CASE BASED DISCUSSION 18th Feb 2020

CASE ONE

12 month girl is brought to triage by her parents. She is flat, poorly responsive and pale, hx of D+V's for 24hrs. She is put into the resuscitation room and the nurse activates the emergency bell.

Obs: HR 80, CRT 6s, Temp 35, Sats un-recordable, BP 65/40

- **Discuss your emergency management of this toddler?**

Shocked child with clinical evidence or perilous or peri-arrest state

GET HELP!

- Paediatric emergency APLS approach : drug sheet
- Ensure adequate ventilation – oxygen
- Urgent fluid resuscitation – IV attempt + simultaneous IO 20ml/kg 0.9% saline bolus and reassess
- Consider sepsis and need for Abs if hx not clear
- VBG is KING: pH/HCO3. Na, K, Glucose, lactate
- Keep warm
- ECG ? sinus brady or other – electrolytes

- **What are your differential diagnoses?**

Hypovoalemic or Distributive Shock most likely

Gastroenteritis with severe dehydration

Septic shock

DKA

CNS pathology (trauma/NAI/infection)

- **How do you assess severity of dehydration in a child?**

- Weight loss is useful but often prior weight not available
- In the management of dehydration, it is much more important to follow a child closely over time, than it is to calculate and replace a hypothetical figure for % dehydration.

Severity	Symptoms	Physical signs
Mild	thirsty, restless	None Slightly dry buccal mucosa
Moderate	lethargic, irritable	Dry buccal mucosa, absent tears Sunken eyes & fontanelle Decreased urine output Altered skin elasticity Signs of ketosis (rapid shallow breathing, smell of ketones)
Severe	limp, drowsy	Drowsiness Shock (tachycardia, poor volume peripheral pulses, cool peripheries) Hypotension is late/ominous sign Skin retraction time > 2 seconds

As a rough guide, the child who is mildly dehydrated (≈5%) may be considered to have a 50 ml/kg deficit, and the child who is shocked (≈10 - 15%) may be considered to have at least a 100 ml/kg deficit.

- **The initial fluid bolus has improved the HR 120, BP 80/50, CRT 3s. Discuss the VBG result and how this would affect your fluid management and choice?**

pH 7.02 HCO_3 8 Na 175 K 3.2 Gluc 3 Lactate 6 AG 26

- Severe hypernatremia likely severe hyperosmolar state
- Needs Glucose and shock Mx as priority
- At risk of cerebral oedema to too rapid reduction in Na/osmol
- Intravenous rehydration in hyperosmolality, aim to lower the serum Na+ **slowly** at a rate of 10 - 15 mEq in 24 hours, and the osmolality by no more than 0.5 - 1 mmol/hr
- Use 0.45% NaCl and 2.5% Glucose (neonates seek advice)
- **Use SSH guideline to calculate fluid replacements**

Definition	Serum Osmolality	Serum Na+
Hypo-osmolar	< 280	< 130
Iso-osmolar	280 - 319	130 - 150
Hyperosmolar (Moderate)	320 - 350	> 150
Hyperosmolar (Severe)	> 350	> 170

Serum osmolality (mOsm/l) = (2x Na+) + (2x K+) + Urea + Glucose

- **How would you calculate On-going fluid requirement after initial fluid bolus if this child weighed 10kg?**

- *In severe hyperosmolar dehydration*, after initial resuscitation, aim to replace the remainder of the deficit and maintenance over a period of 72 - 96 hours.
- Calculate the osmolality at least 4 hourly, and measure it at least 12 hourly. If it is falling too quickly, reduce the rate of infusion by 20% and reassess in 4 hours.
- Use 0.45% NaCl and 2.5% Glucose
- Remember ongoing losses and K (see SSH guidelines)

Daily volume (ml) = maintenance (ml/24hr) + remaining deficit (ml)/3

Maintenance= 40ml/hr x 24hrs = 960ml ml/24hrs
Deficit=(100ml/kg x 10)- 20ml/kg bolus =1000-200=800ml
Daily volume=960 + 800/3 = 1227ml
Per hour =51.123ml/hr for 72hrs

- Calculation of Maintenance Fluids (requirement per 24 hours)*

Age < 1 month	120 ml/kg/day
Age > 1 month	as below

Weight	Hourly maintenance fluid requirements
< 10 kg	4 ml/kg/hr
10 - 20 kg	40 ml/hr + 2 ml/hr for every kg over 10
> 20 kg	60 ml/hr + 1 ml/hr for every kg over 20.

Maximum IV maintenance fluid rate = 100ml/hr

- **Full maintenance fluids at 100% recommended for this condition.*

CASE TWO

A 5yr old Tongan boy is brought into the emergency department with history of fevers and joint pain; he collapsed at home but now is fully alert and relatively well looking. He has had some diarrhoea recently, which other family members in the household have also had. He also complains of significant low back pain prior to the collapse.

Obs HR 100, Temp 38.0, BP 98/65, Sats 99%

- **What are your differential diagnoses?**

- Broad range of potential
- In this setting always consider Rheumatic fever
- Be aware of atypical presentations which are not uncommon

- **What important history do you want to ask?**

- Full social + pmhx + fhx (Rheumatic fever risks, cardiac hx)
- Details of the recent illness
  - Sore throat/skin infection/rash/chest pain/sob
  - Nature of the collapse ? syncope or seizure
  - Oral intake and losses
  - Systems review
- Immunisations
- Current medications and allergies
- Travel and contacts

- **What key examination findings are you looking for?**

- Thorough examination of all systems
- Skin rash, joint arthritis/arthralgia, red throat
- Murmurs
- Review nature of back pain - ? reproducible? bony? referred
- Neurologic exam

- **You find on examination a soft systolic murmur and tender bilateral ankles without obvious swelling, significant lumbar/SI pain worse with movement, and areas of erythematous rash (below). The rest of his exam is unremarkable. Discuss further investigations?**

- ECG ? myopericarditis, PR prolongation, AVB
- CXR – heart size
- Bloods and cultures : CRP/ESR, FBC, U+E, strep titres
- Consider Lumbar XR

- **What are the diagnostic criteria for Rheumatic fever?**

- See NZ Heart foundation guidelines (Nz specific take on Jones Criteria)

The presence of two major symptoms, or one major and two minor symptoms, in both cases with a prior GAS infection, are required to diagnose ARF.

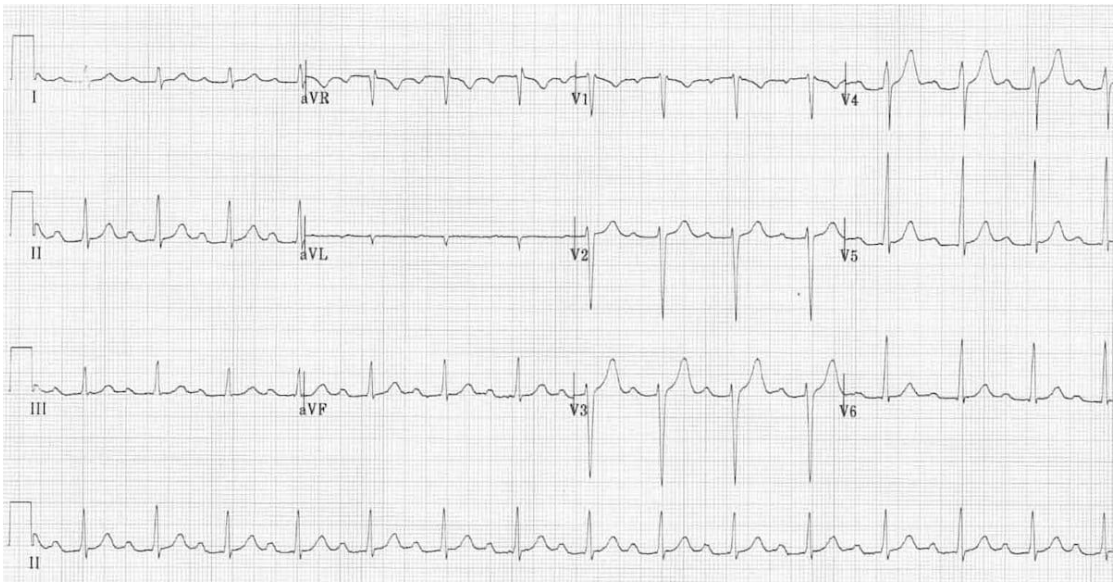
Major symptoms include:

- Arthritis, the most common symptom, occurs in 75% of first attacks, usually in the larger joints such as the knees and ankles[6]
- Carditis almost always affects the mitral and aortic valves and on presentation, a murmur may be heard.[6] In New Zealand, subclinical carditis confirmed by echocardiography is also considered a major symptom.
- Chorea (uncoordinated movements), often in adolescent females, especially affecting the hands, feet, tongue and face which disappear during sleep and may only affect one side of the body. Chorea may occur following a prolonged latency after streptococcus infection and generally resolves within six weeks.
- Erythema marginatum – rare (pink rings on the trunk and limbs)
- Subcutaneous nodules – rare, but highly specific to ARF

Minor symptoms include:

- Fever which accompanies most cases of ARF, except when chorea is present
- Joint pain/arthralgia
- Elevated CRP >30 mg/L or ESR >50 mm/h
- A prolonged P-R interval on ECG

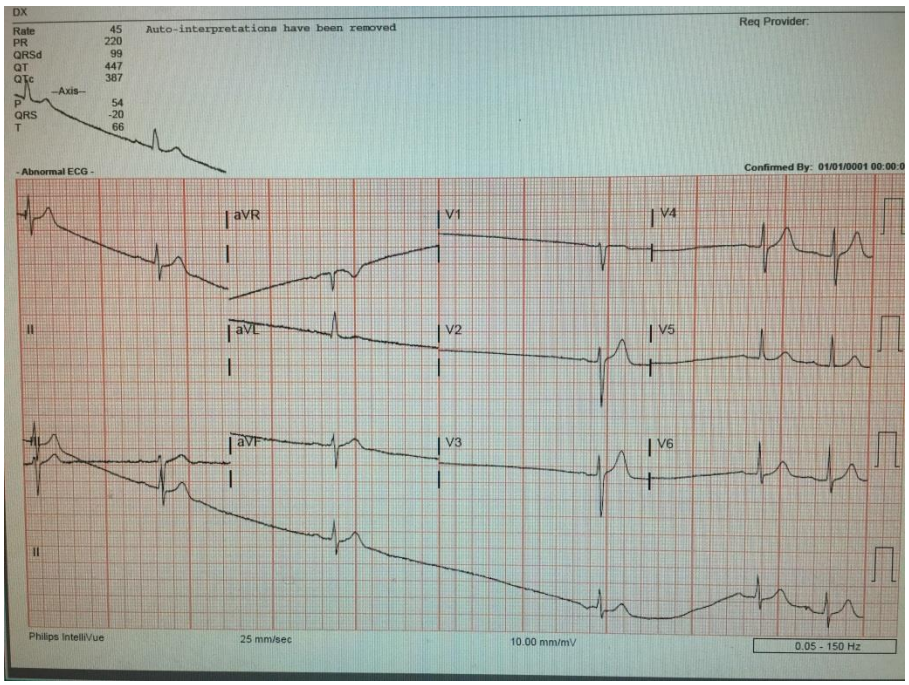
- **Below is his ECG please describe and discuss concerns?**



Markedly prolonged PR interval

- In context of hx of collapse consider possibility of intermittent higher degree block or sinister rhythm
- Suggestive of carditis

- **The child then develops episodes of being pale/clammy, and less responsive while in the assessment bed. These are recurrent lasting 10-20s. He is noted to have a palpated pulse that is very slow during these episodes and his BP is 80 systolic. Below is his ECG. Discuss your management of this child?**



SINUS ARREST/PAUSES

- Move to resus on monitoring and defib
- Get help ED/ICU/PAEDS/PAEDS CARDIO
- Get ready for potential need to intervene he develops sustained haemodynamic compromised state

Atropine 20mc/kg
Dilute adrenaline 0.5-1mcg/kg bolus titrated if required
Consider external pacing (sedation ?)

- Needs urgent paeds cardiology consideration transvenous pacing (not safe for transfer would need to come to patient ?)
- PICU involvement

CASE THREE

8yr old girl brought from home by her Mum with fevers for 1/7, headaches, and vomiting.

Obs HR 140 RR 20 BP 90/50 CRT 2s Sats 98% temp 38.5 GCS 15

- **What are your differential diagnoses and how would you manage this child?**

- Infection most commonly viral but consider bacterial sepsis
- Thorough history and examination
- Antipyretics and antiemetic
- Emla/ametop consideration need for further investigation
- ORT
- Consider establishing IV access immediately and empiric antibiotics if looking unwell

- **Within 20minutes of arrival she starts to look more pale and lethargic. A rash develops rapidly (as below). What is your concern and how would you manage this child?**

PURPURIC RASH

BACTERIAL SEPSIS/MENINGOCOCCAEMIA!

- Resus area and get immediate help!
- IV access x 2 if not already, IO if delay to IV and not able
- IVF bolus 10-20ml/kg N saline ideally warmed
- IV ceftriaxone 100mg/kg (max 2g) or cefotaxime (Firstline in < 12months) (risk reaction with hx of penicillin anaphylaxis < 1%)
- Ensure FBC/U+E/Coag/Grp&Hold/cultures/VBG
- Tx hypoglycaemia
- Keep warm (ongoing volume should be warmed)

- **Despite 40ml/kg boluses she remains shocked as per her observations and VBG/bloods. Discuss your on-going management?**

BP 70/40, HR 150, Sats 92% 4L Hudson, CRT 4s, GCS 13

pH 7.18 HCO_3 14 Na 130, K 3.5, Gluc 4, Lactate 8

Hb 90, WBC 30, Plats 80, Alb 18

APTT 80, PR 1.4, Fibrinogen 0.1 g/L

➢ RESISTANT SEPTIC SHOCK WITH EVIDENCE OF MULTI-ORGAN DYSFUCNTION

- Likely need Airway secured : planning/personnel and drugs
  Resuscitate before your intubate (HOP KILLERS)
- Will require pressors:
  Titrated dilute adrenaline boluses
  Titarted Metaraminol
  Ideally Norad via CVL

- On-going directed volume resuscitation using blood products
  4% albumin
  RBC
  CRYOPRECIPITATE (fibrinogen, von-willebrand factor, factor viii, factor xiii and fibronectin)
  PLATLETS
  FFP (all soluble clotting factors)
- $NaHCO_3$

- Disposition PICU

CASE FOUR

5 weeks old male presented with 1 week of coryzal illness and poor feeding since yesterday. He last feed this morning - 10mls. He was taken to the GP and referred to hospital for dehydration. The GP noted a HR of 110bpm.

On arrival at ED his obs where noted as:

HR 270bpm, BP 100/89, RR65, CRT 3s , Alert

1. **What is you initial concern?**

- Likely tachyarrhythmia given HR > 200bpm
- 30-40% of new SVT present in the first few weeks of life

2. **Discuss your approach outlining important history, examination, and initial investigations?**

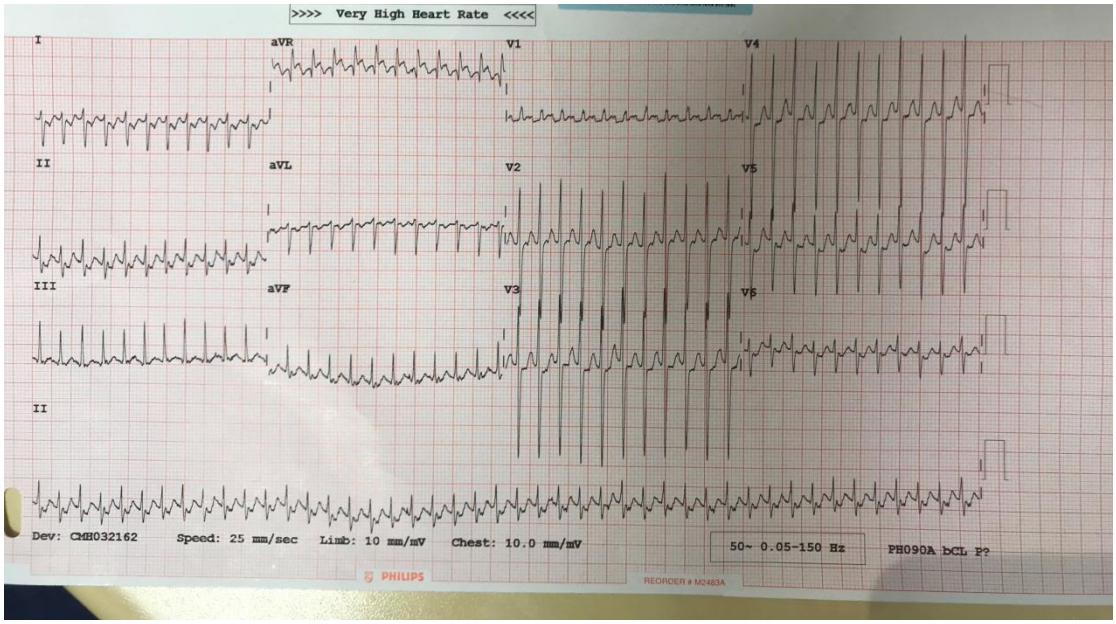
- Place in resus area with monitoring
- Remember the family, explain and ongoing information

- History – antenatal/perinatal/postnatal
- Known cardiac hx
- Feeding
- Breathing, apnoea, colour change
- Infective symptoms

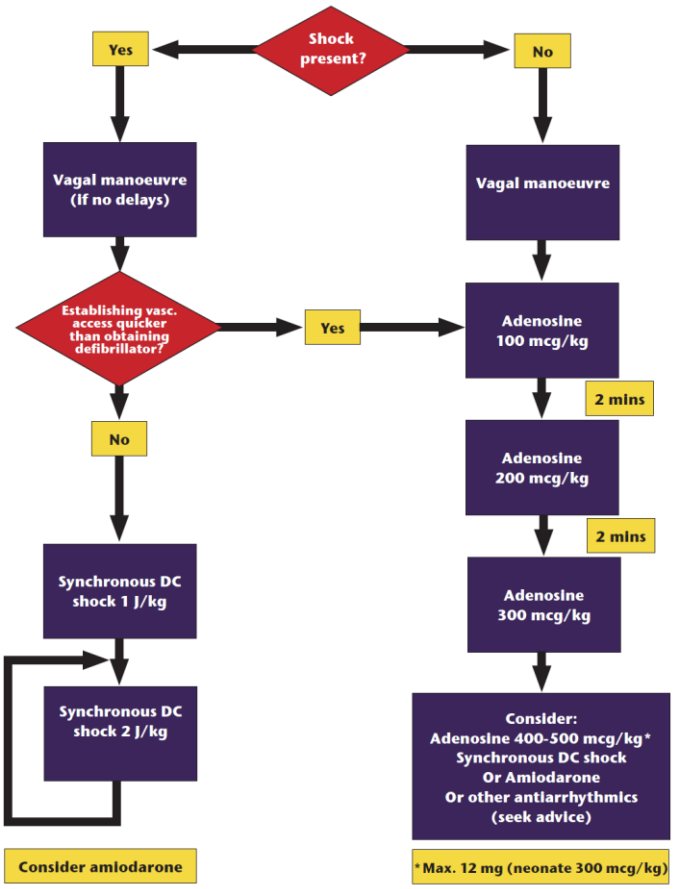
- Examination
- Pulses, BP, and saturations pre and post ductal
- Murmurs
- Signs failure: lungs, liver, edema
- Rashes
- WOB

- Investigations
- ECG
- BGL
- Basic bloods – electrolytes, TFTs

3. **Below is his ECG discuss your diagnosis and management plan?**



- Narrow complex tachyarrhythmia 270bpm : SVT
- Follow SVT algorithm

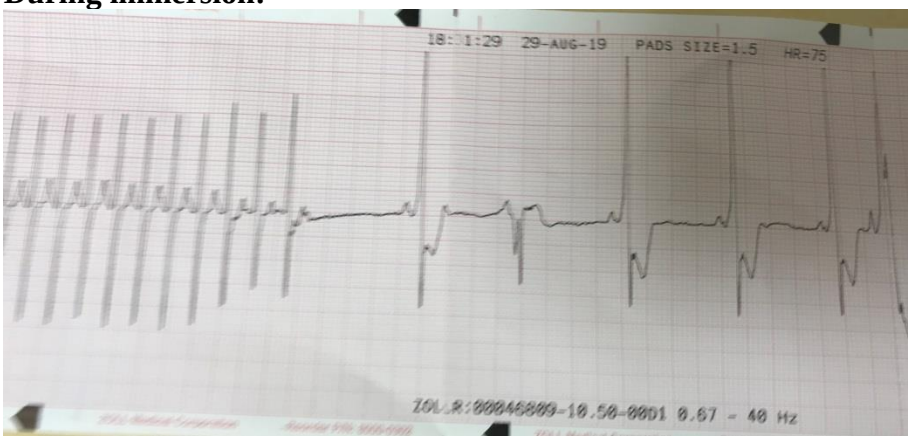


4. **Discuss how to carry out vagal stimulation in neonates/infants and approach with a toddler or older child?**

   - **Neonates and infants:** Facial immersion in ice water 10-15s. **This technique must not be used for infants in circulatory shock.** The baby is attached to a cardiac monitor, arms are wrapped in a towel, and the whole face is immersed in ice water slurry for five seconds. It is unnecessary to occlude the nostrils. This technique is safe and 90% effective in terminating a reentrant tachycardia. Explain carefully to the parents what you are doing. The baby will not drown!
   - **Toddlers:** Ice cold facecloth to the face 30s . Older infants resist being dipped into water as above, but this technique is almost as effective. Eyeball pressure is no longer recommended. Unilateral carotid sinus massage can be useful in older children, but it is often difficult to perform.
   - **School-aged children:** Valsalva technique; ask the child to blow on their thumb after full inspiration for 10-15 seconds. Demonstrate the technique and have the child copy you. There should be no air escape and the child should be seen to strain ("playing the trumpet silently").

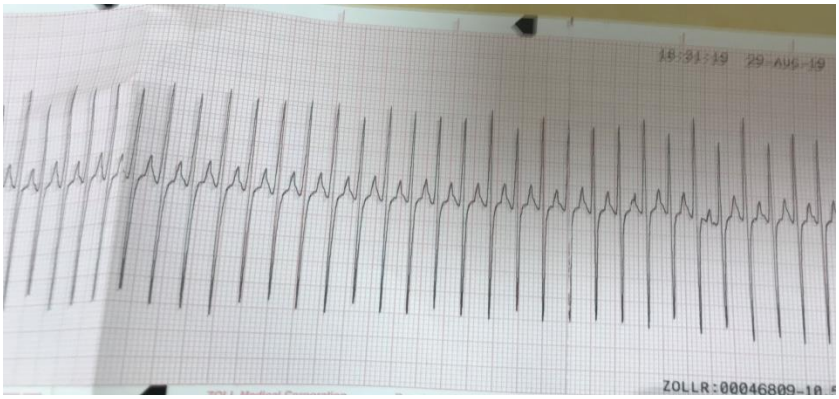
5. **Below is the ECG tracing during and after face immersion after two attempts. Discuss the ECG morphology and your next step in management?**

During immersion:



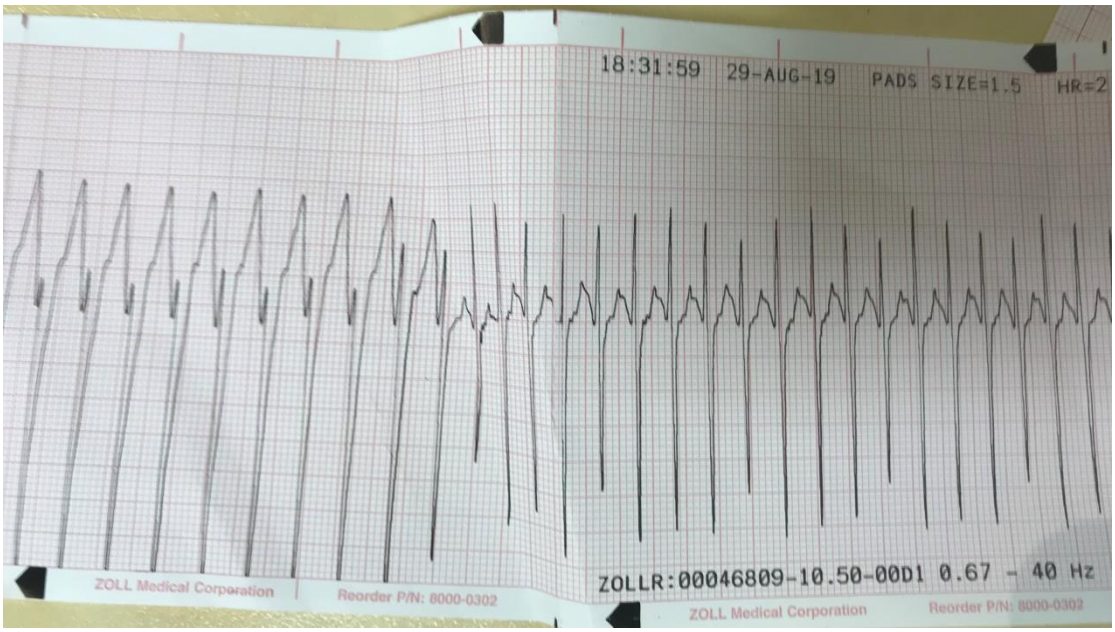
- Reversion to abnormal p-QRS-T morphology: short PR, possible delta wave

Post immersion



- Failed sustained reversion ? underlying pre excitation
- Discuss with cardiology/review tracings post reversion morphology vs pre excite

6. **Cardiology suggest adenosine starting 200mcg/kg bolus. You proceed with this. The below ECG tracing is seen. The child becomes shocked after the adenosine with a BP of 40 and CRT 4s. Discuss your approach?**



- Broad complex tachy likely VT with reversion to SVT

- Manage shock:
- Consider small IVF bolus if not in failure
- Prepare for DC cardioversion

7. **The babies BP and shocked state improves. What would you do from here?**

- Discuss with cardiology – options transfer to site with service and PICU
- Consider amiodarone under specialist advice
- If shocked DC cardioversion

CASE FIVE

2 year old girl is brought to the emergency department with 4 days of high fevers and irritability. She has seen her GP and placed on amoxicillin for an ear infection. Her mother is concerned. She is immunised and has no past history.

- **Discuss how you would approach this patient's care?**

- Standard thorough history of events
- Examination top to toe: do they look unwell?
- Consider potential serious illness
- Is there a focus for infection?
- Consider investigations: Bloods/MSU/ECG/CXR

- **Below are some findings on the child. What other details/findings would you want to know and what other investigations would be useful?**

Consider Kawasaki Disease: multisystem illness with fever and rash, which occurs mainly in children less than 5 years old. **Within 3 days** of the abrupt **onset of fever**, the other characteristic features usually appear:

- Bulbar conjunctivitis (no exudate)
- Mucositis: red cracked lips, red mouth and throat, strawberry tongue
- Polymorphous generalized rash that can be morbilliform, maculopapular, scarlatiniform or may resemble erythema multiforme

- Induration of the hands and feet with red palms and soles
- Cervical lymphadenopathy (usually a solitary, unilateral node > 1.5 cm in size)
- BCG site reactivation (erythema around BCG scar, usually on left upper arm)

- **What are your differential diagnoses?**

- Viral infections e.g. measles, adenovirus, enterovirus
- Scarlet fever
- Staphylococcal scalded skin syndrome
- Toxic shock syndrome
- Polyarteritis nodosa
- Bacterial cervical lymphadenitis
- Drug hypersensitivity reactions
- Stevens-Johnson syndrome
- Leptospirosis
- Mercury hypersensitivity

- **What is Kawasaki Disease and what are the diagnostic findings?**

- Multi-system disease/vasculitis
- 20% of untreated patients may develop coronary artery aneurysm
- Desquammation hand/feet/digits is a late sign
- Pathway for incomplete criteria (SSH guidelines)
- Diagnosis can be made where there is **fever plus at least four of the five features:**

  - Bulbar conjunctivitis (no exudate)
  - Mucositis: red cracked lips, red mouth and throat, strawberry tongue
  - Polymorphous generalized rash that can be morbilliform, maculopapular, scarlatiniform or may resemble erythema multiforme
  - Induration of the hands and feet with red palms and soles
  - Cervical lymphadenopathy (usually a solitary, unilateral node > 1.5 cm in size)
  - BCG site reactivation (erythema around BCG scar, usually on left upper arm)

- **Other Findings:**

Extreme irritability, severe abdominal pain, diarrhoea and vomiting are common. Other features may include:

- Urethritis with sterile pyuria (70% of cases)
- Hepatic dysfunction (40% of cases)
- Arthritis or arthralgias (35%)
- Aseptic meningitis (25%)
- Pericardial effusion or arrhythmias (20%)
- Gallbladder hydrops (<10%)
- Carditis with congestive heart failure (< 5%). This can occur at any time in the first 3 weeks, and usually resolves by 6 to 8 weeks.
- Other arterial aneurysms (e.g. iliac, femoral, renal, axillary) may occur

- **Supplementary Laboratory Information:**

- Albumin < 30g/L
- Anaemia for age
- White cell count > 15 E+9/L
- Platelets after 7 days >450 E + 9/L
- Elevated ALT
- Urine White Cells > 10 per high powered field

- **Echo finds:**

- Positive Echocardiogram (any ONE of the following)

- Z score of RCA or LAD >2.5
- Japanese MOH criteria
- Any 3 suggestive features:

  - Perivascular brightness

  - Lack of tapering of coronary arteries

  - Z score > 2.0

  - Pericardial effusion

  - Mitral regurgitation

  - Impaired LV function

- **Late Manifestations:**

- The lips usually begin to dry, crack and fissure by day 6 of the illness
- The skin of the fingertips, palms ± soles begins to peel in weeks two and three
- Beau lines (transverse grooves in nailbeds) and temporary hair loss
- With no treatment, the average length of fever is 12 days, and when the fever resolves the child may remain irritable for a further 2 to 3 weeks.