Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health 4 (2014) 46–53

Contents lists available at ScienceDirect

Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health

journal homepage: www.elsevier.com/locate/preghy

Original Article

Effect of age, parity, and race on the incidence of pregnancy associated hypertension and eclampsia in the United States

Robert A. Gold [a,*], Kellyanne R. Gold [a], Mark F. Schilling [b], Tamara Modilevsky [a]

[a] Department of Medicine, Olive View-UCLA Medical Center, 14445 Olive View Drive, Sylmar, CA 91342, USA
[b] Department of Mathematics, California State University Northridge, 18111 Nordhoff Street, Northridge, CA 91330, USA

ARTICLE INFO

Article history:
Received 6 August 2013
Accepted 13 October 2013
Available online 30 October 2013

Keywords:
Complications
Epidemiology
Obstetrics
Preeclampsia

ABSTRACT

Purpose: To describe the incidence of pregnancy associated hypertension and eclampsia from adolescence through the fifth decade of life, including the effect of parity and race, in the United States.

Methods: Data were evaluated from the National Center for Health Statistics (vital statistics section). The data were stratified by maternal age group, parity (G1, first pregnancy; G2+, second or higher pregnancy), and racial group.

Results: The incidence of pregnancy associated hypertension (PAH) decreased with increased age in late adolescence in the G2+ group but not the G1 group (total and all racial groups). The incidence of PAH was significantly greater for non-Hispanic black or non-Hispanic white than Hispanic groups for all age groups ($P \leqslant .02$) except age $\leqslant$15 years (G2+ group) and 45–54 years (both G1 and G2+ groups). The incidence of eclampsia decreased with increased age in late adolescence in the G2+ group (total and all racial groups) and the G1 group (total and non-Hispanic black groups). The incidence of eclampsia was significantly greater for non-Hispanic black than non-Hispanic white and for non-Hispanic white than Hispanic groups for all age groups except age $\leqslant$15 years in the G2+ group. The incidence of PAH and eclampsia increased substantially in both G1 and G2+ groups in the fifth decade of life (total and all racial groups).

Conclusions: The incidence of PAH (G2+ group) and eclampsia (G1 and G2+ groups) decreased with increased age during adolescence and increased in the fifth decade (G1 and G2+ groups).

Introduction

The hypertensive disorders of pregnancy include gestational hypertension (nonproteinuric preeclampsia), mild preeclampsia, severe preeclampsia, and eclampsia. There is increased maternal and fetal morbidity and mortality with increased severity of maternal gestational hypertensive syndromes [1–7]. Young maternal age is a risk factor for adverse outcomes including preterm birth, low fetal birth weight, fetal growth restriction, late fetal death, and infant mortality [8]. However, there is controversy about the relation between young maternal age and gestational hypertensive disorders. Most studies were limited because of insufficient sample size, were not stratified by parity, or did not exclude subjects with pregestational hypertension [1,2,9].

Insulin resistance increases during puberty and subsequently resolves [10,11]. Normal pregnancy is characterized by increasing insulin resistance throughout gestation. However, insulin resistance and metabolic syndrome before pregnancy and during early gestation are risk

* Corresponding author. Tel.: +1 818 404 3200.
E-mail addresses: robertgold87@yahoo.com (R.A. Gold), kellyannerosegold@gmail.com (K.R. Gold), mark.schilling@csun.edu (M.F. Schilling), tmmd44@aol.com (T. Modilevsky).

2210-7789/$ - see front matter © 2013 International Society for the Study of Hypertension in Pregnancy Published by Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.preghy.2013.10.001

factors for gestational hypertension and preeclampsia [12–16]. Clarification of the risk for the gestational hypertensive disorders immediately after puberty may add further evidence to the role of insulin resistance in determining the risk for pregnancy associated hypertension (PAH).

There are >4 million annual births in the United States. The National Vital Statistics System is a data collection program of the National Center for Health Statistics in the United States. Data are provided from original birth certificates and vital registration systems that are maintained and operated by all states and territories. The National Center for Health Statistics promotes a uniform national database by compiling the data and working closely with the states and territories to develop standardized certificates, reports for data collection, and methods of data preparation.

The National Center for Health Statistics public database includes 2 categories for hypertensive disorders of pregnancy: (1) pregnancy associated hypertension (PAH), which includes gestational hypertension, preeclampsia, and eclampsia; and (2) eclampsia as an individual category. Gestational hypertension, preeclampsia, and eclampsia have similar risk factors and are important markers for the future development of metabolic syndrome and cardiovascular diseases [15–21]. Therefore, PAH may be a useful clinical indicator. Eclampsia is an extreme manifestation of the maternal hypertensive syndrome. The database includes information about parity, birth order, preexisting medical conditions, race, and ethnicity.

The purpose of the present study was to describe the incidence of PAH and eclampsia from adolescence through the fifth decade of life, including the effect of parity, race, and ethnicity, in the United States.

Methods

Database

The incidence of PAH for first (G1) and second or higher (G2+) pregnancies was calculated using data from the National Center for Health Statistics vital statistics section (public access section). PAH and eclampsia were selected as the health characteristics of interest. Women were excluded from the study because of (1) prepregnancy hypertension, (2) diabetes (prepregnancy or gestational diabetes in the index pregnancy), or (3) absence of information available about diabetes status and hypertension status (Table 1). The data were stratified by maternal age group, parity, and racial group. Parity was determined through the evaluation of the "Total Birth Order" variable in the database. Total Birth Order is defined as the total number of pregnancies the mother has reported, including the index delivery. The data for PAH were further stratified in a sub-study by exclusion of women who reported tobacco use or for whom no information was available regarding tobacco use.

Data analysis

The incidence of PAH was calculated for each maternal age category for both G1 and G2+ groups (G1, first pregnancy; G2+, second or higher pregnancy). The G2+ pregnancy category included data for all pregnancies except the first pregnancy. Data about PAH from 4 years (2004, 2005, 2007, and 2008) were combined for statistical analysis. The incidence of eclampsia was similarly calculated with data from 13 years (1997 through 2009) and combined for statistical analysis. Furthermore, the data were stratified by racial groups including Hispanic, non-Hispanic white, and non-Hispanic black. The incidence of PAH was evaluated in women who self-reported no tobacco use during the reported pregnancy.

For both PAH and eclampsia, statistical significance was evaluated with Spearman's rank correlation test for ordinal trends and with the Z test for difference of proportions [22,23]. Statistical significance was defined by $P \leqslant .05$. A table for PAH and eclampsia was created to emphasize the trend in the adolescent women. Graphs for PAH and eclampsia were created to emphasize the overall incidence trend for all age groups stratified by race.

This study was approved as an Exemption from IRB Review by the Olive View-UCLA Education and Research Institute IRB.

Results

The sample size was substantially larger for eclampsia than PAH (Table 1). The incidence of PAH decreased with increased age in late adolescence in the G2+ group but not in the G1 group (total and all racial groups) (Table 2). In the total adolescent group (ages ⩽15–19), the incidence of PAH was significantly lower in the G2+ than G1 group

Table 1
Total number of subjects in the study of pregnancy associated hypertension and eclampsia in the United States.[a]

Subjects	PAH[b]	PAH in nonsmokers[b]	Eclampsia[c]
Total subjects reported	16,814,328	16,814,328	53,188,835
Subjects excluded	4,069,296[d]	11,966,723[e]	9,119,696[d]
Total subjects analyzed	12,745,032	4,847,605	44,069,139

[a] Data reported as number of subjects. *Abbreviation:* PAH, pregnancy associated hypertension.
[b] Data from years 2004, 2005, 2007, and 2008 (year 2006 excluded because it was a transition year for diabetes reporting).
[c] Data from years 1997–2009.
[d] Exclusions: subjects who had prepregnancy hypertension; diabetes mellitus (including pregestational and gestational diabetes); or absence of information available about diabetes status, or hypertension status.
[e] Exclusions: subjects who had prepregnancy hypertension; diabetes mellitus (including pregestational and gestational diabetes); tobacco use in pregnancy; absence of information available about diabetes status, hypertension status, or tobacco use in pregnancy.