HCS5100 – Assessment Task 5
My lesson plan for a simulated-based education session

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Contents

1 – Lesson Title

Cardiac Advanced Life Support and preparation for resternotomy in the Intensive Care Unit

2 – Purpose

2.1 – Problem Identification

Cardiac tamponade occurs when fluid accumulates in the pericardial sac surrounding the heart. Pressure from fluid accumulation results in compression of heart chambers, preventing appropriate filling and reduces the ability of the heart to stretch and contract (Sharma & Waymack, 2023). This results in reduced cardiac output, manifesting in decreased blood pressure and eventually cardiac arrest. Cardiac tamponade a common cause of cardiac arrest (Australian and New Zealand Committee on Resuscitation [ANZCOR], 2023). Cardiac arrest occurs in approximately 0.7–2.9% of patients post cardiac surgery (ANZCOR, 2023). Therefore, cardiac tamponade resulting in cardiac arrest is a high acuity, low frequency scenario, requiring timely recognition and management. Post cardiac surgery, patients require continuous monitoring in the Intensive Care Unit (ICU), with a highly skilled multidisciplinary team of doctors, surgeons and nurses providing care. These practitioners must have frequent exposure to clinical deteriorations and management, in order to maintain skills of recognition and management of emergency situations in this specific patient population. Simulation-based education sessions can provide exposure to these low frequency high acuity scenarios, without compromising patient care or outcomes.

Closed-loop communication is a method of communication that encourages acknowledgement and clarification of received information between sender and receiver. This process of communication has been shown to reduce ambiguity in instructions, allowing clarification and questioning and therefore, reducing error rates (Trauma Victoria, 2024). In closed-loop communication, the team leader (sender) should request information or for a procedure to be completed by an explicitly named person. This person (the receiver) should acknowledge the request and inform the sender when the task is completed. This ensures that the sender is aware when requests have been completed, allows the receiver to clarify requests and avoid errors of omission (Trauma Victoria, 2024).

2.2 – Needs Assessment

University Hospital Geelong, the hospital in which this simulation will be run, performs over 400 cardiac surgical cases per year (Barwon Health, 2018), all of which require Intensive Care Unit admission postoperatively. Cardiac surgery advanced life support is significantly different to standard advanced life support (see figures 2 and 3). The relatively low occurrence of cardiac arrest due to cardiac tamponade following cardiothoracic surgery results in minimal staff exposure to such situations. Regular deliberate practice and exposure to simulation-based scenarios can improve learner confidence and patient management in these high acuity, low occurrence scenarios.

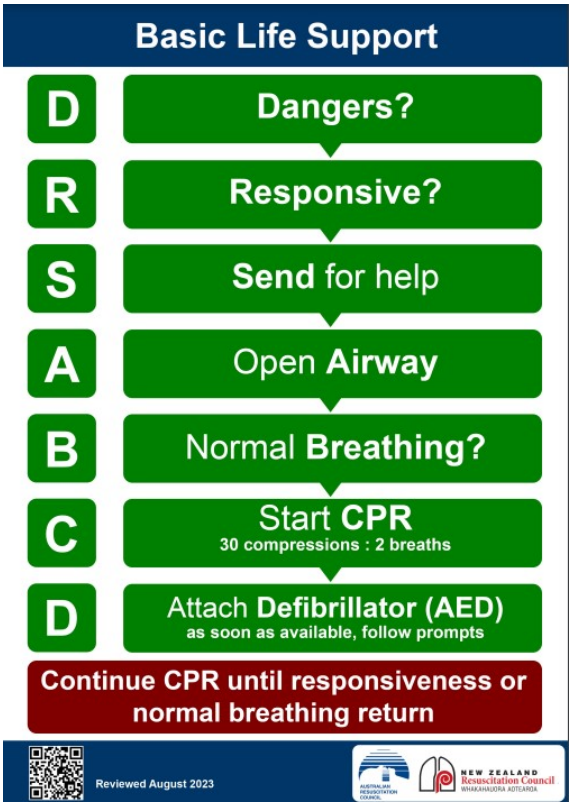

Figure 1: Basic Life Support Algorithm from https://www.anzcor.org/assets/Uploads/Basic-Life-Support-August-2023-1-v3.pdf

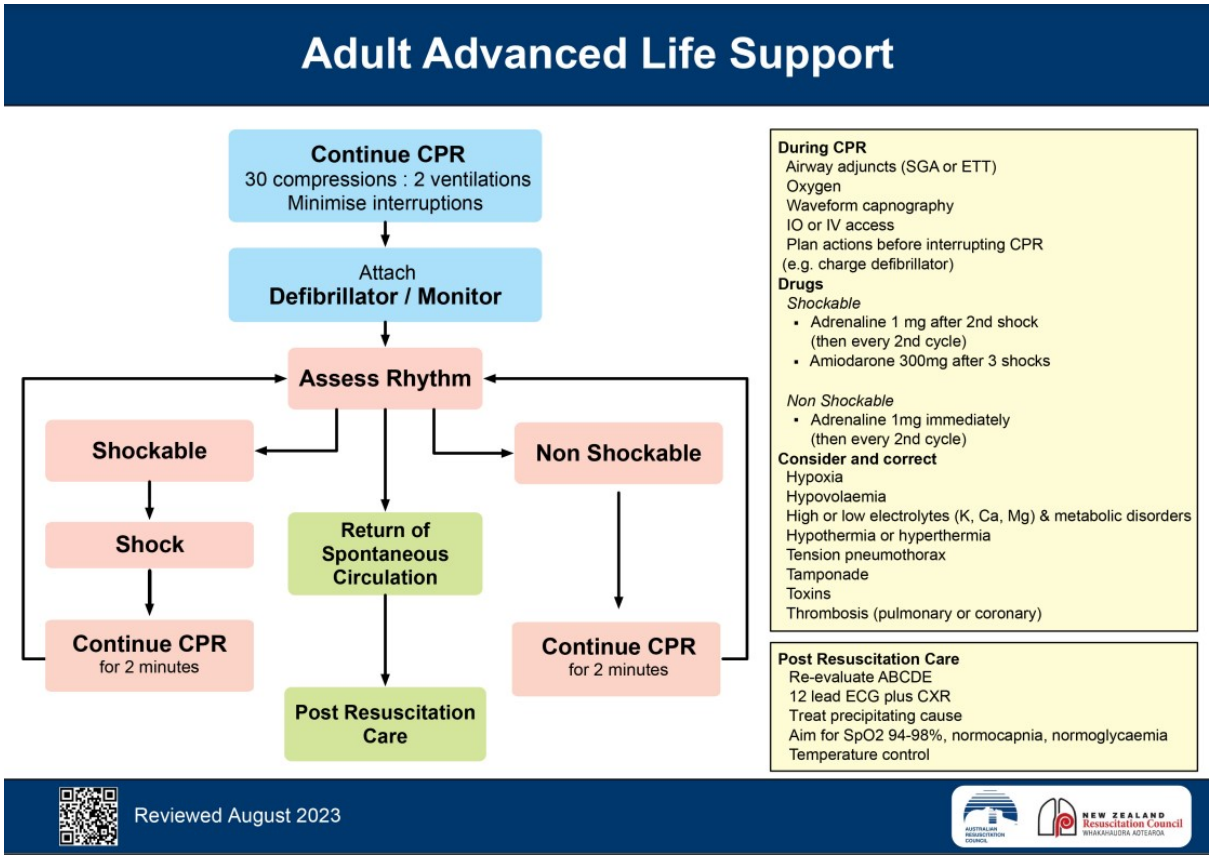

Figure 2: Adult Advanced Life Support Algorithm from https://www.anzcor.org/assets/Uploads/ANZCOR-Algorithm-Adult-Advanced-v2.pdf

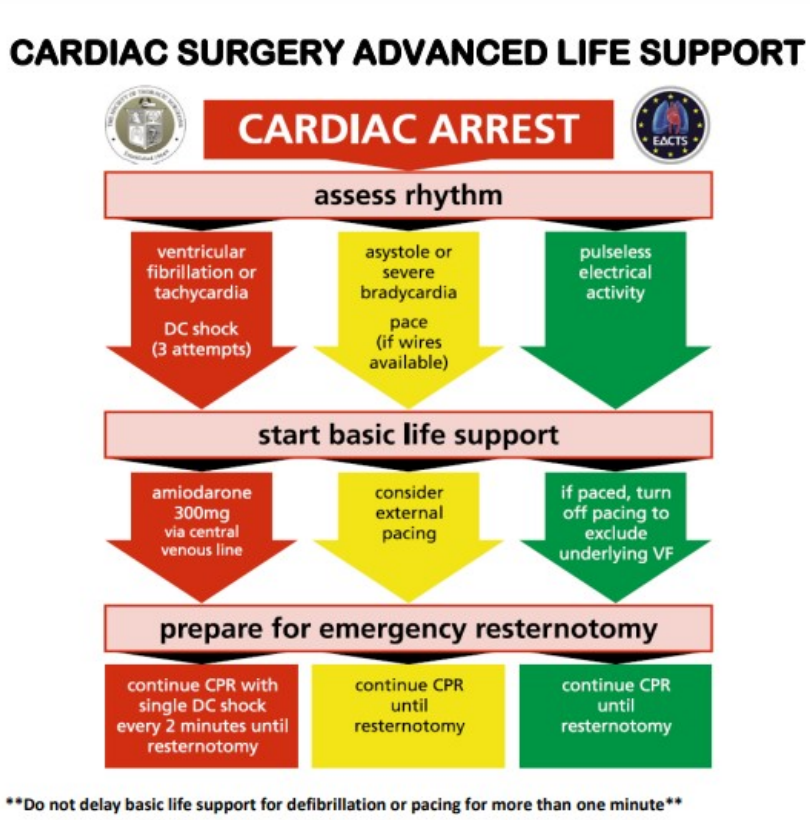

Figure 3: Cardiac Surgery Advanced Life Support Algorithm from https://www.seslhd.health.nsw.gov.au/sites/default/files/groups/POWHICU/Docs/Cardiothoracic%20ALS%20Algorithm.pdf

3 – Aims and Objectives

3.1 – Aim

The aim of this education session is to simulate a cardiac advanced life support scenario (cardiac tamponade) in a post-operative cardiothoracic patient, with a multi-disciplinary ICU team. The session will simulate the deterioration of a cardiothoracic patient due to cardiac tamponade within the ICU environment, and allow the multidisciplinary team of intensive care doctors and nurses to appropriately identify and manage the situation.

3.2 – Learning Objectives

At the completion of this education session, learners will be able to:

- Identify signs and symptoms of cardiac tamponade in a cardiothoracic surgical patient
- Describe the management of cardiac tamponade, according to local policies
- Demonstrate appropriate interventions within the cardiac tamponade advanced life support scenario while maintaining individual scope of practice
- Compare differences in the cardiac advanced life support algorithm to standard advanced life support
- Identify the roles required within a re-sternotomy situation in the ICU setting
- Demonstrate effective closed-loop communication within the multidisciplinary team

3.3 – Learner Background and Characteristics

The learners of this education session will be nurses and doctors working in the ICU at University Hospital Geelong. The nursing staff will be critical care registered nurses or registered nurses completing their postgraduate training, and will have completed hospital-based training surrounding care of cardiothoracic patients. Doctors will be residents or registrars completing a rotation in ICU. The learners will be chosen based on availability on the day as this training is not part of a formal training program. Learners will be informed about the simulation session early in the day, to allow for time management and planning in order for attendance. This simulation-based education session can accommodate up to eight learners in the roles of chest compressions (maximum two learners), airway and breathing, defibrillation, team leader, drug administration (maximum two learners), and ICU co-ordinator. If additional learners are present, they can act as observers to the simulation (see section 5.2).

3.4 – Faculty Background

Only one faculty member is required for this education session. The faculty member will be a Clinical Support Nurse, Clinical Nurse Educator or Clinical Nurse Specialist in ICU who is familiar with cardiac advanced life support and the process of resternotomy within the unit.

4 – Simulation Preparation

4.1 – Expected Knowledge

Learners are expected to have comprehensive knowledge of Basic Life Support and Advanced Life Support (see figures 1 and 2), and to have a basic understanding of Cardiac Surgery Advanced Life Support (see figure 3). The learners are expected to act within their scope of practice and maintain realistic roles throughout the scenario. No pre-session readings or learning material is required, as this is an opportunistic insitu simulation designed to increase exposure to a low volume clinical scenario.

4.2 – Timing

Task	Expected Timing	Notes
Faculty Set Up	30 minutes	- Complete 30 minutes prior to commencement of session - Ensure all required equipment is present and working - See section 4.3.2 for equipment list - See appendix 1 for example
Prebrief	10 minutes	- Introduction and orientation - Re-introduce cardiac ALS algorithm on resuscitation trolley
Scenario	20 minutes	
Debrief	20 minutes	- Following The Diamond Debrief technique outlined in section 7.1
Learner Evaluation	5 minutes	
Faculty Evaluation	10 minutes	

4.3 – Resources

4.3.1 – Setting

This simulation-based education session will occur insitu within the Intensive Care Unit at University Hospital Geelong. The education area in pod 3 will be prepared for this simulation-based education session. This area is regularly used within ICU for training and education purposes. The area can be set up similarly to a regular patient room in all aspects, however separate from the main unit, allowing for privacy and focus on the education session.

4.3.2 – Equipment required

- ICU Bed
- Mannequin – compatible with defibrillation and CPR
    - Intubated and connected to ventilator tubing
    - Pacing Wires connected to pacing box
    - Chest Drain
    - Arterial Line
    - Swann Ganz Catheter (CVC) with Pulmonary Artery Catheter
    - Peripheral IV
    - IDC
- Ventilator – with test lung attached
- Infusion pumps – 1x PCA, 3x standards pumps
- 1x filling line connected to peripheral IV
- Bag Valve Mask connected to oxygen
- Medications connected to CVC
    - Propofol
    - Maintenance fluid – Normal Saline 0.9%
    - Oxycodone PCA (attached with maintenance fluids vis Heidelberg Line)
    - Noradrenaline
- Education Resuscitation Trolley
    - Defibrillator and pads
    - ALS medications (education only)
    - Cardiac Surgery Advanced Life Support Algorithm (printed and laminated)
    - Advanced Life Support Algorithm (printed and laminated)
    - COACHED mnemonic (printed and laminated)
    - Sharps container and kidney dish
- SimPad – connected to monitor (allows change in physiological parameters on monitor)
- Resternotomy trolley
- Moulage: Duoderm dressing to sternotomy site
- ICU observation chart
- Observer checklists x5 printed
- Printed copy of QR code linking to participant evaluation survey (located in section 8.1)
- Copy of local Cardiothoracic Cardiac Arrest Management Policy (Barwon Health for this scenario)
- Copy of The Diamond Debrief Prompt (see figures 4 and 5 in section 7.1)

5 – Simulation

5.1 – Learner Pre-Brief/ Introduction

5.1.1 – Introduction

- Facilitator to welcome everyone to the education session
- Introduce self and role within the unit
- Outline of the session including introduction, simulation, debrief and evaluation
- Expected timing of the education session (approximately 45 minutes)
- Brief description of what will be covered within the session
    - This will be a cardiac surgery crisis scenario involving ALS
    - Learners to be blinded to the specific learning objectives but highlight it will be a crisis
- Probing prior experience in cardiac surgery ALS scenarios – ask learners what they have experienced in practice
- Highlight focus on closed-loop communication throughout scenario

5.1.2 – Orientation

- The room is set up as a standard cardiothoracic patient room
- Everything learners will need during the scenario is within the room
- Work within your regular role and scope of practice, not expecting any role-play ie: nurses will not 'play' as doctors
- Important knowledge while working in ICU, based on a possible real-life clinical scenario
- Highlight the algorithms present on the resuscitation trolley – standard ALS, cardiac surgery ALS and COACHED (see appendix 2, 3 and 4,) – learners are expected to utilise these as required
- Mannequin is suitable for CPR and defibrillation
- Defibrillator is live and will deliver shocks if required – reduce the joules delivered to the mannequin for longevity and use COACHED mnemonic
- Not all aspects of the simulated experience may be totally realistic but learners should immerse themselves into the experience
- What happens in the room stays in the room – highlight confidentiality and privacy in learning
- If unsure about any physiological parameters to ask facilitator
- This is not linked to any formal course or assessment, just an opportunity for exposure, practice and learning (and maybe a bit of fun!)
- Any questions?

5.1.3 – Safety Considerations

- Facilitator to pause scenario if safety concern is present – time out and review
- Standard OH&S considerations apply

Physical

- Live Defibrillator
    - Using the COACHED mnemonic for safety
- Sharps
    - Be aware of sharps when drawing up medications, utilise the sharps container and use kidney dish when transporting medications from trolley to bedside

Psychological

- Discuss confidentiality and privacy within the simulation space, what happens in the room stays in the room
- Probing questions regarding previous cardiac ALS scenarios/experience
- Answer any questions raised by learners

5.2 – Observer role

- If more than eight learners are present in the session, allocate the excess learners as observers.
- Hand out a copy of the observer checklist (see appendix 5) to complete throughout the simulation.
- One observer can act as a scribe and write interventions on the observation chart (within the progress note section)

5.3 – Scenario Background/Handover

Handover

- Mr Edward Lambert is a 75-year-old man who returned to ICU from theatre 3 hours ago following Coronary Artery Bypass Grafting surgery x3 (CABGs) and a mechanical Aortic Valve Replacement (AVR).
- He has a past medical history of high cholesterol, hypertension, type 2 diabetes and increased BMI.
- He had a prolonged bypass time of 3.5 hours with cross clamp time of 2 hours
- The surgical team was concerned about some bleeding intraoperatively and during closing, initially drain output was 100mls/hr on arrival to ICU but has dropped to 50mls/hr.
- The patient received 2 units of packed red blood cells, 4 units of FFP, 10 units of cryoprecipitate and 2L of Plasmalyte intra-operatively. Since arriving to ICU, he been given 2x 500ml bottles of 5% Albumin and 1L CSL, for a MAP sitting between 60-65mmHg and CVP 8.
- The patient arrived back on noradrenaline 2mcg/min and it now on 4mcg/min.
- The cardiac index is 2.3 and the SVRI is slightly elevated at 2500. Pulmonary artery pressures are normal.
- CXR has been completed and is unremarkable.
- Bloods are normal. We are awaiting a TEG that was completed with the last ABG due to high drain output.
- The patient has atrial and ventricular pacing wires and is currently paced in DDD at 80bpm.
- The patient is sedated on propofol 2mg/kg/hr and has an oxycodone PCA. He is intubated and ventilator setting are SIMV-VC 40% FiO2, PEEP 5, PS 10, TV 500mls x 16 breaths per minute.
- The bedside nurse has just completed an ABG: pH 7.30, CO2 45, O2 68, HCO3 20, Lactate 3.1, Hb 73. Another unit of PRBC's has been ordered from blood bank.
- The most recent urine output was 20mls, previously >50mls/hr
- Any questions?

5.4 – Simulation progression

Stage	Airway/Breathing	ETCO2/SpO2	HR	BP	CVP/PAP	Expected Participant Response
Start (0-1 minute)	ETT / SIMV-VC	40 normal trace 93%	DDD paced 80bpm	100/60 (73)	12 35/20 (25)	Patient assessment – recognise elevated lactate, decreased urine output, low Hb
Deterioration (1-5 minutes)	ETT / SIMV-VC	35 normal trace 89%	DDD paced 80bpm	85/55 (65)	20 35/20 (25) CI 1.8	Increase pacing Increase noradrenaline
Filling (5-7 minutes)	ETT / SIMV-VC	30 normal trace 87%	DDD paced 90bpm	78/47 (57)	28 50/30 (37)	Give fluid resus – crystalloid (CSL) vs colloid (Albumin) Increase noradrenaline
PEA (7-8 minutes)	ETT / Bag	10 normal trace Unrecordable	Sinus rhythm 65bpm	Unrecordable 0/0 (0) (flatline)	0 0/0 (0) Flatline	Identification of PEA arrest Code Blue called Turn off DDD pacing Assess for VF BVM at 15L for breathing, rate 10-12/min
VF (8-12 minutes)	ETT / Bag	5 normal trace 80%	VF	Unrecordable 0/0 (0)	0 0/0 (0) Flatline	3 stacked shocks at 200J Call CTS team Start CPR as patient remains in VF
Preparing for resternotomy (12-14 minutes)	ETT / Bag	20 normal trace	Sinus rhythm 65bpm	Unrecordable 0/0 (0)	0 0/0 (0) Flatline	Administer Amiodarone 300mg Ongoing CPR Resternotomy trolley collection Allocation to resternotomy roles
‘Arrival’ of CTS team (determined by faculty) **End Scenario**						
14-20 minutes	Brief discussion – roles required in resternotomy, sequence of resternotomy, utilising the resternotomy packs etc					

6 – Assessment

Learning outcome	Evaluation of Learning
Identify signs and symptoms of cardiac tamponade in a cardiothoracic surgical patient	Learners recognise the signs of cardiac tamponade and decreased cardiac output during scenario - decreased BP, increased CVP and PA pressures, decreased drain output, decreased urine output, elevated lactate
Describe the management of cardiac tamponade, according to local policies	Learners appropriately respond to assessment findings of cardiac tamponade, cardiac arrest and initiation of resternotomy, following local policy and guidelines Learners implement evidence-based interventions based on assessment findings, according to policy and guidelines
Demonstrate appropriate interventions within the cardiac tamponade advanced life support scenario, maintaining individual scope of practice	Learners turn off pacing box when PEA arrest occurs to assess for underlying VF (per algorithm) Learners deliver 3 stacked defibrillations at 200J when patient is in VF (per algorithm)
Compare differences in the cardiac advanced life support algorithm to standard advanced life support	Learners use the cardiac surgery advanced life support algorithm for guidance throughout scenario Learners are able to distinguish the clinical difference between regular ALS and cardiac surgery ALS when deciding which algorithm to use
Identify the roles required within a re-sternotomy situation in the ICU setting	Learners engage with the discussion surrounding role allocation and stages of resternotomy in ICU and can differentiate and allocate roles appropriately
Demonstrate effective closed-loop communication within the multidisciplinary team	Communication is clear throughout the scenario Learners ensure the communication loop is closed and ensure delegation

7 – Debriefing

7.1 – The Diamond Debrief

The debriefing following this simulation-based education session will be based on the 'Diamond Debrief' structure described by Jaye, Thomas and Reedy (2015). This structure moves from description to analysis, and application, with scaffolded questions and signposted transitions between each phase. The debriefer can use a copy of figures 4 and 5 to guide the debrief discussion.

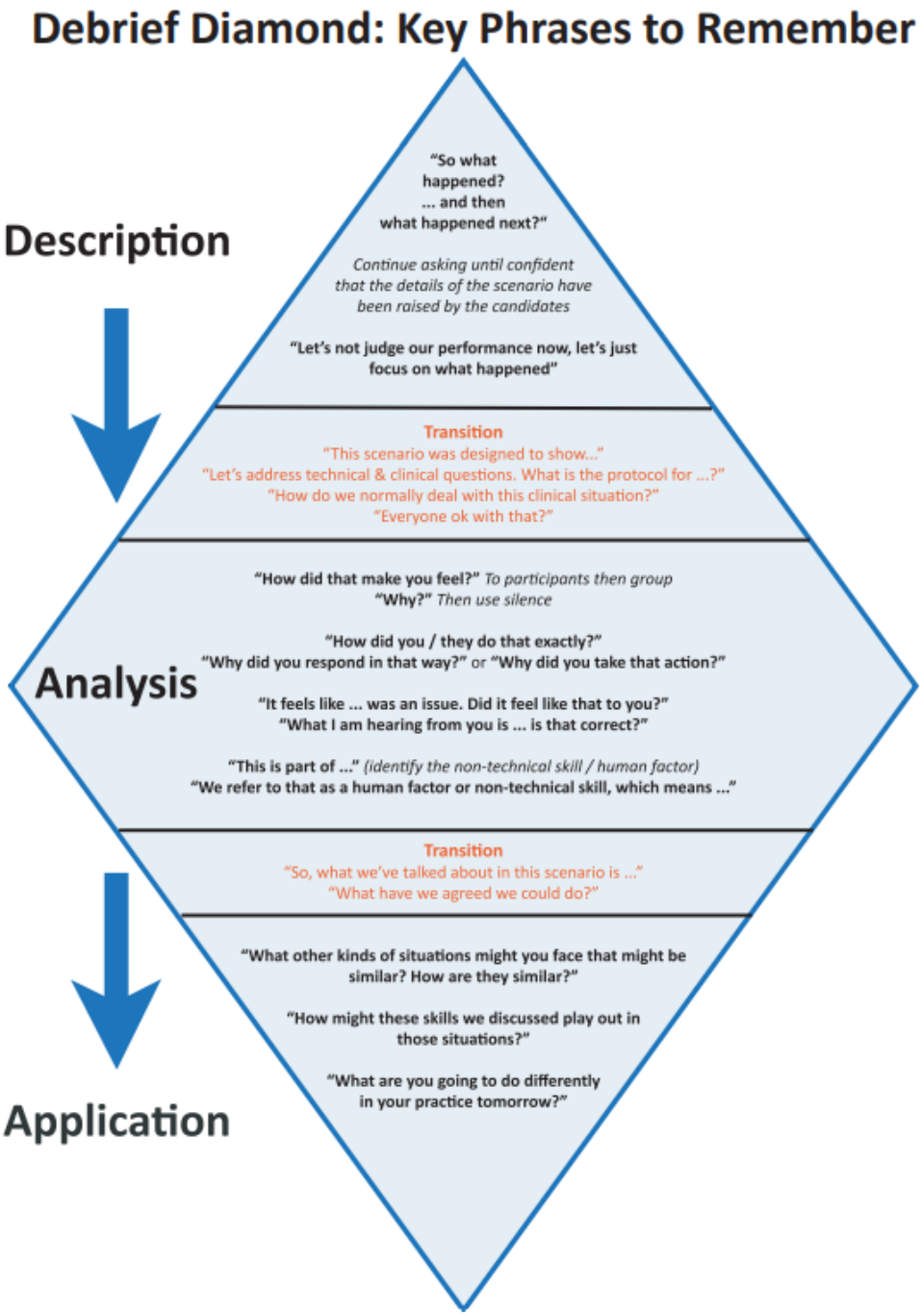

Figure 4: The Diamond Debrief Key Phrases (Side 1) – from Jaye, P., Thomas, L., & Reedy, G. (2015). 'The Diamond': a structure for simulation debrief. *The clinical teacher*, *12*(3), 171–175. https://doi.org/10.1111/tct.12300

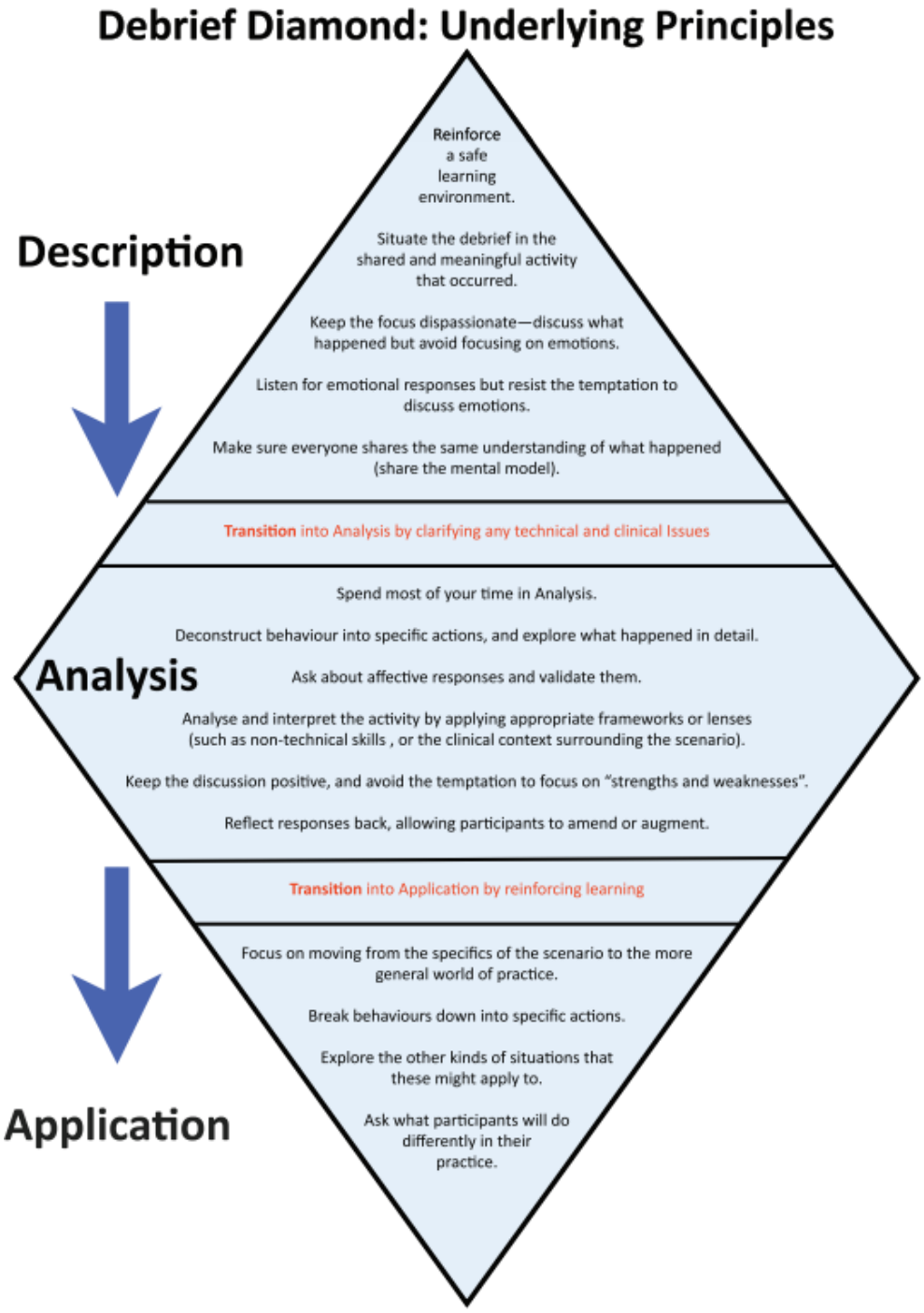

Figure 5: The Diamond Debrief Underlying Principles (Side 2) – from from Jaye, P., Thomas, L., & Reedy, G. (2015). 'The Diamond': a structure for simulation debrief. *The clinical teacher*, *12*(3), 171–175. https://doi.org/10.1111/tct.12300

7.2 – Debrief Discussion

Setting

- Conduct debrief session in pod 3 where the simulation occurred
- Arrange chairs in a circle, ensure enough chairs for all participants

Description

- Start with initial statements of what happened in the scenario without judgement
    - *So, how did the scenario start? What happened next?*
    - *Let's not judge the performance, let's just focus on what happened*
- Continue asking until the details of the scenario have been raised
- Make sure everyone shares the same understanding of what happened
- Avoid focusing on emotions, take note of emotional responses

Transition 1

- Moving to analysis by clarifying any technical and clinical issues
    - *This scenario was designed to show the progression of cardiac tamponade in a patient following cardiothoracic surgery, to the point of requiring an emergency resternotomy*
    - *Does anyone have any questions regarding the clinical situation we experienced?*
    - *Is everyone okay with moving on?*

Analysis

- Spend the most time in analysis
- Discuss emotional responses to scenario
    - *How did that make you feel?* – the simulation, blinding to learning outcomes, the element of surprise/unknown
- Deconstruct behaviour
    - *Why do you think you responded in that way? Why did you take that action?* – choice of specific fluids for resus, role allocation, calling/delaying cardiothoracic team
- Reflect responses back and allow participants to agree or augment responses
    - *What I am hearing from you is…. is that correct?*
    - *It feels like …. was an issue. Did it feel like that to you?*
- Use silence/pauses
- Keep the discussion positive – avoid talking about strengths and weaknesses

Transition 2

- Reinforce learning before moving into application
    - *So, what we have talked about in this scenario is…*
    - *What have we agreed we could do?*

Application

- Focus on moving from scenario specifics to general clinical practice
    - *How might the skills we discussed play out in other clinical situations?*
- What changes will be made to practice based on the learnings from this session?
    - *What are you going to do differently in your clinical practice moving forward?*

Summary

- Ask each participant to share a take home message from the education session
    - *What is something you'll be taking from today? What is something you'll be implementing into practice?*

8 – Evaluation

8.1 – Participant Evaluation

On completion of the simulation-based education session, learners will be provided with a QR code that directs them to an online survey through the website SurveyMonkey. The responses will remain anonymous. The survey will take a maximum of 5 minutes to complete, time has been allocated within the lesson plan to account for this evaluation.

Figure 6: QR code linking to SurveyMonkey quiz

The participant evaluation includes the following statements, that will be rated based on a Likert Scale.
The first statement will be rated between excellent, very good, good, fair and poor

- Overall, how would you rate the course?

The following statements will be rated between strongly disagree, disagree, neutral, agree and strongly agree.

- I feel that my knowledge of the signs and symptoms of cardiac tamponade has improved following this session
- My confidence in managing a patient with cardiac tamponade has improved following this session
- My knowledge of role allocation in resternotomy has improved following this session
- I think that the group communicated well as a multidisciplinary team
- I feel that this session has been helpful for my learning
- I felt well supported during this session

The following statements will have a text response area in which participants can write specific feedback

- What is something you enjoyed about this session?
- How could this session be improved for next time?

8.2 – Faculty Evaluation

8.2.1 – Participant Evaluation Review

The purpose of this evaluation is to determine if the learning objectives of this education session were met. The results of this evaluation can assist to identify areas of the session that are effective in meeting learnings expectations, requirements and learning outcomes, and areas that need improvement (Thomas, 2016). The evaluation outlined in section 8.1 combines qualitative data, obtained from Likert scale ratings, with qualitative data from text responses, in order to identify strengths, weaknesses and suggestions of improvement from learners. This evaluation should be completed within one week of the education session.

Faculty are required to:

- Review participant responses from the evaluation survey
- Record a summary of the feedback from the participant evaluation
- Assess for areas scoring neutral or below on the Likert scale (on average) and determine how these areas could be improved through the lesson plan (ie: through changing the scenario complexity, highlighting a specific area of interest, presenting learning outcomes during prebrief etc)
- Review areas for improvement as identified by participants
- Consider if the areas of improvement can be implemented in future iterations of the session

8.2.2 – Faculty Reflection

Faculty should reflect on the simulation-based education session based on Gibb's Reflective Cycle. As cited by The University of Edinburgh (2024), this cycle was developed to give structure to learning from experiences, allows for learning from aspects of the experience that needed improvement, and plan for similar experiences in the future. The cycle includes six-stages; description, feelings, evaluation, analysis, conclusion and action plan. Critical reflection is essential for faculty to improve performance and confidence in their teaching practice, and Gibb's Reflective Cycle provides a framework for this reflection. The action plan within their reflection may inform changes to the lesson plan and future performance within this simulation scenario. Faculty should complete their critical reflection soon as possible following the education session. Faculty may also conduct a debrief with other faculty members to discuss aspects of the session that requires follow-up, such as difficult learner questions and unexpected reactions.

9 – References

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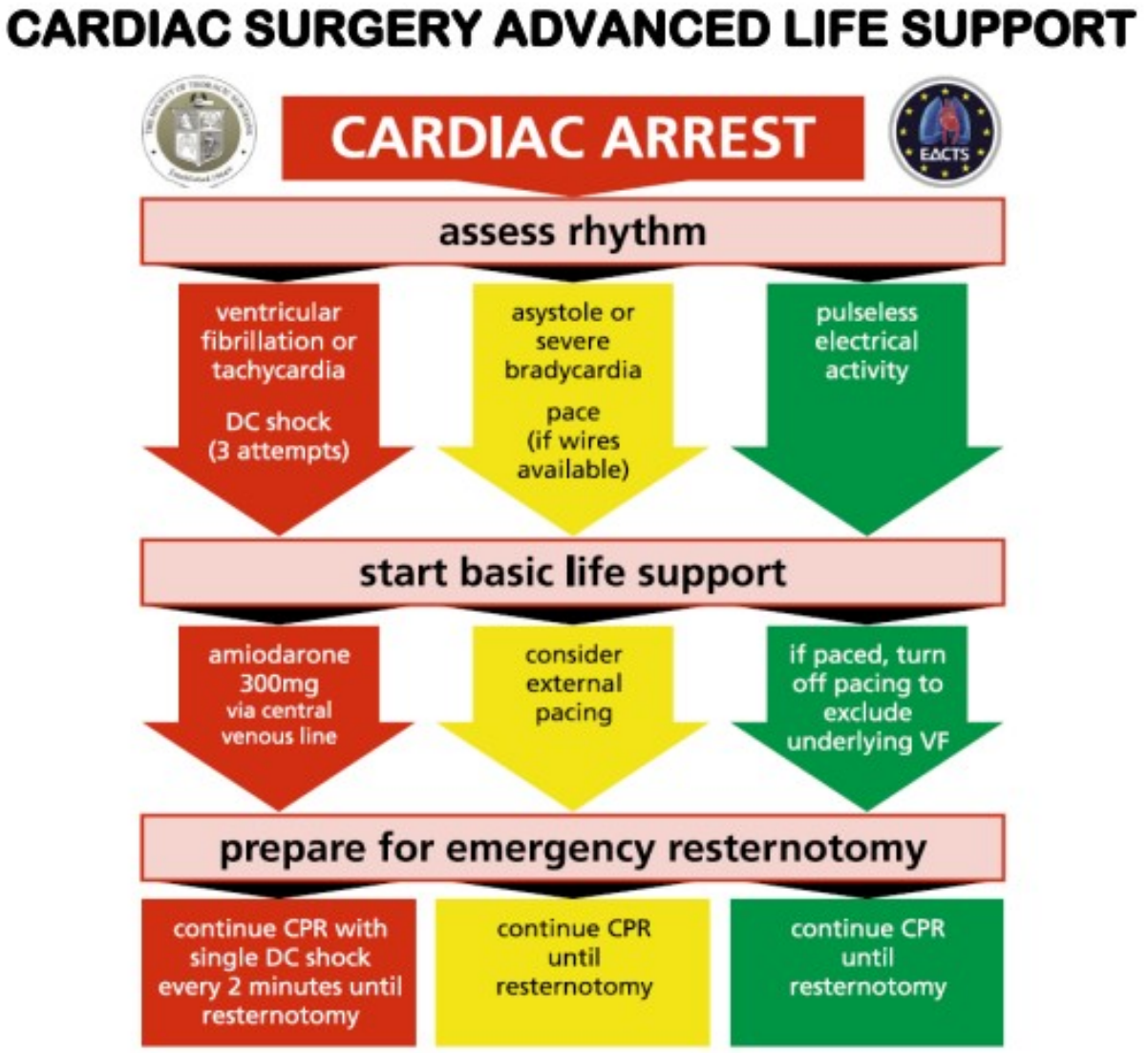
10 – Appendices

Appendix 1: Set up example

Note: Pacing box not available for this example due to unit requirements but would be connected to the mannequin's chest on either side of sternum

Note: Noradrenaline connected to manifold, propofol connected to white lumen and maintenance (with oxycodone) connected to brown lumen

Appendix 2: Cardiac Surgery Advanced Life Support Algorithm



Do not delay basic life support for defibrillation or pacing for more than one minute

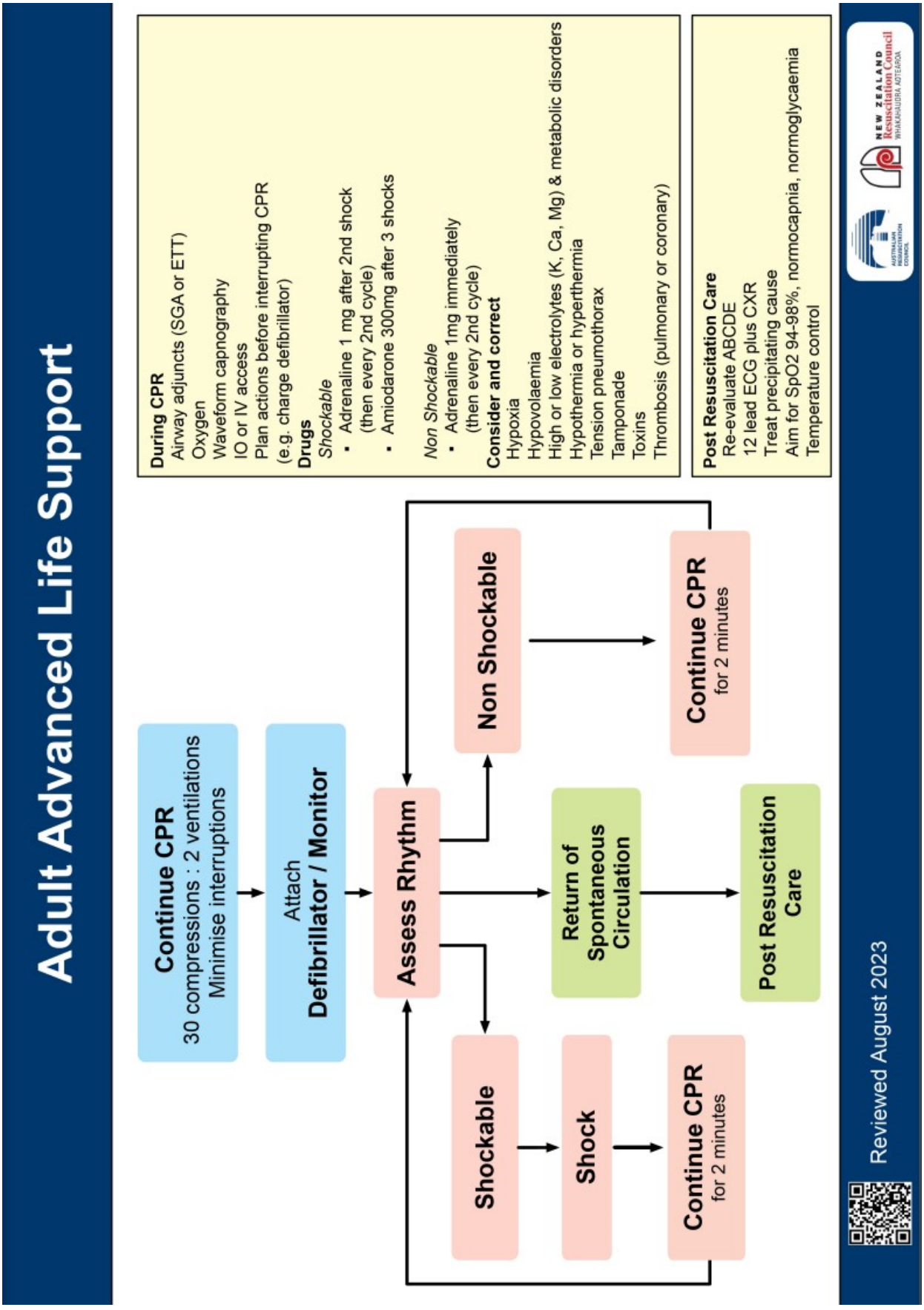
AIRWAY AND VENTILATION

- If ventilated, increase Fi02 to 100% and switch off PEEP
- Change to bag/ valve with 100% O2, verify ETT position and cuff inflation and listen for breath sound bilaterally to exclude pneumothorax or haemothorax
- If tension pneumothorax suspected, immediately place large bore canula in the 2nd rib space, anterior mid-clavicular line.

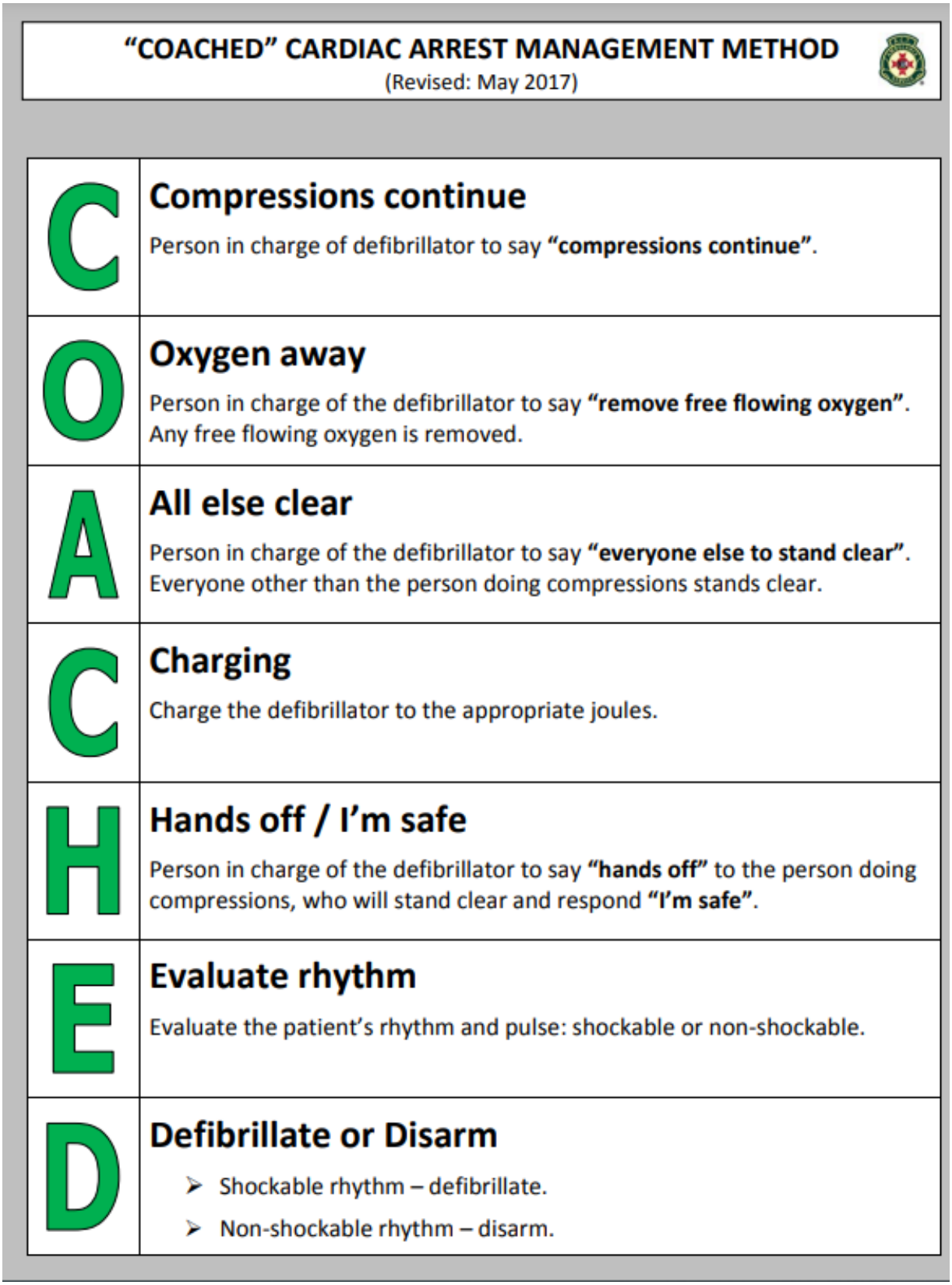
ADRENALINE may be given in small increments (50 – 200mcg) under the advice and supervision of a senior medical officer

If an IABP is in place, change to pressure trigger

Appendix 3: Adult Advanced Life Support Algorithm



Appendix 4: COACHED Mnemonic



"COACHED" CARDIAC ARREST MANAGEMENT METHOD
(Revised: May 2017)

C	**Compressions continue** Person in charge of defibrillator to say **"compressions continue"**.
O	**Oxygen away** Person in charge of the defibrillator to say **"remove free flowing oxygen"**. Any free flowing oxygen is removed.
A	**All else clear** Person in charge of the defibrillator to say **"everyone else to stand clear"**. Everyone other than the person doing compressions stands clear.
C	**Charging** Charge the defibrillator to the appropriate joules.
H	**Hands off / I'm safe** Person in charge of the defibrillator to say **"hands off"** to the person doing compressions, who will stand clear and respond **"I'm safe"**.
E	**Evaluate rhythm** Evaluate the patient's rhythm and pulse: shockable or non-shockable.
D	**Defibrillate or Disarm** ➢ Shockable rhythm – defibrillate. ➢ Non-shockable rhythm – disarm.

From https://esa.act.gov.au/sites/default/files/wp-content/uploads/35-COACHED-CARDIAC-ARREST-MANAGEMENT-METHOD.pdf

Appendix 5: Observer Checklist

What signs of cardiac tamponade were present within the scenario?

_____
_____
_____
_____

Did the learners in the scenario correctly identify Advanced Life Support Algorithm? YES/NO

Why was the algorithm chosen correct/incorrect?

_____
_____
_____
_____

Did learners turn off pacing box when PEA arrest identified? YES/NO

Did learners deliver 3 stacked shocks when VF identified? YES/NO

Did learners highlight the need to call for the Cardiothoracic team? YES/NO

Who was allocated the role of calling the Cardiothoracic team? _____

Was communication 'closed loop' throughout the scenario? YES/NO

Who was allocated to each role during the scenario?

1. Team Leader _____
2. Airway/ Breathing _____
3. CPR _____
4. Defibrillation _____
5. Medications _____
6. ICU Co-ordinator _____

Were these role allocations appropriate? YES/NO

Comments

_____
_____
_____
_____