OBSTETRICS

Severe placental abruption: clinical definition and associations with maternal complications

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BACKGROUND: *Placental abruption* traditionally is defined as the premature separation of the implanted placenta before the delivery of the fetus. The existing clinical criteria of severity rely exclusively on fetal (fetal distress or fetal death) and maternal complications without consideration of neonatal or preterm delivery-related complications. However, two-thirds of abruption cases are accompanied by fetal or neonatal complications, including preterm delivery. A clinically meaningful classification for abruption therefore should include not only maternal complications but also adverse fetal and neonatal outcomes that include intrauterine growth restriction and preterm delivery.

OBJECTIVES: The purpose of this study was to define severe placental abruption and to compare serious maternal morbidity profiles of such cases with all other cases of abruption (ie, mild abruption) and non-abruption cases.

STUDY DESIGN: We performed a retrospective cohort analysis using the Premier database of hospitalizations that resulted in singleton births in the United States between 2006 and 2012 (n = 27,796,465). *Severe abruption* was defined as abruption accompanied by at least 1 of the following events: maternal (disseminated intravascular coagulation, hypovolemic shock, blood transfusion, hysterectomy, renal failure, or in-hospital death), fetal (nonreassuring fetal status, intrauterine growth restriction, or fetal death), or neonatal (neonatal death, preterm delivery or small for gestational age) complications. Abruption cases that did not qualify as being severe were classified as mild abruption cases. The morbidity profile included amniotic fluid embolism, pulmonary edema, acute respiratory or heart failure, acute myocardial infarction, cardiomyopathy, puerperal cerebrovascular disorders, or coma. Associations were expressed as rate ratios with 95% confidence intervals that were derived from fitting log-linear Poisson regression models.

RESULTS: The overall prevalence rate of abruption was 9.6 per 1000, of which two-thirds of cases were classified as being severe (6.5 per 1000). Serious maternal complications occurred in 15.4, 33.3, and 141.7 per 10,000 among nonabruption cases and mild and severe abruption cases, respectively. In comparison with no abruption, the rate ratio for serious maternal complications were 1.52 (95% confidence interval, 1.35—1.72) and 4.29 (95% confidence interval, 4.11—4.47) in women with mild and severe placental abruption, respectively. Rate ratios for the individual complications were 2- to 7-fold higher among severe abruption cases. Furthermore, the rate ratios for serious maternal complications among severe abruption cases compared with mild abruption cases was 3.47 (95% confidence interval, 3.05—3.95). This association was considerably stronger for virtually all maternal complications among cases with severe abruption compared with mild abruption. Annual rates of mild and severe abruption were fairly constant during the study period. Although the maternal complication rate among non-abruption births was stable from 2006-2012, the rate of complications among mild abruption cases dropped from 2006-2008 and then leveled off thereafter. In contrast, the rate of serious complications among severe abruption cases remained fairly stable from 2006-2010 and increased sharply thereafter.

CONCLUSIONS: Severe abruption was associated with a distinctively higher morbidity risk profile compared with the other 2 groups. The clinical characteristics and morbidity profile of mild abruption were more similar to those of women without an abruption. These findings suggest that the definition of severe placental abruption based on the proposed specific criteria is clinically relevant and may facilitate epidemiologic and genetic research.

Key words: blood transfusion, disseminated intravascular coagulation, fetal death, intrauterine growth restriction, maternal complication, placental abruption, preterm delivery

Placental abruption traditionally is defined as the premature separation of the implanted placenta before the delivery of the fetus. The existing clinical criteria of severity rely exclusively on fetal (fetal distress or fetal death) and maternal complications without consideration of neonatal or preterm delivery-related complications.[1] However, two-thirds of abruption cases are accompanied by fetal or neonatal complications, which includes preterm delivery. A clinically meaningful classification for abruption therefore should include not only maternal complications but also adverse fetal and neonatal outcomes that include intrauterine growth restriction and preterm delivery.

We hypothesized that the criteria that were needed to define placental abruption as "severe" should be clinically meaningful and should include at least 1 of maternal (disseminated intravascular coagulation, hypovolemic shock, blood transfusion, hysterectomy, renal failure, or in-hospital death), fetal (nonreassuring fetal status, intrauterine growth restriction, or fetal death), or neonatal (neonatal death, preterm delivery, or small for gestational age) complications. The intrinsic motivation for this hypothesis was that abruption cases with ≥1 of the aforementioned criteria will identify a distinct subset of women with very high risks of serious maternal complications, in comparison

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with women with mild abruption or no abruption. We tested this hypothesis in a large cohort of almost 28 million singleton pregnancies in the United States.

Methods

Premier data

We performed a retrospective cohort analysis of data from the Premier database (www.premierinc.com; Premier, Inc, Charlotte, NC) to obtain all maternal hospital records for deliveries that occurred from 2006-2012. The data include hospitalizations from in-patient, ambulatory, and emergency admissions in approximately 500 hospitals each year in the United States. These hospitals are chosen to provide a representation of hospitalizations across the United States. The Premier data can be purchased from Premier, Inc. All diagnosis and procedure codes in the Premier data were coded based on the International Classification of Disease, 9th version; the codes used for conditions in this study are listed in the Supplemental Table. We sought and obtained approval from the Institutional Review Board as an exempt protocol from Columbia University Medical Center, NY.

Placental abruption

A diagnosis of placental abruption was based on clinical symptoms that include vaginal bleeding accompanied with severe abdominal pain, uterine tenderness, or tetanic contractions. *Severe placental abruption* was defined as a delivery with an abruption accompanied by ≥1 of the following maternal, fetal, or neonatal complications. Maternal complications included disseminated intravascular coagulation, hypovolemic shock, blood transfusion, hysterectomy, renal failure, and in-hospital death. Fetal complications included nonreassuring fetal status, intrauterine growth restriction, or fetal death. Neonatal complications included neonatal death, preterm delivery, and small-for-gestational-age (SGA) births. Although the risk of some of the severe maternal morbidities, such as pulmonary edema or cardiomyopathy, are expected to be higher among pregnancies that are complicated by abruption, these conditions are not the typical complications after abruption; therefore, we do not consider these variables in the definition of severe abruption.[2-4] Abruption cases that did not qualify as being severe were classified as mild abruptions.

Maternal morbidity profile

The primary endpoint was a composite morbidity outcome comprised of serious maternal complications that included pulmonary edema, acute respiratory failure, acute heart failure, acute myocardial infarction, cardiomyopathy, puerperal cerebrovascular disorder, coma, and amniotic fluid embolism. In addition, we also examined the associations between abruption and each of these serious maternal complications.

Clinical characteristics

We examined the rates of mild and severe abruption across patient characteristics. Maternal sociodemographic and behavioral characteristics included year of delivery (2006-2012), maternal age, single marital status, insurance status, and tobacco, drug, or alcohol use. Maternal comorbidities included hypertensive diseases (chronic hypertension, gestational hypertension, or preeclampsia/eclampsia), chronic renal disease, asthma, and congenital cardiac disease. Intrapartum and labor characteristics included premature rupture of membranes (at preterm or term gestations), anemia, intrapartum fever, polyhydramnios, oligohydramnios, and chorioamnionitis. SGA was used as a proxy for intrauterine growth restriction.

Statistical analysis

Two sets of log-linear regression models (with a Poisson distribution and a log-link function) were fit: the first model was to evaluate the maternal characteristics that are associated with mild and severe placental abruption; the second model was to estimate the association of serious maternal complications (morbidity profile) that are associated with births with mild and severe abruptions compared with births with no abruption and to compare serious maternal complications between severe vs mild (reference) abruptions. For evaluating risk factors for mild and severe abruptions, we first estimated the unadjusted rate ratio (RR) and 95% confidence interval (CI). From this analysis, we chose risk factors that had RRs either >1.2 or <0.8 for mild and severe abruption; risk factors that met this criterion were entered in the final multivariable log linear Poisson regression models from which we evaluated the associations.

RRs and 95% CIs were calculated for the composite serious maternal morbidity profile and for each severe maternal outcome individually. In this analysis, we adjusted for all maternal characteristics as potential confounding factors. All analyses were weighted based on the weights provided in Premier to generate national estimates.

Cohort composition

From 28,504,661 (weighted) singleton deliveries that were identified in the Perspectives database, records identified as male (n = 1308; unweighted, 236), twins and higher-order multiple births (n = 530,065; unweighted, 79,594) and women <15 or >59 years old were sequentially excluded (n = 32,688; unweighted, 5187). We additionally excluded women who received a diagnosis of placenta previa (n = 144,135; unweighted, 21,241). After all exclusions, the analysis cohort was composed of 27,796,465 (3,961,031 unweighted) women.

Results

In this cohort of 27,796,465 singleton births, the prevalence rates of mild and severe abruption were 3.1 and 6.5 per 1000, respectively (overall prevalence rate, 9.6 per 1000). The distribution of clinical characteristics among the 3 groups of nonabruption, mild abruption, and severe abruption is shown in Table 1. Maternal age ≥35 years old, black race, cigarette smoking status, and the use of drugs or alcohol were associated with increased rates of abruption. Compared with nonabruption births, the prevalence rates of hypertensive disorders were increased among women with mild abruption but were