

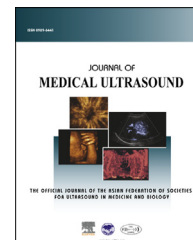


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EDUCATIONAL FORUM

Early Screening and Prevention of Preeclampsia

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Introduction

The probability of obstetric complications in a pregnant patient is a lot higher than the probability of a diagnosis of Down syndrome. Detection of chromosomal abnormalities in the fetus allows termination of pregnancy at an appropriate time; however, obstetric complications, such as preeclampsia, may have a substantial effect on the fetus, the mother, and even the entire family, and therefore careful attention should be paid to these complications.

Most clinicians still believe obstetric complications cannot be prevented and they can only provide treatment upon identification of the symptoms. In reality, increasing evidence has indicated that many obstetric complications can be prevented by careful screening and evaluation, but this field has not attracted much attention in Taiwan (Fig. 1).

After embryo implantation, the ability of trophoblasts to invade the uterine decidual cells and degeneration of the intimal smooth muscle of the maternal spiral arteries for blood exchange between the mother and the fetus are required for expansion of uterine arteries and reduction of uterine artery resistance to provide sufficient blood supply for embryo development. The trophoblasts in patients with preeclampsia have a relatively poor ability to invade the

uterine decidual cells for various reasons, and also show decreased recombination. As a result, the intimal smooth muscle of the maternal spiral arteries does not degenerate and the tension remains high, which consequently increases resistance.

During the first trimester of pregnancy, the fetus requires little blood supply, and thus increased uterine artery blood flow would not cause an appreciable effect. As the gestation proceeds, however, the blood flow required by the fetus will also increase and uterine artery blood flow

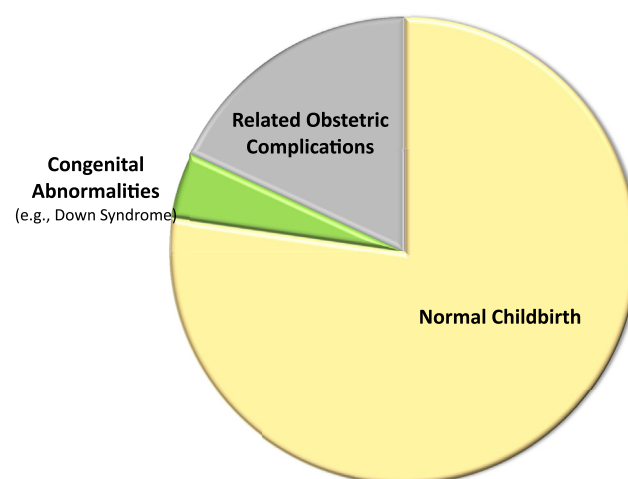


Fig. 1 The probability of obstetrics complications is much higher than the probability of the incidence of chromosome anomaly.

Conflicts of interest: The authors have no conflicts of interest of this screening method.

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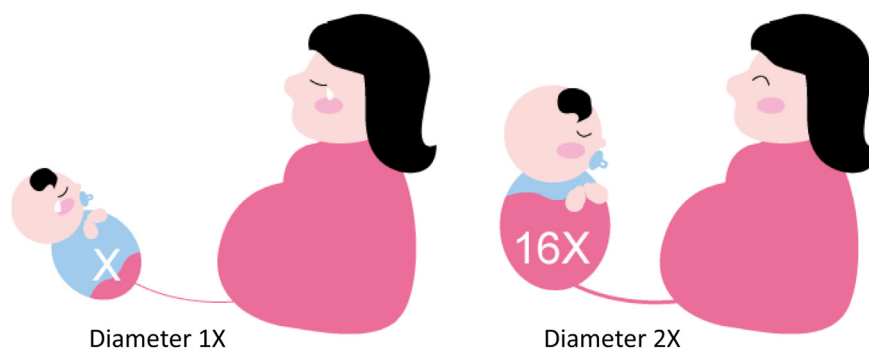


Fig. 2 The diameter of uterine artery results in changes of blood volume up to 16-fold.

becomes insufficient. The diameters of blood vessels may vary up to onefold, resulting in 16 times more blood flow through the larger vessels, as shown in Fig. 2.

Uterine arteries with high resistance are insufficient to supply the blood required for fetal development, and thus may easily lead to intrauterine growth restriction (IUGR). Some pregnant women will develop elevated blood pressure to increase the supply of blood to the fetus, which is the phenomenon of hypertension that occurs in preeclampsia.

The current preeclampsia screening model (Fig. 3) was developed based on the research of Dr K. Nicolaides at King's College, London, UK. This authoritative literature and the accompanying clinical guidelines show the optimal time for such screening is during the first trimester (preferably between Week 9 and Week 14). Preeclampsia screening is usually performed simultaneously with a nuchal translucency scan and first trimester screening for chromosomal and structural malformations or Down syndrome, including measurement of blood pressure, measurement of uterine artery resistance, placenta growth factor (PGF),

pregnancy-related protein A (PAPP-A), and the basic features of the mother, to make an overall and conclusive assessment.

Measurement of uterine artery blood flow

Uterine artery volume blood flow is directly related to fetal development and the diameter of blood vessels has a significant effect on blood flow volume (up to 16-fold) and measurement of the pulsatility index (PI) of uterine artery blood flow best represents the change in blood flow volume.

Change in PGF

The level of PGF reflects placental development, and reduced placental growth factor indicates changes in placental implantation that may result in placental malfunction.

Studies have shown that preeclampsia results from the changes that occur during placental development after

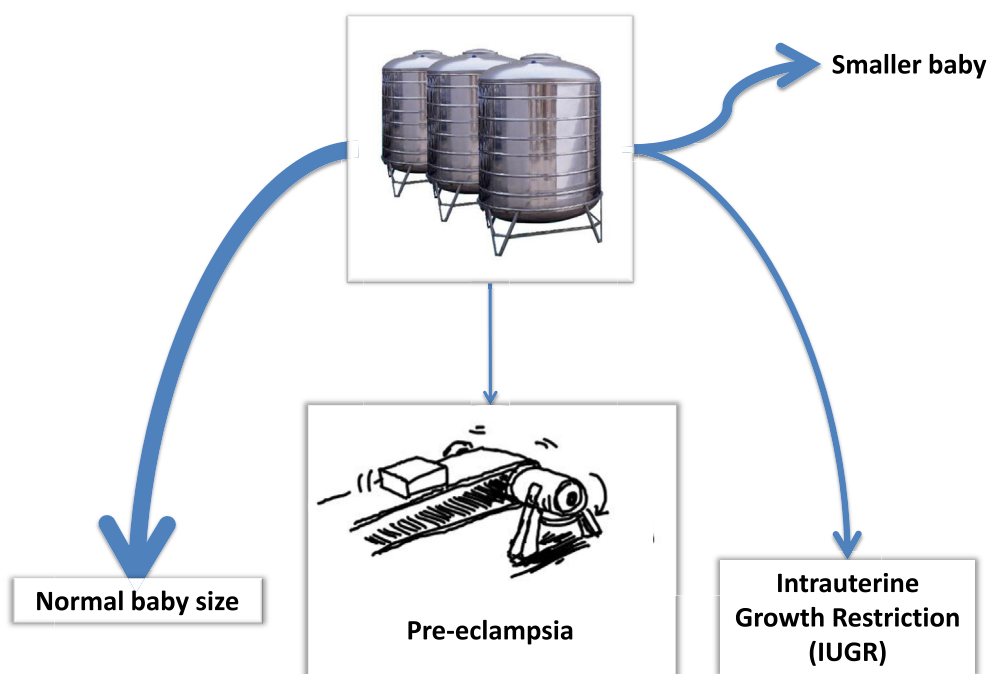


Fig. 3 The total flow uterine artery may result in the difference outcome of pregnancy: normal, small baby, intrauterine growth restriction, or preeclampsia.

Severe pre-eclampsia	Number of cases	Relative risk (95% confidence interval)
Treatment given before week 16	649	0.18
Treatment given after week 16	1494	0.65
Fetal deaths	Number of cases	Relative risk (95% confidence interval)
Treatment given before week 16	1308	0.41
Treatment given after week 16	9557	0.93

Fig. 4 The use of aspirin during the early stage of pregnancy effectively reduces the incidence of pre-eclampsia and the fetal mortality rate. Note. From "Prevention of perinatal death and adverse perinatal outcome using low-dose aspirin: a meta-analysis," by S. Roberge, K.H. Nicolaides, S. Demers, P Villa, and E. Bujold E. 2013, *Ultrasound Obstet. Gynecol.*, 41, p. 491–499. Copyright 2013, ISUOG. Reprinted with permission.

embryo implantation in the first trimester [1]. According to the statistics revealed by the Fetal Medicine Foundation in the United Kingdom, > 30,000 pregnant women with early-onset preeclampsia had changes in the PGF concentration and PAPP-A level during the first trimester, and thus PGF and PAPP-A levels are good predictive indicators of pre-eclampsia. Moreover, the lower the concentrations of PGF and PAPP-A, the earlier preeclampsia occurs.

If the patient is at low risk for preeclampsia, routine prenatal screening is sufficient; however, medication and periodic monitoring of uterine and fetal blood flow is required for high-risk pregnant women.

What should you do if you are in the high-risk group based on the screening results?

According to the latest study in 2013 [2], the incidence of early-onset preeclampsia in pregnant women in the early-onset, high-risk group, as based on the preeclampsia screening results, was reduced by approximately 20% when treated after 16 weeks of pregnancy. The risk of developing early-onset preeclampsia and IUGR or fetal growth restriction, however, would be reduced by > 80% and 60%, respectively, if the treatment was given between Week 12 and Week 16. Therefore, early screening significantly reduces the incidence of early-onset preeclampsia and related complications (Fig. 4).

The safety of using aspirin in pregnant women is unquestionable; the World Health Organization (WHO) in 2008

and the 2010 British guidelines on maternal and child safety (NICE guidelines) have confirmed this finding and also strongly recommend the use of low-dose aspirin to prevent the occurrence of preeclampsia and its complications in high-risk pregnant women. The NICE guidelines suggest low-dose aspirin for these women until the postpartum period. Hence, there is no need to worry about safety issues or an adverse prognostic effect on the fetus.

Preeclampsia is an obstetric emergency. Through screening, > 95% of early-onset preeclampsia can be detected and preventive treatment can also significantly reduce the incidence of preeclampsia by > 80%. We should try to provide this type of screening to pregnant women to reduce the risks accompanying obstetric practice and improve the health of pregnant women during pregnancy.

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