Simulation Package : SVT

An open access resource for clinical educators

Optimus BONUS

Queensland Government

Optimus BONUS

Bank Of iNdependently Useful Simulations

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

Optimus BONUS : Supraventricular Tachycardia

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For more information contact:

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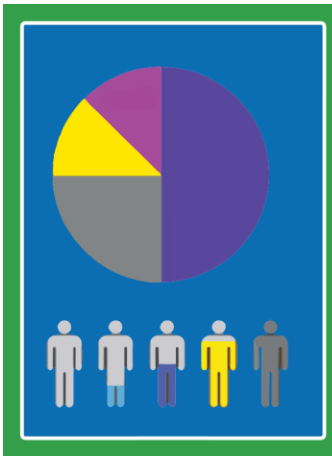
An electronic version of this file is available at: https://www.childrens.health.qld.gov.au/research/education/queensland-paediatric-emergency-care-education/optimus-bonus/

Contents of this educational package:

Simulation

IV Adenosine for paediatric SVT
Synchronised DC Shock
SVT Algorithm



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

Fill out our participant survey to receive a training certificate

(Select Optimus BONUS as course)

Introduction by Dr Ben Reeves, FRACP

Dr Reeves is a Paediatric Cardiologist from Cairns Base Hospital in Queensland with an interest in echocardiography for congenital and rheumatic heart disease.

He grew up in Townsville and Brisbane and completed his medical degree at the University of Queensland, later completing his internship at Cairns Base Hospital. The majority of his clinical training was completed in Brisbane at the Royal Children's and Mater Children's Hospitals, with further training in Paediatric Intensive Care at the Bristol Royal Hospital for Children. Subspecialty training in Paediatric Cardiology was undertaken at the Mater Children's Hospital and he has also worked as a Paediatrician and Lecturer in Paediatrics at the Fiji School of Medicine.

He is a regular APLS instructor as well as on Paeds BASIC and Beyond Paeds BASIC.

"Cardiac issues in children present infrequently to emergency departments and can be a cause for anxiety amongst treating staff. Supraventricular tachycardia is one of the more common arrhythmias in childhood and can lead to non-specific presentations, especially in infants, resembling respiratory tract infections such as pneumonia and bronchiolitis. Children and infants will present with poor feeding, lethargy, tachycardia, poor perfusion and respiratory distress.

Clues suggesting a cardiac cause include very high heart rates (over 220 bpm), liver enlargement, cardiomegaly on chest xray, and a lack of response to other interventions for shock. Early recognition is important and allows definitive treatment and stabilisation.

There is a very useful algorithm to guide patient management contained within the APLS course manual and lectures. Important decision points relate mainly to the presence of shock and haemodynamic instability which guide the treating team towards more urgent interventions. In practical terms, whatever is the quickest intervention is usually preferred in the case of a shocked child. Vagal manoeuvres may well be faster than any other intervention and are usually tried first. In the resus bay of an emergency department, placing appropriately sized pads and using synchronised DC cardioversion perhaps with some sedation may well be faster than obtaining IV access and administering a dose of adenosine. In many cases however, SVT is not likely to be a life-threatening emergency and time can be taken to choose the most appropriate means of cardioversion."

There are a number of different sub-types of SVT and for this reason having an ECG recording during the attempt at cardioversion is often useful for more complicated or resistant cases. In general however, children resistant to cardioversion will require discussion with a paediatric cardiologist and sometimes additional therapy tailored to specific conditions."

Simulation

Section I: Scenario Demographics

Scenario Title:	BONUS – Treating SVT in infants
Date of Development:	June 2019
Target Learning Group:	Multidisciplinary Teams that look after Paediatric Patients

Section II: Scenario Developers

Scenario Developers:	Dr Sonia Twigg, Dr Benjamin Symon, Dr Ben Lawton, Louise Dodson, Tricia Pilotto, Dr Caroline Ardilo Sarmiento
Reviewed by :	Dr Ben Reeves (FRACP), Ms Mary Wilson (Paediatric Cardiology Nurse Educator), Dr Fiona Brown (Simulation Fellow)

Section III: Curriculum

Learning Goals & Objectives	
Educational Goal:	● Recognise Paediatric Supraventricular Tachycardia ● Differentiate SVT from SVT with shock
Skills Rehearsal:	● Paediatric Vagal Manoeuvres ● Safe dosage prescription, preparation and administration of Adenosine ● Safe delivery of synchronised cardioversion with appropriate sedation
Systems Assessment:	● Presence of a departmental SVT treatment algorithm ● Location of ice and appropriate size bucked in department

Case Summary: Brief Summary of Case Progression and Major Events

This case involves an 8 month old boy brought in by ambulance to the emergency department in SVT. Initial management with vagal manoeuvres and Adenosine are unsuccessful. He develops haemodynamic compromise and requires synchronised DC cardioversion. He reverts to normal sinus rhythm and stabilises.

Section IV: Equipment and Staffing

Scenario Cast	
Patient:	☐ Mannequin
Clinical Expert	An expert comfortable with management of SVT. Can be called for help if needed during the scenario.
Confederate:	Ambulance officer. Hands over using SBAR format.
Confederate:	Parent appropriately caring for their child, quietly concerned.

Required Monitors	
☐ ECG Leads/Wires	☐ Temperature probes
☐ NIBP Cuff	☐ Defibrillator pads
☐ Pulse Oximeter	

Required Equipment		
☐ Gloves	☐ Nasal Prongs	☐ Other: Tub of iced water and small towels.
☐ Stethoscope	☐ Non-Rebreather Mask	☐ Syringes
☐ IV Bags/Lines	☐ Bag Valve Mask	☐ 3 way taps
☐ IV Push Medications	☐ Adenosine, Adrenaline, Saline	
☐ Intraosseous Set-up	☐ Defibrillator and pads	

Moulage
None

Approximate Timing							
Set-Up:	15 mins	Prebrief :	15 mins	Scenario:	20 mins	Debriefing:	20 mins

Section V : Scripts

Handover from Paramedic at Start of Simulation

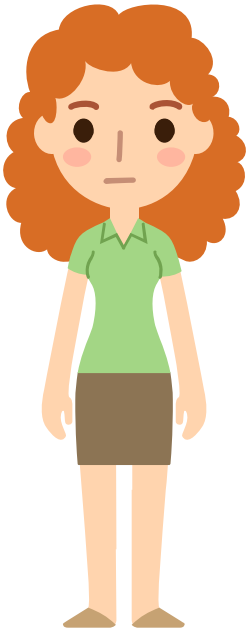
Hi I am the ambulance officer, I've got Harry here with me. He is 8 months old and 8kg.

- His parents called the ambulance this morning because he was more sleepy than usual and not feeding.
- His brother has a cold at the moment.
- When we arrived, Harry was very tachycardic.

Vital signs were; HR 240, BP 80/48, RR 60, SaO2 96%, BSL 4.3.

- Harry has no allergies, takes no regular medications, has no significant past medical history and his immunisations are up to date.
- As you can see he's crying and alert.

Parent script



I'm Harry's mum

- He's had no medical problems in the past
- He was born at term, natural delivery with no complications
- He's fully immunised up to 6 months of age
- He has no siblings
- There's no family history of any cardiac problems
- He continues to have breastfeeds plus solids
- I'm not on any medication myself
- In the last few days he's had a couple episodes of suddenly seeming irritable but then he's perked up

Section VI: Scenario Progression

Scenario States			
State 1 : Arrival			
Patient State	**Patient Status**	**Learner Actions**	**Modifiers & Triggers to Move to Next State**
Rhythm: SVT **HR:** 240 / min **BP:** 80/48 **Cap refill** 2s **RR:** 60 / min **O_2 SAT**: 96% **T:** 36.9 ^oC **AVPU** = V	Alert, crying, tachycardic with delayed peripheral cap refill 4 secs but centrally 2	☒ Receive handover ☒ Apply cardiorespiratory monitoring; pulse oximetry, cardiac monitoring, BP cuff, BSL. ☒ Allocate team roles and team brief ☒ Facilitate primary assessment ☒ ECG ☒ Consider differentials	
State 2 : Initial Management			
Rhythm: SVT **HR:** 240 / min **BP:** 80/48 **Cap refill** 2s **RR:** 60 / min **O_2 SAT**: 97% **T:** 36.9 ^oC **AVPU** = V	Alert, crying, tachyacardic with delayed peripheral cap refill 4 secs but centrally 2	☒ Try vagal manoeuvre; iced water on face washer to face, iced water in glove to face, bathing infant in tub of iced water, suction. ☒ Consult cognitive aid/ hospital policy	Modifiers Vagal manoeuvre has no effect. Triggers - have tried vagal manoeuvres or 5 minutes pass
Phone advice if called for:			

A baby with a rapid regular heart rate of 240 sounds very much like SVT. Are you aware of where our algorithm is?

They don't sound too shocked, so I'd suggest starting with vagal manoeuvres then adenosine. You'll need to flush the adenosine fast and give a 5mL bolus of fluid immediately after with a fast push. You can use a 3 way tap to speed it up.

Make sure to have the ECG leads printing or recording when giving adenosine or cardioversion! It's very helpful for the cardiology team later!

State 3 : Adenosine

Rhythm: SVT **HR:** 240 / min **BP:** 74/48 **Cap refill** 2s **RR:** 60 / min **O_2 SAT**: 97% **T:** 36.9 ^oC **AVPU** = V	Not improved with initial treatment – vagal manouvre	Learner Actions ☒ Consult cognitive aid/ hospital policy ☒ IV access ☒ Check dose for adenosine ☒ Apply defibrillation pads ☒ Prepare resus drugs ☒ Give adenosine (preferably through large bore, proximal IVC) ☒ Continuous monitoring, printing or recording throughout cardioversion	Modifiers - First dose of adenosine 100mcg/kg has no effect. - 2nd dose of 200mcg/kg has no effect. - 3rd dose of 300mcg/kg has no effect Triggers - 3rd dose of adenosine given or 5 minutes have passed. - BP drops and CRT increases moving to next state *To simulate giving adenosine, switch rhythm from SVT to asystole and then back to either SVT or Sinus. Occasionally staff will interpret this incorrectly as an arrest rather than the normal effect of adenosine, which may need coaching that the child shows signs of life.*

Phone advice if called for:

OK if the 3 doses of adenosine haven't worked and the baby has some signs of shock, we'll need to shock him.

Make sure we've got monitoring on, and consider a 0.5mg/kg dose of ketamine for sedation prior. Start at 1J/kg and if that doesn't work go to 2J/kg.

Make sure to have the ECG leads printing or recording when giving adenosine or cardioversion, it's very helpful for the cardiology team later!

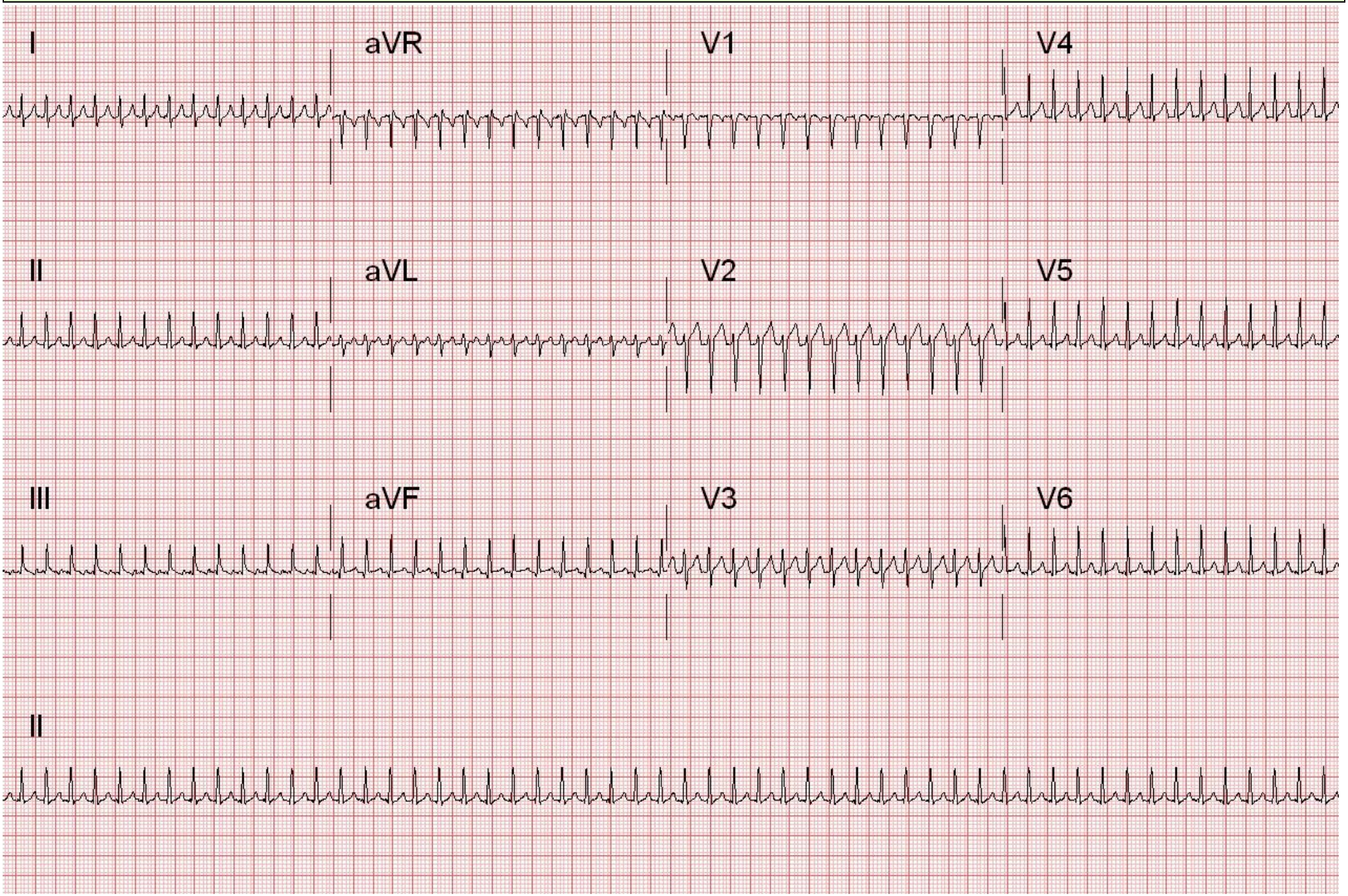
Scenario States			
State 4 : Cardiogenic Shock			
Patient State	**Patient Status**	**Learner Actions**	**Modifiers & Triggers to Move to Next State**
Rhythm: SVT **HR:** 240 / min **BP:** 59/40 **Cap refill** 4s **RR:** 60/min **O_2 SAT**: 94% **T:** 36.9ºC **AVPU** = U Mottled, cool peripheries	Now in shock. Prompt that baby appears clinically more unwell, peripherally shut down and quiet. Pulse remains palpable.	☒ Recognise patient now in shock. ☒ Calls for help; consultant/ PICU consult/ retrieval service ☒ Gives sedation for cardioversion (e.g. ketamine 0.5 -1mg/kg) ☒ Synchronised cardioversion at 1J/kg.	Modifiers -if synchronised shock delivered, patient reverts to NSR 120/min, alert, BP 80/55, SaO2 99%RA, RR 50, cap refill 2s. - if unsynchronized shock then patient develops VT – with a pulse. Next shock results in ROSC.
State 5 : Stable			
Rhythm: Sinus **HR:** 120 / min **BP:** 80/55 **Cap refill** 2s **RR:** 50 **O_2 SAT**: 99% **T:** 36.9ºC **AVPU** = A	Baby is stable	☒ Repeat 12 lead ECG ☒ Consider referral to appropriate specialty service in your organisation	

Section VII: Supporting Documents, Laboratory Results, & Multimedia

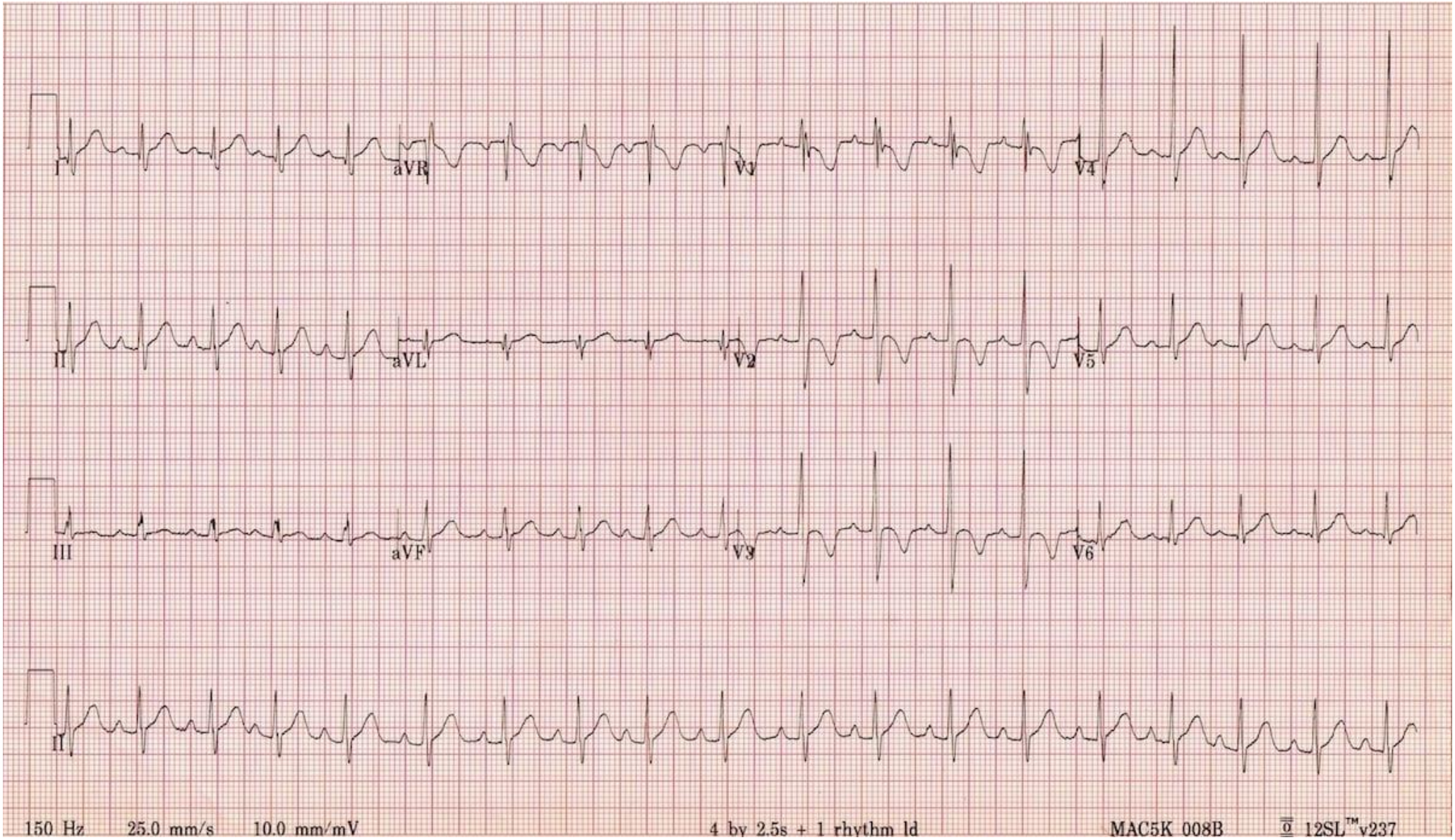
Venous Blood Gas Result

VBG	Results	Units	Normal Range
pH	7.32		**7.32 – 7.42**
pCO2	50	mmHg	**41 - 51**
pO2	35	mmHg	**25 - 40**
O2 Saturations	50	%	**40 - 70**
Bicarb	25	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+	4.5	mmol/L	**3.2 - 4.5**
Ca++ (ionised)	1.2	mmol/L	**1.15 – 1.35**
Glucose	4.3	mmol/L	**3.0 – 7.8**
Lactate	2	mmol/L	**0.7 – 2.5**

ECG 1



Post reversion ECG



Section VIII: Debriefing Guide

Objectives	
Educational Goal:	• Recognise Paediatric Supraventricular Tachycardia • Differentiate SVT from SVT with shock
Skills Rehearsal:	• Paediatric Vagal Manoeuvres • Safe dosage prescription, preparation and administration of Adenosine • Safe delivery of synchronised cardioversion with appropriate sedation
Systems Assessment:	• Presence of a departmental SVT treatment algorithm • Location of ice and appropriate size bucked in department

Sample Questions for Debriefing

- I'd like to explore diagnosing SVT in infancy :
  - What was your differential diagnosis at presentation?
  - How did you come to the conclusion this child was in SVT?
- Can we take some time to discuss the management of SVT :
  - Did we have an algorithm for SVT in the department? Was it accessible and easy to use?
  - Where do we find an ice bucket?
  - What factors affected your decision making around cardioverting this child?
  - How do you perform vagal manoeuvres in a child?
  - How do you elicit the dive reflex in an infant?
  - What strategies did your team use to effectively administer Adenosine?
  - What prompted you to move from adenosine to synchronised cardioversion?
- How can we better prepare our team for managing SVT within our department?

Key Moments

- Recognition of SVT
- Use or absence of a pathway
- Performance of vagal manoeuvre
- Administration of adenosine
- Administration of synchronised cardioversion

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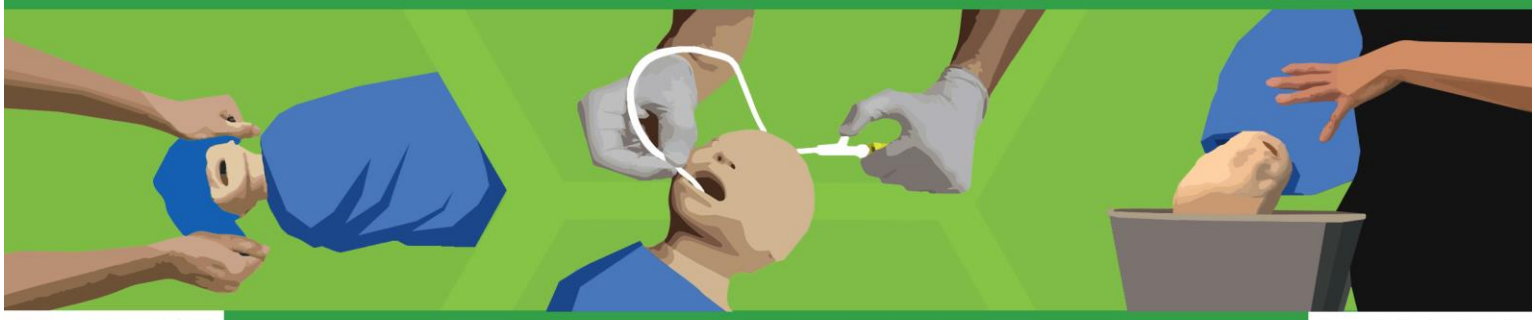
TREATING SVT IN INFANTS

VAGAL MANOEUVRES

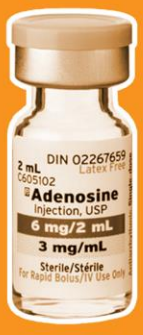


COLD CLOTH SUCTION BRIEF IMMERSION

NOT SHOCKED?

ADENOSINE

Have the ECG Printing



Proximal IV

Fast Push

0.1 mg/kg
then
0.2 mg/kg
then
0.3 mg/kg

SHOCKED?

SYNCHRONISED CARDIOVERSION

Have the ECG Printing

Sedation Considered

Resus Drugs

Pads on

Push **SYNC**

1 Joule / Kg (max 50)
then
2 Joule / Kg (max 100)

Section X : Resources for SVT Simulation Participants

APLS SVT algorithm

Tutorial video: Vagal manoeuvres

Tutorial video: Immersion for SVT

Tutorial video: Giving adenosine right

Tutorial video: Cardioversion for SVT

Section XI : 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 specific conditions.

Optimus CORE	Optimus PRIME	Optimus BONUS
Rhythm recognition	Sedation in shock	SVT treatment algorithm
IV access	Escalation of care	Adenosine Administration and Prescription
Safe Defibrillator use		Synchronised Cardioversion

This package is designed to offer your **department** a systems level check regarding :	
Access to paediatric resources on : • SVT Algorithm • Prescribing Guidelines for Adenosine (ie CREDD)	☐ ☐
Equipment Check : • Access to defibrillator and paediatric pads • Access to adenosine	☐ ☐
Departmental Protocols for : • Escalation of paediatric patients with arrhythmia	☐

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, PRIME and PULSE.
- 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. In particular SToRK would like to thank Dr Ben Reeves, Ms Mary Wilson and Dr Katie Tinning for their assistance with this project.

1. Flowchart for management of Paediatric Cardiopulmonary resuscitation, (2017), Children's Health Queensland Hospital and Health Service. Available through QHEPS intranet as Paediatric Resuscitation Algorithm to download https://qheps.health.qld.gov.au/childrenshealth/html/lcch/met/met-resources
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4. APLS SVT Management Algorithm, available at : https://www.apls.org.au/algorithm-svt
5. Cover photograph downloaded from https://www.flickr.com/photos/missjadeallen/11903213484 Image courtesy of Jade Alexandra Allen on flickr under a CC Attribution-NoDerivs 2.0 Generic (CC BY-ND 2.0) license, Many thanks for her consent to use this photograph of her son. This image may not be reproduced or altered in any other format.
6. Post reversion ECG sourced from https://litfl.com/normal-paediatric-ecg/
7. The Simulation Template has been adapted from the template from emsimcases.com, available at : https://emsimcases.com/template/