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CASE REPORTS

Thromboelastography as a point-of-care guide for spinal anesthesia in an eclamptic patient: a case report

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Abstract Neuraxial anesthesia is a standard of care during parturition. Since bleeding diathesis is a contraindication to neuraxial techniques, data about its safe administration in a thrombocytopenic milieu is limited and evolving. Thrombocytopenia associated with preeclampsia or eclampsia and hemolysis, elevated liver enzymes, and low platelet count (HELLP) syndrome leads to significant maternal and neonatal morbidity. We present a case of uneventful spinal anesthesia for urgent cesarean section in an eclamptic patient with a precipitous drop in platelet count from 124,000 to 97,000 per cubic millimeter under thromboelastography (TEG) guidance.

Introduction

Regional neuraxial techniques are the gold standard for analgesia and anesthesia during labor as well as cesarean delivery. Bleeding diathesis is an absolute contraindication to neuraxial anesthesia because of the risk of developing hematoma, which can lead to sensorimotor deficits. In obstetric patients, the overall risk of developing hematoma after epidural and spinal techniques is estimated to be about 1:200,000.[1]

Pregnancy is a state characterized by profound hematological changes, such as physiological anemia, neutrophilia, thrombocytopenia, increased procoagulant factors, and diminished fibrinolysis. Following anemia, thrombocytopenia is the second-most common abnormality in pregnancy. Thrombocytopenia is either isolated (gestational or immunological) or associated with systemic disorders, such as Hemolysis, Elevated Liver Enzymes, and Low Platelet count (HELLP) syndrome or acute fatty liver of pregnancy. Since platelets are an important component of the normal

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hemostasis coagulation process, there is always a concern when offering neuraxial anesthesia to a pregnant woman with a low platelet count.

This report describes the case of an obstetric patient who developed eclampsia and low platelet count and underwent an urgent cesarean delivery, under spinal anesthesia, guided by Thromboelastography (TEG). The patient has provided written permission to publish this case report.

Case report

At 25-weeks of pregnancy, a 20-year-old African American female (weight 75 kg, height 1.75 meters, body mass index 24.5 $kg.m^{-2}$) presented to the emergency room in a postictal state following a generalized tonic-clonic seizure that was reportedly preceded by a new-onset headache. Her blood pressures ranged from 170–140 and 120–90 mmHg. Her prenatal care and medical history were unremarkable and negative for any known hypertensive or seizure disorders. The initial lab values were abnormal and revealed a platelet count of 124,000 per cubic millimeter (normal range: 150,000–450,000 per cubic millimeter), alkaline phosphatase 207 $IU.L^{-1}$ (normal range: 30–120 $IU.L^{-1}$), alanine aminotransferase 60 $IU.L^{-1}$ (normal range: 10–40 $IU.L^{-1}$), aspartate aminotransferase 50 $IU.L^{-1}$ (normal range: 10–40 $IU.L^{-1}$), lactate dehydrogenase 353 $IU.L^{-1}$ (normal range: 80–255 $IU.L^{-1}$), uric acid 7.4 $mg.dL^{-1}$ (normal range: 2.6–6 $mg.dL^{-1}$), Prothrombin Time (PT) 9.9 seconds (normal range: 11–13.5 seconds), fibrinogen 463 $mg.dL^{-1}$ (normal range: 175–400 $mg.dL^{-1}$), and 3+ urine protein (normal range: negative or trace). The other measured coagulation parameters were the International Normalized Ratio (INR) of 0.9 (normal range: 0.8–1.1) and Partial Thromboplastin Time (PTT) of 29.2 seconds (normal range: 25–35 seconds). If a grand mal seizure occurs in a pregnant woman with a preeclamptic background, such as the new onset of persistently elevated blood pressures $\geq$ 140/90 mmHg after 20 weeks of gestation with accompanying proteinuria, eclampsia is considered the predominant differential diagnosis; therefore, a magnesium sulfate infusion was started. The obstetrician decided to manage the patient for the next 24–48 hours with frequent neurological checks, blood tests, and continuous fetal monitoring (to optimize fetal well-being while the fetus was premature). The patient was immediately admitted, and a decision was made to delay any head imaging until clinical stabilization had been achieved. Following admission and while receiving magnesium, her blood pressures varied from 160–140 and 100–80 mmHg. Hourly clinical examinations revealed a neurologically improving patient who was increasingly becoming more awake, alert, responsive, and oriented with intact motor strength and sensations. There were no more seizure episodes, and the patient denied any other symptoms, such as headache or visual disturbances. She also received a dose of betamethasone for fetal lung maturity. Although the patient continued to remain clinically stable with a reassuring fetal status under monitoring, her platelet counts decreased from 124,000 to 97,000 per cubic millimeter over a 3-hour period. This raised the possibility that she had HELLP syndrome. The repeat coagulation profile, similar to the initial set, revealed low PT, elevated fibrinogen, and normal INR and PTT. Given the possibility that she could develop recurrent seizures, disseminated intravascular coagulation, and stroke, the risk of maintaining her pregnancy was perceived to be greater than that of delivery. Therefore, it was decided to deliver the fetus under an urgent cesarean section. By this time, a TEG had been performed to study the blood coagulation efficiency and assess the platelet function in clot formation. The test yielded normal results: Reaction (R) time 5.8 minutes, Kinetics (K) time 1.8 minutes, alpha angle 66.2 degrees, and Lysis index 30 (LY30) 0%, including a Maximal Amplitude (MA) of 66.2 mm. The MA is a direct function of the maximum dynamic properties of fibrin and platelet bonding via glycoprotein IIb/IIIa, which represents the ultimate strength of a fibrin clot and correlates to platelet function. Hence it was decided to proceed with the cesarean section under spinal anesthesia.

Spinal anesthesia was performed using 14.25 mg of hyperbaric 0.75% bupivacaine and 0.02 mg of intrathecal morphine at the level of the lumbar 3–4 intervertebral space using a 20G needle introducer and a 24G spinal needle under aseptic precautions. An adequate thoracic 4-sensory level block was achieved, and the cesarean section proceeded uneventfully. The delivered neonate's appearance, pulse, grimace, activity, and respiration scores were 7/7/7, and he was sent to the neonatal intensive care unit for observation and further management. The patient was hemodynamically stable throughout the delivery, with blood pressures ranging from 140–130 mmHg to 90–60 mmHg while she remained on magnesium infusion; she received no other cardiovascular supportive medications. There was no excessive bleeding during the surgery and the blood loss was estimated to be 700 mL. The patient recovered in the recovery unit with no issues and blood pressures in the 140/90 mmHg limits. The post-spinal anesthesia evaluation was unremarkable for any symptoms or signs of neuraxial hematoma. Over the next two postoperative days, frequent neurological checks were made, and her platelet counts and liver function tests began to improve. On postoperative day five, she was discharged home without any complications.

Discussion

Thrombocytopenia is a known contraindication for neuraxial techniques. Half of preeclamptic patients have thrombocytopenia and its pathogenesis remains unknown. The possible mechanisms include vascular endothelial damage, increased fibrin deposition within the vascular bed, and impaired prostacyclin production. Preeclampsia management primarily focuses on stabilizing the mother until fetal maturity is more favorable for delivery.

As previously reported, the risk of developing hematoma following neuraxial anesthesia in a parturient with thrombocytopenia is exceptionally low when platelet counts are less than 100,000 per cubic millimeter but more than 70,000 per cubic millimeter[2,3]; however, when thrombocytopenia is accompanied by coagulopathy during pregnancy, there are no formal recommendations from either the American Society of Anesthesiologists or the American College of Obstetrics and Gynecology.[4,5] Gestational and immune-related thrombocytopenias have stable platelet counts with preserved functions, but platelet counts fall drastically

Table 1 Discrete coagulation cascade values.

	Normal	Description
R	5–10 min	Measures time to initial fibrin formation
K	1–3 min	Time to clot formation
Alpha angle	53–72 degrees	Rate of clot formation
MA	50–70 mm	Maximal amplitude
LY30	0–3%	Percentage decrease in amplitude at 30 minutes post-MA

under preeclampsia- and eclampsia-related thrombocytopenias, and platelet functions are impaired. Below 100,000 per cubic millimeter, a significant hypo-coagulopathic state might coexist with thrombocytopenia. In such scenarios, it becomes imperative to assess platelet functions during clot formation, rather than just using counts, to determine the adequacy of coagulation for safely administering neuraxial anesthesia. More specific platelet function tests cannot comprehensively assess coagulation; can be time-consuming, expensive, and inflexible. But TEG, a dynamic visco-kinetic testing allows the assessment of clotting capacity in vivo and provides information regarding the dynamics of clot development, stabilization, and dissolution. Discrete coagulation cascade values provided by TEG are shown in Table 1.

TEG analyzes whole-blood coagulation, including the effects of red blood cells and platelets, compared to tests performed on platelet-poor plasma, such as PT, Activated Partial Thromboplastin Time (aPTT), or fibrinogen levels. Thus, clinically, TEG is complete and more descriptive than the other tests. PT and aPTT tests performed in central or core laboratories can result in significant time delays in getting results, in contrast to TEG, which is done as a point-of-care hemostasis monitoring test.

As seen in this eclamptic patient, TEG revealed a normal R time, which correlates with normal INR and PTT and therefore normal clotting factor levels. The patient's K time and alpha angle were normal. However, with the platelet count below 100,000 per cubic millimeter, a normal MA result suggested adequate platelet function in clot formation, enabling the urgent cesarean section to be performed under spinal anesthesia without any complications.

There are no formal recommendations as to when is it safe to administer neuraxial anesthesia in a parturient with low platelet count, especially during scenarios with coexisting coagulopathies, such as preeclampsia or eclampsia; this case suggests that TEG, together with other coagulation studies, could serve as a point-of-care guide for safe neuraxial anesthesia administration. When there is a concern regarding aspiration and airway challenges in the mother or whether the side effects of anesthetic medications will affect the baby, regional anesthesia is always preferred to general anesthesia. Urgent scenarios, such as the one described here, should be considered when there are no absolute contraindications and when time permits. Thus, TEG could make it possible for many women to receive neuraxial intervention during labor and delivery, including those who would otherwise not be eligible for it. With further reporting and data analysis from large cohorts of thrombocytopenic pregnant women undergoing neuraxial blockade under TEG guidance, the clinical use of TEG can be streamlined for this specific population.

Conflicts of interest

The authors declare no conflicts of interest.

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