OPTIMUS BONUS :

PEA Arrest

Version 2 : Post Arrest Cares

Queensland Government

OPTIMUS BONUS: PEA Arrest – Post Arrest Cares

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For more information contact:

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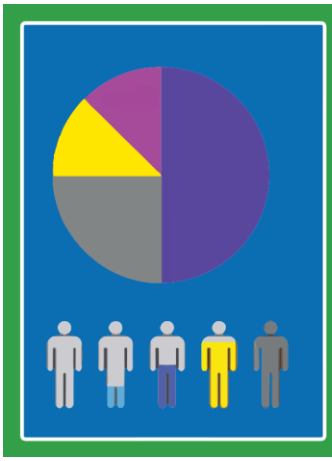
Contents of this educational package:

Simulation

ABCDE approach to post arrest care
Use of services for advice & transfer



Infographic

For sharing in the weeks before or after your simulation via email or in poster format.

Further Reading

Podcasts and Blog Posts
Online Videos
Journal Articles

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Simulation

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:	BONUS : PEA Arrest Version 2 – 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

Section III: Equipment and Staffing

Scenario Cast	
Patient:	☐ Mannequin
Clinical Expert:	Consultant in Retrieval or ED or PICU. Gives helpful advice over the phone using ABCDE structure. They can be called for advice at any time during the scenario.
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		
☐ ECG Leads/Wires	☐ Pulse Oximeter	☐ Capnography
☐ NIBP Cuff	☐ Defibrillator Pads	

Required Equipment		
☐Gloves	☐ IV Bags/Lines	☐ ET Tubes
☐ Stethoscope	☐ IV Push Medications	☐ LMA
☐ Defibrillator	☐ Bag Valve Mask	☐ Ventilator with test lung attached
☐ Intraosseous Set-up	☐ Laryngoscope	☐ Other: tapes to secure ETT

Moulage

- 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

A note from the developer
This Simulation has been written in two versions : • Version 1 : PEA Arrest (CPR Refresh) • Version 2 : PEA Arrest (Post Arrest Cares) Version 2 (this package) is designed to focus staff on rehearsing a structured approach to the post arrest child. It is our opinion that this is an under-rehearsed skill compared to BLS competencies. As such we have budgeted the entire simulation to focus on post arrest cares, rather than try and do BLS & Post Arrest Cares in the one session. If you have extensive time for your simulation, you may wish to combine the two packages into one. To do this simply run Version 1, and then skip the handover section for Version 2. We suggest running each sim separately to allow time to dig into these broad learning objectives.

Learning Goals & Objectives – Post arrest version	
Educational Goal:	• Develop a structured approach to post arrest patient

Skills Rehearsal:	• Reassess and care for the child post arrest using an ABCDE approach based on evidence based strategies as below.
	  ○ Airway; caring for an ETT, securing an ETT
	  ○ Breathing; Choose an appropriate ventilation strategy and show understanding of target parameters; Tidal Volume and RR aiming for ETCO2 35-40, titrate FiO2 aiming for SaO2 94-98%.
	  ○ Circulation; Show understanding of BP management, targets for BP (start with normal for age and discuss with PICU to adapt to the clinical situation) and strategies to achieve this (fluids, inotropes) in the critically unwell child.
	  ○ Disability; ensure sedation, avoid hypoglycaemia
	  ○ Exposure; Target temperature management - aim for T36 and avoid hyperthermia

Systems Assessment:	• 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 had a PEA arrest after drowning in the bath. He was discovered within 5 minutes, effective CPR given and ALS commenced by ambulance paramedics 10 minutes after he was found. ROSC was obtained at 25 minutes after he was found. An LMA has been inserted. They are about to arrive in ED - approx. 40 minutes post arrest. The availability and timing of paediatric and retrieval services available for your hospital should reflect your locally available services.

Section V: Scenario Progression

A. Clinical Vignette: To Read Aloud at Beginning of Case

Phone rings.

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 - PEA rhythm - IO placed – 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.

<u>Paramedic handover for State 2. IMISTAMBO format</u>

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

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

M: 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.

I: “She pulled him out, started CPR and her partner called the ambulance.

T: 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: Toby has an LMA insitu.

B: We have 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 seem to localise to a painful stimulus but has not opened his eyes or made any noise – GCS 7.

AMBO: Toby has no allergies, no medical problems, has been well recently and his immunisations are up to date. His parents are on the way and should arrive in about 15 minutes.”

Scenario States

State 1: Handover of Post Arrest Patient

Patient State	Patient Status	Learner Actions, Modifiers & Triggers to Move to Next State	
En route	Phone call by ambulance as per script	☐ Call for resuscitation team and Senior Medical Officer if not present. ☐ Allocate roles ☐ Team leader gives briefing ☐ Prepare appropriate equipment	Triggers Ambulance arrives at facilitator discretion

State 2 : Handover of Post Arrest Patient

Rhythm: NSR **HR:** 150 **BP:** 60/40 **Cap refill** 4s **RR:** 10-15 **O_2 SAT**: 90% LMA **ETCO2**: 35 **T:** 35.5 **AVPU** = P **GCS** 7 (E1 M5 V1) Eyes closed Localises to pain. No sounds. **BSL** 4.4	Handover of post arrest patient as per script.	Structured Assessment of Post Arrest Child : ☐ Attach cardiac and pulse ox monitoring. Organise for BPs at least every 5 mins. ☐ ABCDE assessment ☐ Airway: check ventilating adequately with LMA, Discuss if intubation required. ☐ Breathing: continue to bag, auscultate chest, organize CXR. ☐ Circulation: IVC placed and bloods taken, Fluid bolus given. Consider adrenaline infusion. ☐ Disability: BSL requested – avoid hypoglycaemia BSL 4.4-10. ☐ Exposure: Temperature taken. ☐ Recognise child needs a PICU admission, Call retrieval or PICU to organise transfer and gain advice.	Modifiers When fluid bolus given, BP rises to 75/50. Triggers 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.

Scenario States

State 3: Structured Reassessment and Stabilisation

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 **O_2 SAT**: 90% LMA **ETCO2**: (adjust to rate that team ventilates) **T:** 35.5^{o}C **AVPU** P **GCS** 7 Eyes closed Localises to pain. No sounds. **BSL:** 4.4	Talk to retrieval	Learner Actions ☐ 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 36^{0}	Modifiers Retrieval consultant recommends they use a retrieval checklist and advises using ABCDE approach : A: Intubate if within scope of team. Otherwise wait until retrieval team arrives but make preparations to intubate when they arrive – recommend using a checklist and directs to CHQ airway cognitive aid if no local checklist. B: Continue to bag at approx. 20 per minute until intubation. C: Aim for systolic BP of 90. Advise to commence inotrope infusion (adrenaline) - BP gradually rises to 90/60 once commenced. 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. Team is being mobilised and estimated to arrive in 1 hour.

State 4: Intubation – if appropriate for group level

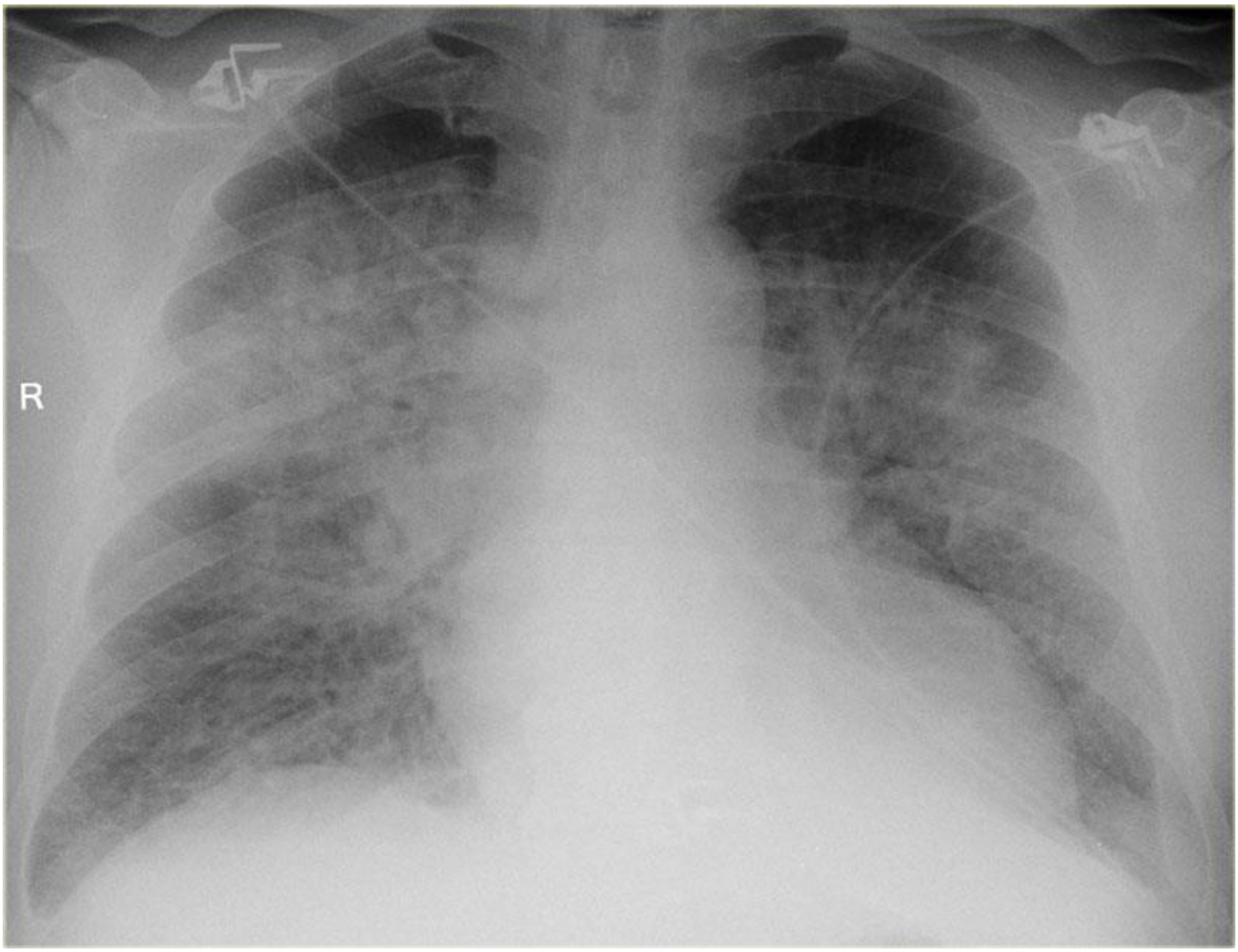
Rhythm: NSR **HR:** 150/min **BP:** 90/60 **Cap refill** 3s **RR:** as per bagging or ventilator **O_2 SAT**: 92% **T:** 36.1^{o}C **AVPU** = P **GCS** 7 (E1 M5 V1)	Prepare for intubation	Learner Actions ☐ Prepare to intubate using a checklist. ☐ Intubate ☐ Check ETT correctly positioned. ☐ Tape ETT. ☐ Attach to ventilator. ☐ Start sedation infusion after ETT.	Modifiers Retrieval consultant can assist with details of intubation, parameters for ventilator and post intubation sedation medications as needed. Triggers Finish Sim when intubated or earlier if appropriate for your learners. Primary learning objective is not the intubation but team should have prepared to intubate.

Section VI: Supporting Documents, Laboratory Results, & Multimedia for version 2

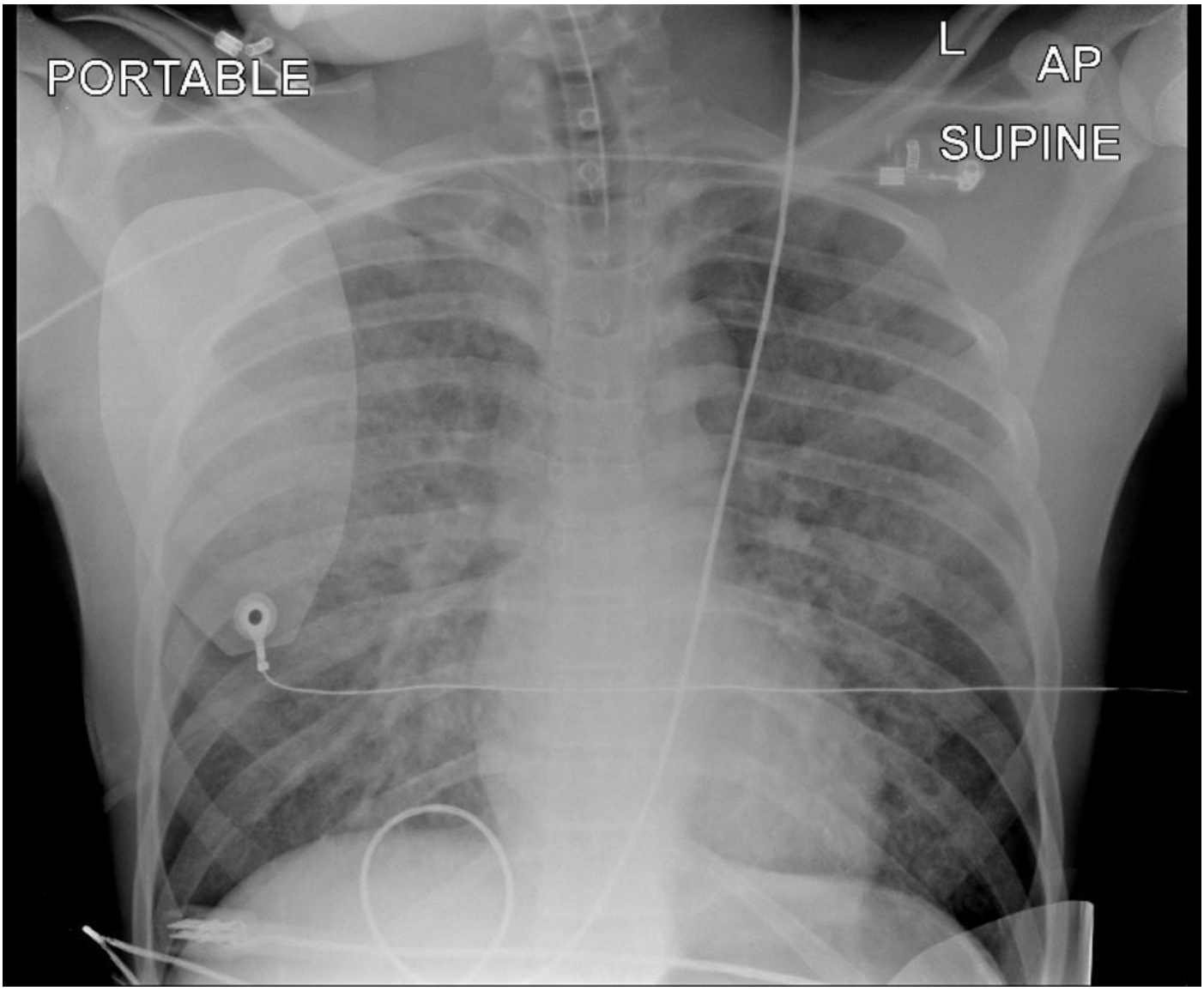
Venous gas (First sample post arrest)

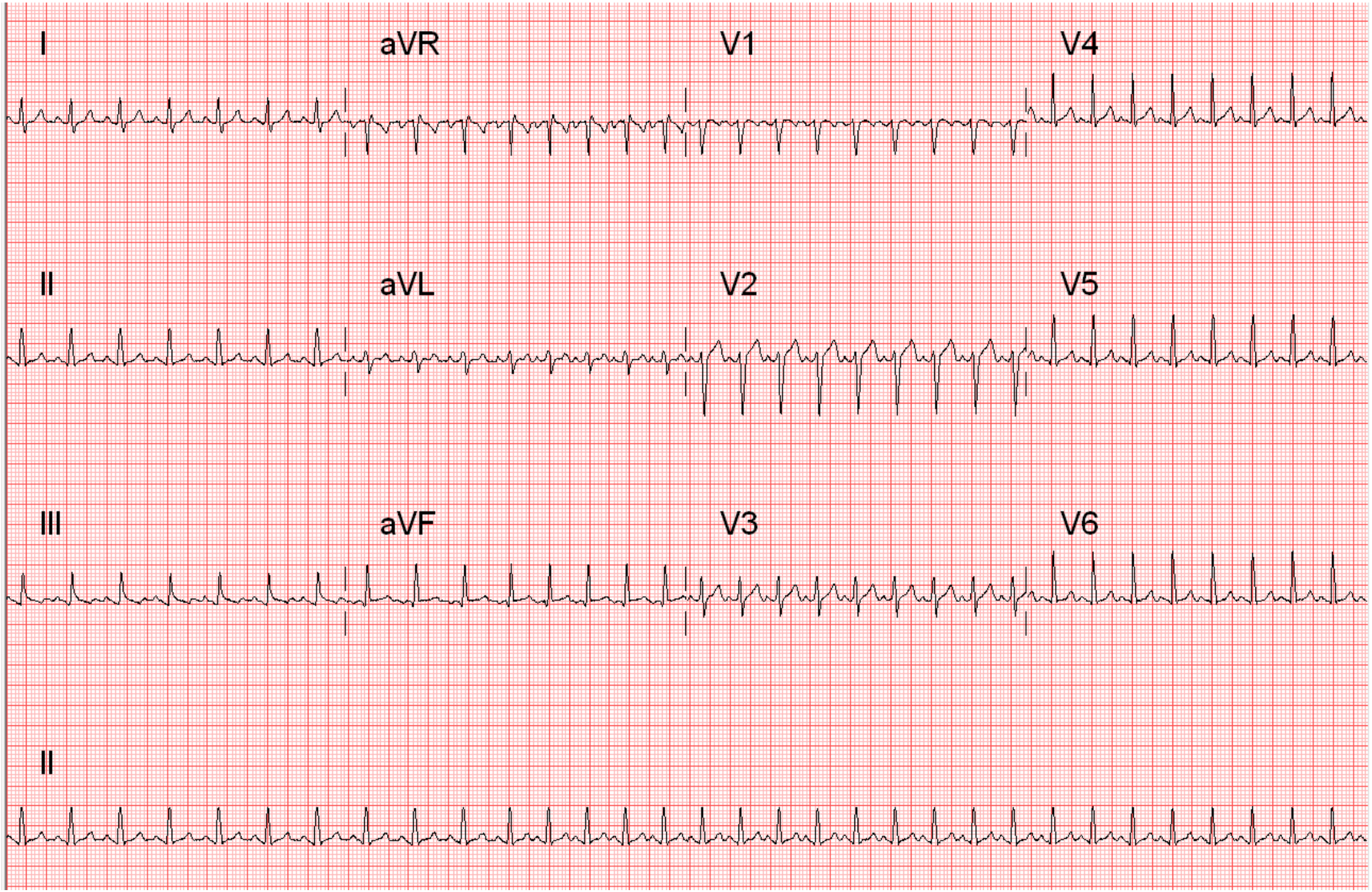
VBG	Results	Units	Normal Range
pH	7.0		**7.32 – 7.42**
pCO2	55	mmHg	**41 - 51**
pO2	60	mmHg	**25 - 40**
O2 Saturations	95%	%	**40 - 70**
Bicarb	13	mmol/L	**22 - 33**
BE		mmol/L	**-3 - +3**
HCT			**0.3 - 0.42**
Hb	110	g/L	**105 - 135**
Na+	135	mmol/L	**135 - 145**
K+	5.5	mmol/L	**3.2 - 4.5**
Ca++ (ionised)	1.2	mmol/L	**1.15 – 1.35**
Glucose	4.4	mmol/L	**3.0 – 7.8**
Lactate	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)




I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

Section VII: Debriefing Guide

Objectives	
Educational Goal:	• Develop a structured approach to post arrest patient
Skills Rehearsal:	• Reassess and care for the child post arrest using an ABCDE approach based on evidence based strategies.
Systems Assessment:	• Departmental resources on Paediatric Drug Infusions • Paediatric Ventilator Software and Equipment available • Departmental protocols for escalation of care

Sample Questions for Debriefing

- Acknowledge that paediatric cardiac arrest is an emotive event.
  - Thank participants for engaging with the sim.
  - Remind participants that clinical event debriefing might be useful after such an event.
- 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

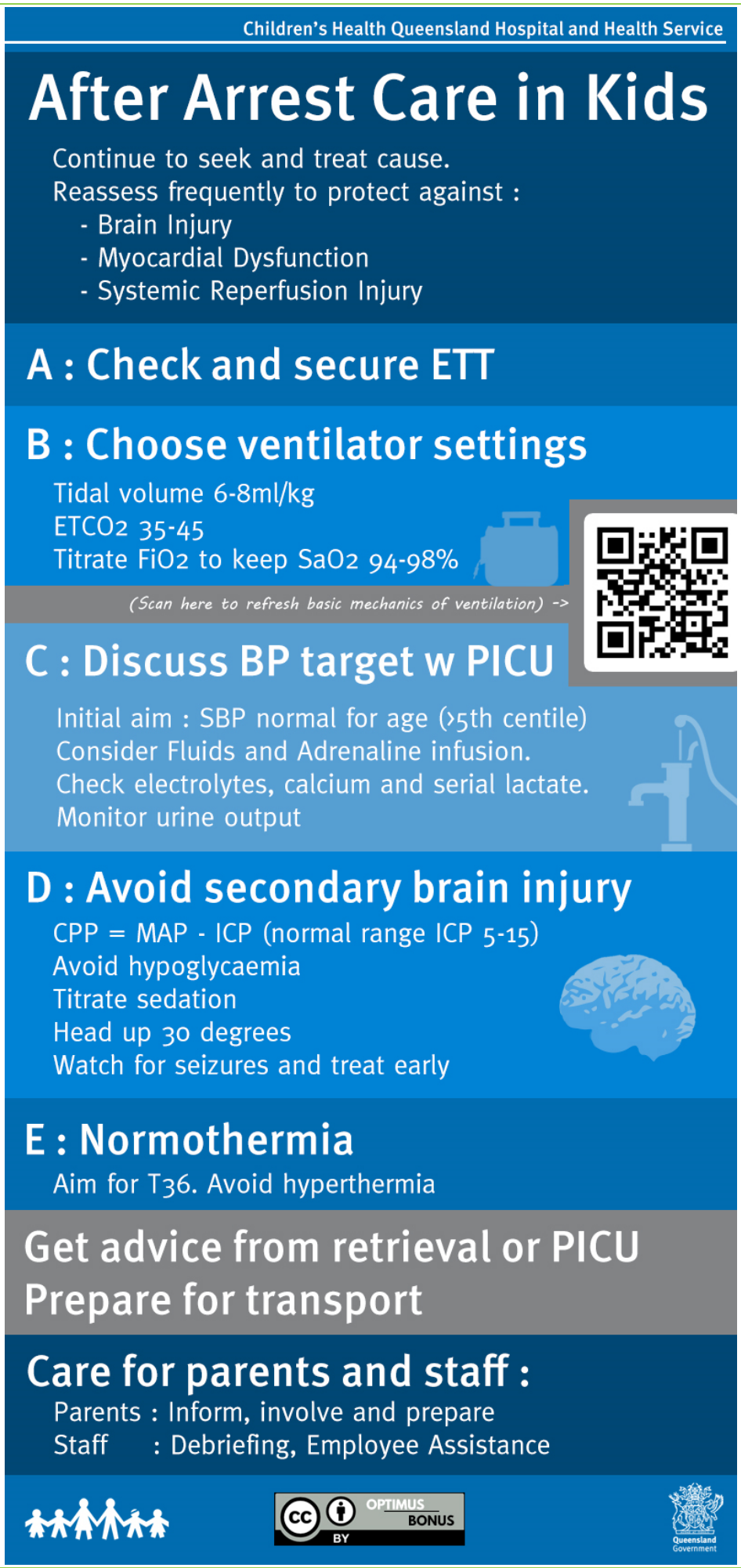
- Using an ABCDE approach to organize care.
- Decision to intubate or continue with LMA.
- Putting them on the ventilator.
- Deciding and achieving BP target.
- Communicating with the retrieval team and PICU.

Ask participants to complete our survey!

Just show them this QR code for their phone for a quick 5 minute survey.

Scan me

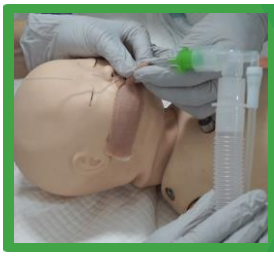
Infographic



Resources for participants in Simulation

ANZCOR
Paediatric Cardiorespiratory Arrest Flowchart

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



How to secure a paediatric endotracheal tube
Optimus Prime eLearning

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
Intravenous access	Assessing a critically unwell child	Refresh ALS
Fluid prescription & rapid administration	Securing an endotracheal tube	Managing BP in critically unwell child.
ALS	Setting a Ventilator	Care of the patient post-arrest
Escalation of care	Fluids in shock	Communicating with other services
	Inotrope prescription and administration	Organising for transfer

This package is designed to offer your **department** a systems level check regarding:	
Access to paediatric resources on: • ALS training • Caring for a child after the arrest • Securing an endotracheal tube in a child	☐ ☐ ☐
Equipment Check: • Use of infusion pumps for administering adrenaline • Use of the ventilator	☐ ☐
Departmental Protocols for: • Intubation/ airway checklist • Organising retrieval or transfer • Preparing for retrieval – use of a checklist.	☐ ☐ ☐

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
@LankyTwig
FACEM, MBBS, BA, BSc
Fellow, STORK (Simulation Training Optimising Resuscitation for Kids)
Queensland Children's Hospital

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
@symon_ben
RACP PEM, MBBS, BAnim
Simulation Consultant and Paediatric Emergency Physician
Queensland Children's Hospital and The Prince Charles Hospital

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 has recently been invited to join as international faculty for the Master Debriefer 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.

About the BONUS Project :

The OPTIMUS BONUS project 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 waiting 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.
- 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 .

Resources to email to participants

1. ANZCOR Paediatric Cardiorespiratory Arrest Flowchart Jan 2016. Available at: https://resus.org.au/guidelines/flowcharts-3/
2. Reid, S. Post arrest patient: Waiting for the retrieval team conference 2019. Paediatric Emergencies, Jun 2019. Available at: https://www.paediatricemergencies.com/post-arrest-patient-waiting-for-the-retrieval-team-conference-2019/
3. How to secure an endotracheal tube. Optimus Prime eLearning. Children's Health Queensland 2019. Available at: https://vimeo.com/295718472
4. Twigg, S. (2019). Basics of Mechanical Ventilation. [online] Vimeo. Available at: https://vimeo.com/355257586/ec6f94a6b6

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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 12.7; Management after return of spontaneous circulation (ROSC), Jan 2016. Available at: https://resus.org.au/guidelines/
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. 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
Case courtesy of Dr Jan Frank Gerstenmaier, <a href= https://radiopaedia.org/">Radiopaedia.org</a From the case rID: 24685