

Simulation Package: PEA & Post Arrest Cares

An open access resource for clinical educators



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Bank Of iNdependently Useful Simulations

Part of the Children's Health Queensland 'Optimus' curriculum.

Optimus BONUS : CPR & Post Arrest Cares

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Simulation 1: Pulseless Electrical Activity

Simulation focused on CPR rehearsal & co-ordination



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Introduction by Professor Jason Acworth



Jason Acworth is a paediatric emergency physician working at the QCH emergency department. He is the Director of the CHQ STORK Statewide Simulation Service and the Medical Lead of the CHQ Rapid Response System Coordination Unit.

Jason has a long-held passion for paediatric resuscitation and simulation education. He started facilitating in situ interprofessional paediatric emergency simulations in his ED in 1998 and has been doing them ever since. He has been an APLS Course Director & Instructor for over 25 years and is the Past President of APLS Australia. He has an ongoing role in the publication of international paediatric resuscitation guidelines as the Chair of the Australian Resuscitation Council PLS Sub-committee and the ANZCOR PLS Expert Reference Group; and as the Vice Chair of International Liaison Committee on Resuscitation (ILCOR) PLS Task Force.

“Out of hospital cardiac arrest (OHCA) is, thankfully, rare in children. In the Aus-ROC Australian and New Zealand OHCA Registry, fewer than 500 (2.5%) of the 19722 OHCA case recorded in 2015 occurred in children.

The majority of paediatric OHCA (~70%) occur in younger children (<8years) with >20% occurring in infants. Most (88%) OHCA in kids occur in the family home. In 90% of paediatric OHCA the first monitored rhythm is asystole or PEA (non-shockable) but in teenage patients up to 1/3 may have a first monitored rhythm of VT or VF.

Unfortunately, only around 1 in 12 children suffering OHCA survive to hospital discharge (as opposed to 1 in 8 adults) and only ¾ of these survive with a favourable neurological outcome. Children with VT/VF are 6 times more likely to survive with a good neurological outcome.

High quality CPR is the cornerstone of resuscitation. Bystander CPR in the pre-hospital setting is associated with improved outcomes. Once a patient makes it into hospital, we use advanced equipment, agreed algorithms & systems of care, and slick teamwork to give these kids the best chance at a good survival. If we manage to get return of spontaneous circulation (ROSC) the focus instantly changes to post-arrest care and maximising neurological outcome.

As clinicians, we also need to recognise that paediatric cardiac arrest is a highly emotive event – for the family, for our teams, and for us as individuals. As a father of 2 boys, I remember every single paediatric cardiac arrest I have managed.

I am very passionate about educating our resuscitators (community, pre-hospital & hospital) and improving systems of care to help improve outcomes from paediatric cardiac arrest. I hope this BONUS simulation contributes to that improvement.”

Section I: Scenario Demographics

Scenario Title:	CPR: Pulseless Electrical Activity
Date of Development:	July 2019
Target Learning Group:	Multidisciplinary Teams that look after Paediatric Patients

Section II: Scenario Developers

Scenario Developers:	Dr Sonia Twigg, Dr Ben Symon, Dr Ben Lawton, Ms Louise Dodson, Ms Tricia Pilotto, Dr Carolina Ardila Sarmiento
Reviewed by:	Dr Jason Acworth, Dr Fiona Brown (2025 update)

Section III: Equipment and Staffing

Scenario Cast		
Patient:	<input type="checkbox"/> Mannequin suitable for CPR rehearsal [ideally with CPR performance feedback]	
Actors	1 or 2 Paramedics delivering CPR on arrival	
Required Monitors		
<input type="checkbox"/> ECG Leads/Wires	<input type="checkbox"/> Pulse Oximeter	<input type="checkbox"/> Capnography
<input type="checkbox"/> NIBP Cuff	<input type="checkbox"/> Defibrillator Pads	<input type="checkbox"/> CPR feedback devices
Required Equipment		
<input type="checkbox"/> Gloves	<input type="checkbox"/> IV Bags/Lines	<input type="checkbox"/> ET Tubes
<input type="checkbox"/> Stethoscope	<input type="checkbox"/> IV Push Medications	<input type="checkbox"/> LMA
<input type="checkbox"/> Defibrillator	<input type="checkbox"/> Bag Valve Mask	<input type="checkbox"/> Ventilator with test lung attached
<input type="checkbox"/> Intraosseous Set-up	<input type="checkbox"/> Laryngoscope	<input type="checkbox"/> Other: tapes to secure ETT
Moulage		
<ul style="list-style-type: none"> • Intraosseous R tibia • LMA inserted and taped • 2 x IVC with drainage bags attached <ul style="list-style-type: none"> ○ One in a cubital fossa labelled "No IVC" ○ One in alternative cubital fossa labelled "Intraosseous Medication Line" 		

Section IV: Curriculum

Learning Goals & Objectives – Post arrest version

Educational Goal:	<ul style="list-style-type: none"> Team approach to paediatric arrest secondary to pulseless electrical activity
Skills Rehearsal:	<ul style="list-style-type: none"> Team approach to Paediatric CPR Ventilating via LMA during CPR CPR coaching
Systems Assessment:	<ul style="list-style-type: none"> Availability & ergonomics of equipment for paediatric cardiac arrest Presence of guidelines and cognitive aids in department for paediatric cardiac arrest Availability and integration of paediatric CPR feedback devices [if used in your service]

Case Summary: Brief Summary of Case Progression and Major Events

A toddler arrives in PEA arrest 25 minutes after drowning in the bath:

- Effective CPR given by parent and paramedics en route
- The availability and timing of paediatric and retrieval services available for your hospital should reflect your locally available services
- The simulation continues long enough for the team to rehearse the associated clinical skills.

Simulation Customisation Options

Environment

You are welcome to change the location or setting of this scenario to fit your workplace.

For example:

- The arrest has occurred in the hospital bath on the ward.

Section V: Scripts

Begin Sim with Phone Warning from Ambulance Service



"Hi, this is Ambulance Comms.

A crew is a few minutes away with a 20 month old boy who has drowned in the bath – found within 5 minutes. Weight 12kg.

They arrived 10 minutes after he was found.

CPR is ongoing - PEA rhythm - IO placed and 1 dose of adrenaline given. An LMA has been inserted. They will be there in 5 minutes."

Paramedic Handover on arrival of patient



Can your team take over CPR and I'll handover?

This is Toby, 20 month old boy. Weight 12kg.

This is Mum.

Toby drowned in the bath at his home, very close to the hospital. His mother went to check on the dinner cooking with an older sibling, and when she came back in less than 5 minutes, he was lifeless in the bath. She pulled him out, started CPR and her partner called the ambulance.

We arrived 10 minutes after the call, Mum was doing effective CPR.

Our team started ALS, noted a PEA rhythm, inserted an IO, inserted an LMA and transported to hospital. He's now had 2 doses of 10mcg/kg of adrenaline. It is about 25 minutes post arrest.

A: LMA insitu and taped

B: Bag Mask ventilation getting good chest rise and fall

C: IO in right tibia. Due adrenaline at the next rhythm check

D: No signs of life throughout. BSL 4.1

No allergies, no medical problems, well recently and immunisations up to date

Scenario State 1: Notification and Team Briefing

Patient State	Patient Status	Learner Actions	Modifiers & Triggers to Move to Next State
Pre arrival	Patient en route via ambulance Initial phone call to team informing of arrival (as per handover card)	Anticipate and plan for child in cardiac arrest, including : <ul style="list-style-type: none"> • Activate resuscitation team • Team leader gives pre-brief • Allocate roles including CPR coach (if utilized in your hospital) • Prepare equipment, medication and optimise space including IV equipment, defibrillation machine, CPR feedback pads and ventilator 	<u>Triggers</u> Allow sufficient time for team to effectively brief and prepare



“Hi, this is Ambulance Comms.

A crew is a few minutes away with a 20 month old boy who has drowned in the bath – found within 5 minutes. Weight 12kg.

They arrived 10 minutes after he was found.

CPR is ongoing - PEA rhythm - IO placed and 1 dose of adrenaline given. An LMA has been inserted. They will be there in 5 minutes.”

State 2: Paramedic Handover

Patient State	Patient Status	Learner Actions	Modifiers & Triggers to Move to Next State
Rhythm: PEA HR: no trace BP: no trace Cap refill >5s RR: 0 O₂ SAT: no trace T: 35.5 AVPU = U GCS 3 BSL 4.1	PEA Arrest Paramedic provides handover as per script	Receive handover while maintaining high quality CPR <ul style="list-style-type: none"> Deliver high quality CPR according to ANZCOR guidelines Investigate 4 H's and 4 T's Bedside ECHO report, venous gas, CXR available if requested 	<u>Modifiers</u> <ul style="list-style-type: none"> If inadequate CPR then ET CO₂ is 5. If effective CPR then ETCO₂ is 25. <u>Triggers</u> <ul style="list-style-type: none"> Continue cycles of CPR and rhythm checks for the length of time you deem necessary for your team to have rehearsed At this point, confirm ROSC occurs. ROSC is indicated by rise in ETCO₂ to 32 and return of pulse. Then move to next state.



Can your team take over CPR and I'll handover? This is Toby, 20 month old boy. Weight 12kg. This is Mum.

Toby drowned in the bath at his home, very close to the hospital. His mother went to check on the dinner cooking and when she came back in less than 5 minutes, he was lifeless in the bath. She pulled him out, started CPR and her partner called the ambulance.

We arrived 10 minutes after the call, Mum was doing effective CPR.

Our team started ALS, noted a PEA rhythm, inserted an IO, inserted an LMA and transported to hospital. He's now had 2 doses of 10mcg/kg of adrenaline. It is about 25 minutes post arrest.

A: LMA insitu and taped

B: Bag Mask ventilation getting good chest rise and fall

C: IO in right tibia. Due adrenaline at the next rhythm check

D: No signs of life throughout. BSL 4.1

No allergies, no medical problems, well recently and immunisations up to date

State 3: Return of Spontaneous Circulation

Patient State	Patient Status	Learner Actions	Modifiers & Triggers to Move to Next State
Rhythm: NSR HR: 150 BP: 60/40 Cap refill 4s RR: bagging rate O₂ SAT: 91% LMA ETCO₂: 35 T: 35.5 AVPU = P GCS 8 (E1 M5 V2) Eyes closed Localises to pain. Moans to pain. BSL 4.4	Colour starts to improve ETCO ₂ increases Pulse palpable	<u>Learner Actions :</u> <ul style="list-style-type: none"> • Detect pulse • Review for signs of life • Cease CPR once adequate signs of life and stable BP • Identify need for post arrest cares • Discuss disposition with senior staff / retrieval services as appropriate for your location 	

Optional handover to close scenario



Hi, I'm the Senior Medical Officer on call.
 Thanks for managing the case so far, can you give me a recap of where we're up to?

OK great, we'll need to shift gears now to thinking about post arrest cares.

Section VII: Debriefing Guide

Objectives

Educational Goal:	<ul style="list-style-type: none"> Team approach to paediatric arrest secondary to pulseless electrical activity
Skills Rehearsal:	<ul style="list-style-type: none"> Team approach to Paediatric CPR Ventilating via LMA during CPR CPR coaching
Systems Assessment:	<ul style="list-style-type: none"> Availability & ergonomics of equipment for paediatric cardiac arrest Presence of guidelines and cognitive aids in department for paediatric cardiac arrest Availability and integration of paediatric CPR feedback devices [if used in your service]

Sample Questions for Debriefing

I'd like to explore how our department is equipped to treat paediatric cardiac arrest :

- Was the equipment appropriate?
- What should be changed?
- What cognitive aids do we have in ED about Paediatric Cardiac Arrest?
 - How could we more effectively use them when treating real patients?

I'd like to talk about ensuring effective CPR in an Arrest :

- How does your team facilitate effective ambulance handover when CPR is in progress?
- Have you considered assigning a CPR coach during real arrests?
- How do we monitor CPR performance in our department?
 - E.g. CPR feedback devices, ETCO₂, Arterial BP

I'd like to reflect on caring for this patient after ROSC in our department :

- What will be disposition for this patient after ROSC?
- How do you organise retrieval or transfer to PICU within your service?

Key Moments

Team briefing

Quality of CPR including:

- Rate and depth of compressions
- Staff rotation on 2 minutely cycles
- Minimisation of hands-off time at rhythm check

Exploration of cause (ie 4 H's and 4 T's)

Using an ABCDE approach to reassess after ROSC.

Communicating with the retrieval team and PICU.

Section VI: Investigation Results

Venous Gas

VBG	Results	Units	Normal Range
pH	6.9		7.32 – 7.42
pCO ₂	60	mmHg	41 - 51
pO ₂	60	mmHg	25 - 40
O ₂ Saturations	95%	%	40 - 70
Bicarb	13	mmol/L	22 - 33
BE		mmol/L	-3 - +3
HCT			0.3 - 0.42
Hb	110	g/L	105 - 135
Na ⁺	135	mmol/L	135 - 145
K ⁺	5.5	mmol/L	3.2 - 4.5
Ca ⁺⁺ (ionised)	1.2	mmol/L	1.15 – 1.35
Glucose	4.4	mmol/L	3.0 – 7.8
Lactate	5.0	mmol/L	0.7 – 2.5

Bedside ECHO report (if requested)

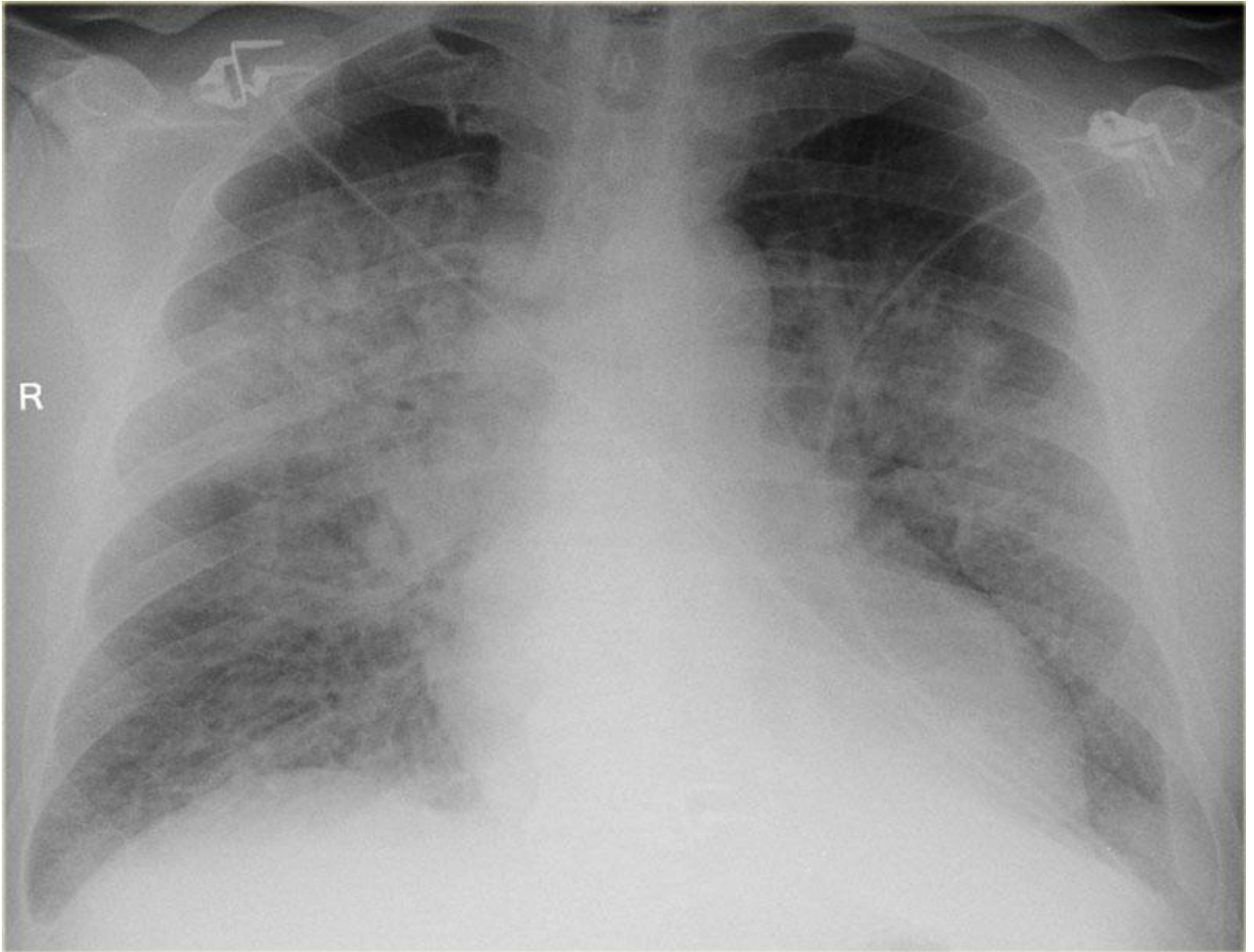
“Occasional weak, erratic cardiac contractility was observed, though overall cardiac output remains severely compromised.

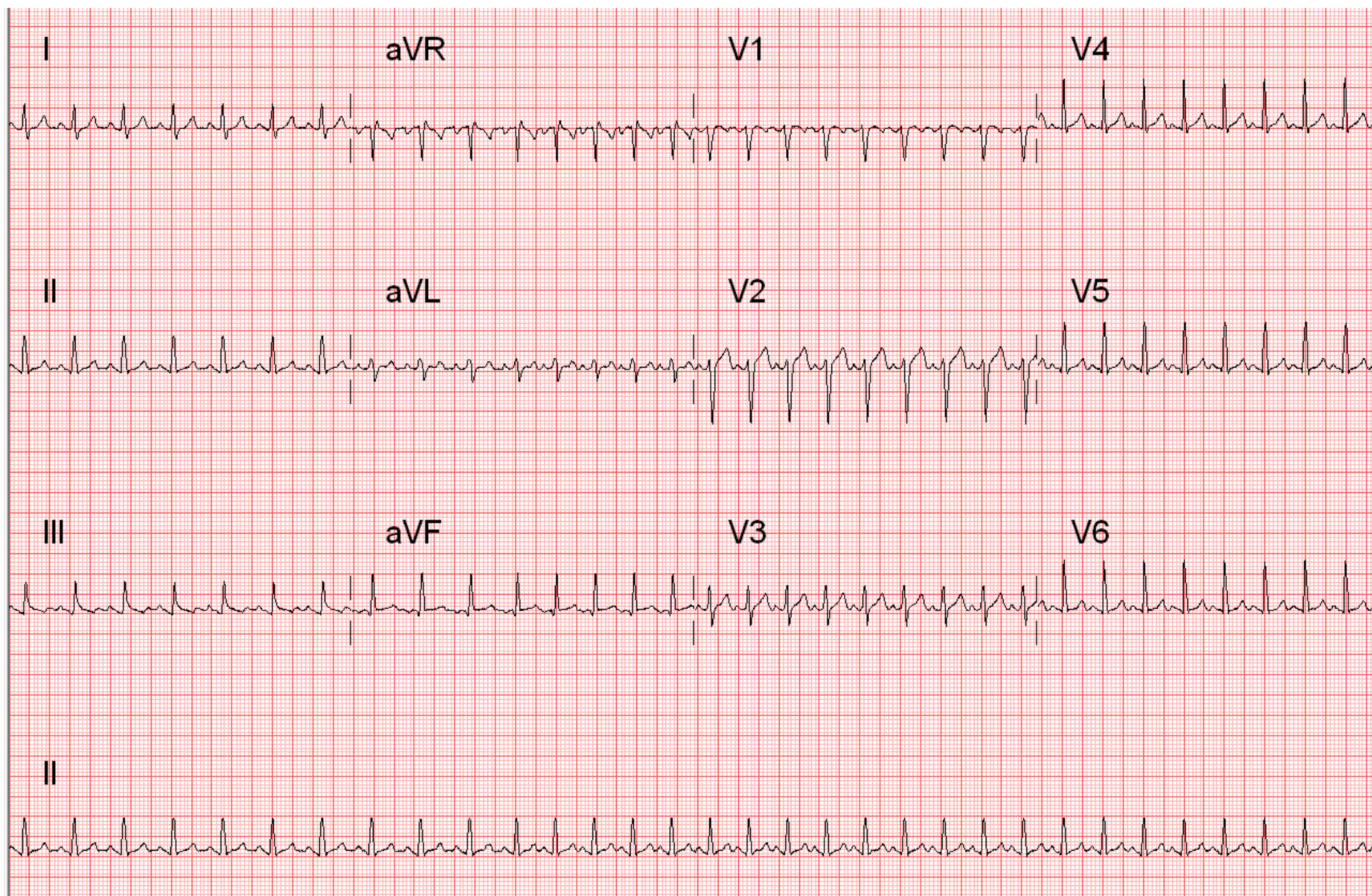
No significant pericardial effusion or structural abnormalities were seen.

Both left and right ventricles appeared of normal size without signs of acute dysfunction, and no major valvular abnormalities were noted.

The findings suggest hypoxic myocardial injury, with some transient mechanical activity despite ongoing PEA.”

Chest X-Ray





Resources for Pulseless Electrical Activity Simulation



ANZCOR Guidelines



Online Video : APLS PAC 2018 What's New in Paediatric Resuscitation? Dr Jason Acworth



DRSABCD Demonstration Video Optimus CORE



Blog Post : The CPR Coach A Paradigm Shift in Resuscitation Teams

Curriculum

This package is designed for **individuals** to refresh and retain the following skills learned in previous OPTIMUS courses as well as add new knowledge on paediatric resuscitation

Optimus CORE	Optimus PRIME	Optimus PULSE
<ul style="list-style-type: none"> Intravenous access Fluid prescription & rapid administration Paediatric Basic Life Support Adrenaline prescription and administration 	<ul style="list-style-type: none"> Securing an endotracheal tube Fluids in shock Inotrope prescription and administration 	<ul style="list-style-type: none"> Paediatric CPR as per ANZCOR guidelines

This package is designed to offer your **department** a systems level check regarding:

Access to paediatric resources on: <ul style="list-style-type: none"> ALS training 	<input type="checkbox"/>
Equipment Check: <ul style="list-style-type: none"> Use of infusion pumps for administering adrenaline Use of the ventilator 	<input type="checkbox"/> <input type="checkbox"/>
Departmental Protocols for: <ul style="list-style-type: none"> Intubation/ airway checklist Organising retrieval or transfer Preparing for retrieval – use of a checklist. 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

If you would like any assistance obtaining access or advice for any of the above issues, please contact stork@health.qld.gov.au

Simulation 2: Post Arrest Cares

Simulation focused on stabilisation post arrest



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Introduction by Dr Michaela Waak

MD/PhD, FRACP, FRACP Neurology, Queensland Children's Hospital



Dr Waak is internationally one of the few paediatric specialists with fellowships in paediatrics, neurology and paediatric intensive care including paediatric retrieval medicine and has obtained these degrees in different international settings.

Since arriving in Brisbane in 2012 she has implemented significant improvements in the care of children through audits and guideline developments including an EEG pathway and paediatric code stroke process.

She is CIA on projects investigating the impact of an interdisciplinary educational program for paediatric neurocritical care. She is also inaugural faculty and manual author of the national education and training course in neurocritical care (Paediatric Neuro-critical Care: beyond BASIC), the first paediatric course of its kind.

“A significant proportion of paediatric patients presenting to Emergency Departments that require PICU admission have a neurological injury on presentation (20%). An even larger proportion is at risk of neurological complications or injury during their PICU stay (>60%). There is convincing evidence that receiving care by appropriately trained multidisciplinary teams following best practice bundles of care will significantly improve outcomes. Best practice care starts in the pre-hospital and Emergency Department setting and continues through the patient's journey.

Appropriate recognition and timely management of patients at risk of brain injury is a significant problem in Australian hospitals and in healthcare facilities around the world. Like polytrauma, acute myocardial infarction, or stroke, the speed and appropriate choice of therapy in the initial hours after brain injury are crucial. These are aimed at preventing secondary brain injury and can influence outcome.

This Simulation is designed to raise awareness getting your “A, B, C”s right and ensuring good “brain support” or “D”. The brain is the only organ that once damaged cannot be replaced or transplanted. Learning points from this scenario aim to help reduce variability in paediatric neurocritical care.

Considerable work has been done across the globe to address brain injury and develop neurocritical care models. But in contrast to other time critical diseases, the lack of benchmarking and systematic quality improvement in the field of hypoxic brain injury and other neurocritical care disease in Queensland, and low community awareness and education, represents a major risk to patients and society. It is time to change the trajectory of patients at risk of secondary brain injury.

The key educational points for you to consider are:

- **Early recognition** of patients who could be at risk for secondary brain injury - listen to parental concerns and their reasoning, trust your gut - look at the big picture not the individual pieces in front of you.
- **Paediatric brain injury (especially hypoxic injury) can present in a variety of different shapes and forms.** Thorough, individual patient assessment is key. Use your clinical judgement to detect abnormalities. There are no easy and clear early prognostication indices, so an individual patient centred approach should be used when assessing a patient and deciding if full neuroprotective care is indicated.
- **Some good prognostic markers for out of hospital cardiac arrest patients are :** age > 1 year, initial cardiac rhythm VF and CPR < 20 min (although these should NOT be used in isolation, but as part of the big picture and initial full assessment).
- **Manage patients early and use the resources available to you to assist** (including experienced Paediatric Emergency or PICU physicians).
- **Peripheral sites are asked to consider that if a paediatric patient has sustained a brain injury, manage according to local hospital policy and escalate to the appropriate service early.** Retrieval services would prefer to get a call early and not respond, then receive a call late, when it is too late.”

Section I: Scenario Demographics

Scenario Title:	Post Arrest Cares
Date of Development:	July 2019
Target Learning Group:	Multidisciplinary Teams that look after Paediatric Patients

Section II: Scenario Developers

Scenario Developers:	Dr Sonia Twigg, Dr Ben Symon, Dr Ben Lawton, Louise Dodson, Tricia Pilotto, Dr Carolina Ardila Sarmiento
Reviewed by:	Dr Michaela Waak, Dr Jason Acworth, Dr Bruce Lister, Dr Phil Sargent Dr Fiona Brown (2025 Update)

Section III: Equipment and Staffing

Scenario Cast							
Patient:	<input type="checkbox"/> Mannequin						
Confederate 1:	Airway Paramedic : Ventilating using Bag Valve Mask to give breaths via LMA.						
Confederate 2:	Handover Paramedic : Gives handover once team gives OK						
Required Monitors							
<input type="checkbox"/> ECG Leads/Wires	<input type="checkbox"/> Pulse Oximeter	<input type="checkbox"/> Capnography					
<input type="checkbox"/> NIBP Cuff	<input type="checkbox"/> Defibrillator Pads						
Required Equipment							
<input type="checkbox"/> Gloves	<input type="checkbox"/> IV Bags/Lines	<input type="checkbox"/> ET Tubes					
<input type="checkbox"/> Stethoscope	<input type="checkbox"/> IV Push Medications	<input type="checkbox"/> LMA					
<input type="checkbox"/> Defibrillator	<input type="checkbox"/> Bag Valve Mask	<input type="checkbox"/> Ventilator with test lung attached					
<input type="checkbox"/> Intraosseous Set-up	<input type="checkbox"/> Laryngoscope	<input type="checkbox"/> Other: tapes to secure ETT					
Moulage							
<ul style="list-style-type: none"> Intraosseous R tibia (with drainage bag attached to leg) LMA insitu and taped 2x IVC with drainage bag attached – one in each cubital fossa. One of these has a 'No IV' Sticker, which can be taken off when second line successfully placed 							
Approximate Timing							
Set-Up:	15 mins	Prebrief:	15 mins	Scenario:	20 min	Debriefing:	20 min

A. Patient Profile and History			
Patient Name: Toby	Age: 20 months	Weight: 12kg	
Gender: Male			
Chief Complaint: Cardiac arrest			
History of Presenting Illness: Drowned in the bath			
Past Medical History:	NVD at term	Medications: Nil regular	Immunisations: Up to date
Allergies: NKDA			
Social History: Lives with parents			
Family History: Nil significant			

Section IV: Curriculum

Learning Goals & Objectives – Post Arrest Cares

Educational Goal:	<ul style="list-style-type: none"> Develop a structured approach to the post arrest patient
Skills Rehearsal:	<ul style="list-style-type: none"> Reassess and care for the child post arrest using an ABCDE approach based on evidence based strategies
Systems Assessment:	<ul style="list-style-type: none"> Departmental resources on Paediatric Drug Infusions Paediatric Ventilator Software and Equipment available Departmental protocols for escalation of care

Case Summary: Brief Summary of Case Progression and Major Events

A toddler in PEA arrest has been resuscitated by a paramedic team. After 25 minutes of CPR he has just developed signs of life upon arrival into your department.

- This scenario provides the opportunity for staff to rehearse what happens *after the arrest*.
- The availability and timing of paediatric and retrieval services available for your hospital should reflect your locally available services.

Section V: Scripts

Begin sim with phone warning from ambulance service



Hi, this is Ambulance Comms.

A paramedic crew is a few minutes away with a 20 month old boy who has drowned in the bath. He was found within 5 minutes. Weight 12kg.

The crew arrived 10 minutes after he was found in PEA rhythm. An IO has been placed and 3 arrest doses of adrenaline given.

They obtained ROSC at 25 minutes after he was found. They have placed an LMA. They will be there in 5 minutes.

Paramedic handover on arrival of patient



Hi I am..... the critical care paramedic called to the scene.

This is Toby, 20 month old boy. His mother says he weighs 12kg.

Toby drowned in the bath at his home very close to the hospital. His mother went to check on the dinner cooking and when she came back within 5 minutes, he was lifeless in the bath. She pulled him out, started CPR and her partner called the ambulance.

When we arrived 10 minutes later, she was doing effective CPR. Our team started ALS, noted a PEA rhythm, inserted an IO – gave 3 arrest doses each of 120 micrograms of adrenaline, placed an LMA and gained ROSC at 25 minutes after he was found. It is about 40 minutes post arrest.

Going through a quick ABCD:

A: He has an LMA inserted which he's tolerating

B: We've been assisting his breathing - bagging via the LMA. Good ETCO₂ trace. SaO₂ 90% on 15L/min oxygen. RR about 10-15 per minute.

C: He has an IO in his right tibia. BP has been low 60/40, HR in NSR at 150bpm. We have given a 10ml/kg fluid bolus enroute.

D: BSL was 4.1. Pupils equal. He does localise to a painful stimulus but has not opened his eyes or made any noise – GCS 7.

Toby has no allergies, no medical problems, has been well recently and his immunisations are up to date. His parents are here."

Script for parent (optional)

As you are representing parents of children in this scenario, please present as a supportive, sensible parent. It can be tempting to be dramatic in a cardiac arrest scenario, but this often stereotypes parents and is unhelpful to clinical rehearsal.

Within this role, please present yourself as understandably upset about what has happened, but are relieved that your son's heart is now in a normal rhythm. You are appropriately concerned about what will happen next, and why he is still so flat despite his heart rhythm returning. Your main goal as an actor is to provide the team with the opportunity to communicate with a parent during a resuscitation, rather than communicating with a highly distressed person.

You will seek guidance from the team about your son's trajectory and where he will be heading next for further care.

Please provide this information as requested from treating team. Some of it may not be necessary.



Questions to ask at appropriate times:

I'm Toby's Mum.

I can't believe this has happened and I feel awful, is he going to be OK?

What happens next?

Is he going to recover?

If asked:

- Toby has no past medical problems, he's been completely well before now.
- He was in the bath with his older brother when I stepped out to check on the cooking, but when I came back 5 minutes later he was under the water.
- I gave CPR straight away while my partner called the ambulance, I'm a community life support instructor so we were onto that quite fast.
- He has had all his immunisations and he has no allergies.

Section VI : Post Arrest Cares Simulation

Scenario State 1: Notification and Team Briefing

Patient State	Patient Status	Learner Actions	Modifiers & Triggers to Move to Next State
Pre arrival	<p>Patient en route via ambulance</p> <p>Initial phone call to team informing of arrival (as per handover card)</p>	<p>Anticipate and plan for child in cardiac arrest, including :</p> <ul style="list-style-type: none"> • Activate resuscitation team • Team leader gives pre-brief • Allocate roles • Prepare equipment, medication and optimise space 	<p><u>Triggers</u></p> <p>Allow sufficient time for team to effectively brief and prepare</p>



Hi, this is Ambulance Comms.

A paramedic crew is a few minutes away with a 20 month old boy who has drowned in the bath. He was found within 5 minutes. Weight 12kg.

The crew arrived 10 minutes after he was found in PEA rhythm. An IO has been placed and 3 arrest doses of adrenaline given.

They obtained ROSC at 25 minutes after he was found. They have placed an LMA. They will be there in 5 minutes.

State 2: Paramedic Handover

Patient State	Patient Status	Learner Actions	Modifiers & Triggers to Move to Next State
Rhythm: Sinus HR: 150 BP: 60/40 Cap refill 4s RR: 10-15 O₂ SAT: 90% LMA ETCO₂: 35 T: 35.5 AVPU = P GCS 7 (E1 M5 V1) BSL 4.4	Airway: LMA Breathing: Air entry bilaterally Circulation: cool peripheries Disability: Eyes closed, no localising to pain, No spontaneous sounds.	<ul style="list-style-type: none"> - Receive handover - Attach cardiac and pulse ox monitoring - Structured clinical assessment <ul style="list-style-type: none"> o Airway: check ventilating adequately with LMA, Discuss if intubation required. o Breathing: continue to bag, auscultate chest, organize CXR. o Circulation: IVC placed and bloods taken, Fluid bolus given. Consider adrenaline infusion. o Disability: BSL requested – avoid hypoglycaemia BSL 4.4-10. o Exposure: Temperature assessment 	<u>Modifiers</u> When fluid bolus given, BP rises to 75/50. <u>Triggers</u> If team does not escalate care appropriately, then consultant calls them explaining the ambulance service advised them there was a child who had had an arrest and they wondered if the team would like any help. Move to next phase.



Hi I am..... the critical care paramedic called to the scene. This is Toby, 20 month old boy. His mother says he weighs 12kg.

Toby drowned in the bath at his home very close to the hospital. His mother went to check on the dinner cooking and when she came back within 5 minutes, he was lifeless in the bath. She pulled him out, started CPR and her partner called the ambulance. When we arrived 10 minutes later, she was doing effective CPR. Our team started ALS, noted a PEA rhythm, inserted an IO – gave 3 arrest doses each of 120 micrograms of adrenaline, placed an LMA and gained ROSC at 25 minutes after he was found. It is about 40 minutes post arrest.

Going through a quick ABCD:

A: He has an LMA inserted which he's tolerating

B: We've been assisting his breathing - bagging via the LMA. Good ETCO₂ trace. SaO₂ 90% on 15L/min oxygen. RR about 10-15 per minute.

C: He has an IO in his right tibia. BP has been low 60/40, HR in NSR at 150bpm. We have given a 10ml/kg fluid bolus enroute.

D: BSL was 4.1. Pupils equal. He does localise to a painful stimulus but has not opened his eyes or made any noise – GCS 7.

Toby has no allergies, no medical problems, has been well recently and his immunisations are up to date. His Mum is here."

State 3: Structured reassessment and referral to ICU

Patient State	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State	
Rhythm: NSR HR: 150/min BP: 65/45 Cap refill 4s RR: 10-15 O₂ SAT: 90% LMA ETCO₂: (adjust to rate that team ventilates) T: 35.5°C AVPU P GCS 7 Eyes closed Localises to pain. No sounds. BSL: 4.4	Patient status unchanged from previous	<ul style="list-style-type: none"> - Refer to retrievals for transportation / escalation and advice - Airway: Discuss if child should be intubated. Options : intubate now if team confident, or later once retrieval team arrives. - Breathing: Option to put patient on the ventilator even if continuing with LMA. Aim for SaO₂ 94-98% Normoxia, and ETCO₂ 35-45 Normocapnia. - Circulation: Place 2nd IVC. Start by aiming for a normal for age BP. Consider adrenaline infusion. Request ECG. - Disability: ensure patient is sedated. - Exposure: check for any signs of trauma. Aim for normothermia T 36⁰ 	<u>Modifiers</u> Retrieval consultant recommends they use a retrieval checklist and advises using ABCDE approach :



Hello, it is from retrievals. How can I help?

This child needs to be transferred to PICU post their PEA arrest. We'll activate a team and come as soon as we can. In the meantime it is important to continue to manage the patient. We can consider post arrest cares using an A-E approach:

A: Intubate (if within scope of team). Otherwise wait until retrieval team arrives but make preparations to intubate when they arrive

B: Continue to bag at approx. 20 per minute until intubation

C: Aim for systolic BP of 90. Advise to commence inotrope infusion (adrenaline)

D: Continue to check AVPU or GCS regularly. If patient waking up then discuss again – may need LMA removed or intubation and sedation.

E: Aim for T 36 – no active cooling but important to avoid fever.

If you could prepare for intubation, we would recommend ketamine and rocuronium as RSI agents and then ongoing sedation with morphine and midazolam infusion. We will be there as soon as possible.

State 4: Intubation and preparation for transport

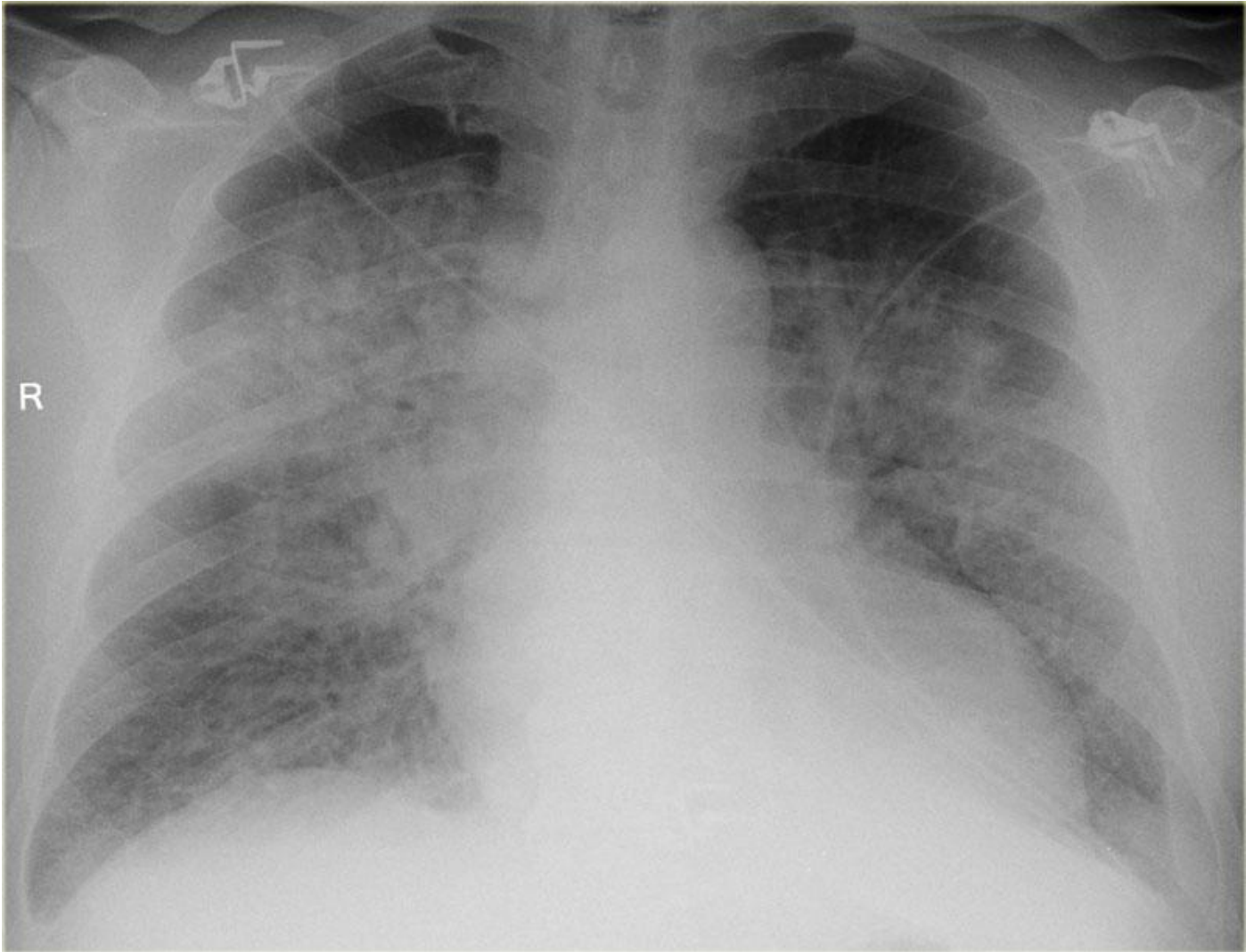
Patient State	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State	
Rhythm: NSR HR: 150/min BP: 90/60 Cap refill 3s RR: as per bagging or ventilator O₂ SAT: 92% T: 36.1°C AVPU = P GCS 7 (E1 M5 V1)		<ul style="list-style-type: none"> - Prepare to intubate using a checklist. - Intubate - Check ETT correctly positioned. - Tape ETT. - Attach to ventilator - Start sedation infusion after ETT 	<p><u>Modifiers</u></p> <p>Retrieval consultant can assist with details of intubation, parameters for ventilator and post intubation sedation medications as needed.</p> <p><u>Triggers</u></p> <p>Finish Sim when intubated or earlier if appropriate for your learners.</p> <p>Primary learning objective is not the intubation but team should have prepared to intubate.</p>

Section VI: Investigation Results for Post Arrest Cares

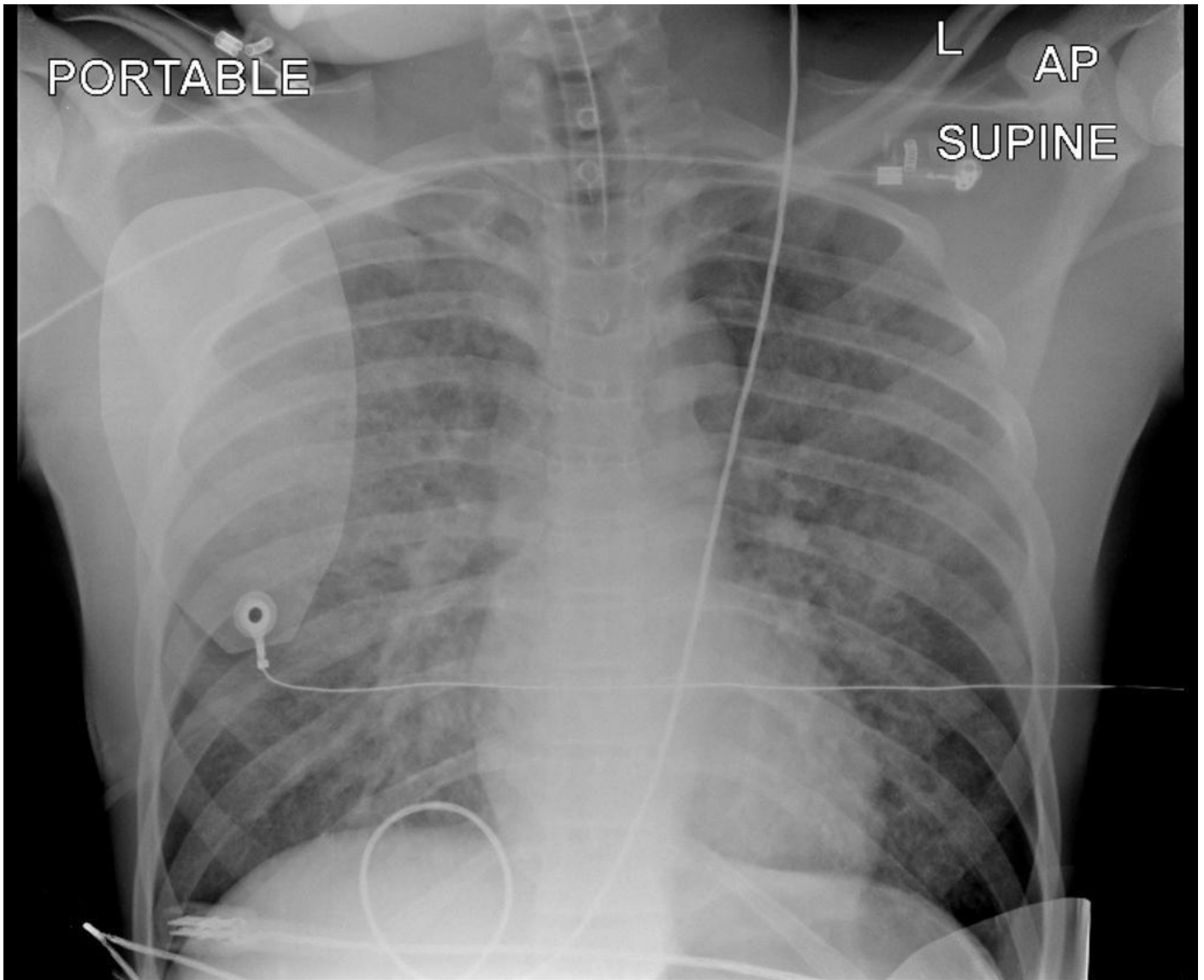
Venous gas (First sample post arrest)

VBG	Results	Units	Normal Range
pH	7.0		7.32 – 7.42
pCO ₂	55	mmHg	41 - 51
pO ₂	60	mmHg	25 - 40
O ₂ Saturations	79	%	40 - 70
Bicarb	13	mmol/L	22 - 33
BE	-10	mmol/L	-3 - +3
HCT	0.40		0.3 - 0.42
Hb	110	g/L	105 - 135
Na ⁺	135	mmol/L	135 - 145
K ⁺	5.5	mmol/L	3.2 - 4.5
Ca ⁺⁺ (ionised)	1.2	mmol/L	1.15 – 1.35
Glucose	4.4	mmol/L	3.0 – 7.8
Lactate	6.0	mmol/L	0.7 – 2.5

CXR (if patient not intubated at time of imaging)



Chest Xray (If Intubated at time of imaging)



Bedside ECHO report

Patient: Toby

Age: 20 months

Indication: Post-cardiac arrest assessment following drowning

Findings:

Cardiac Chambers:

- Normal cardiac anatomy
- No chamber dilatation or hypertrophy

Left Ventricle (LV):

- Mildly dilated
- Globally reduced contractility (LVEF estimated at 30-35%)
- No regional wall motion abnormalities
- No left ventricular thrombus

Right Ventricle (RV):

- Mildly reduced systolic function
- No significant dilatation

Valves:

- No structural abnormalities
- Trace physiological tricuspid and mitral regurgitation

Pericardium:

- No pericardial effusion

Inferior Vena Cava (IVC):

- 8 mm, collapses >50% with respiration (suggestive of normal right atrial pressure)

Aortic Arch & Great Vessels:

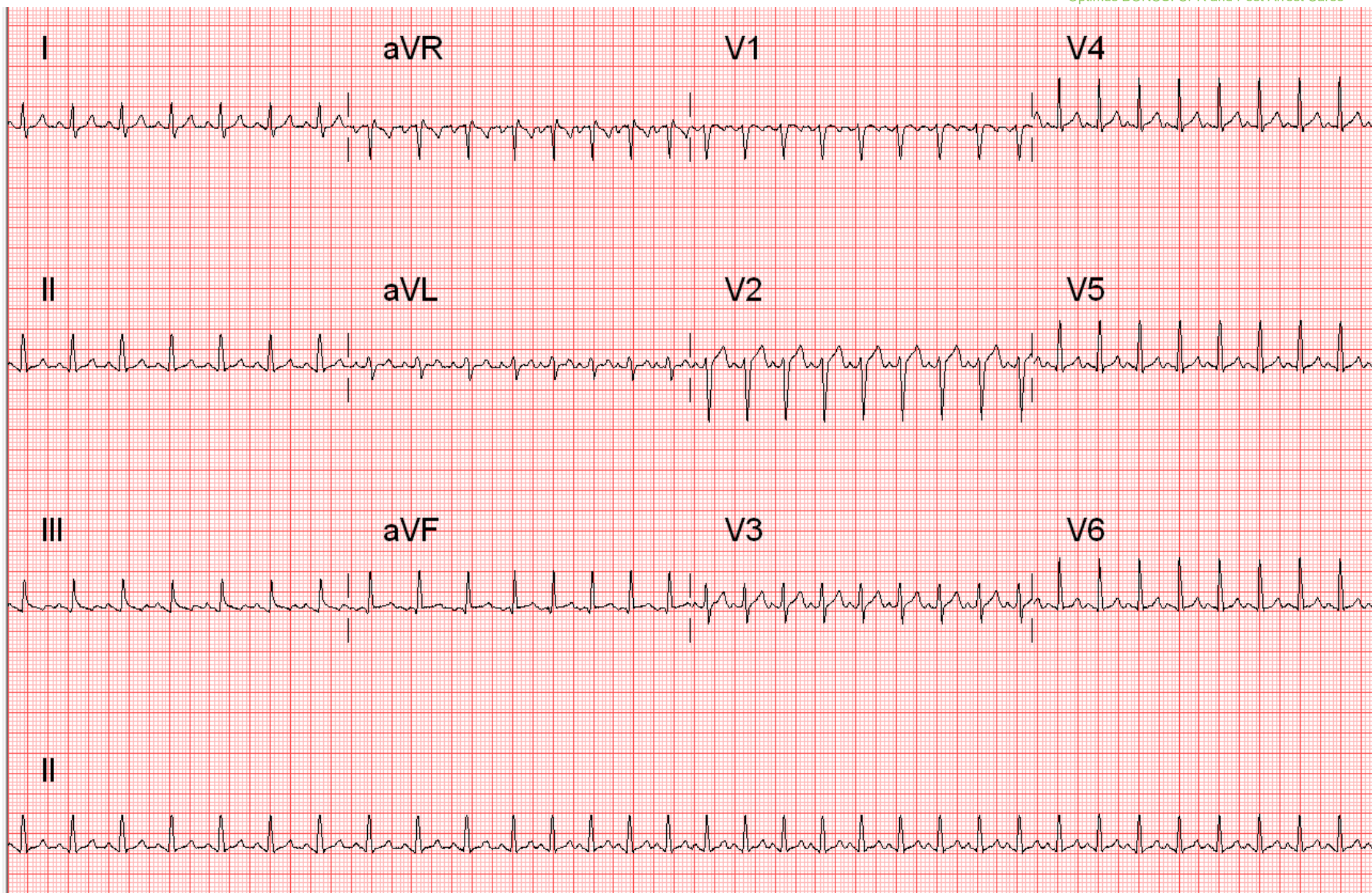
- Normal caliber
- No evidence of coarctation or PDA

Interpretation:

- Structurally normal heart
- Impaired global LV systolic function, likely due to post-arrest myocardial stunning
- No evidence of tamponade or significant pericardial effusion
- No evidence of congenital heart disease

Clinical Correlation & Recommendations:

- Findings suggest post-arrest myocardial dysfunction (myocardial stunning), which is expected following prolonged cardiac arrest.
- Monitor hemodynamics closely. Consider inotropic support if indicated (e.g., epinephrine, milrinone).
- Serial echocardiographic assessments may be required to evaluate recovery.



Section VII: Debriefing Guide

Objectives

Educational Goal:	<ul style="list-style-type: none"> Develop a structured approach to post arrest patient
Skills Rehearsal:	<ul style="list-style-type: none"> Reassess and care for the child post arrest using an ABCDE approach based on evidence based strategies.
Systems Assessment:	<ul style="list-style-type: none"> Departmental resources on Paediatric Drug Infusions Paediatric Ventilator Software and Equipment available Departmental protocols for escalation of care

Sample Questions for Debriefing

I'd like to explore the team's approach to Post Arrest Care :

- Can we explore how to structure post arrest assessment?
- I'd like to talk about protecting the airway for a patient post arrest

What factors influenced your decisions around intubation?

- How did you choose parameters for the ventilator?

Can we explore the team's haemodynamic support strategies?

- What blood pressure did you aim for in this child? How did you achieve this?
- I think we should talk about protecting against neurological harm post arrest :

Can anyone outline their thinking regarding the strategies the team used?

- How do you monitor sedation in a child? How do you titrate your sedation infusion?
- How can we use available services to help us manage this critically ill patient?

Key Moments

- Using an ABCDE approach to post arrest cares
- Decision to intubate or continue with LMA
- Putting them on the ventilator
- Deciding and achieving BP target
- Communicating with the retrieval team and PICU

**Complete our online survey and
receive a training certificate!**
Scan the QR code with your phone :



After Arrest Care in Kids

Continue to seek and treat cause.

Reassess frequently to protect against :

- Brain Injury
- Myocardial Dysfunction
- Systemic Reperfusion Injury

A : Check and secure ETT

B : Choose ventilator settings

Tidal volume 6-8ml/kg

ETCO₂ 35-45

Titrate FiO₂ to keep SaO₂ 94-98%



(Scan here to refresh basic mechanics of ventilation) ->

C : Discuss BP target w PICU

Initial aim : SBP normal for age (>5th centile)

Consider Fluids and Adrenaline infusion.

Check electrolytes, calcium and serial lactate.

Monitor urine output



D : Avoid secondary brain injury

CPP = MAP - ICP (normal range ICP 5-15)

Avoid hypoglycaemia

Titrate sedation

Head up 30 degrees

Watch for seizures and treat early



E : Normothermia

Aim for T₃₆. Avoid hyperthermia

Get advice from retrieval or PICU

Prepare for transport

Care for parents and staff :

Parents : Inform, involve and prepare

Staff : Debriefing, Employee Assistance



Resources for participants in Post Arrest Cares Simulation



ANZCOR Guidelines



Dr Stewart Reid
Post Arrest Patient – Waiting for the Retrieval Team
Conference 2019
Paediatric Emergencies Podcast



Video: How to secure a paediatric endotracheal tube



Basics of Mechanical Ventilation
Dr Sonia Twigg

Curriculum

This package is designed for **individuals** to refresh and retain the following skills learned in previous OPTIMUS courses as well as add new knowledge on Paediatric Sepsis.

Optimus CORE	Optimus PRIME	Optimus BONUS
<ul style="list-style-type: none"> - Intravenous access - Fluid prescription & rapid administration - ALS - Escalation of care 	<ul style="list-style-type: none"> - Assessing a critically unwell child - Securing an endotracheal tube - Setting a Ventilator - Fluids in shock - Inotrope prescription and administration 	<ul style="list-style-type: none"> - Care of the patient post-arrest - Organising retrieval

This package is designed to offer your **department** a systems level check regarding:

Access to paediatric resources on: <ul style="list-style-type: none"> • ALS training • Caring for a child after the arrest • Securing an endotracheal tube in a child 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Equipment Check: <ul style="list-style-type: none"> • Use of infusion pumps for administering adrenaline • Use of the ventilator 	<input type="checkbox"/> <input type="checkbox"/>
Departmental Protocols for: <ul style="list-style-type: none"> • Intubation/ airway checklist • Organising retrieval or transfer • Preparing for retrieval – use of a checklist. 	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

If you would like any assistance obtaining access or advice for any of the above issues, please contact stork@health.qld.gov.au

About the Creators :



Dr Sonia Twigg : Primary Author

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FACEM, MBBS, BA, BSc

Fellow, STORK (Simulation Training Optimising Resuscitation for Kids)

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Dr Sonia from STORK is an emergency physician doing subspecialty training in Paediatric Emergency Medicine and works at the Queensland Children's Hospital as a fellow in the emergency department and for the STORK simulation team.

She is part of the ALIEM faculty incubator program for 2019-2020 and facilitated the 2019 Health Workforce Queensland workshops for GPs on Paediatric Emergency Medicine. Sonia is interested in critical care, medical education and ultrasound. She is passionate about fun, creativity and innovation in education.



Dr Ben Symon : Consultant Supervisor, Infographics and Editor

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RACP PEM, MBBS, BAnim

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Dr Symon is a PEM Physician and Simulation enthusiast with a passion for translating clinical and educational research to front line health care workers. He is co-producer of the podcast '[Simulcast](#)' and facilitates the Simulcast Online Journal Club, an online journal club for simulation educators throughout the world. He is faculty on the APLS Educational Skills Development Course and international faculty for the Master Debrief Course by [the Debriefing Academy](#). His original degree in Animation has proved surprisingly useful in his career in medical education.



Dr Carolina Ardila : eLearning and Multimedia

@caroelearning

MBBS, MPH(TH), GradDipHlthMgt

Dr Ardila is a medical doctor from Colombia with an award winning skill set in eLearning development. Carolina has been working on eLearning for the last 4 years at the Royal Brisbane and Women's Hospital and Children's Health Queensland. During these years she has developed extensive knowledge in designing, developing and implementing engaging courses and launching award winning paediatric eLearning. She has a special interest in emergency and neonatology and in her spare time loves making videos and improving her animation and drawing skills.



Dr Fiona Brown: 2025 Update

Simulation Fellow STORK

Fiona is a doctor who has a keen interest in medical education and simulation. After starting her educational career as a simulation fellow in the UK, she swapped rainy England for a warmer climate and has been very grateful to work with the STORK team, delivering paediatric education around Queensland. She is continuing her training in Australia with the Australian College of Emergency Medicine.

About the BONUS Project :

Optimus BONUS is a bank of useful scenarios that are open access and available for free use. It has been designed by the Simulation Training Optimising Resuscitation for Kids team for Children's Health Queensland.

We aim to use the packages to provide :

- Spaced repetition to reinforce learning objectives from CORE and PRIME
- Connections to high quality, up to date paediatric resources for health professionals
- Quality and Safety checks for local hospitals regarding paediatric clinical guidelines, resources and equipment

The scenarios have been designed in response to :

- Paediatric coronial investigations in Queensland, Australia.
- Clinical skills issues revealed through In Situ Translational simulations in hospitals throughout Queensland.
- Quality and Safety Initiatives

About STORK

In 2014, Children's Health Queensland funded the 'Simulation Training Optimising Resuscitation for Kids' service. STORK is a paediatric education team focused on improving healthcare outcomes for children throughout the state.

STORK has developed a number of courses aimed at different phases of paediatric critical care :

- CORE is a course for first responders to a paediatric emergency, and teaches recognition of the deteriorating patient, Children's Early Warning Tools, and resuscitation competencies.
- PRIME is a course for mid phase responders who look after unwell patients while awaiting for retrieval or escalation to an Intensive Care. It aims at contextualising Seizure Management, Intubation and Inotrope Administration within host hospital's real clinical environments in order for healthcare teams to generate their own practice improvement strategies as well as link peripheral hospitals with high quality resources.
- PULSE is a CPR refresher course based on the principles of Rapid Cycle Deliberate Practice.
- BONUS was proposed as a solution to skill and knowledge decay after these courses are run.

If you would like to know more information about STORK or acquire copies of our resources, please contact us at stork@health.qld.gov.au .

References

This educational package has been reviewed by content experts and a Statewide Steering Group Review on behalf of Children's Health Queensland.

1. Kurz et al, Thermoregulate, autoregulate and ventilate; Brain directed critical care for paediatric cardiac arrest. Current Opinion in Pediatrics, 2017, 29 (3): 259-265.
2. ANZCOR guideline 12.5; Management after Return of Spontaneous Circulation (ROSC), Jan 2016. Available at: [https:// www.anzcor.org/home/paediatric-advanced-life-support](https://www.anzcor.org/home/paediatric-advanced-life-support)
3. Children's Health Queensland Retrieval Service CHQRS referring hospital checklist. Available through Optimus Prime eLearning, iLearn <https://ilearn.health.qld.gov.au/d2l/login>
4. CHQ HHS Guideline: Nursing Care of the Intubated/Ventilated patient. Available through Optimus Prime eLearning, iLearn <https://ilearn.health.qld.gov.au/d2l/login>
5. Reid, C, Post arrest hypothermia in children did not improve outcomes. May 2015. Available at: <http://resus.me/post-arrest-hypothermia-in-children-did-not-improve-outcome/>
6. Kneyber et al, Recommendations for mechanical ventilation of critically ill children from the paediatric mechanical ventilation consensus conference (PEMVECC), Intensive Care Medicine 2017, 43 (12): 1764-1780
7. Twigg S, Basic Ventilation in Children, Children's Health Queensland, 2019, Available at: <https://vimeo.com/355257586>
8. The Simulation Template has been adapted from the template from emsimcases.com, available at : <https://emsimcases.com/template/>

Images (ECGs, CXRs, etc.)

Cremers S, Bradshaw J and Herfkens F, Chest X-ray- Heart Failure in Radiology Assistant, 2010. Available at: <http://www.radiologyassistant.nl/en/p4c132f36513d4/chest-x-ray-heart-failure.html>