SOAP Society for Obstetric Anesthesia and Perinatology

Simulation Patient Design (September 2023)

Disseminated Intravascular Coagulation (DIC) in Intrauterine Fetal Demise (IUFD)

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Introduction:

Disseminated Intravascular Coagulation (DIC) is a complex hematological disorder characterized by the simultaneous activation of clotting and fibrinolytic systems within the body. This intricate interplay results in the widespread formation of microthrombi, depletion of clotting factors, an increased risk of bleeding and end-organ injury due to ischemia. DIC can arise as a secondary complication in response to various underlying triggers, one of which is the unfortunate event of Intrauterine Fetal Demise (IUFD). [1]

IUFD, the loss of a fetus within the uterus after 20 weeks of gestation, presents multifaceted challenges to both patients and healthcare providers. The release of fetal tissue factors and placental debris into the maternal circulation sets in motion a cascade of events that disrupt the delicate balance between coagulation and anticoagulation and can potentially culminate in DIC. [1,2,3,4] The manifestation of DIC in the wake of IUFD can lead to a host of clinical complications. Consumption of clotting factors and platelets, along with microthrombi formation, results in a hypercoagulable state along with compromising the body's hemostasis maintenance. Simultaneously, the activation of the fibrinolytic system exacerbates the disruption by degrading clotting factors and further elevating the risk of bleeding.[3,4]

The multifactorial nature of DIC after IUFD underscores the need for a comprehensive understanding of its underlying mechanisms and management. Coagulopathy associated with DIC requires the prompt initiation of targeted interventions. Anesthesiologists are integral to the management of DIC during labor and delivery and operative interventions. An anesthesiologist's role is vital in cases like DIC by providing neuraxial anesthesia for labor and delivery, managing patient hemodynamics, laboratory surveillance and resuscitation in collaboration with the Obstetricians and other consultants.[5]

This simulation scenario aims to replicate the complexities and challenges of managing DIC after IUFD, enabling participants to refine their knowledge and skills. Using protocols and current literature, this exercise prepares anesthesiologists and staff to manage this complex obstetric complication effectively.

Educational Rationale: To teach team skills in management of an obstetric patient who presents with DIC in the setting of IUFD.
Target Audiences: OB, Anesthesiology, Nursing
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*: Recognize the need and initiate emergency management of an obstetric patient who necessitates management of postpartum hemorrhage and DIC.
- *Patient care*: Describe how physiologic changes of pregnancy affect coagulation status in the parturient. Recognition of risk factors that may lead to DIC.
- *Practice-based learning and improvement*: Discuss the approach to a bleeding parturient. Discuss

anesthesia drug effects during postpartum hemorrhage. Accurate recognition, work up and management of DIC.

- *Interpersonal and communication skills*: Effectively communicate with L&D teams. Effectively communicate anesthesia management with the patient during an emergency situation during the conversion from neuraxial to general anesthesia. Effectively communicate with obstetrician regarding management of hemorrhage and DIC. Utilize closed loop communication among all participants.
- *Professionalism*: Demonstrate mutual respect for the expertise of other team members.
- *Systems-based practice*: Ensure all resuscitation equipment including suction are set up in the L&D OR; ventilator is checked; drugs are available; identify the location of the airway equipment and back-up airway equipment (e.g. video laryngoscope and fiberoptic scope). Identify the location of the crash cart.

Questions to ask after the scenario:

1. What is the pathophysiology of DIC in the setting of IUFD?
2. How often does DIC occur as an aftermath of IUFD?
3. Did each team member have well-defined roles? Was the approach collaborative?
4. What are the risk factors for DIC in this scenario?
5. Was all the necessary equipment available to advance care to general anesthesia?
6. How would you improve your management in this scenario?
7. Was the communication with patient and family appropriate? How would you improve disclosure of complications with the family?

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

Mannequin
Monitors: EKG, BP, Pulse oximetry
18 g IV connected to a bag of Crystalloid
Anesthesia machine (simulated) with circuit attached
Suction with Yankeur (not turned on)
Airway equipment
Anesthetic drugs, vasoactive drugs, uterotonic drugs
Rapid Infusion system

Simulation Scenario:

Ms. Dedra Isla Cole is 38 years old G2P1001 at 38 weeks gestation who presents to the emergency room with decreased fetal movement and abdominal pain. Her medical history is significant for chronic hypertension with superimposed preeclampsia with severe features and intermittent tobacco abuse throughout the pregnancy. Her first delivery was an uncomplicated term spontaneous vaginal delivery. She now reports no fetal movement for 2 days. Upon evaluation, she was unfortunately found to have intrauterine fetal demise. Her cervix was 3 cm dilated on admission and induction was begun with oxytocin per protocol. She had an epidural placed uneventfully for labor analgesia with a T10 sensory level bilaterally.

She is now fully dilated and started to push with her nurse about ten minutes ago. She was just now moved back to the Labor and Delivery operating room as her nurse felt her delivery was imminent and there was concern due to some vaginal bleeding while pushing.

NKDA
Weight: 80 kg, Height: 5'4"
Vital signs: BP: 98/65 mmHg, HR: 105/min, O2 Sat: 98%, RR 22/min
Type and Screen done. Hct 27%; Platelets 200k

Simulation Pre-brief

- Read the scenario and instruct team members on their roles during the simulation
- The learners take their places inside and outside of the operating room
- One nurse, one OB, and one anesthesiologist in the OR initially when patient begins pushing
- Confederate plays the role of the patient's voice. An additional confederate can play the role of the patient's partner.

Scenario Details

Trigger	Patient Condition	Action	Done	Time	Comments
Patient with IUFD entered L&D OR. Pt is fully dilated and pushing with some vaginal bleeding. Patient has epidural in place with continuous infusion running.	Patient awake and responsive T11 bilateral level on epidural	1. OB performs patient examination and begins to push with patient o Anesthesia team assesses patient's epidural and level o Anesthesia team places patient on monitors: EKG, pulse ox, and NIBP. o Anesthesia team has oxytocin available and access to other uterotonic agents			
Vaginal delivery of Fetal contents and placenta. Postpartum bleeding begins.	HR 110 bpm BP 95/60 mm Hg SpO_2 99% (air) Resp 24/min Temp 36.5ºC Patient comfortable with her epidural but complaining of "feeling light-headed"	1. Discussion on the differential for cause and management of postpartum bleeding. o Operative vs. Medical 2. Discuss resuscitation goals of hemorrhage. 3. Establish additional PIV access. 4. Oxytocin infusion begun and increased for postpartum bleeding o Discuss options for additional uterotonic medications if needed (carboprost or misoprostol) and contraindication of methergine. 5. Examination or ultrasound for retained uterine products- no retained products seen.			

Preliminary management of postpartum hemorrhage fails. Patient continues to bleed with a QBL of 1500ml.	Supine, awake, and oriented. Feeling nauseous. HR 120 bpm BP 94/59 mmHg SpO_2 97% (air) Resp 25/min Temp 36.5ºC	1. Discussion on further evaluation of continued bleeding. Discuss differentials based on risk factors (Uterine atony, HELLP Syndrome, DIC, other bleeding disorders). 2. Initiate resuscitation; Order blood products, consider initiation of massive transfusion protocol. 3. Send relevant labs including CBC, Fibrinogen, PT/INR, PTT, D-Dimer, TEG/ROTEM. 4. Start vasopressor infusion in conjunction with resuscitation. 5. Obstetrician calls device for conservative management such as Bakri balloon or Jada system			
Pt reports worsening light headedness, heart racing and nausea. QBL=1800 ml	Patient scared: "I feel bad, lightheaded and nauseous" Pt appears pale and dry heaving. HR 132 BP 83/40 SpO2 91% (room air) Resp 26/min Temp 36.0ºC	1. Anesthesia check of patient's sensory level- notes appropriate level. 2. Re-evaluate and establish adequate IV access. 3. Consider general anesthesia due to continued bleeding and decreasing oxygen saturation. Prepare and perform emergency general anesthetic with RSI. 4. Consider arterial line placement to send ABG and for hemodynamic monitoring. 5. Begin 2 units of PRBC's based on QBL.			
Patient under general anesthesia. Slow bleeding around the newly inserted IV noted. Balloon tamponade performed by OB by Bakri balloon placement	After induction: HR 148 bpm BP 70/42 mm Hg SpO_2 98% (intubated) Temp 36.0ºC Bp increases to 90/64 mmHg and HR decreases to 130 bpm as vasopressors and fluid are given and Bakri balloon is in.	1. Continue resuscitation efforts with transfusions and vasopressors as needed. Check additional units of blood. Call for other blood products: FFP, platelets, and cryoprecipitate. 2. Address anesthetic goals that are consistent with continued bleeding. 3. Follow up lab work. 4. Discuss the etiology of further bleeding and surgical interventions if the bleeding again increases including arterial ligation and/or uterine artery embolization.			
Lab tests are resulted. Obstetrician reports improving uterine tone though pt	ABG: pH 7.38, PaO2 300 mmHg, CO2 35 mmHg, Hgb 6.9 g/dl Hct 19%, Ca++ 4.12 mg/dL; Lac 1.8mmol/L	1. Discuss the significance of lab results. Start transfusion of FFP, platelet, and cryoprecipitate. 2. Discuss the most likely diagnosis of DIC. Discuss goals of care. a. Addressing the underlying problem with the			

continues to slowly ooze blood.	Plt 63k Fibrinogen 30mg/dL PT elevated High D-Dimer FIBTEM CT: 206 s, A10: 7mm EXTEM CT: 102 s	obstetricians. b. Supportive care. 3. Discuss transfusion goals. a. Hgb > 8-10 g/dl b. Plt >75k c. Fibrinogen >100 mg/dL 4. Discuss special medications in treatment of DIC a. rFVIIa b. Heparin/Antithrombin III/Activated protein C. c. Tranexamic Acid			
Obstetrician again confirms placement of balloon tamponade device. Blood loss controlled.	HR 102 bpm. BP 109/72 mm Hg SpO_2 98% (intubated). Temp 36.0º C	1. Discuss postoperative disposition, goals, and further management. 2. Send repeat labs. 3. Transfer to the ICU for continued supportive care. 4. Update family			

Appendix 1

Learner Knowledge Assessment
Labor and Delivery Multidisciplinary Team Simulation

Name of simulation: _____ Date: _____

OB Nursing Anes

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.

1. How would you rate your knowledge of DIC and postpartum hemorrhage?

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

2. How would you rate your knowledge of your institutional protocol for postpartum hemorrhage?

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

3. How would you rate your knowledge of potential factors that would contribute to postpartum hemorrhage and DIC?

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

4. How would you rate your knowledge of assessing if neuraxial analgesia is adequate for labor analgesia/surgical anesthesia?

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

5. How would you rate your overall confidence on the correct steps to take when confronted with a parturient needing massive transfusion?

BEFORE THE SIMULATION	END OF SIMULATION
1 2 3 4 5 6 7 Little/none Knowledgeable	1 2 3 4 5 6 7 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
PHYSICAL SPACE						
Realism of the simulator space	1	2	3	4	5	N/A
EQUIPMENT						
Satisfaction with the mannequin	1	2	3	4	5	N/A
SCENARIOS						
Realism of the scenarios	1	2	3	4	5	N/A
Ability of the scenarios to test technical skills	1	2	3	4	5	N/A
Ability of the scenarios to test behavioral skills	1	2	3	4	5	N/A
Overall quality of the debriefings	1	2	3	4	5	N/A
DID YOU FIND THIS USEFUL?						
To improve your clinical practice?	1	2	3	4	5	N/A
To improve your teamwork skills?	1	2	3	4	5	N/A
To improve your VERBAL communication?	1	2	3	4	5	N/A
To improve your NONVERBAL communication?	1	2	3	4	5	N/A
FACULTY						
Quality of instructors	1	2	3	4	5	N/A
Simulation as a teaching method	1	2	3	4	5	N/A

COMMENTS/SUGGESTIONS:

References:

1. **Erez O, Othman M, Rabinovich A, Leron E, Gotsch F, Thachil J. DIC in Pregnancy - Pathophysiology, Clinical Characteristics, Diagnostic Scores, and Treatments. J Blood Med. 2022;13:21-44. Published 2022 Jan 6. doi:10.2147/JBM.S273047**
2. **Muin DA, Haslacher H, Koller V, Kiss H, Scharrer A, Farr A. Impact of fetal maceration grade on risk of maternal disseminated intravascular coagulation after intrauterine fetal death - A retrospective cohort study. Sci Rep. 2018;8(1):12742. Published 2018 Aug 24. doi:10.1038/s41598-018-30687-0**
3. **Erez O, Mastrolia SA, Thachil J. Disseminated intravascular coagulation in pregnancy: insights in pathophysiology, diagnosis and management. Am J Obstet Gynecol. 2015;213(4):452-463. doi:10.1016/j.ajog.2015.03.054**
4. **Kerns JL, Ti A, Aksel S, Lederle L, Sokoloff A, Steinauer J. Disseminated Intravascular Coagulation and Hemorrhage After Dilation and Evacuation Abortion for Fetal Death. Obstet Gynecol. 2019;134(4):708-713. doi:10.1097/AOG.0000000000003460**
5. **Hossain N, Paidas MJ. Disseminated intravascular coagulation. Semin Perinatol. 2013;37(4):257-266. doi:10.1053/j.semperi.2013.04.008**