

# Rotational Thromboelastometry-guided Transfusion in Major Obstetric Hemorrhage: A Case Series

David\*, Tjahya Aryasa EM, Marilaeta Cindryani Ra Ratumasa

*Department of Anesthesiology and Intensive Therapy, Udayana University, Denpasar, Indonesia*

## Corresponding Author

David, MD  
Department of Anesthesiology and  
Intensive Therapy, Udayana  
University, Denpasar 80113,  
Indonesia  
david.24006@student.unud.ac.id

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## Abstract

Major obstetric hemorrhage remains a critical cause of maternal morbidity and mortality, requiring rapid yet precise transfusion management to prevent coagulopathy and adverse outcomes. We report a case series of seven obstetric patients with major perioperative hemorrhage managed using rotational thromboelastometry (ROTEM) guided transfusion at a tertiary referral center. The patients, predominantly with placenta accreta spectrum disorders, placenta previa, uterine atony, and one case of idiopathic thrombocytopenic purpura, experienced a wide range of estimated blood loss from 200 to 4500 mL. ROTEM assessment using EXTEM and FIBTEM parameters was performed during active bleeding to identify specific coagulation abnormalities and guide transfusion decisions. All patients received packed red cell transfusion, while fibrinogen replacement, fresh frozen plasma, platelet concentrates, and tranexamic acid were administered selectively based on viscoelastic findings rather than estimated blood loss alone. Four patients received tranexamic acid due to evidence of impaired clot stability, whereas others with preserved clot firmness were managed without empiric plasma or antifibrinolytic therapy despite significant hemorrhage. One patient with minimal bleeding required platelet transfusion after ROTEM detected qualitative platelet dysfunction. All patients achieved hemodynamic stabilization without major transfusion-related complications or need for reoperation. This case series highlights the clinical value of ROTEM in enabling goal-directed, individualized transfusion strategies in obstetric hemorrhage, emphasizing that viscoelastic-guided management may optimize hemostasis while limiting unnecessary blood product exposure..

**Keywords:** Antifibrinolytic Agents, Hemostasis, Platelet Transfusion, Thromboelastography, Tranexamic Acid

## Introduction

Obstetric hemorrhage remains one of the leading causes of maternal morbidity and mortality worldwide, accounting for a substantial proportion of preventable maternal deaths.<sup>1</sup> Rapid blood loss during obstetric surgery or postpartum hemorrhage may lead to acute coagulopathy, hemodynamic instability, and multiorgan dysfunction if not promptly and appropriately managed. Early recognition of coagulation abnormalities and

timely, targeted transfusion therapy are therefore essential components of modern obstetric critical care.

Massive obstetric hemorrhage is commonly defined as blood loss exceeding 1500 mL, a decrease in hemoglobin greater than 4 g/dL, or the need for transfusion of four or more units of packed red cells (PRC) within a short time frame.<sup>1</sup> Traditionally, massive transfusion protocols (MTPs) employ fixed-ratio strategies, most commonly PRC, fresh frozen plasma (FFP), and platelet concentrates in a 1:1:1 ratio to rapidly restore circulating volume and coagulation factors.<sup>2</sup> Although this approach is widely adopted, it does not account for individual variations in coagulation status and may result in unnecessary transfusion of blood products, increasing the risk of transfusion-related complications such as transfusion-associated circulatory overload (TACO) and transfusion-related acute lung injury (TRALI).

Conventional coagulation tests (CCTs), including prothrombin time (PT) and activated partial thromboplastin time (aPTT), have limited utility in acute obstetric hemorrhage due to delayed turnaround times and their inability to reflect the dynamic process of clot formation and fibrinolysis.<sup>3</sup> In contrast, viscoelastic testing using Rotational thromboelastometry (ROTEM) provides a real-time, global assessment of hemostasis, allowing clinicians to identify specific coagulation deficits and guide targeted transfusion therapy at the bedside. Key parameters such as EXTEM and FIBTEM amplitudes enable differentiation between fibrinogen deficiency, platelet dysfunction, and impaired clot kinetics, thereby facilitating individualized, goal-directed transfusion strategies.<sup>4</sup> Increasing evidence supports the use of ROTEM-guided

algorithms in obstetric hemorrhage to reduce unnecessary plasma and platelet transfusion while maintaining effective hemostasis.<sup>5</sup> This approach is particularly relevant in obstetric patients, where early hypofibrinogenemia and qualitative platelet dysfunction may occur even before classical thresholds for massive transfusion are met.<sup>6</sup>

This case series aims to describe the clinical characteristics, ROTEM findings, transfusion strategies, and outcomes of seven obstetric patients with major perioperative hemorrhage managed using ROTEM-guided transfusion. By presenting a series of cases with varying degrees of blood loss and distinct coagulation profiles, this report highlights the practical role of ROTEM in tailoring transfusion therapy and optimizing hemostatic management in complex obstetric hemorrhage.

### Case Presentation

This case series included seven obstetric patients who experienced major perioperative hemorrhage and were managed using ROTEM-guided transfusion strategies. All cases were treated at a tertiary referral hospital, and clinical data were collected retrospectively from medical records following patient consent. The indications for surgery and transfusion, estimated blood loss, ROTEM parameters, transfusion components, and clinical outcomes were analyzed descriptively.

### Patient Characteristics and Surgical Context

The patients comprised six multiparous women with high-risk obstetric conditions, primarily placenta accreta spectrum disorders and placenta previa, who underwent cesarean delivery followed by

hysterectomy. One patient was diagnosed with idiopathic thrombocytopenic purpura (ITP) and underwent cesarean delivery without hysterectomy. General anesthesia with orotracheal intubation was used in four cases, while three patients received regional anesthesia via subarachnoid block. Estimated blood loss (EBL) ranged widely from 200 mL to 4500 mL, reflecting the heterogeneity of clinical severity within the series.

### ROTEM Findings and Transfusion Strategy

ROTEM analysis was performed intraoperatively or immediately following the onset of significant bleeding. The primary parameters assessed were EXTEM clotting time (CT) and amplitude at 5 minutes (A5), as well as FIBTEM A5, to evaluate clot initiation, clot firmness, and fibrinogen contribution.

All patients received packed red cell (PRC) transfusion, with requirements ranging from 1 to 4 units (approximately 254–759 mL). Transfusion decisions were guided by ROTEM findings rather than estimated blood loss alone. Patients with preserved clot firmness (FIBTEM A5  $\geq 12$  mm and EXTEM A5  $\geq 35$  mm) were managed with

PRC transfusion alone, without empiric administration of plasma or antifibrinolytic therapy, despite blood loss exceeding 1500–2000 mL in some cases.

In contrast, patients demonstrating hypofibrinogenemia on ROTEM (FIBTEM A5  $< 12$  mm) received fibrinogen replacement in the form of cryoprecipitate. Two patients with severe reductions in clot amplitude (FIBTEM A5  $\leq 9$  mm) received 5 units of cryoprecipitate in addition to PRC transfusion. Fresh frozen plasma (FFP) was administered selectively in cases with prolonged EXTEM CT or ongoing bleeding despite initial correction.

### Use of Antifibrinolytic Therapy

Tranexamic acid (TXA) was administered to four of the seven patients based on ROTEM evidence of impaired clot stability and clinical assessment of bleeding severity. TXA use was not routine and was avoided in patients with preserved viscoelastic parameters, even when estimated blood loss exceeded traditional thresholds for massive transfusion. This selective approach underscored the role of ROTEM in preventing unnecessary antifibrinolytic exposure.

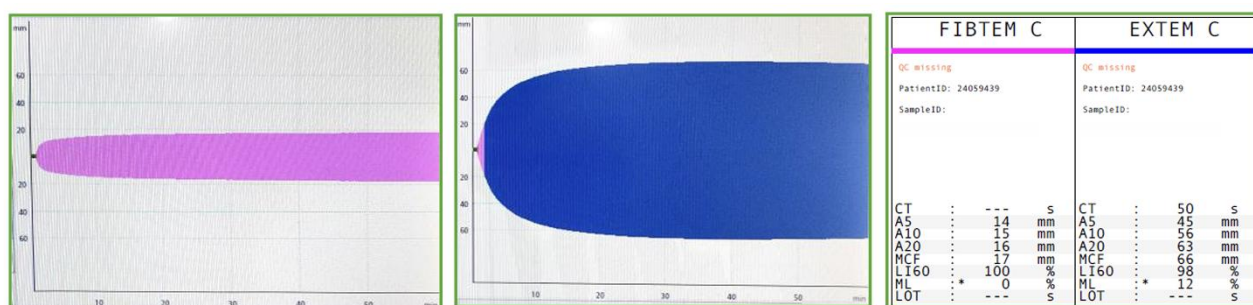
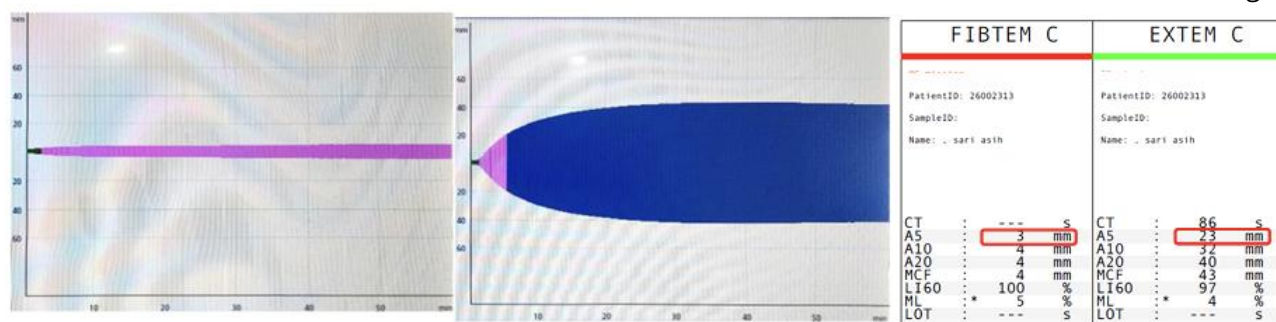
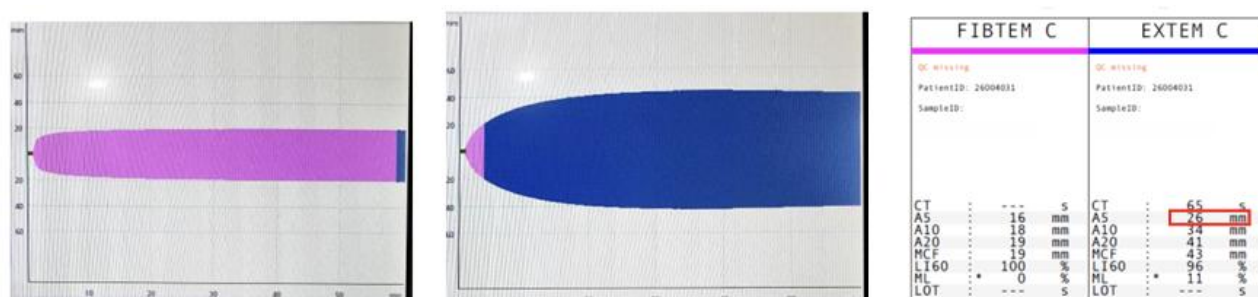


Figure 1. Normal ROTEM



**Figure 2.** Postoperative FIBTEM C rotational thromboelastometry showing reduced clot amplitude, indicating impaired fibrin-based clot formation



**Figure 3.** Postoperative EXTEM C rotational thromboelastometry demonstrating abnormal clotting kinetics with altered clot amplitude.

### Representative Clinical Scenario

One patient with placenta accreta experienced massive hemorrhage with an estimated blood loss of 4500 mL. ROTEM demonstrated marked hypofibrinogenemia (FIBTEM A5 9 mm) and reduced clot firmness (EXTEM A5 41 mm). Management included transfusion of 3 units of PRC, 5 units of FFP, 5 units of cryoprecipitate, and TXA, resulting in hemodynamic stabilization and cessation of bleeding.

Conversely, another patient with an estimated blood loss of 2000 mL showed preserved coagulation profiles (FIBTEM A5 14 mm; EXTEM A5 45 mm) and was successfully managed with PRC transfusion alone, without plasma, cryoprecipitate, or TXA.

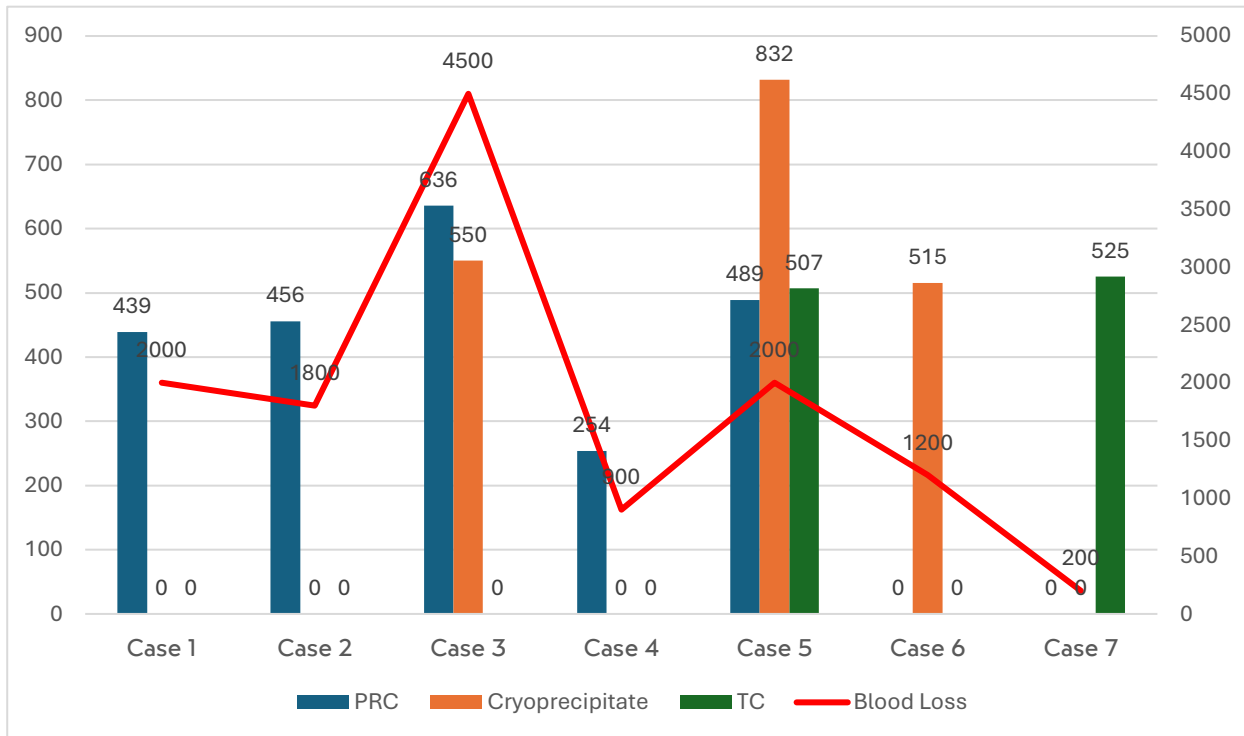
The patient with idiopathic thrombocytopenic purpura exhibited

minimal blood loss (200 mL); however, OTEM revealed reduced clot amplitude suggestive of qualitative platelet dysfunction. Based on these findings, platelet concentrate transfusion was administered despite the low volume of bleeding, highlighting the sensitivity of ROTEM in detecting clinically relevant coagulopathy not apparent from blood loss estimation alone.

### Outcome

All patients achieved hemodynamic stability following ROTEM-guided transfusion. No major transfusion-related complications, including transfusion-associated circulatory overload or transfusion reactions, were observed. None of the patients required reoperation for bleeding, and all survived to hospital discharge.





**Figure 4.** Total Blood Loss and Transfusion Given

## Discussion

This case series demonstrates the practical value of rotational thromboelastometry (ROTEM) in guiding transfusion management during major obstetric hemorrhage. Across seven heterogeneous cases with estimated blood loss ranging from 200 to 4500 mL, ROTEM enabled individualized correction of coagulation abnormalities, rather than reliance on fixed-ratio massive transfusion protocols. The findings highlight how viscoelastic testing can refine transfusion decisions even when classical thresholds for massive transfusion are approached or exceeded.

Obstetric hemorrhage is frequently complicated by early hypofibrinogenemia, which has been identified as an independent predictor of severe postpartum hemorrhage and adverse maternal outcomes.<sup>1</sup> In this series, reduced FIBTEM A5 values (<12 mm) consistently guided fibrinogen supplementation using cryoprecipitate. This targeted approach aligns with current evidence suggesting that early fibrinogen replacement improves

hemostasis and may reduce overall transfusion requirements.<sup>4</sup> Importantly, not all patients with large-volume blood loss exhibited fibrinogen deficiency, underscoring the limitation of estimated blood loss as a sole trigger for empiric plasma or cryoprecipitate administration.

Traditional massive transfusion protocols are designed to rapidly correct coagulopathy using fixed ratios of PRC, plasma, and platelets. While effective in trauma settings, such protocols may result in over-transfusion in obstetric patients, particularly when coagulation deficits are selective rather than global.<sup>2,5</sup> In the present case series, ROTEM-guided management limited the use of fresh frozen plasma and platelet concentrates to cases with demonstrable abnormalities in EXTEM clotting time or clot amplitude. This selective strategy may reduce the risk of transfusion-related complications such as TACO and TRALI, which are of particular concern in peripartum patients.<sup>6</sup>

The role of antifibrinolytic therapy in obstetric hemorrhage has been well established, particularly following the results of large trials supporting early TXA administration. However, indiscriminate use of TXA may expose patients to unnecessary thrombotic risk. In this series, TXA was administered to four patients based on ROTEM evidence of impaired clot stability and clinical bleeding severity. Patients with preserved viscoelastic parameters did not receive TXA, even in the presence of significant blood loss. This approach supports the concept that viscoelastic testing may help refine antifibrinolytic therapy, complementing clinical judgment rather than replacing it.<sup>4</sup>

An important observation from this case series is the ability of ROTEM to identify clinically relevant coagulopathy independent of bleeding volume. The patient with idiopathic thrombocytopenic purpura experienced minimal blood loss but demonstrated reduced clot amplitude on EXTEM, prompting platelet transfusion. This finding illustrates the advantage of viscoelastic assays in detecting qualitative platelet dysfunction that may not be apparent from standard laboratory values or clinical estimation alone.<sup>3</sup>

Several studies have reported favorable outcomes associated with viscoelastic-guided transfusion in obstetric hemorrhage. One study demonstrated reduced plasma transfusion and improved hemostatic control using a ROTEM-guided algorithm in postpartum hemorrhage, while a recent meta-analysis found that viscoelastic-guided strategies were associated with lower transfusion requirements and reduced rates of emergency hysterectomy.<sup>4,7</sup> Although the present case series is descriptive and not

designed to establish causality, the observed hemodynamic stabilization and absence of major transfusion-related complications are consistent with these reports.

This study has several limitations. The small sample size and retrospective design limit generalizability and preclude statistical comparison with conventional transfusion strategies. The heterogeneity of underlying obstetric conditions and surgical interventions may also influence transfusion requirements and outcomes. Additionally, the availability of ROTEM and institutional expertise may limit the applicability of this approach in resource-limited settings. Nevertheless, the strength of this case series lies in its detailed clinical characterization and real-world demonstration of ROTEM-guided transfusion across a spectrum of obstetric hemorrhage severity.

In conclusion, this case series supports the role of ROTEM as a valuable adjunct in the management of major obstetric hemorrhage. By enabling real-time identification of specific coagulation deficits, ROTEM facilitates goal-directed transfusion, minimizes empiric blood product use, and may enhance patient safety. Larger prospective studies are warranted to further define standardized ROTEM-guided algorithms and to clarify their impact on maternal outcomes in obstetric hemorrhage.

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None.

### Declaration of Patient Consent

The authors confirm that all necessary patient consent forms have been obtained. In these forms, the patient(s) provided

informed consent for the publication of their images and relevant clinical information in the journal. The patients have been informed that while their names and initials will not be published and reasonable efforts will be made to protect their identity, complete anonymity cannot be guaranteed.

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None reported.

### Conflict of Interest

The author(s) report no conflict of interest.

### Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

### Author's Contributions

Conceptualization: DD, TA, and MCR. Data curation: DD. Investigation: DD, TA and MCR. Writing – original draft: DD. Writing – review & editing: TA, MCR. Supervision: IKW, MCR. All authors have read and approved the final version of the manuscript.

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