

Simulation Patient Design (February, 2023) Case of DIC Secondary to Placental Abruption

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Introduction:

Obstetric hemorrhage and resultant DIC (Disseminated Intravascular Coagulation) is one of the leading causes of maternal mortality worldwide.¹ DIC does not occur in isolation, but is a secondary condition arising from a maternal and/or fetal condition. The rate of DIC ranges from 0.03% to 0.35%.¹⁻² The National Inpatient Sample data revealed an increase in DIC in the United States. In 2010-2011, DIC was associated with approximately one fourth of maternal deaths but was rarely the sole cause of mortality.³ Multiple obstetric complications, conditions, or disorders can precipitate DIC. It has been associated with acute peripartum hemorrhage, placental abruption, preeclampsia/eclampsia, acute fatty liver of pregnancy, HELLP, retained stillbirth, amniotic fluid embolism, and sepsis.^{2,3}

DIC is initiated by the release of tissue factor (TF) by a number of pathological conditions. TF is found in high concentrations within amniotic fluid and trophoblastic tissue. In DIC, instead of there being local activation of TF by damaged endothelium, there is a generalized systemic activation. This initiates a pathologic cycle of coagulation and fibrinolysis, resulting in a consumptive coagulopathy manifested by a depletion of coagulation factors and platelets. DIC originates in the vascular endothelium leading to endothelial dysfunction and possible organ damage.^{3,4}

Diagnosing DIC is crucial for early treatment. Diagnosis is most often made based on clinical assessment and laboratory values. Physiologic changes in maternal coagulation factors, underestimation of blood loss, and delayed laboratory testing are some factors that lead to delayed diagnosis of DIC. DIC is a dynamic situation which requires continuous assessment of laboratory values while considering the clinical situation. Diagnosis is made by recognizing the underlying condition, down trending fibrinogen and platelet count, and prolongation of prothrombin time. Although multiple scoring systems exist for DIC, none have proved to be more efficacious than assessment of clinical and pertinent laboratory parameters.³

Clinical management involves the prompt identification and treatment of the underlying condition or cause. The majority of DIC cases in pregnancy are associated with massive obstetric hemorrhage. Treatment involves providing supportive care of the consumptive coagulopathy and replacement of blood components according to recommended transfusion protocols. Patients require continued clinical and laboratory surveillance, and likely admission to an intensive care unit.^{3,5}

Educational Rationale: To teach team skills in early recognition and management of DIC

Target Audiences: Nursing, OB, Anesthesiology, OR personnel

Learning Objectives: As per Accreditation Council for Graduate Medical Education (ACGME) Core Competencies

Upon completion of this simulation (including the debrief) learners will be able to:

- *Medical knowledge*: Identification of patients at high risk for peripartum bleeding. Early recognition and treatment of obstetric complications. Continuous assessment of clinical and laboratory parameter with recognition of DIC. Recognition and treatment of the underlying cause of the DIC. Blood product replacement according to protocols.
- *Patient care*: Discuss acute management of patients with DIC.
- *Practice-based learning and improvement*: Identify the setting, equipment, and protocols necessary to manage a patient with underlying maternal complication, DIC, and its sequelae.
- *Interpersonal and communication skills*: Designate a team leader who will manage the team through the crisis and maintain communication amongst the various team members to optimize patient care.
- *Professionalism*: Demonstrate mutual respect for the experience, expertise, and opinions of all team members.
- *Systems-based practice*: Ensure all resuscitation equipment, medications, and protocols are readily identifiable on the labor and delivery unit including rescue airway devices, massive transfusion equipment, vascular access devices, laboratory parameter monitoring.

Questions to ask after the scenario:

- What were the signs or symptoms of potential DIC in this patient?
- What are the risk factors for a parturient developing DIC?
- How was the management for DIC?
- Was a team leader identified?
- Did each team member feel that they had a defined role and were effectively able to communicate to the team leader?
- Were there any barriers identified in diagnosing and stabilizing the unstable patient?

Assessment Instruments:

1. Learner Knowledge Assessment form (Appendix 1)
2. Simulation Activity Evaluation form (Appendix 2)

Equipment Needed and Set-up:

In-situ set-up

L&D suite:

Gravid Mannequin in the labor and delivery room

Standard monitors: BP cuff, pulse oximeter, ECG available

Fetal heart rate monitor

18 gauge IV in place and IV fluids

L&D OR:

Standard ASA monitors

Anesthesia Machine

Airway equipment, i.e., non-rebreather, video laryngoscope, ETTs, suction

Crash Cart with resuscitation and intubation medications
 Rapid transfuser/fluid warmer
 Central/arterial vascular access
 Massive Transfusion Protocol blood products
 Laboratory surveillance

Simulation Scenario Set-up:

The case

Patient is a 36 year old G2P1001 at 37 weeks who presented for induction of labor due to preeclampsia without severe features. She has a history of 1 prior vaginal delivery 7 years ago. Her past medical history is otherwise significant for a BMI of 35. Initially laboratory values show elevated LFTs (ALT 67 U/L and AST 88 U/L). Pt received a labor epidural at 4 cm dilated. She is comfortable with a T10 sensory level bilaterally, but her labor is complicated by intermittent late FHR decelerations. The Obstetric team makes the decision for artificial rupture of the amniotic membrane. During AROM, 300 cc of blood is noted with subsequent fetal bradycardia to the 80's.

Simulation Pre-brief

- Read the scenario and instruct team members on their role during the simulation.
- The learners take their places inside of the Labor and Delivery suite.
- Other team members include a circulating RN.
- Patient's partner is in the room as plays confederate role.

Scenario Details

Trigger	Patient Condition	Action	Done	Time	Comments
Pt laboring in the L&D suite and is comfortable with a labor epidural (T10 sensory level bilaterally). Ob Resident notes 300 cc of frank blood with AROM.	HR 118 bpm BP 128/85 mm Hg SpO ₂ 95% (air) Resp 26/min Temp 36.9°C FHR 80s for 3 minutes (baseline 140)	1. L&D nurse calls for additional help. <ul style="list-style-type: none"> • Anesthesia is alerted about the blood loss and fetal heart rate deceleration to the 80s. • OB attending is alerted. • OR team is informed about a possible emergent cesarean section. 			
Fetal Heart Rate in the 70s for 4 minutes.	Patient appears visually agitated.	1. OB team decides to proceed with emergent cesarean section for sustained FHR in the 70s and suspected placental abruption. <ul style="list-style-type: none"> • Inform OR team that an emergent cesarean section has been called. • Cord prolapse is ruled out • Anesthesia team discuss plan for surgical anesthesia 			

<p>Patient in OR. She is altered and minimally responsive.</p>	<p>HR 134 BP 88/52 SpO2 92%</p> <p>FHR 72</p>	<ol style="list-style-type: none"> 1. Emergently intubate due to fetal bradycardia, hypotension, altered mental status, inability to protect airway, and urgency of the case. Consider the use of induction agents with more preferable hemodynamic profile than propofol e.g. ketamine or etomidate. Inhalational agent and nitrous oxide started for maintenance of anesthesia. 2. Prepare oxytocin and give antibiotics if not already given. 3. Tell Ob surgeon to proceed after airway is secured. 4. Establish additional large bore IV access +/- central line, and place arterial line. 5. Vasopressors in line and started: phenylephrine or norepinephrine given hypotension. 6. Send labs: CBC, Coagulation profile, Fibrinogen, BMP, TEG/ROTEM, ABG 			
<p>During hysterotomy, placental abruption is noted. Neonate delivered with Apgars of 1/6/8.</p>	<p>Intubated</p> <p>HR 134 BP 85/53 SpO2 97%</p>	<ol style="list-style-type: none"> 1. Decrease inhalational agent to half MAC, supplement with nitrous oxide or propofol. 2. Start oxytocin dosing per protocol. 3. Discuss other potential uterotonics given preeclampsia history. 			

<p>Good uterine tone.</p> <p>OBs reporting continued bleeding despite adequate uterine tone.</p>	<p>HR 138 BP 79/56 SpO₂ 96%</p> <p>Labs significant for Hgb 7.0 g/dL Fibrinogen 74 Platelets 78 x10⁹/L INR 1.5</p> <p>TEG/ROTEM with prolonged clotting time, low clot amplitude with low fibrinogen clot contribution, and increased clot lysis.</p> <p>Blood oozing around the IV site.</p>	<ol style="list-style-type: none"> 1. Recognize DIC. 2. Utilize rapid transfuser. 3. Activate Massive Transfusion Protocol, which allows for rapid delivery of blood products. Treat unstable vitals with vasopressors, and IVF while awaiting blood products. 4. Order cryoprecipitate. 5. Institute MTP with 1:1:1 ratio of Plasma to PRBCs to Platelets. 6. Regular surveillance of laboratory parameters to assist with blood replacement, including TEG/ROTEM and ABG. 7. Administer Calcium replacement. 8. Consider TXA. 9. Consider synthetic fibrinogen (e.g. RiaSTAP). 10. Maintain normothermia with forced warming device. 			
<p>Bleeding has slowed per Obstetricians following 4 units of PRBCs, 4 units of FFP, 1 pooled unit of platelets and 1 unit of cryoprecipitate.</p> <p>QBL 3600 mL</p> <p>Surgery almost completed.</p>	<p>Patient with improving hemodynamics</p> <p>HR 108 bpm BP 89/51 mm Hg SpO₂ 94% (intubated) Temp 36.9°C</p> <p>Repeat labs: Hb 8.1 g/dL Plt 94 x10⁹/L INR 1.3 Fib 158 mg/dL</p>	<ol style="list-style-type: none"> 1. Continue hemodynamic support and transfuse as needed in setting of continued slow bleeding. 2. Contact the ICU for admission. 3. Plan to take patient to the ICU, intubated and sedated. 4. Update family. 5. Discuss consulting IR for potential uterine artery embolization in case of continued medical bleeding. 6. Discuss not to remove epidural until coagulopathy resolved. 			
<p>Per Obstetricians, very slow oozing is still noted. They do not think it is surgical bleeding, but rather some continued “medical bleeding” from DIC.</p> <p>Surgery completed.</p>	<p>HR 108 bpm BP 89/51 mm Hg SpO₂ 94% (intubated) Temp 36.9°C</p>	<ol style="list-style-type: none"> 1. Transfer to ICU signing out that she will need to be closely monitored for further bleeding, serial CBCs and coagulation studies until stable. 2. Discuss lab/hemodynamic parameters for when IR procedure vs. additional surgical procedure would be indicated 			

Learner Knowledge Assessment
Labor and Delivery Multidisciplinary Team Simulation

Date: _____

Each item has two components. The “Before the simulation” column (left side) examines your perspective at the beginning of the simulation. The “End of Simulation” column (right side) is to evaluate your perspective at the completion of the simulation.

BEFORE THE SIMULATION							END OF SIMULATION						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
Little/none				Knowledgeable			Little/none				Knowledgeable		

BEFORE THE SIMULATION							END OF SIMULATION						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
Little/none			Knowledgeable				Little/none			Knowledgeable			

BEFORE THE SIMULATION							END OF SIMULATION							
1	2	3	4	5	6	7	1	2	3	4	5	6	7	
Little/none					Knowledgeable		Little/none					Knowledgeable		

BEFORE THE SIMULATION							END OF SIMULATION						
1	2	3	4	5	6	7	1	2	3	4	5	6	7
Little/none			Knowledgeable				Little/none			Knowledgeable			

BEFORE THE SIMULATION							END OF SIMULATION							
1	2	3	4	5	6	7	1	2	3	4	5	6	7	
Little/none					Knowledgeable		Little/none					Knowledgeable		

Appendix 2

Simulation Activity Evaluation

DATE OF SIMULATION: _____

OCCUPATION: Consultant PG Yr 1 2 3 4 STUDENT NURSE MIDWIFE
OTHER

SPECIALTY: _____ YEARS IN PRACTICE: _____

Please rate the following aspects of this training program using the scale listed below:

1 = Poor 2 = Suboptimal 3 = Adequate 4 = Good 5 = Excellent

Use "N/A" if you did not experience or otherwise cannot rate an item

INTRODUCTORY MATERIALS

Orientation to the simulator	1	2	3	4	5	N/A
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PHYSICAL SPACE

Realism of the simulator space	1	2	3	4	5	N/A
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EQUIPMENT

Satisfaction with the mannequin	1	2	3	4	5	N/A
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SCENARIOS

Realism of the scenarios	1	2	3	4	5	N/A
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Ability of the scenarios to test technical skills	1	2	3	4	5	N/A
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Ability of the scenarios to test behavioral skills	1	2	3	4	5	N/A
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Overall quality of the debriefings	1	2	3	4	5	N/A
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DID YOU FIND THIS USEFUL?

To improve your clinical practice?	1	2	3	4	5	N/A
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To improve your teamwork skills?	1	2	3	4	5	N/A
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To improve your VERBAL communication?	1	2	3	4	5	N/A
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To improve your NONVERBAL communication?	1	2	3	4	5	N/A
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FACULTY

Quality of instructors	1	2	3	4	5	N/A
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Simulation as a teaching method	1	2	3	4	5	N/A
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References:

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