

Postpartum venous thromboembolism readmissions in the United States

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BACKGROUND: There are limited data on when postpartum readmissions for thromboembolism occur after delivery hospitalizations on a population basis in the United States.

OBJECTIVE: We sought to characterize risk factors for and timing of postpartum venous thromboembolism readmission after delivery hospitalization discharge.

STUDY DESIGN: The Healthcare Cost and Utilization Project Nationwide Readmissions Database for calendar years 2013 and 2014 was used to perform a retrospective cohort study evaluating risk for readmission for venous thromboembolism within 60 days of discharge from a delivery hospitalization. Risks for deep vein thrombosis and pulmonary embolism were individually assessed. Obstetric, medical, demographic, and hospital factors associated with postpartum readmission for venous thromboembolism were analyzed. Risk was characterized as odds ratios with 95% confidence intervals. Both unadjusted and adjusted analyses were performed. Adjusted analyses included relevant obstetric, medical, demographic, and hospital factors within logistic regression models.

RESULTS: From Jan. 1 through Oct. 31 in 2013 and 2014, 6,269,641 delivery hospitalizations were included in the analysis. In all, 2975 cases of readmission for any venous thromboembolism were identified (4.7 per 10,000 delivery hospitalizations) including 1170 cases of deep vein thrombosis and 1805 cases of pulmonary embolism. In all, 69.6% of readmissions for any venous thromboembolism occurred within the first 20 days of discharge vs 22.3% and 8.0% at 21–40 and 41–60 days after discharge. Median times to readmission were 12.7, 14.0, and 11.7 days for venous thromboembolism, deep vein thrombosis, and pulmonary embolism, respectively. Women readmitted for any venous

thromboembolism were more likely to have a history of venous thromboembolism (4.2% vs 0.3%, $P < .01$), to have had a cesarean delivery (54.4% vs 32.4%, $P < .01$), to have a thrombophilia (1.8% vs 0.4%, $P < .01$), to have had a longer delivery hospitalization of >3 days for vaginal delivery and >4 days for cesarean (18.0% vs 6.6%, $P < .01$), to have been diagnosed with gestational hypertension or preeclampsia (19.7% vs 8.2%, $P < .01$), and to have had postpartum hemorrhage with transfusion (2.6% vs 0.5%, $P < .01$). These factors retained significance in adjusted models. History of venous thromboembolism and hemorrhage with transfusion were associated with the largest odds of readmission (odds ratio, 9.5; 95% confidence interval, 6.6–13.6, and odds ratio, 3.6; 95% confidence interval, 2.4–5.5, respectively). Other factors associated with increased odds included thrombophilia (odds ratio, 2.0; 95% confidence interval, 1.2–3.5), cesarean delivery (odds ratio, 2.0; 95% confidence interval, 1.8–2.3), longer delivery hospitalization (odds ratio, 1.8; 95% confidence interval, 1.5–2.2), and preeclampsia or gestational hypertension (odds ratio, 2.0; 95% confidence interval, 1.6–2.4).

CONCLUSION: While the majority of events occurred within 20 days of discharge, risk factors other than thrombophilia and prior venous thromboembolism were generally associated with modestly increased odds of events, and only a small proportion of readmissions occurred among women with thrombophilia and prior events. Our data demonstrate both the challenging nature and urgent need for further research to determine which clinical practices and interventions may reduce risk for venous thromboembolism readmissions on a population basis.

Key words: obstetric thromboembolism, postpartum thromboembolism, severe maternal morbidity

Introduction

Obstetric venous thromboembolism (VTE) is a leading cause of maternal mortality and severe morbidity in the United States.¹ Pregnancy involves all 3 factors of Virchow triad² and risk for events can be particularly high soon after delivery.^{3,4} In the United States, VTE during postpartum hospitalizations

appears to be rising⁵ with the Centers for Disease Control and Prevention estimating the rate of thrombotic embolism during postpartum hospitalizations increased 169% from 1998 through 2009.⁶

Currently in the United States, obstetric patients at highest risk for VTE such as those with thrombophilia and prior VTE events receive routine pharmacologic postpartum thromboprophylaxis with unfractionated or low-molecular-weight heparin during delivery hospitalizations.^{7,8} Major guideline recommendations generally agree on continuation of pharmacologic prophylaxis after delivery hospitalization discharge for women with the highest

risk.^{9–11} However, little is known regarding timing and incidence of postpartum VTE readmission after delivery hospitalization discharge on a population basis in the United States. Knowledge of when events occur could be useful in patient counseling and management; if events are most proximal to discharge, recommendations to patients with risk factors could be made to ensure frequent ambulation and adequate hydration.

Given that population-based postpartum readmission risk for thromboembolism is not well characterized, the purpose of this study was to evaluate risk for deep vein thrombosis (DVT) and pulmonary embolism (PE)

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AJOG at a Glance

Why was this study conducted?

Given that population-based postpartum readmission risk for thromboembolism is not well characterized, the purpose of this study was to evaluate risk for deep vein thrombosis and pulmonary embolism after discharge home from a delivery hospitalization.

Key findings

In all, 69.6% of readmissions for any venous thromboembolism occurred within the first 20 days of discharge. Most risk factors were associated with only modestly increased risk for events.

What does this add to what is known?

This study demonstrates both the challenging nature and urgent need for further research to determine which clinical practices and interventions may reduce risk for venous thromboembolism readmissions on a population basis.

after discharge home from a delivery hospitalization.

Materials and Methods**Data source**

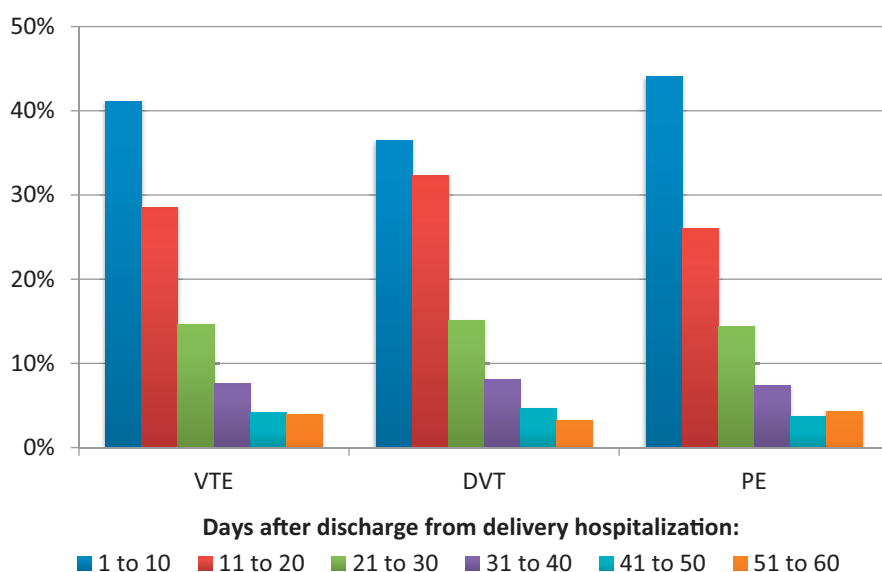
The analysis was performed using the Healthcare Cost and Utilization Project Nationwide Readmissions Database (NRD) from 2013 and 2014. The NRD is an all-payer database with data

collected on a state level capable of tracking patients across hospital admissions within a state. The data can be used to create national estimates of readmissions for the insured and uninsured. The NRD includes public and community hospitals and academic medical centers.¹² It has been used across a wide number of medical and surgical subspecialties to evaluate

readmission hospitalizations.^{13–15} Data in the NRD are weighted to provide national estimates with an estimated 35 million US discharges. In 2014, 22 geographically dispersed states contributed data to the NRD, accounting for 51% of US residents and 49% of all US hospitalizations.¹² The Columbia University and University of Southern California institutional review boards granted exemptions given that the NRD is deidentified and publicly available.

Study population

Index delivery hospitalizations were captured using *International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)* diagnoses codes 650 and V27.x. These criteria ascertain >95% of delivery hospitalizations.¹⁶ Women aged 15–54 years were included. VTE was defined as either acute DVT or PE. Diagnoses of acute PE were captured with *ICD-9-CM* codes 415.1x, 673.2x, 673.3x, and 673.8x.¹⁷ Diagnoses of acute DVT were captured with *ICD-9-CM* codes: 451.11, 451.19, 451.81, 451.83, 453.40, 453.41, 453.42, 453.8, 453.82, 453.83, 453.85, 453.87, 453.89, 453.9, 671.3x, 671.4x, and 671.5x.^{5,18,19} As the primary outcome of the study, we assessed risk for readmission with a new VTE diagnosis within 60 days of discharge from a delivery hospitalization. Women were determined to have a VTE readmission if they had a diagnosis of acute PE or DVT as the primary indication for postpartum readmission. Readmissions were identified using methodology provided by the Healthcare Cost and Utilization Project in the NRD. To account for multiple readmissions within 60 days, only the first readmission was included in the analysis. To avoid misclassification of historical vs acute diagnosis, women with a diagnosis of VTE during the delivery index hospitalization were excluded. Population weights from the NRD were applied to create national estimates. Because the NRD data sets are year-based and cannot be linked, only delivery hospitalizations where discharge occurred from Jan. 1 through Oct. 31 for each year were included; delivery hospitalizations during

FIGURE**VTE readmissions by days from delivery hospitalization discharge**

Proportion of admissions for VTE, DVT, and PE occurring within 60 days of discharge from delivery hospitalization by 10-day periods (1–10, 11–20, 21–30, 31–40, 41–50, or 51–60 days).

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