Readmission for postpartum eclampsia in the United States

Elizabeth Yoselevsky, Thomas McElrath and Sarah Little
Department of Obstetrics and Gynecology, Division of Maternal-Fetal Medicine, Brigham and Women’s Hospital, Boston, MA, USA

ABSTRACT

Objective: To characterize the contemporary prevalence of eclampsia in the United States and determine whether eclampsia is taking place during the delivery hospitalization or a postpartum readmission.

Study design: We conducted a retrospective cohort using the 2016 Nationwide Readmission Database, a discharge database of all hospitalizations in 27 states in the U.S. Through the database, we identified women with an admission for delivery of a neonate > 20 weeks gestation. We also identified readmissions that occurred within 6 weeks after discharge from that delivery admission. ICD-10-CM codes were used to identify deliveries, eclampsia and co-morbidities. The primary outcome was timing of eclampsia relative to discharge from the delivery admission.

Results: We identified 1,590,563 deliveries of which 2955 (0.19%) were complicated by eclampsia during the delivery admission or a postpartum readmission. Of these cases of eclampsia, 1575 (53.5%) occurred during the delivery admission, 1354 (45.8%) during a postpartum readmission and 26 (0.88%) during both the delivery and a postpartum readmission. Of the 1380 readmissions with eclampsia, 1117 (81%) occurred within the first week after delivery discharge. Another 194 (14%) occurred in the second week after discharge. Women with readmissions for eclampsia were older (30.1 vs. 28.8 years; \( p < .01 \)), delivered earlier (37.7 vs. 38.5 weeks; \( p < .01 \)), and more likely to have a cesarean delivery (48.4 vs. 32.4%; \( p < .01 \)) or multiple gestation (4.0 vs. 1.8%; \( p < .01 \)) as compared to those not readmitted for eclampsia and 44% had any hypertensive disorder during the delivery admission (vs. 12.2% without an eclampsia readmission; \( p < .01 \)).

Conclusion: Of the 2955 cases of eclampsia identified, almost half of them occurred after discharge from the delivery admission, 95% of which occurred within the first 2 weeks after discharge, demonstrating the prominence of postpartum eclampsia which may warrant new strategies for prevention and education targeted at postpartum patients after delivery hospitalization.

Introduction

Eclampsia, a severe condition along the preeclampsia spectrum that is notable for generalized seizures, occurs in 2–3% of women with preeclampsia who do not receive seizure prophylaxis \[1,2\]. The maternal consequences can be severe and include stroke, disseminated intravascular coagulopathy, pulmonary edema, acute renal failure, aspiration pneumonia, cardiopulmonary arrest, and death \[3\]. While cases of eclampsia are usually preceded by hypertension and/or headache or visual changes, many are not, making it a particularly elusive disease to predict \[4\]. Further complicating care is that disorders in the preeclampsia spectrum such as eclampsia can occur postpartum. Small and older studies have estimated the incidence of postpartum eclampsia to be anywhere from 14% to 33% and occurring anytime from 1 week to 23 days postpartum \[5–8\]. However, the current prevalence and timing of postpartum eclampsia have not been well-defined with contemporary, large-scale data. Therefore, the objective of this study was to use a large national database to better clarify the prevalence of eclampsia in the United States and whether it occurred during delivery hospitalization or a separate postpartum readmission.

Methods

We conducted a retrospective cohort study using the 2016 Nationwide Readmission Database (NRD), a claims-based database of all hospitalizations in 27 states in the United States. Data for the NRD is drawn from the statewide inpatient databases (SID) for states...
which have reliable, verified, patient linkage data necessary to track hospitalizations across the state in any given calendar year. These 27 states represent 56.6% of all hospitalizations in the U.S. We identified women with an admission for delivery of a neonate of at least 20 weeks gestation and excluded any women who had more than one delivery admission in the year. ICD-10-CM codes were used to identify deliveries and maternal characteristics including age, parity, gestational age at delivery, mode of delivery, presence of stillbirth, presence of diabetes, tobacco use, obesity, presence of hypertensive condition, type of hypertensive condition if present, presence of eclampsia, and any postpartum readmissions and their associated billing codes. We included only readmissions that occurred within 6 weeks after discharge from the delivery admission as that is the time period when postpartum eclampsia could occur. Only patients with deliveries in January through October were included so that we would be able to detect 6-week readmissions in the data set. Our primary outcome was eclampsia and the timing of it relative to discharge from the delivery admission. Secondary outcomes included maternal and delivery characteristics of those women who did not have eclampsia, those who had eclampsia during their delivery admission, and those who had eclampsia after their delivery admission.

For statistical analysis, chi-squared was used for categorical variables and a t-test was used for continuous variables. We considered any $p < .05$ to be significant. All analyses were performed with SAS 9.4 (Cary, NC).

This study was exempt from our institutional review board.

Results

We identified 1,590,563 deliveries in the database of which 2955 (0.19%) were complicated by eclampsia during the delivery admission or a postpartum readmission. Using NRD survey weights, this is equivalent to 5711 deliveries (0.19%) nationally. Of these cases of eclampsia, 1575 (53.5%) occurred during the delivery admission, 1354 (45.8%) during a postpartum readmission and 26 (0.88%) during the delivery admission and a postpartum readmission.

Of the 1380 readmissions for eclampsia (1354 during the readmission alone and 26 during the delivery admission and a readmission), all were either during a first or second readmission after the delivery admission. Of the 1369 first readmissions with eclampsia, 1117 (81.4%) occurred within the first week and another 194 (14.2%) occurred within the second week after the delivery admission discharge (Figure 1).

There were 34 women whose second readmission was for eclampsia, with 75.0% occurring within 15 days after discharge from the delivery admission.

Women with readmissions for eclampsia were older, delivered earlier, were more likely to have unspecified diabetes, use tobacco, be obese and were more likely to have a cesarean delivery or multiple gestation as compared to those not readmitted for eclampsia and more had any hypertensive disorder identified during the delivery admission than those without a readmission for eclampsia. (Table 1(A)) Women with readmissions for eclampsia were older, had a higher gestational age at delivery, were more likely to use tobacco, were less likely to have had a stillbirth, were

Figure 1. Frequency of postpartum readmissions with eclampsia by number of days from delivery admission.
less likely to have had a cesarean delivery and were more likely to be identified as having preeclampsia as compared to women who had eclampsia during their delivery admission. (Table 1(B))

Discussion

In this large national database, we found that nearly half the cases of eclampsia occurred after discharge from the delivery admission, with most of these occurring in the first week after delivery and almost 96% occurring by the second week after delivery.

Our findings are consistent with other studies that demonstrate eclampsia's prominence in the postpartum period. Leitch et al. looked at patients over a period of 60 years (from 1931 to 1990), identified 1259 cases of eclampsia, and observed that the eclampsia occurred in the postpartum period in 23% of those cases. They also noted that there has been a relative increase over time in postpartum eclampsia as compared to antepartum and intrapartum eclampsia [7]. Our contemporary rate of postpartum eclampsia speaks to this increase, as it is almost double what Leitch and colleagues found. This is also in line with increasing rates of preeclampsia over time being observed in the United States [9]. In addition, the true rate of postpartum eclampsia we identified is likely to be even higher than estimated as we only considered readmissions for eclampsia, however, even during the delivery hospitalization, many of the seizures likely occurred postpartum.

Our data expound on the timing of late eclampsia, supporting other studies’ results that postpartum eclampsia is likely to occur well after delivery. In a cohort of 89 patients with eclampsia from 1996 to 2001, at multiple hospitals, Chames et al. found that 32.6% of cases occurred postpartum and, of those, 79.3% occurred greater than 48 h after delivery [8]. Al-Safi et al. noted cases up to 23 days after delivery in their cohort of 22 patients with postpartum eclampsia [5]. Both these studies corroborate our large database findings that a significant percentage of postpartum eclampsia occurs days after delivery and notably after all seizure prophylaxis has been discontinued [8].

Our findings that those who are readmitted for eclampsia tend to be older, deliver earlier, have a

| Readmitted for eclampsia (%) | Not readmitted for eclampsia (%) | p-Value |
|-----------------------------|---------------------------------|---------|
| (A) | | |
| Number of women | 1380 (0.1) | 1,587,851 (99.9) | N/A |
| Age (mean, [SD]) | 30.1 (6.3) | 28.8 (5.8) | <.01 |
| Gestational age at delivery (mean, [SD]) | 37.7 (2.6) | 38.5 (2.2) | <.01 |
| Stillbirth | 13 (0.94) | 9781 (0.62) | .12 |
| Multiple gestation | 55 (4.0) | 28,286 (1.8) | <.01 |
| Cesarean delivery | 668 (48.4) | 514,651 (32.4) | <.01 |
| Hypertensive complications | | | |
| Chronic hypertension | 135 (9.8) | 46,210 (2.9) | <.01 |
| Superimposed preeclampsia | 33 (2.4) | 11,259 (0.7) | <.01 |
| Severe preeclampsia | 156 (11.3) | 32,584 (2.1) | <.01 |
| Preeclampsia | 299 (21.7) | 70,062 (4.4) | <.01 |
| Other | | | |
| Diabetes | 175 (12.7) | 132,243 (8.3) | <.01 |
| Tobacco | 76 (5.5) | 65,138 (4.1) | <.01 |
| Obesity | 233 (16.9) | 152,777 (9.6) | <.01 |

| Readmitted for eclampsia (%) | Eclampsia during delivery admission (%) | p-Value |
|-----------------------------|----------------------------------------|---------|
| (B) | | |
| Number of women | 1380 (46.7) | 1575 (53.3) | N/A |
| Age (mean, [SD]) | 30.1 (6.3) | 27.7 (6.5) | <.01 |
| Gestational age at delivery (mean, [SD]) | 37.7 (2.6) | 36.2 (3.5) | <.01 |
| Stillbirth | 13 (0.94) | 31 (2.0) | .02 |
| Multiple gestation | 55 (4.0) | 72 (4.6) | .43 |
| Cesarean delivery | 668 (48.4) | 941 (60.0) | <.01 |
| Hypertensive complications | | | |
| Chronic hypertension | 135 (9.8) | 151 (9.6) | .90 |
| Superimposed preeclampsia | 33 (2.4) | 28 (1.8) | .24 |
| Severe preeclampsia | 156 (11.3) | 199 (12.3) | .67 |
| Preeclampsia | 299 (21.7) | 264 (18.0) | .01 |
| Other | | | |
| Diabetes | 175 (12.7) | 213 (13.5) | .50 |
| Tobacco | 76 (5.5) | 78 (5.0) | .04 |
| Obesity | 233 (16.9) | 275 (17.5) | .68 |
hypertensive disorder, and have multifetal gestations as compared to those not readmitted with eclampsia are consistent with prior literature regarding the risk factors for eclampsia in general [10]. The risk factors for those women with eclampsia during a readmission as compared to eclampsia during the labor admission are less clear to understand and likely need further research into the pathophysiology of postpartum eclampsia.

Our study is limited by the inability to obtain granular data from the Nationwide Readmission Database. As with other studies from large datasets, we were unable to verify the diagnosis of eclampsia and the accuracy of the ICD-10 coding and the clinical circumstances around its occurrence such as the concurrent presence of hypertension, severity of preeclampsia if present, symptoms or lab abnormalities. Additionally, due to the nature of the data, we were able to identify only cases of eclampsia after discharge from the delivery admission which potentially led to the omission of postpartum cases that occurred during the delivery admission.

Despite these limitations, our study provides current information regarding the timing and prevalence of postpartum eclampsia drawn from a large, heterogeneous population. It especially highlights the medical vulnerability of the postpartum period when it comes to eclampsia. Given our findings, postpartum patients, especially those with risk factors, should be adequately counseled on the risk of postpartum eclampsia and premonitory symptoms. They may also benefit from more frequent postpartum visits for surveillance of symptoms and blood pressure.

Of note, however, identifying a group most likely to benefit will remain a challenge. In our cohort, the risk factor with highest prevalence (any form of hypertension during the delivery hospitalization) lacked both sensitivity (present in 44% of those women readmitted with eclampsia) and specificity (less than 0.1% of those with hypertension were readmitted with eclampsia). Future research is needed into identifying the group of women at highest risk for a postpartum eclamptic seizure.

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ORCID
Elizabeth Yoselevsky [http://orcid.org/0000-0002-8674-4793]

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