Queensland
Trauma Education

TRAUMA IN PREGNANCY

Resuscitative hysterotomy

Immersive scenario

Facilitator resource kit

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Queensland Trauma Education

The resources developed for Queensland Trauma Education are designed for use in any Queensland Health facility that cares for patients who have been injured as a result of trauma. Each resource can be modified by the facilitator and scaled to the learners needs as well as the environment in which the education is being delivered, from tertiary to rural and remote facilities.

Developed by
Dr Frances Williamson, Staff Specialist Emergency Physician – Metro North Health

Reviewed by
Kimberly Ballinger, Simulation Educator – Clinical Skills Development Service

Education Working Group, Statewide Trauma Clinical Network – Clinical Excellence Queensland

Queensland Trauma Education
Trauma in Pregnancy – Resuscitative hysterotomy: Immersive scenario – Facilitator resource kit
Version 1.0

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About this training resource kit

This resource kit provides healthcare workers with the ability to recognise the indications and perform a resuscitative hysterotomy in a pregnant patient who has sustained significant trauma.

National Safety and Quality Health Service (NSQHS) Standards

Target audience

- Emergency department medical and nursing clinicians
- Obstetric medical and midwifery clinicians

Duration

45-60 minutes

Group size

4-6 participants (or team composition applicable to local area)

Learning objectives

By the end of this session the participant will be able to:

- Recognize the severely injured pregnant trauma patient
- Perform a detailed clinical assessment to identify life threats following major trauma
- Understand the indications and contraindications for resuscitative hysterotomy
- Understand the technical skill of resuscitative hysterotomy
- Understand the Crisis Resource Management (CRM) principles when managing maternal cardiac arrest.

Facilitation guide

1. Facilitator to provide participant resource kit to the learner.
2. Facilitator to discuss the pre-simulation briefing and deliver the immersive scenario on maternal resuscitative hysterotomy.
3. Utilise the supporting documents to maximise the learning throughout immersive scenario.
4. Utilise the debriefing guide to evaluate and support participant performance and provide feedback.

Overview of resuscitative hysterotomy

Resuscitative hysterotomy (or perimortem caesarean section) as the name suggests, is a resuscitative procedure that is initiated following maternal traumatic cardiac arrest with the primary focus being maternal survival. The aim of the procedure is to empty the uterus which ultimately alleviates both aortocaval and inferior vena cava compression, restoring blood volume and venous return to the woman.

Widespread evidence suggests that if RH is performed between 4-5minutes following maternal collapse there is an increased chance of both maternal and fetal survival. Given the critical timing to initiate RH, the procedure typically occurs in the emergency department following maternal trauma and requires team preparedness and knowledge of the procedural techniques to improve the chances of survival for both the mother and fetus. Considerations also need to be made around crisis resource management principles including requirements within the resuscitation team for both the woman and the fetus.

Further reading

Trauma in Pregnancy Guideline	
Source	Queensland Clinical Guidelines
Link	https://bit.ly/3ApZRNb

Maternal Collapse in Pregnancy and Puerperium Green-top Guideline No.56	
Source	Royal College of Obstetricians & Gynaecologists
Link	https://bit.ly/3FUSCho

Management of pregnancy and obstetric complications in prehospital trauma care: prehospital resuscitative hysterotomy/perimortem caesarean section	
Source	Emergency Medicine Journal
Link	http://dx.doi.org/10.1136/emermed-2016-205979

Circulation - Hysterotomy (resuscitative)	
Publication	Emergency Care Institute, New South Wales
Link	https://bit.ly/3u99jDJ

Perimortem caesarean section	
Source	Emergency Medicine Journal
Link	https://doi.org/10.1136/emermed-2014-204466

Challenging the 4- to 5-minute rule: from perimortem cesarean to resuscitative hysterotomy	
Source	American Journal of Obstetrics & Gynecology
Link	https://doi.org/10.1016/j.ajog.2015.07.019

Supporting resources

- Online video of a real-time simulation scenario of a perimortem caesarean section
- Initial assessment and management of the pregnant trauma patient flowchart
- Specific management poster
- Structured assessment poster
- Resuscitative hysterotomy considerations poster

Online videos

Real-time simulation scenario of a perimortem caesarean section	
Source	Royal College of Obstetricians & Gynaecologists
Link	https://bit.ly/3GVdMNC

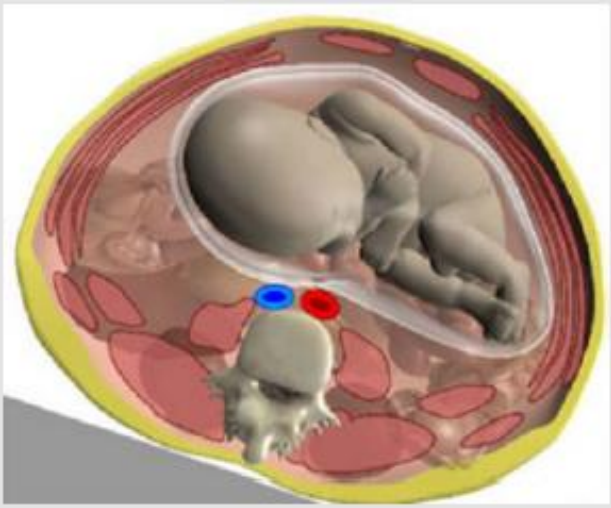
Specific management

Manual displacement

In the supine position the gravid uterus compresses the inferior vena cava and impairs venous return and reduces cardiac output.

Compression is relieved by either:

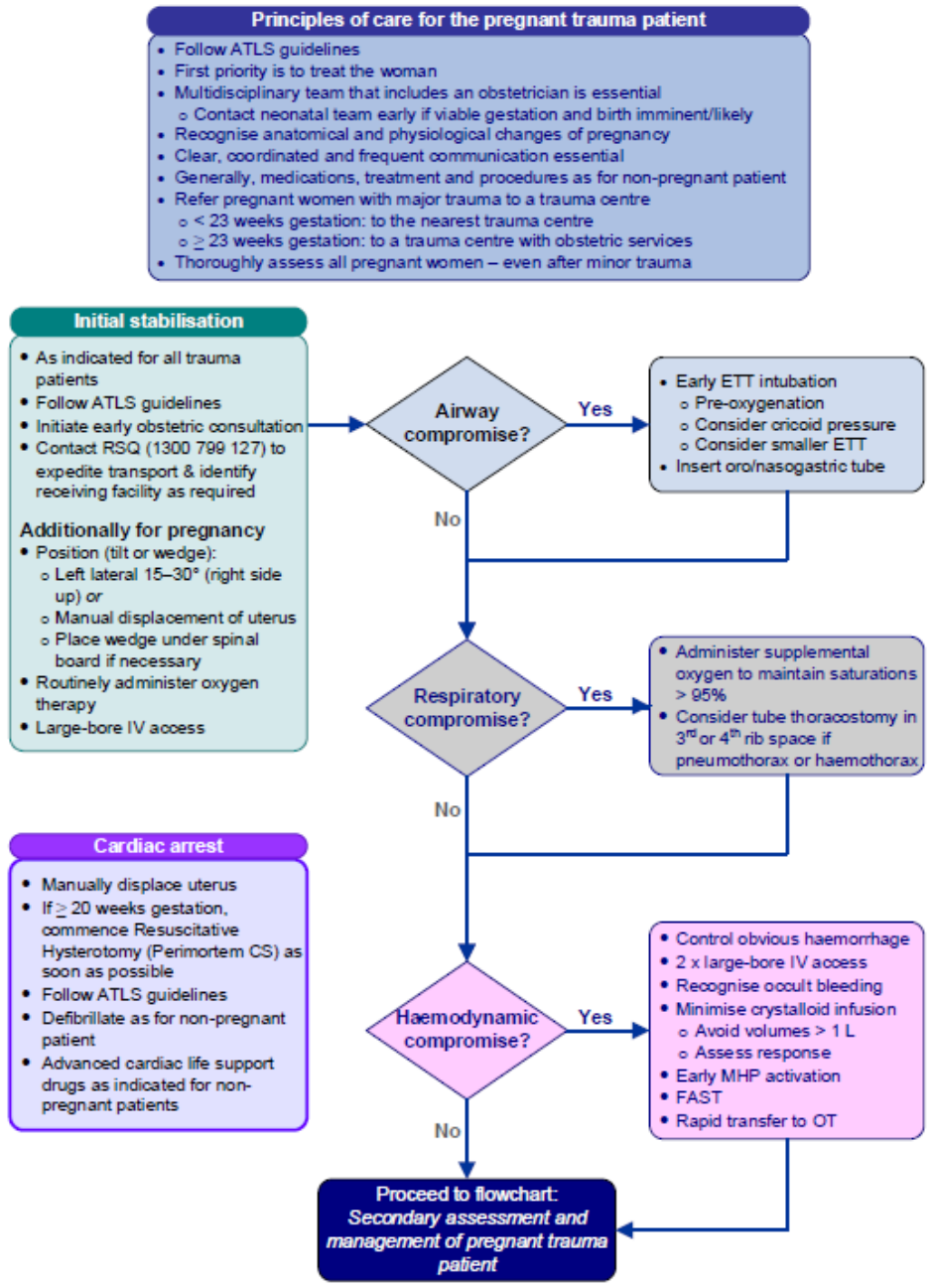
a) left lateral tilt



b) manual uterus displacement — preferred position for cardiac compressions.

Images produced by: Clinical Multimedia Unit
Metro North Hospital and Health Service, Queensland.

Initial assessment and management of the pregnant trauma patient flowchart



ATLS: Advanced Trauma Life Support, **CPR:** Cardiopulmonary Resuscitation, **CS:** Caesarean section, **ETT:** Endotracheal tube, **FAST:** Focused Abdominal Sonography for Trauma, **IV:** Intravenous, **MHP:** Massive Haemorrhage Protocol, **OT:** Operating Theatre, **RSQ:** Retrieval Services Queensland, >: greater than, ≥: greater than or equal to

Flow chart: F19.31-1-V2-R24

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TRAUMA IN PREGNANCY

Placental abruption

Structured assessment

1 Perform a primary survey

https://bit.ly/35lpUtv

Scan to view the Queensland Clinical Guideline ›

2 Perform fetal assessment

Obtain obstetric history. › Obtain estimation of gestational age. › Perform FHR monitoring
- over 23 weeks, initiate CTG
- normal value 110-160 bpm.

3 Perform a secondary survey

https://bit.ly/3tXwz7d

Scan to view the Queensland Clinical Guideline ›

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TRAUMA IN PREGNANCY

Resuscitative hysterotomy considerations

About the procedure

Contraindications

- If it is deemed the mother will not benefit from it
- If the uterus is not large enough to cause aortocaval compression or with a fetus before viability
- If maternal cardiac arrest for >15 minutes

Risks

As with any caesarean section there may be damage to associated structures: to the fetus, maternal bowel or bladder, uterus and uterine blood vessels

Timing

If basic and advanced life support are unsuccessful, perform procedure as early as possible following maternal cardiac arrest.

Threshold for requirement is when the uterus is of a size to cause aortocaval compression. In singleton pregnancy, this is generally 20 weeks, it may be earlier with multiple pregnancies.

If the gestational age is less that 23-24 weeks this procedure will likely lead to sacrifice of the fetus, but if over 24 weeks this procedure is also the best chance of neonatal survival.

If the mother's condition is deemed un-survivable, the procedure may still be performed, with the primary aim of fetal survival.

Technique

1. Perform the procedure at the site where cardiac arrest has occured, with continuation of BLS and ALS resuscitation.
2. Continue manual displacement of the patient's uterus towards the L side to reduce aortovocal compression.
3. Maintain basic asepsis by pouring antiseptic solution over the abdomen. Have assistant provide manual displacement throughout until the fetus has been delivered to aid resuscitation.
4. Open the uterus using either a midline or Pfannenstiel incision. Deliver the fetus and give to a second team for ongoing care.
5. Massage uterus to stimulate contraction. Close the uterus with long running locking absorbable suture. Close the abdomen until the patient is transferred to the operating theatre for formal closure, if not already there.
6. Consider uterotonic medications for their effect on haemorrhage control balancing against the potential to cause hypotension.
7. If resuscitation is successful: administer antibiotics to reduce infection risk and further uterotonic medications are often required to aid haemorrhage from the atonic uterus.

Simulation event

This section contains the following:

1. Pre-simulation briefing poster
2. Immersive scenario
3. Resource requirements
4. Handover card
5. Scenario progression
    a. State 1
    b. State 2
    c. State 3
    d. State 4
    e. State 5
6. Supporting documents
7. Debriefing guide

Pre-simulation briefing

Establishing a safe container for learning in simulation

1 Clarify objectives, roles and expectations

- Introductions
- Learning objectives
- Assessment (formative vs summative)
- Facilitators and learners' roles
- Active participants vs observers

2 Maintain confidentiality and respect

- Transparency on who will observe
- Individual performances
- Maintain curiosity

3 Establish a fiction contract

Seek a voluntary commitment between the learner and facilitator:

- Ask for buy-in
- Acknowledge limitations

4 Conduct a familiarisation

- Manikin/simulated patient
- Simulated environment
- Calling for help

Note: Adjust the pre-simulation briefing to match the demands of the simulation event, contexts or the changing of participant composition.

5 Address simulation safety

Identify risks:

- Medications and equipment
- Electrical or physical hazards
- Simulated and real patients

V2 Effective: 1/7/2021. Adapted from Rudolph, J., Raemer, D. and Simon, R. (2014). Establishing a Safe Container for Learning in Simulation. Simulation in Healthcare: Journal of the Society for Simulation in Healthcare, 9(6), pp.339-349.

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Immersive scenario

Type	Immersive scenario
Target audience	• Emergency Department medical & nursing staff • Obstetric medical staff/midwives and neonatal team (if available in your local area)
Overview	This resource is for facilitators to explore the indications for a resuscitative hysterotomy and perform the technical skill in an immersive scenario. The scenario also incorporates the decision making, timing and crisis resource management principles required to manage traumatic maternal cardiac arrest. **Emergency Department presentation:** A 34yo G1,P0 29+4/40 gestation is brought via ambulance to the ED following a high speed RTC at 100km/hr on the freeway. She is the single occupant of the vehicle which was seen to veer into the central barriers to avoid collision with a merging vehicle. Airbags deployed, seatbelt worn. Prolonged extrication (30 minutes) by the QLD Fire and Emergency Services due to position of the vehicle against the concrete barrier. Pre-hospital notification of vital signs: GCS 14 (confused), HR 120, BP 90/60, sats 100% NRB, temp 37.4. On arrival in the Emergency Department her vital signs are unchanged and she has received 100mcg fentanyl IV and 500mls NSaline IV. She complains of severe abdominal and chest pain with a seatbelt mark across her chest and abdomen.
Learning objectives	By the end of this session the participant will be able to: • Recognize the severely injured pregnant trauma patient • Perform a detailed clinical assessment to identify life threats following major trauma • Understand the indications and contraindications for resuscitative hysterotomy • Understand the technical skill of resuscitative hysterotomy • Understand the Crisis Resource Management (CRM) principles when managing maternal cardiac arrest.
Duration	45-60 minutes, including debrief

Resource requirements

Physical resources

Room setup	Resus bay in Emergency Department
Simulator/s	Sim Mom (with resuscitative hysterotomy insert). *See additional 'RH Manikin setup guide' & 'RH bundle'*
Simulator set up	• Street clothes lying supine • C-collar insitu • Moulage: 30/40 pregnant abdomen. Driver seatbelt bruising to chest and abdomen
Clinical equipment	• Standard resuscitation bay equipment • Standard delivery bundle pack • Resuscitative hysterotomy procedural kit • Foetal Doppler (or Ultrasound machine for foetal HR) • Resuscitaire setup (if applicable to local unit)
Access	• 16G L) ACF with empty N/saline 500ml bag • No IV sticker R side
Other	See RH Manikin Setup Guide

Human resources

Faculty	2 facilitators (Dr/Nurse with debriefing experience) to take on roles of scenario commander and primary debrief
Simulation coordinators	1 for manikin set up and control
Confederates	• QAS officer to deliver handover (optional) • Junior Registered nurse
Other	Resuscitation team in resus bay to receive QAS handover

Handover card

Handover from ambulance officer

This is Mary. She is a 34yo G1,P0 29+4/40 gestation that has been involved in a high speed RTC at 100km/hr on the freeway approximately 1 hour ago. She is the single occupant of the vehicle which was seen to veer into the central barriers to avoid collision with a merging vehicle.

Her airbags had deployed, she was wearing a seatbelt. A prolonged extrication (30 minutes) was required by the Qld Fire and Emergency Services due to position of the vehicle against the concrete barrier.

As mentioned, her vital signs initially were: GCS 14 (confused), HR 120, BP 90/60, sats 100% NRB, temp 37.4.

Just now on arrival to the Emergency Department her vital signs are unchanged, and she has received 100mcg fentanyl IV and 500mls Nsaline IV via a 16G IVC in her L) ACF.

She complains of severe abdominal and chest pain and I have noticed a seatbelt mark developing across her chest and abdomen.

There is no PV discharge and she has not felt the baby move since the accident. Her antenatal care to date has been normal. Her PMHx is unremarkable, with no known allergies. Her husband was contacted by the QPS officer on scene and is on his way up to hospital.

Thanks for taking over Mary's care - I will just be in the write up room if you need further details.

Scenario progression

<table>
<tr><th colspan="4">STATE 1: INITIAL ASSESSMENT</th></tr>
<tr><th colspan="2">Vital signs</th><th>Script</th><th>Details</th><th>Expected actions</th></tr>
<tr><td>ECG</td><td>ST</td><td rowspan="8">Mary: ‘Please help me, I am in so much pain. Is my baby okay?’ *Confused, worried, crying, anxious*

Confederate:</td><td rowspan="8">Primary survey results

A: maintaining own, cx collar, nil anterior neck injury

B: tachypneac, nil increased resp effort, bilateral BS, tender across chest wall where seatbelt marks are, tender sternum, nil crepitus/subcut emphysema

C: nil external bleeding sources, cool peripherally, nil PV loss

D: GCS E4V4M6, PEARL 4mm. No motor deficits

E: seatbelt marking across chest and abdomen

Foetal assessment:
• Abdominal palpation= 29 weeks
• Longitudinal lie
• Abdomen firm and tender
• FHR 170 with doppler
• No foetal movements since accident</td><td rowspan="8">Commence Primary Survey

❑ Assess airway
❑ Assess breathing
❑ Assess circulation:
• Position left lateral 15-30deg tilt
• Confirm bilateral large bore PIVC
• Assess for PV loss

❑ Assess disability
❑ Expose patient to identify other injuries
❑ Perform foetal assessment
❑ Obtain obstetric history
❑ Perform abdominal examination including for PV loss
❑ Obtain gestational age
❑ Determine foetal wellbeing
• Auscultate foetal HR
• Discuss foetal movements

❑ Correct format</td></tr>
<tr><td>HR</td><td>120</td></tr>
<tr><td>SpO₂</td><td>99%NRB</td></tr>
<tr><td>BP/ART</td><td>90/60mmHg</td></tr>
<tr><td>RR</td><td>28</td></tr>
<tr><td>Temp</td><td>37.4</td></tr>
<tr><td>BGL</td><td>5</td></tr>
<tr><td>GCS</td><td>14 (E4V4M6)</td></tr>
<tr><td></td><td></td></tr>
</table>

STATE 2: Ongoing management/ secondary assessment				
Vital signs		**Script**	**Details**	**Expected actions**
ECG	ST	**Mary:** *moaning* **Confederate:** 'Should we check the baby again?'	**Secondary survey results** Head- nil injury noted Chest- significant seatbelt marks R upper chest extending to L lower chest Abdomen- seatbelt mark over anterior abdomen Limbs- no injury noted Spine- no tenderness/wounds **Results- see supporting documents** • Bloods: VBG • CXR/Pelvis X-ray: NAD • EFAST: NAD • FHR: 60	**Secondary survey** ❑ Perform head to toe assessment **Investigations** ❑ Bedside Ixn- bloods, ECG, urine ❑ CXR and Pelvic Xray ❑ EFAST ❑ Repeat FHR **Management** ❑ Recognise significant injury profile ❑ Notification to Surgical team for urgent attendance ❑ Referral to O&G and neonatal team for urgent attendance- may use hospital activation process ❑ Prepare team for intervention for deterioration
HR	130			
SpO_2	96			
BP/ART	70/50			
RR	30			
Temp	37			
BGL	5			
GCS	12 (E3V3M6)			

STATE 3: Deterioration				
Vital signs		**Script**	**Details**	**Expected actions**
ECG	SB	**Mary:** Unresponsive *snoring/obstructed sounding respirations* **Confederate:** (may prompt if required) 'I don't think Mary is responding anymore'	BP, HR and SpO2 decrease over 2 minutes and decrease conscious state **Primary survey results** **A:** snoring **B:** poor respiratory effort, shallow respirations **C:** no palpable pulse felt **D:** no response to painful stimuli	**Assessment** ❑ Repeat primary survey and recognise peri-arrest state ❑ Declare traumatic cardiac arrest ❑ Commence ACLS as per algorithm **Investigations** ❑ Can use USS to assess for cardiac contractility during pulse checks **Management** ❑ Standard ACLS ❑ Recognition of need to displace gravid uterus off IVC ❑ Commence crystalloid/haemostatic resuscitation ❑ Rapidly assess for and treat reversible causes including chest decompression ❑ Involvement of surgical/obstetric and neonatal teams (if available)
HR	40			
SpO_2	nil trace			
BP/ART	unrecordable			
RR	10			
Temp	36			
BGL	5			
GCS	3 (E1V1M1)			

STATE 4: Management of Maternal Cardiac Arrest				
Vital signs		**Script**	**Details**	**Expected actions**
ECG	SB	**Mary:** unresponsive **Confederate:**	**Assessment** **A:** BVM, LMA or ETT without disrupting ACLS **B:** high flow O2 via delivery device **C:** CPR position with uterus displacement (following decompression of chest) **D:** no response to painful stimuli	❑ Ensure team effectively communicate patient priorities **Investigations** ❑ Can use USS to assess for cardiac contractility during pulse checks **Management** ❑ Continue ACLS as per algorithm- identify traumatic arrest and consider reversible causes ❑ Prioritise early intubation and optimise oxygenation ❑ Team leader to communicate plan for resuscitative hysterotomy and ensure procedure preparation/readiness
HR	25			
SpO_2	nil trace			
BP/ART	unrecordable			
RR	nil			
Temp	36			
BGL	5			
GCS	3 (E1V1M1)			

<table>
<tr><th colspan="4">STATE 5: Perform Resuscitative Hysterotomy and post-procedure care</th></tr>
<tr><th colspan="2">Vital signs</th><th>Script</th><th>Details</th><th>Expected actions</th></tr>
<tr><td>ECG</td><td>SB- SR</td><td rowspan="9">Mary: *localising to painful stimuli following ROSC*

Confederate: (prompt if required) ‘She seems to be moving her arms’</td><td rowspan="9">ROSC will occur with delivery of baby and uterine compression

End scenario following ROSC and Team leader discussion about patient disposition and ongoing management</td><td rowspan="9">Management
❑ Timing of RH performed ASAP but no later than 4-5minutes following onset of maternal cardiac arrest
❑ Performance of resuscitative hysterotomy
• Stepwise procedure
• Hand off baby to team
• Continue CPR/resuscitation of mother
• Perform uterine compression post procedure
❑ Move patient to OT to formalize resuscitation</td></tr>
<tr><td>HR</td><td>40 - 85</td></tr>
<tr><td>SpO_2</td><td>nil trace – 85% FiO2 1.0</td></tr>
<tr><td>BP/ART</td><td>Unrecordable – 75syst</td></tr>
<tr><td>RR</td><td>0-10</td></tr>
<tr><td>Temp</td><td>36</td></tr>
<tr><td>BGL</td><td>5</td></tr>
<tr><td>GCS</td><td>3</td></tr>
<tr><td></td><td></td></tr>
</table>

Supporting documents

The following supporting documents are provided for this immersive scenario:

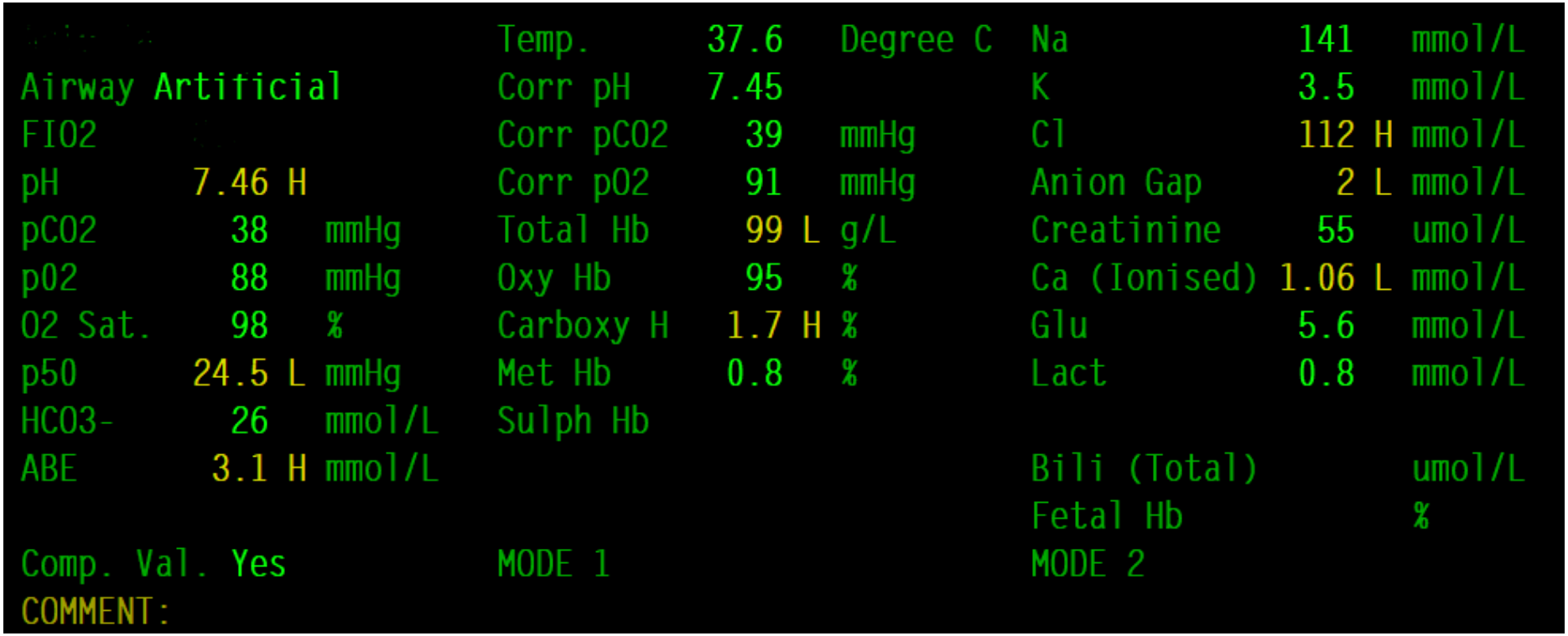
Radiology results

1. CXR: normal
2. Pelvic Xray: ring intact, incomplete film, fetal skeleton insitu
3. EFAST: RUQ/Morrisons: negative
4. EFAST: LUQ/splenorenal: negative
5. EFAST: Bladder/pelvic: negative
6. EFAST: Cardiac/suxiphoid: negative

Radiology results

1. Venous blood gas

Venous blood gas



			Temp.	37.6	Degree C	Na	141	mmol/L
Airway	Artificial		Corr pH	7.45		K	3.5	mmol/L
FIO2			Corr pCO2	39	mmHg	Cl	112 H	mmol/L
pH	7.46 H		Corr pO2	91	mmHg	Anion Gap	2 L	mmol/L
pCO2	38	mmHg	Total Hb	99 L	g/L	Creatinine	55	umol/L
pO2	88	mmHg	Oxy Hb	95	%	Ca (Ionised)	1.06 L	mmol/L
O2 Sat.	98	%	Carboxy H	1.7 H	%	Glu	5.6	mmol/L
p50	24.5 L	mmHg	Met Hb	0.8	%	Lact	0.8	mmol/L
HCO3-	26	mmol/L	Sulph Hb					
ABE	3.1 H	mmol/L				Bili (Total)		umol/L
						Fetal Hb		%
Comp. Val.	Yes		MODE 1			MODE 2		
COMMENT:								

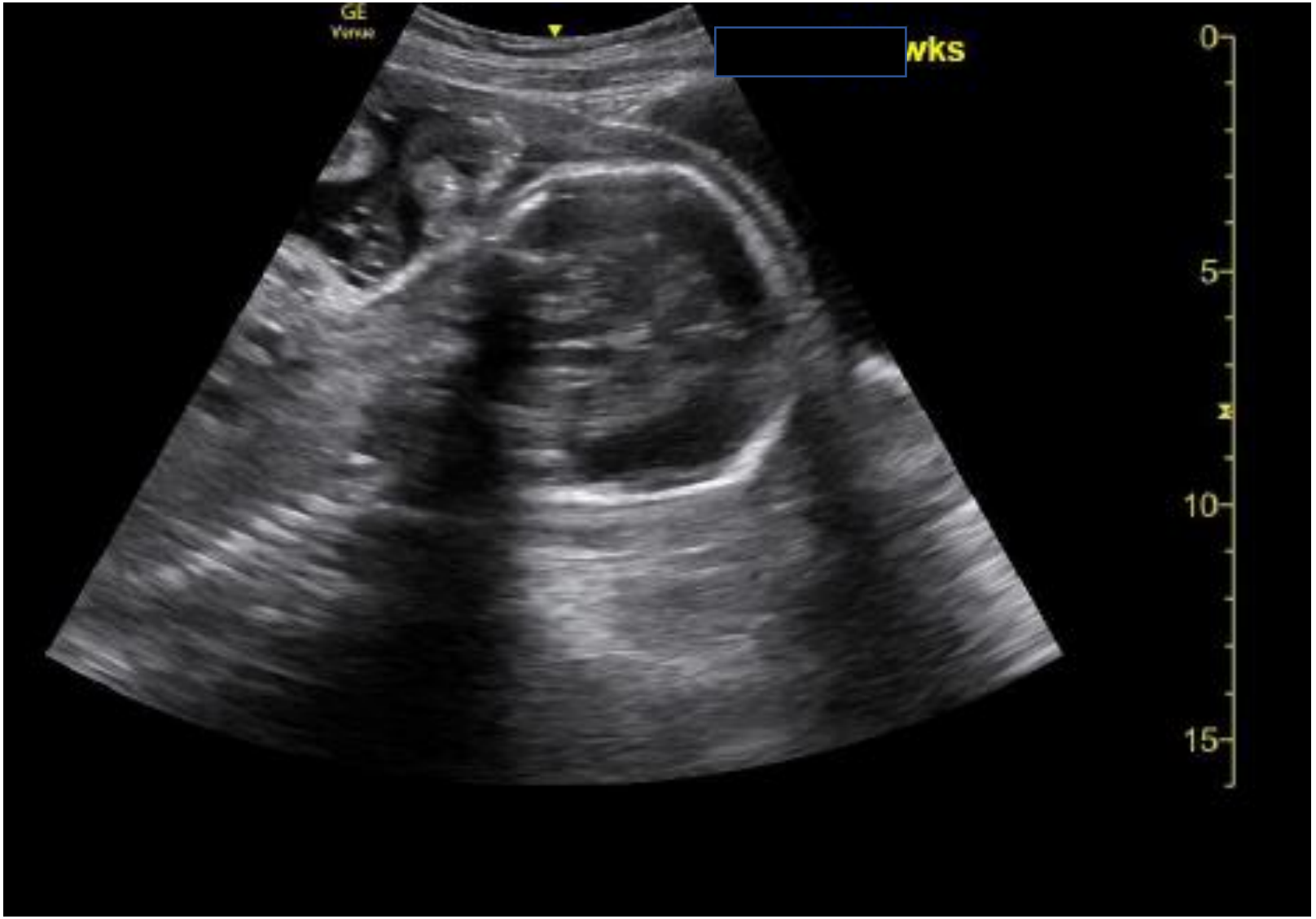
CXR

Pelvic Xray

EFAST RUQ/Morrisons

EFAST LUQ/splenorenal

EFAST Bladder/Pelvic



EFAST Cardiac/subxiphoid

Debriefing guide

Scenario objectives

- Recognize the severely injured pregnant trauma patient
- Perform a detailed clinical assessment to identify life threats following major trauma
- Understand the indications and contraindications for resuscitative hysterotomy
- Familiarize the learner with the technical skill of performing a resuscitative hysterotomy
- Understand the issues pertaining to CRM with maternal cardiac arrest

Example questions

Exploring diagnosis

- How did you recognise the clinical deterioration in this pregnant patient who sustained traumatic injuries?
- What physiological variables are different in each trimester of pregnancy? How does this impact on the assessment of hypovolaemia following trauma?

Discussing management

- What was different in the management of this patient compared to the 'standard' trauma patient?
- How is a cardiac arrest following trauma managed differently to the resuscitation in medical conditions?
- In particular- what is the role of the resuscitative hysterotomy?
- What gestational age does this become important to aid haemodynamics?

Discussing teamwork / Crisis Resource Management

- What available resources do you have in your environment/hospital to assist with managing critically unwell pregnant trauma patients?
    - → How do you rapidly notify speciality teams and what teams are available?
    - → Do you have any cognitive aids to assist around your department?
    - → Are you able to have specific teams to care for the baby and mother?

Key moments

- Recognition of critically unwell pregnant trauma patient
- Performing a structured assessment
- Correct positioning and impact on haemodynamics
- Performance of traumatic cardiac arrest algorithm
- Performance and understanding of role of resuscitative hysterotomy and after care
- Understand the importance of clinician wellbeing in emotive resuscitations

Acronyms and abbreviations

Term	Definition
CPR	Cardiopulmonary Resuscitation
RH	Resuscitative Hysterotomy
ACLS	Advanced Cardiac Life Support
ROSC	Return of Spontaneous Circulation
IVC	Inferior vena cava

References

1. Wilson C. Evidence behind Focussed Sonography for Trauma During Pregnancy. ACEP Now. 21.01.2021. Evidence Behind Focused Sonography for Trauma During Pregnancy - Page 2 of 4 - ACEP Now | Page 2
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https://www.surveymonkey.com/r/3FWL3ZD

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Visit csds.qld.edu.au/qte
Email CSDS-Admin@health.qld.gov.au
Phone +61 7 3646 6500

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