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Review article

Using ultrasound and Doppler ultrasound to assess vascular changes in pre-eclampsia and eclampsia: a systematic review



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ABSTRACT

Objectives: This systematic review aimed to evaluate whether Doppler ultrasound of the ophthalmic artery and uterine artery, and ultrasound of flow-mediated dilation of the brachial artery, can be used to effectively assess vascular function in pregnant women without disease or other complications with pre-eclampsia and eclampsia to establish the most appropriate method for evaluating these diseases.

Methods: Two databases were searched for relevant articles: the National Library of Medicine (PubMed) and the Virtual Health Library. Articles published between 1989 and 2014 about Doppler ultrasound of the ophthalmic artery were retrieved; all articles published from 2000 to 2014 about using ultrasound to assess flow-mediated dilation of the brachial artery were retrieved; and for Doppler ultrasound of the uterine artery, only articles published between January 2013 and March 2014 were retrieved because the literature in this area is extensive. **Results:** A total of 260 articles were retrieved; 32 were eligible for inclusion. There were 16 articles on using Doppler ultrasound to evaluate the ophthalmic artery and eight about using it to assess the uterine artery, and eight articles evaluated the use of ultrasound to assess flow-mediated dilation of the brachial artery.

Conclusions: Doppler ultrasound is useful in diagnosing pre-eclampsia and eclampsia in pregnant women; the use of this technique makes early intervention feasible, and thereby improves prognosis; and it reduces the morbidity and mortality of pregnant women and their newborns.

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Uso de ultrassom Doppler e ultrassom na avaliação das alterações vasculares na pré-eclampsia e eclampsia: Uma revisão sistemática

R E S U M O

Palavras chave:

Artéria oftálmica
Dilatação fluxo-mediada
Artéria uterina
Sonografia Doppler
Pré-eclampsia
Eclampsia

Objetivos: Essa revisão sistemática teve como objetivo avaliar se o ultrassom Doppler das artérias oftálmica e uterina e o ultrassom de dilatação fluxo-mediada da artéria braquial podem ser utilizados para uma avaliação efetiva da função vascular em mulheres grávidas com pré-eclampsia e eclampsia e sem outras doenças ou complicações, para estabelecer o método mais apropriado para avaliação dessas doenças.

Métodos: Pesquisa em dois bancos de dados—National Library of Medicine (PubMed) e Virtual Health Library—em busca de artigos relevantes. Foram recuperados artigos publicados entre 1989 e 2014 sobre ultrassom Doppler da artéria oftálmica; todos os artigos publicados de 2000 até 2014 sobre o uso do ultrassom para a avaliação da dilatação fluxo-mediada da artéria braquial; e apenas artigos publicados entre janeiro de 2013 e março de 2014 sobre ultrassom Doppler da artéria uterina, diante da grande riqueza da literatura nessa área.

Resultados: No total, foram recuperados 260 artigos; 32 se qualificaram para inclusão: 16 artigos sobre uso do ultrassom Doppler para avaliar a artéria oftálmica, oito artigos sobre o uso dessa técnica para avaliar a artéria uterina e, finalmente, oito artigos sobre o uso do ultrassom para avaliar a dilatação fluxo-mediada da artéria braquial.

Conclusões: O ultrassom Doppler tem utilidade no diagnóstico da pré-eclâmpsia e da eclâmpsia em mulheres grávidas; o uso dessa técnica possibilita uma intervenção precoce e, com isso, melhora o prognóstico; e ainda diminui a morbidade e a mortalidade de grávidas e de seus neonatos.

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Introduction

Pre-eclampsia (PE) has been a major cause of maternal and perinatal morbidity and mortality worldwide.¹ Although the condition can be treated, PE can be fatal. Ten percent of women experience high blood pressure during pregnancy, and PE cause complications in 2–8% of pregnancies. In general, 10–15% of direct maternal deaths are associated with PE and eclampsia.^{2,3}

More than half a million women worldwide die each year from pregnancy-related causes. PE is common and is a major cause of maternal death both in developed and developing countries.⁴ However, in developing countries, mortality from PE can reach 99%, as it does in some countries in Africa. PE also causes high rates of perinatal and neonatal death. Two Millennium Development Goals—4 and 5—specifically aim to reduce child and maternal mortality.⁵

PE affects 2–8% of all pregnancies, although treatment is generally effective. However, 10–15% of direct maternal deaths are associated with PE and eclampsia.^{2,3} PE causes complications in the liver, kidneys, brain and the circulatory system. For the newborn, the risks include intrauterine growth retardation (IUGR) and prematurity.²

PE has been called the “disease of theories” because of its enigmatic pathophysiology. Screening for PE and restricted intra uterine growth (IUGR) has been a major clinical and research issue since the disease was first reported in the 19th century.¹ Since then, clinical studies have shown that early detection and treatment of PE and eclampsia reduce maternal and fetal morbidity and mortality.^{1,4} However, preventing PE

and eclampsia remain major problems in maternal and child health.³

Ultrasound of the brachial artery, and Doppler ultrasound of the ophthalmic artery and uterine artery are propaedeutic, non-invasive methods that contribute to the understanding of the pathophysiology of PE and eclampsia.^{6–9} The present study is a systematic review of the literature that evaluates the effectiveness of these tests in assessing vascular function in normal pregnant women and in women with PE and eclampsia to establish the most appropriate methods for the evaluating these diseases.

Methods

For this systematic review, a search protocol not registered in databases of systematic reviews was prepared. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria were used.¹⁰ In this protocol all of the following were predefined and limited: the topic of interest, inclusion criteria, search strategies and selection of studies, the quality evaluation form used to record the data for analysis and to present results, and interpretation of study results.

Inclusion criteria varied in accordance with the artery being studied. Articles about Doppler ultrasound of the ophthalmic artery published between 1989 and 2014 were retrieved. All articles published between 2000 and 2014 about using ultrasound to assess flow-mediated dilation of the brachial artery were retrieved. For Doppler ultrasound of the uterine artery, only articles published between January 2013 and March 2014 were retrieved because the literature in this area is extensive.

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