 7). CTG can be classified into normal, intermediate and abnormal (Table I). Antenatal cardiotocography is being used widely in high-risk pregnancies, including post-term pregnancies, reduced foetal movements, hypertensive disease and pregnancies complicated by intrauterine growth restriction. Routine use of this modality of foetal monitoring in low-risk pregnancies has not been studied and is generally not supported.

**What is the evidence?**

Only four randomised controlled trials assessing the use of antepartum cardiotocography in intermediate or high-risk pregnancies are available and they were all conducted in the early 1980s<sup>(17-20)</sup>. There has been no trial published in recent years, despite the CTG being used extensively in modern practice. Pattison and McCowan performed a meta-analysis on these trials but the meta-analysis did not have sufficient power to address perinatal mortality and abnormal neurological outcome<sup>(21)</sup>. Antenatal cardiotocography does not increase interventions, such as induction of labour and elective caesarean delivery. The one trial that examined an effect on antenatal patient management showed that antepartum cardiotocography is associated with a significant reduction in hospital admissions and a reduction in inpatient stay. No randomised controlled trial has been reported on the use of antepartum cardiotocography for low-risk pregnancies.

**What to do if the antepartum cardiotocography is abnormal?**

Intervention is necessary if the antepartum cardiotocography is performed and is suggestive of foetal compromise. These women would need to be admitted to the delivery suite/labour ward for continuous foetal heart rate monitoring. Further plan of action would depend on various factors, including the gestational age, modified Bishop score of the cervix and other factors affecting the pregnancy.

**Table I. CTG classification (Modified from the FIGO guidelines, 1997).**

CTG classification	Baseline heart frequency	Variability reactivity	Decelerations
Normal CTG	• 110-150 bpm	• 5-25 bpm • Accelerations	• Early decelerations • Uncomplicated variable decelerations with a duration of <60 seconds and loss of <60 beats
Intermediary CTG*	• 100-110 bpm • 150-170 bpm • Short bradycardia episode	• >25 bpm without accelerations • <5 bpm for >40 min	• Uncomplicated variable decelerations with a duration <60 seconds and loss of >60 beats
Abnormal CTG	• 150-170 bpm and reduced variability • >170 bpm • Persistent bradycardia	• <5 bpm for >60 min • Sinusoidal pattern	• Complicated variable decelerations with a duration >60 seconds • Repeated late decelerations
Preterminal CTG	• Total lack of variability and reactivity with or without decelerations or bradycardia		

\* A combination of several intermediary observations will result in abnormal CTG

## CONCLUSION

Antepartum foetal monitoring is crucial for the detection of foetuses at risk so that timely intervention can improve the perinatal outcome. Although the use of the various modalities of foetal monitoring is well-established in high-risk pregnancies, its application across all low-risk pregnancies is not strongly evidence-based. These tests are often carried out to provide reassurance for the practitioners as well as the patients. In the absence of strong evidence from high-level research, clinical experience has a greater impact on patient management. We feel that the foetal movement chart should be used in high-risk pregnancies but not recommended routinely in low-risk pregnancies. Symphysis-fundal height measurement, being associated with low cost and ease of use, is a reasonable screening tool for foetal well-being. Third trimester ultrasonography is, thus far, the best modality available for the assessment of foetal growth, and can be used until a better modality for foetal growth assessment becomes available. Antepartum cardiotocography can be used to monitor foetal well-being in normal pregnancies beyond the estimated date of delivery but it probably serves little purpose prior to that. However, with the advance of medical science, more research should be focused on this aspect of obstetrical care so that our practice can become more evidence-based.

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## SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME

### Multiple Choice Questions (Code SMJ 200610A)

	True	False
<b>Question 1:</b> The following methods are commonly used to detect foetal growth restriction:		
(a) Foetal movement chart.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Symphysis-fundal height measurement.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Abdominal circumference on ultrasonography.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Doppler velocimetry of the middle cerebral artery.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 2:</b> Regarding advice given to pregnant women regarding foetal movement chart, which of the following statements are true?		
(a) She should feel a minimum of ten movements in 12 hours.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Foetal movements are only felt in the evenings.	<input type="checkbox"/>	<input type="checkbox"/>
(c) If foetal movement chart is used with vigilance, late trimester intrauterine deaths can always be prevented.	<input type="checkbox"/>	<input type="checkbox"/>
(d) With reduced foetal movements, she should report to her doctor or the hospital immediately.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 3:</b> In a case where a 36-week pregnant woman has a symphysis-fundal height of 32 cm:		
(a) Growth ultrasonography should be arranged for her.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Cardiotocography should be arranged for her.	<input type="checkbox"/>	<input type="checkbox"/>
(c) This may reflect underlying intrauterine growth restriction.	<input type="checkbox"/>	<input type="checkbox"/>
(d) This may reflect underlying multiple pregnancies.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 4:</b> Regarding third trimester ultrasonography:		
(a) It is a useful monitoring tool for high-risk pregnancies.	<input type="checkbox"/>	<input type="checkbox"/>
(b) It has been shown to improve perinatal outcome in low-risk pregnancies.	<input type="checkbox"/>	<input type="checkbox"/>
(c) It is usually done at 36 weeks' gestation.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Repeat growth scan should only be performed after two to three weeks.	<input type="checkbox"/>	<input type="checkbox"/>
<b>Question 5:</b> The following statements about antepartum cardiotocography are correct:		
(a) It should be performed for all women beyond 35 weeks' gestation	<input type="checkbox"/>	<input type="checkbox"/>
(b) It should be performed for women who complained of reduced foetal movements.	<input type="checkbox"/>	<input type="checkbox"/>
(c) It can be used to monitor pregnancies beyond the estimated date of delivery.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Routine use on low-risk pregnancies has been shown to reduce intrauterine deaths.	<input type="checkbox"/>	<input type="checkbox"/>

**Doctor's particulars:**

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MCR number: \_\_\_\_\_ Specialty: \_\_\_\_\_

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**Submission instructions:****A. Using this answer form**

1. Photocopy this answer form.
2. Indicate your responses by marking the "True" or "False" box
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1. Log on at the SMJ website: URL <<http://www.sma.org.sg/cme/smj>> and select the appropriate set of questions.
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1. Answers will be published in the SMJ December 2006 issue.
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3. All online submissions will receive an automatic email acknowledgment.
4. Passing mark is 60%. No mark will be deducted for incorrect answers.
5. The SMJ editorial office will submit the list of successful candidates to the Singapore Medical Council.