phn NORTH WESTERN MELBOURNE

An Australian Government Initiative

Meningitis and sepsis in children – assessment, diagnosis and immediate treatment

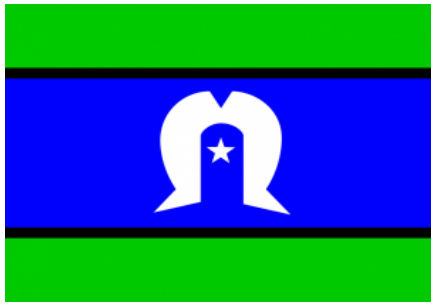
Wednesday, October 23 2024

The content in this session is valid at date of presentation

Acknowledgement of Country

North Western Melbourne Primary Health Network would like to acknowledge the Traditional Custodians of the land on which our work takes place, The Wurundjeri Woi Wurrung People, The Boon Wurrung People and The Wathaurong People.

We pay respects to Elders past, present and emerging as well as pay respects to any Aboriginal and Torres Strait Islander people in the session with us today.



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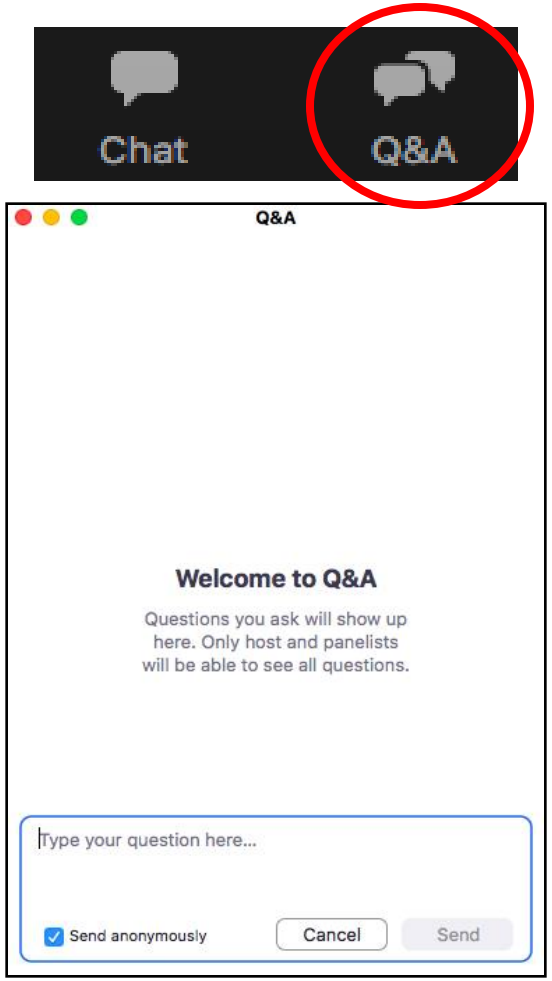

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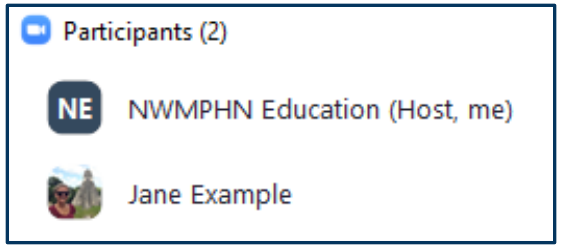

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Pathways are written by GP clinical editors with support from local GPs, hospital-based specialists and other subject matter experts

- clear and concise, evidence-based medical advice
- Reduce variation in care
- how to refer to the most appropriate hospital, community health service or allied health provider.
- what services are available to my patients

HealthPathways – Paediatrics

Navigating HealthPathways –Rash in Unwell Children

Relevant and Related Pathways

Relevant Pathways

Fever in Children

Rash in Unwell Children

Related Pathway

Normal Paediatric Observations

Urgent Care Clinics

Referral Pathway

Acute Paediatric Medicine Referral or Admission (Same-day)

Non-acute Paediatric Medicine Referral (> 24 hours)

Non-acute Paediatric Dermatology Referral (> 24 hours)

Paediatric Dermatology Referrals

CPD Hours for HealthPathways Use

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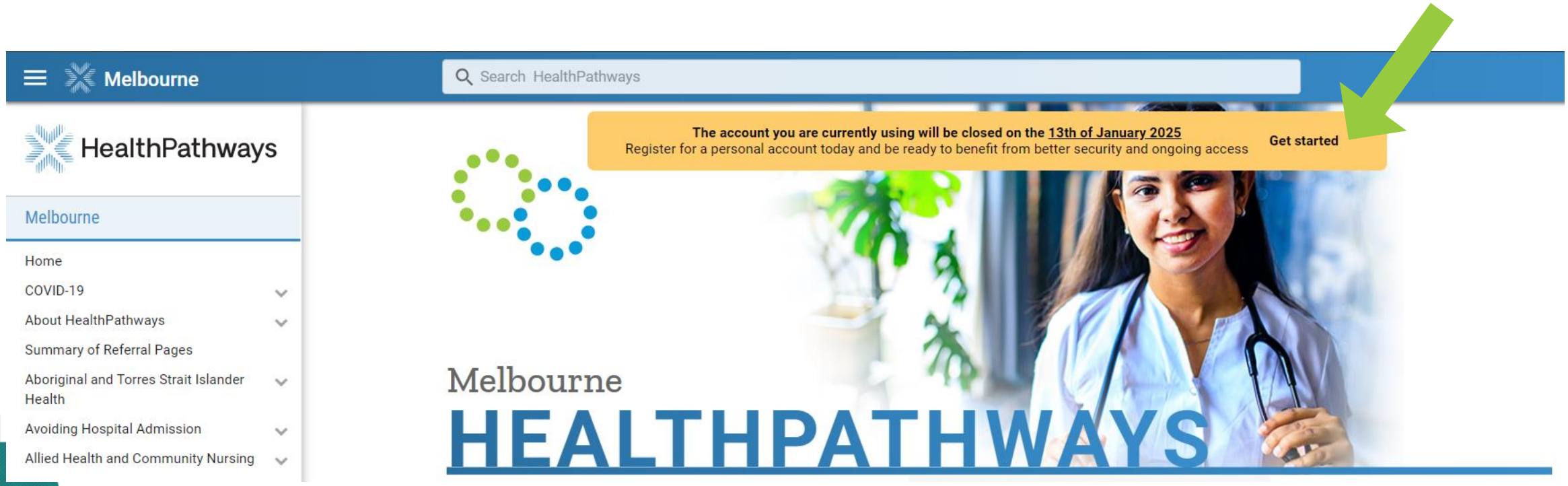

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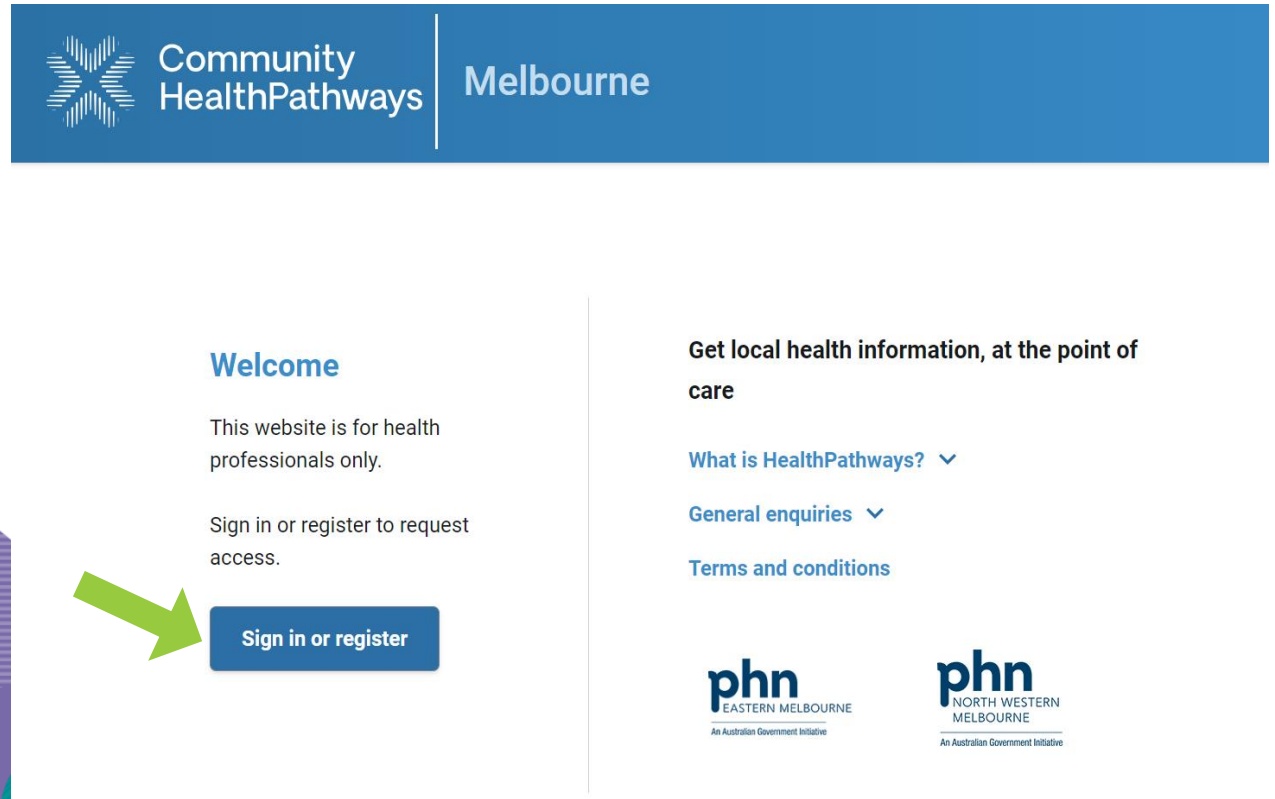
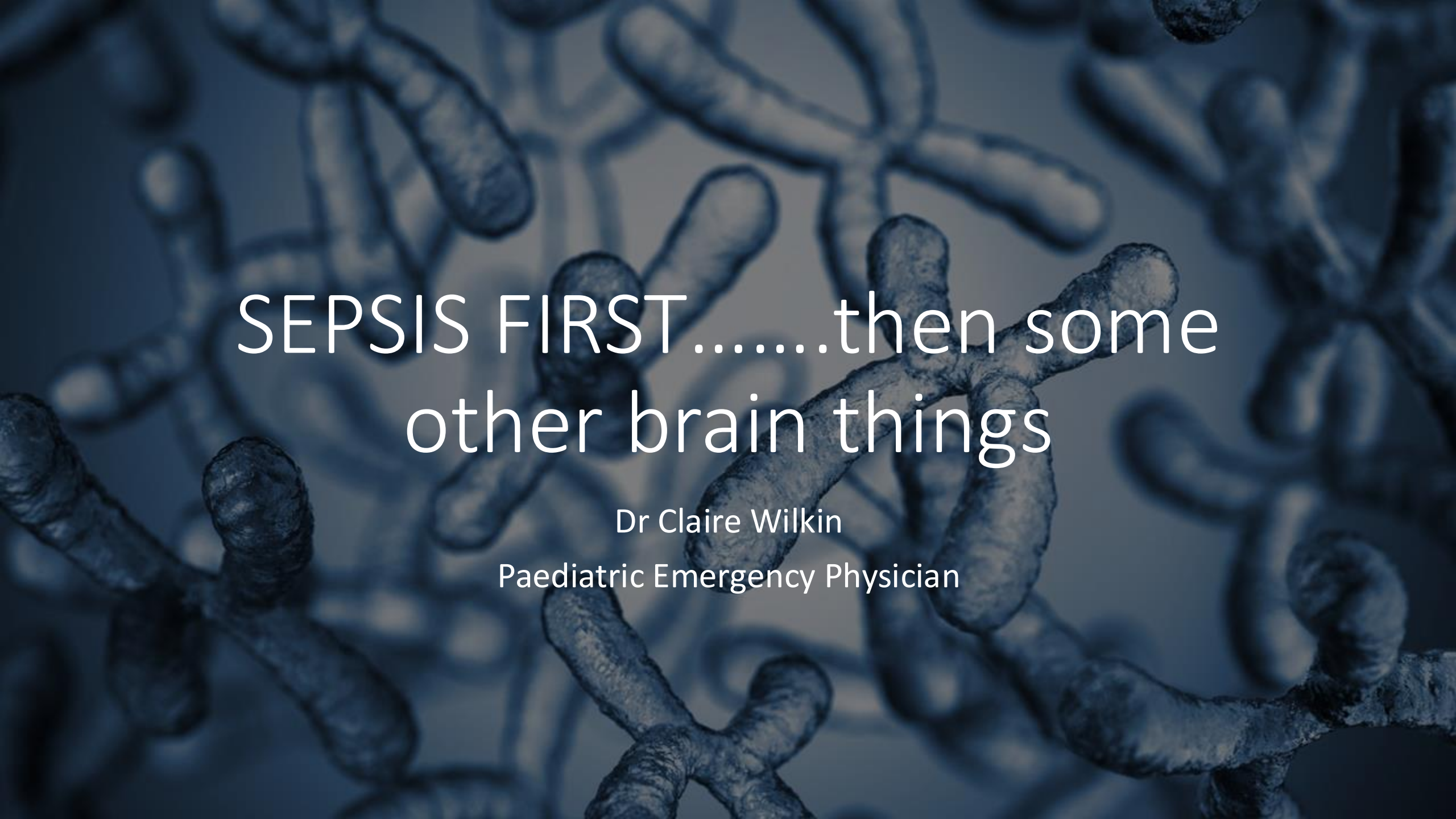


Questions? Contact the team on:
info@healthpathwaysmelbourne.org.au

Speaker

Dr Claire Wilkin *MBBS (Hons) MPH (Aeromed) FRACP (PEM), Paediatric Emergency Physician* - Royal Children's Hospital

- Dr Claire Wilkin, a paediatric emergency physician at the Royal Children's Hospital, specialises in pre-hospital and retrieval medicine. She also holds a Master's degree in aeromedical retrieval.
- Additionally, Claire plays a vital role on the Medical Advisory Committee for Ambulance Victoria, contributing to guideline development and education. Her career has included working in Australia, the UK and Africa.
- Claire gave a riveting presentation earlier this year on respiratory illnesses in children that had many clinicians asking when she would present again.



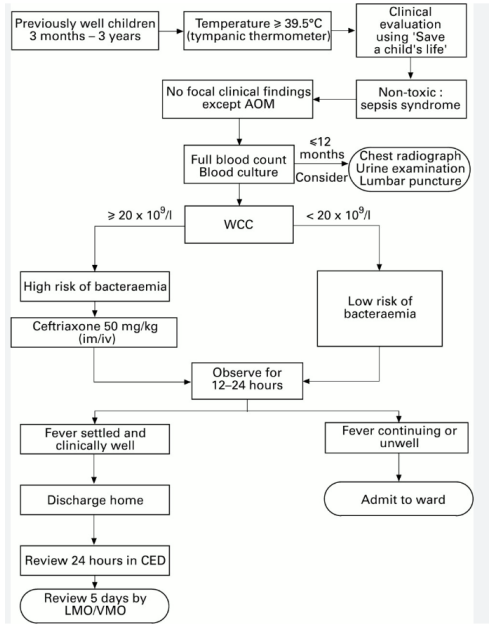
SEPSIS FIRST…….then some other brain things

Dr Claire Wilkin

Paediatric Emergency Physician

Fever!!!

No worries – there are guidelines….. And evidence…….



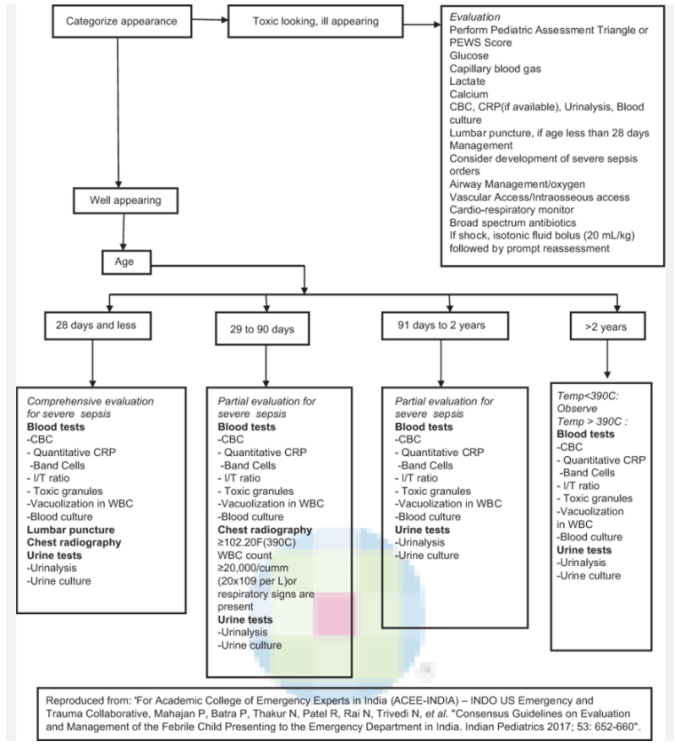
NICE National Institute for Health and Care Excellence

Traffic light system for identifying risk of serious illness in under 5s

Refer to the summary version of table 3 for the NICE guideline on sepsis if a child presents with fever and symptoms or signs that indicate possible sepsis

	Green – low risk	Amber – intermediate risk	Red – high risk
Colour (of skin, lips or tongue)	• Normal colour	• Pallor reported by parent/carer	• Pale/mottled/ashen/ blue
Activity	• Responds normally to social cues • Content/smiles • Stays awake or awakens quickly • Strong normal cry/not crying	• Not responding normally to social cues • No smile • Wakes only with prolonged stimulation • Decreased activity	• No response to social cues • Appears ill to a healthcare professional • Does not wake or if roused does not stay awake • Weak, high-pitched or continuous cry
Respiratory		• Nasal flaring • Tachypnoea: – RR >50 breaths/ minute, age 6–12 months – RR >40 breaths/ minute, age >12 months • Oxygen saturation ≤95% in air • Crackles in the chest	• Grunting • Tachypnoea: RR >60 breaths/minute • Moderate or severe chest indrawing
Circulation and hydration	• Normal skin and eyes • Moist mucous membranes	• Tachycardia: – >160 beats/minute, age <12 months – >150 beats/minute, age 12–24 months – >140 beats/minute, age 2–5 years • CRT ≥3 seconds • Dry mucous membranes • Poor feeding in infants • Reduced urine output	• Reduced skin turgor
Other	• None of the amber or red symptoms or signs	• Age 3–6 months, temperature ≥39°C • Fever for ≥5 days • Rigors • Swelling of a limb or joint • Non-weight bearing limb/not using an extremity	• Age <3 months, temperature ≥38°C* • Non-blanching rash • Bulging fontanelle • Neck stiffness • Status epilepticus • Focal neurological signs • Focal seizures

CRT, capillary refill time; RR, respiratory rate
* Some vaccinations have been found to induce fever in children aged under 3 months
This traffic light table should be used in conjunction with the recommendations in the NICE guideline on fever in under 5s.



Reproduced from: 'For Academic College of Emergency Experts in India (ACEE-INDIA) – INDO US Emergency and Trauma Collaborative, Mahajan P, Batra P, Thakur N, Patel R, Rai N, Trivedi N, *et al.* "Consensus Guidelines on Evaluation and Management of the Febrile Child Presenting to the Emergency Department in India. Indian Pediatrics 2017; 53: 652-660".

But despite these……

Fever

Meningococcal

iGAS

“Sepsis”

SEPSIS – what is it?

Life-threatening organ dysfunction caused by a **dysregulated host response** to infection

Rapid diagnosis is critical BUT over-diagnosis also has consequences

Most children with fever (with or without a focus) do not have sepsis

Septic shock is sepsis with evidence of cardiovascular organ dysfunction; hypotension is a late sign

Rapid vascular access, early initiation of empiric antibiotics and carefully titrated fluid resuscitation is vital

Sepsis – high risk group

High risk groups include:

- neonates
- immunocompromised children
- children with central venous access devices (CVAD)
- Aboriginal and Torres Strait Islander children

How do you recognize sepsis?

- Altered conscious state (lethargy, irritability, floppiness, weak cry)
- “Unwell” appearance
- Non-blanching rash
- Features of cardiovascular dysfunction: CRT<2secs, tachycardia, decr UO, mottled skin,
- Tachypnoea ± hypoxia ± grunting (not adequately explained by a respiratory illness)
- Unexplained pain
- Fever or hypothermia (temperature may be normal in neonates or the immunocompromised)
- Toxin mediated sepsis: caused by superantigens from toxin-producing strains of *S. aureus* or GAS
- Clinical features may include fever, vomiting, diarrhoea, myalgia, conjunctival injection, confusion, collapse and a widespread erythematous rash

SICK CHILD

Sepsis – more questions than answers

THERE ARE NO USEFUL SEPSIS SCREENING TOOLS IN PAEDIATRICS

EVEN THE DEFINITION OF SEPSIS ISN'T AGREED

What do we know?

- Sepsis is a needle in a haystack in previously well children
- But it does kill and it is very quick! (Schlapbach et al found in prev well pts with septic shock who died in ICU, the median time to death was 16 hours, with **54.5%** dying within 24 hours and **72.7%** within 48 hours)
- Viraemic children are very hard to differentiate from septic children
- Children have a very labile physiological response to fever
- Sepsis screening tools have a very low positive predictive value in children
- We cannot take adult tools and use them in children

What do clinicians do now?

Guidelines provide clinicians with long lists of signs of a sick child

The tragedy is by the time these signs are elicited the patient is a long way down the sepsis spiral and it is very difficult to retrieve

“Sick child” lists

- Altered conscious state (lethargy, irritability, floppiness, weak cry)
- Unwell appearance ± non-blanching rash
- Features of cardiovascular dysfunction:
  - reduced peripheral perfusion, pale, cool or mottled skin, prolonged central capillary refill time (CRT >2), tachycardia, decreased urine output (<1 mL/kg/hr) or narrow pulse pressure
  - cold shock: narrow pulse pressure, prolonged capillary refill (more common in neonates/infants)
  - warm shock: wide pulse pressure, bounding pulses, flushed skin with rapid capillary refill (more common in older children/adolescents and often under-recognised)
- Tachypnoea ± hypoxia ± grunting (not adequately explained by a respiratory illness)
- Unexplained pain
- Fever or hypothermia (temperature may be normal in neonates or the immunocompromised)
- Toxin mediated sepsis: caused by superantigens from toxin-producing strains of *S. aureus* or GAS Clinical features may include fever, vomiting, diarrhoea, myalgia, conjunctival injection, confusion, collapse and a widespread erythematous rash

RECOGNITION: Fever/hypothermia or other evidence of infection
(eg petechial rash)
AND one or more signs of impaired tissue perfusion as below:

- Cold shock: cool peripheries, CRT > 2 sec, reduced peripheral pulses
- Warm shock: brisk CRT, bounding pulses, wide pulse pressure
- Altered LOC/drowsiness
- Reduced urine output
- Tachycardia disproportionate to fever, anxiety, meds
- Bradycardia
- Hypotension (a LATE sign in paediatric septic shock)

AND “unwell appearance”

Sepsis Recognition

Sepsis should be considered in a patient with suspected or proven infection
AND/OR fever / hypothermia (temperature ≥ 38 ºC or < 36 ºC)
AND one or more signs of impaired tissue perfusion below:

- Tachycardia disproportionate to fever, anxiety, medications
- Bradycardia
- Cold shock: capillary refill time (CRT) ≥ 3 seconds, cool peripheries, cool or mottled skin, reduced peripheral pulses, narrow pulse pressure
- Warm shock: CRT < 1 second, bounding pulses, wide pulse pressure
- Altered level of consciousness (LOC) / drowsiness / irritability
- Hypotension (a late sign of septic shock in children)
- New onset end organ dysfunction
- Evolving petechial or purpuric rash
- Unexplained pain

Things that don’t help

Schlapbach LJ, MacLaren G, Festa M, Alexander J, Erickson S, Beca J, Slater A, Schibler A, Pilcher D, Millar J, Straney L. Prediction of pediatric sepsis mortality within 1 h of intensive care admission. Intensive Care Medicine. 2017 Feb 20:1-2.

- Need for ventilatory support –can’t breathe
- Poor Oxygenation status - can’t oxygenate tissues
- Profound Hypotension – can’t maintain perfusion
- Raised lactate – end organ death
- Cardiac arrest – already dead
- Fixed dilated pupils – neurological death

- These are markers of children who are already dead/actively dying!

But we want to pick the child before they are peri-arrest!?

- Here's the challenge!
- How do you look out on the sea of winter fevers and sickness in the waiting room caused by Flu, Covid, RSV, Mycoplasma, adenovirus and pick the one child in the waiting room with iGAS?

We can risk stratify

- Neonates and infants <28days (esp if premature)
- Immunosuppression
- Immunocompromise
- Oncological conditions
- CVAD patients
- Chronic lung disease
- Congenital heart disease
- Previous invasive bacterial infections
- Indigenous children
- Children with severe underlying complex disease (ie GMFCS V CP)

But the previously well children….. there is no guideline for them

The severity of illness cannot be predicted by:

- the degree of fever
- its rapidity of onset
- its response to antipyretics
- the presence of febrile seizures
- parental concern

And it cannot be excluded by:

- Resolution of tachycardia after defervescence

“The appearance of the child is the most useful indicator” – we need to do better than this

NB Rates of meningococcal and pneumococcal are low because of vaccination – both now very rare

Does giving antipyretics in ED to improve vital signs help us to rule out a serious bacterial infection?

Wittmann S, Jorgensen R, Oostenbrink R, Moll H, Herberg J, Levin M, Maconochie I, Nijman R. Heart rate and respiratory rate in predicting risk of serious bacterial infection in febrile children given antipyretics: a prospective observational study. Eur J Pediatr. 2023 May;182(5):2205-2214.

Why this study?

- Febrile children are the bread and butter of PED.
- They are almost always tachycardic and tachypnoeic but only around 8-10% have a serious bacterial infection.
- If more tachy-anything, must be sicker (age specific vital signs charts)
- So…… we give antipyretics and reassess – if the HR/RR improves on repeat measurement with defervescence – send them home (must not be that sick)

- *Seems fair… Right?*

The study

Question: Does administration of antipyretics mask tachycardia and tachypnoea in serious bacterial illness in children presenting to ED?

Study type: Prospective cohort

Population: 1455 children 1 mo – 16yrs bw June'14 - March'15

Location: Single centre data only (large London metro teaching hospital)

- **Inclusion:**
- fever
- ≥ 1 warning sign of SBI (as per NICE guidelines)
- Received antipyretic

- SBI was defined using cultures, micro, virology and imaging results, and an expert panel.

Exclusion:

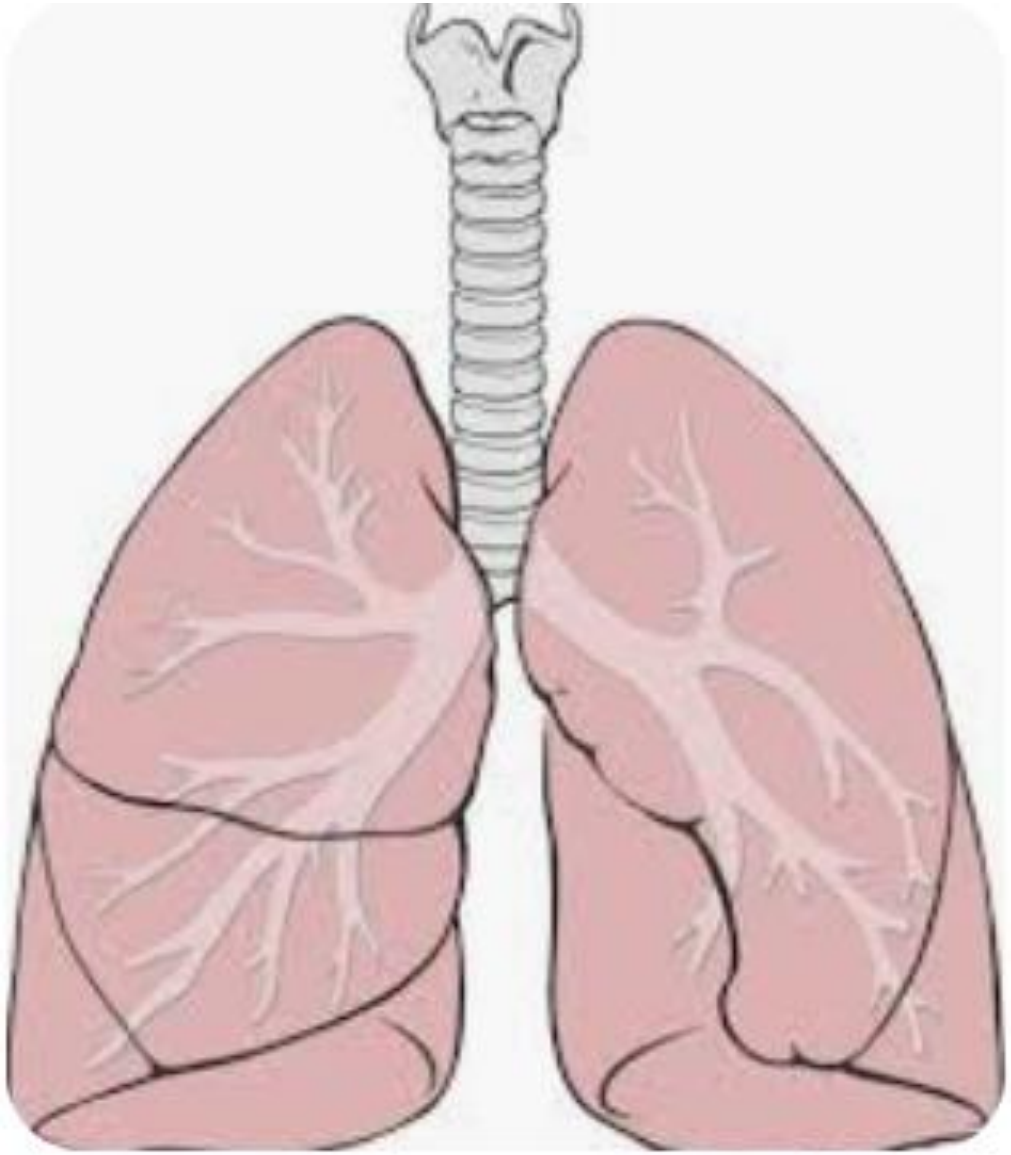
- ‘immediate’ triage category
- complex medical history
- DNW
- discharged to urgent care
- non-UK residents
- Primary problem not fever
- No consent

Findings

Persistent tachypnoea after defervescence was a predictor of **pneumonia**, especially if >97th percentile (OR 1.92), but not other SBI. **So good for ruling pneumonia in.**

Persistent tachycardia did not independently predict an SBI.

Isolated tachycardia was not a useful predictor for future admission or need for significant interventions



Conclusion

- **Persistent tachycardia** alone does not appear to be linked to a higher incidence of any underlying bacterial infection.
- **Persistent tachypnoea** in an afebrile child is a useful predictor of pneumonia
- **There appears to be no benefit in giving antipyretics and awaiting normalisation before discharge in febrile children with tachycardia and no other abnormal findings.**

But assuming wellness in a child if HR/RR resolve with defervescence is also not justified

Because…… (wait for the punch line of the whole study)

One child died of sepsis several hours after discharge when normal vital signs were recorded


OMG!

- *Long E, Solan T, Stephens DJ, et al.* ***Febrile children in the Emergency Department: Frequency and predictors of poor outcome.*** *Acta Paediatr. 2020; 00: 1– 10*

Study

Design: Retrospective observational cohort study in large single tertiary PED

Aim: To determine the frequency of poor outcomes in undifferentiated children presenting to the ED with fever and evaluate predictors of poor outcome

Inclusion: All children with ‘fever’ in their triage or a temp of >38.0°C at triage

Exclusion: none

How: Data extracted from electronic medical records (incl demographics, vital signs, blood results, diagnosis, disposition, organ support therapies, organ dysfunction scores and mortality)

Definitions

- **Poor outcome** - development of new organ dysfunction +/- need for organ support
- **Organ support therapy** – requirement for inotrope infusion, mechanical ventilation, renal replacement therapy (RRT), or extracorporeal life support (ECLS) (uses PELOD-2 criteria)

- **Predictor variables:**
- **vital signs**: HR, RR, BP, and GCS
- **blood tests**: lactate, creatinine, WCC, platelets, and INR
- **clinical scores**: SIRS, qSOFA, and qPELOD-2

Results

- **6217 (13.8%**) children presented to the ED with fever. (58.3% <3yrs old)

- 65.4% were discharged home, 34.6% admitted and 0.5% admitted to PICU

- **0.4% developed new organ dysfunction**
- **0.2% required organ support therapy (inotropes (5), mechanical ventilation (6), RRT (1), ECLS (1)**

- Large sample size = good **internal validity** (results likely represent the truth)
- Good **external validity** (results generalisable to other populations)

- ***All* predictor variables were poor predictors for the development of new organ dysfunction and the requirement for organ support therapy**

Discussion

Poor outcomes in undifferentiated febrile children are rare. Most can simply be discharged

Only 0.5% required close observation in PICU and even fewer developed new organ dysfunction or required support

The rarity of this outcome reinforces that the use of these existing "**predictor variables**" isn't helpful

Few Hidden Pearls

- **High HR and RR** were not helpful – no increased risk
- **Think Lactate** - high lactate significantly increased the risk of new organ dysfunction and support (ventilation and inotropes), - the higher the lactate, the higher the risk
- High INR and Cr also increased risk

Clinical scores – didn't help

So where does that leave us?....

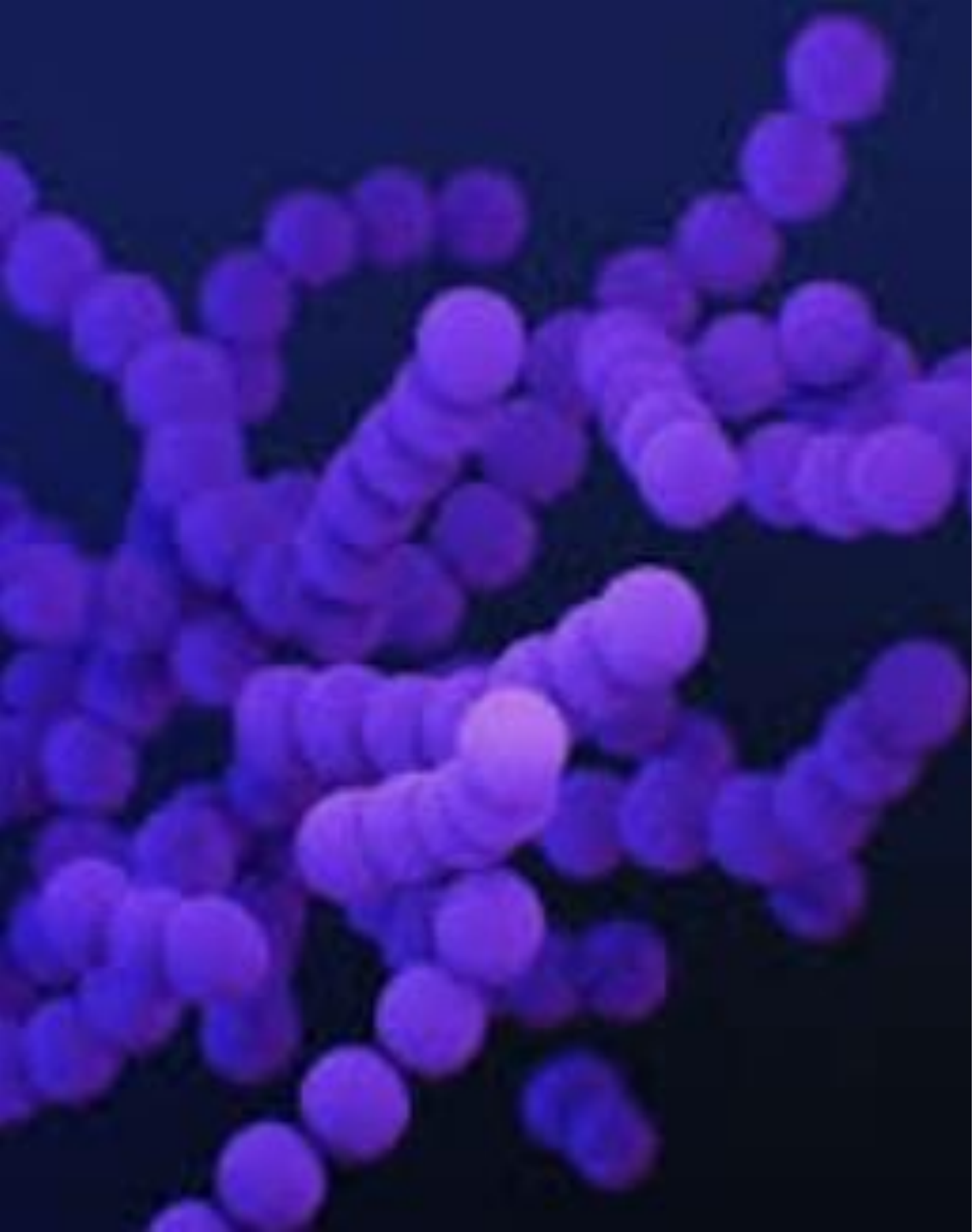
iGAS

This is the beast you are hunting

iGAS is defined by the isolation of GAS from a normally sterile site. Manifestations include:

- bacteraemia/septicaemia
- streptococcal toxic shock syndrome (STSS)
- necrotising fasciitis
- pneumonia and empyema
- retropharyngeal abscess
- osteomyelitis or septic arthritis

Cellulitis, scarlet fever and pharyngitis
are **not** considered to be invasive disease – same bug but different disease process



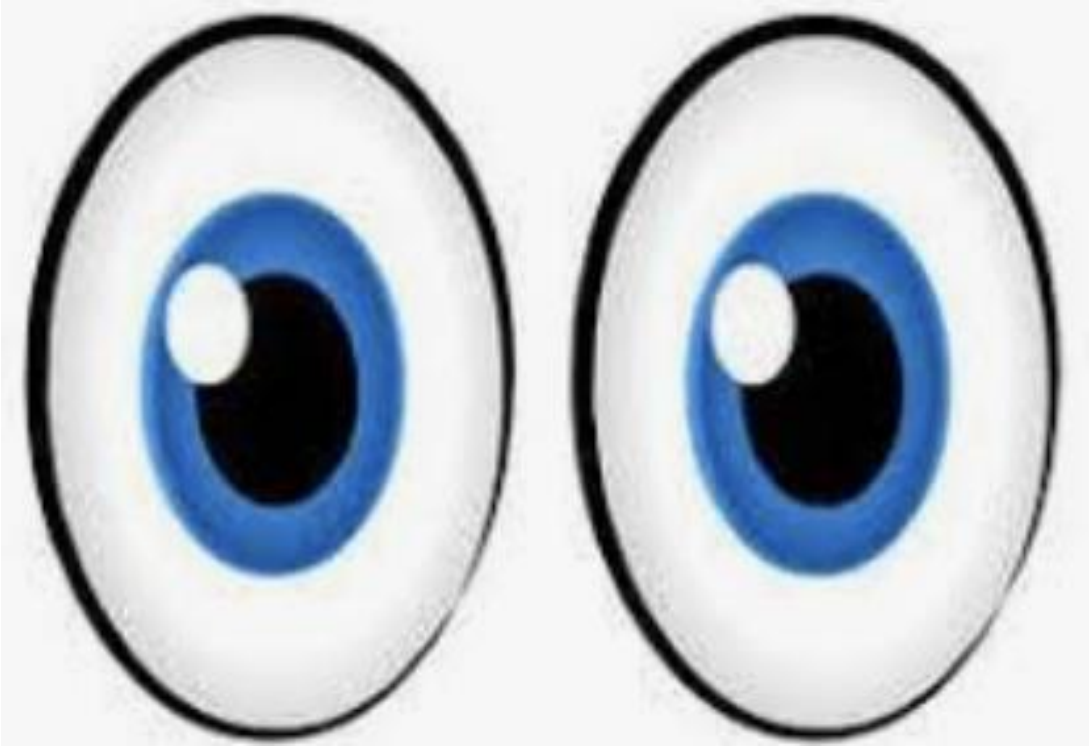
Sore throat

- Positive throat swab reflects asymptomatic carriage (15-20% population) and is irrelevant
- There is no evidence that treating sore throat with antibiotics decreases the risk of iGAS
- Most patients presenting with iGAS do not have history of GAS pharyngitis
- Only groups at risk of suppurative or non-suppurative complications (ATSI, immunocompromised) should receive antibiotics for possible GAS pharyngitis

How to pick sepsis

There is no list (other than our previous "sick child' list)

- Unfortunately once we reach that point, the mortality climbs over 30% which is the highest of any childhood infection in the developed world
- So……. THINK about febrile children
- Look for a source (this doesn't always help but remember teething doesn't cause fever)
- OBSERVE them (eyes on the waiting room)
- Serial observations

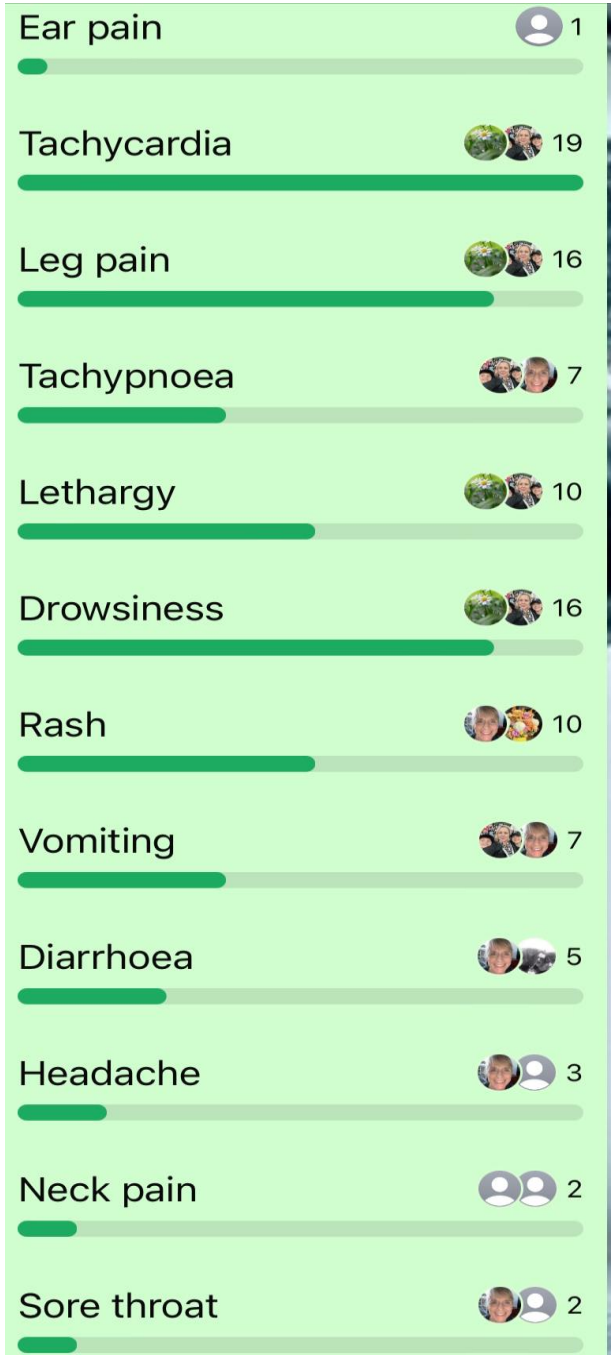


Symptoms more likely to think sepsis

- Persistent tachycardia
- Flat, very lethargic
- Thigh pain
- Refusing to stand/walk
- Grunting resps
- Headache in preschoolers
- Widespread erythematous hot rash
- CRT >3secs
- “Unwell looking”
- Hypotension is a late sign – should be able to take BP in these kids – use the right cuff

What symptoms might be associated with iGAS?

- 19 PEM physicians asked " which of the following signs/symptoms make you suspicious that a patient may have iGAS"



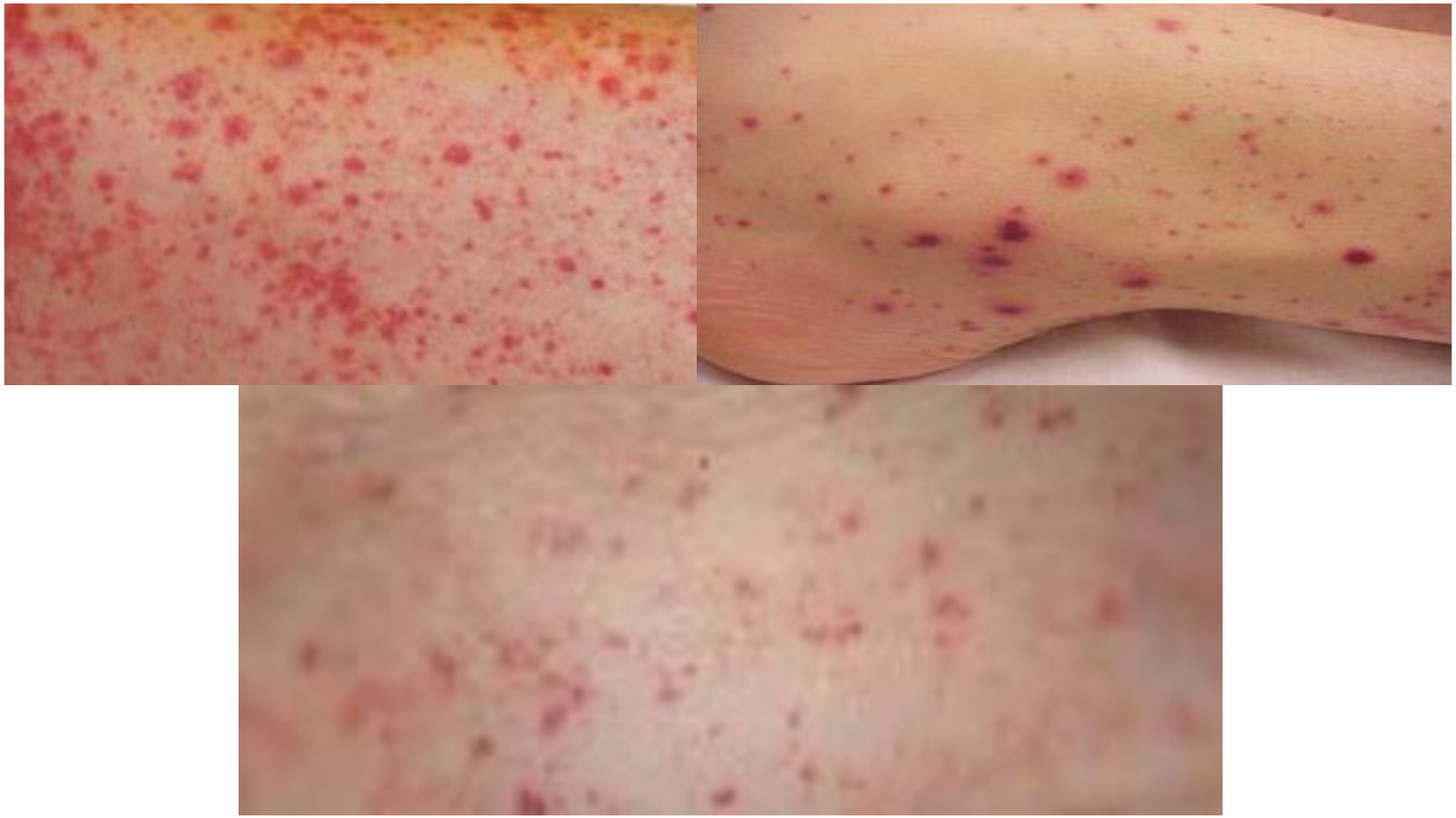
Symptoms not usu assoc with sepsis

- Well child
- Normal observations
- Isolated Neck pain
- Single febrile convulsion
- Sudden onset fever
- Runny nose and cough
- Running around waiting room
- Height of fever

Sepsis Pearls

- There is no good predictor of paediatric sepsis
- RECOGNITION IS HARD
- Viraemic children often meet SIRS criteria
- Observation is critical
- Treat High risk children – ATSI, neonates, immunocompromised, CVAD

But doesn’t sepsis come with a rash?



Petechiae…

- **Argh…….**
- **Quick!!**
- **Get me some *Cef-fix-it-all!***
- **STAT!!!!**

Petechiae – stop and think!

Most common cause is actually local compression

- Coughing/vomiting – above nipple line from raised intrathoracic pressure
- Bjorn legs - bilateral lower limbs from compression of pelvic/prox thigh vessels
- Tourniquet/tight clothing on ankles/wrists
- Friction – cloth nappies/covers

Petechiae – in a well child

- Safe to observe
- If child isn't unwell – mark the petechiae and observe for 4/24
- If no progression unlikely sinister cause
- Be more alert in immunocompromised/immunosuppressed
- If progression or significantly unwell – refer for bloods for FBE and blood culture and give 3rd generation cephalosporin if in doubt.
- Meningococcal, Hib and GAS all cause petechial rash as do several enteroviruses

Neisseria Meningitidis

- **“Meningococcus”** is a gram-negative diplococcus
- Can cause **meningococcaemia** (blood-borne sepsis) or **meningitis**, and rarely septic arthritis, pneumonia or occult bacteraemia
- About 10% of adults are nasopharyngeal carriers
- Human only pathogen
- Spread through saliva and respiratory secretions
- Reported to be transmitted through oral sex and may cause urethritis in men

One Bacteria – Different Diseases

- **Like iGAS, Meninogococcus is a bacteria that can cause several diseases.**
- One does not cause the other
- **Meningococcal meningitis is a SEPARATE disease to meningococcaemia (sepsis)**
- Meningococcal meningitis is slower moving and somewhat protective against development of Meningococcaemia
- **More importantly, absence of meningitis symptoms doesn't exclude sepsis**

Meningococcaemia

- **Fever**
- **Rapid onset** of loss of appetite, nausea, vomiting, sore throat, coryza, headache, lethargy
- Infants may have reduced feeds, irritability
- Leg pain or myalgia

Sepsis Recognition

Sepsis should be considered in a patient with suspected or proven infection
AND/OR fever / hypothermia (temperature ≥ 38 ºC or < 36 ºC)
AND one or more signs of impaired tissue perfusion below:

- Tachycardia disproportionate to fever, anxiety, medications
- Bradycardia
- Cold shock: capillary refill time (CRT) ≥ 3 seconds, cool peripheries, cool or mottled skin, reduced peripheral pulses, narrow pulse pressure
- Warm shock: CRT < 1 second, bounding pulses, wide pulse pressure
- Altered level of consciousness (LOC) / drowsiness / irritability
- Hypotension (a late sign of septic shock in children)
- New onset end organ dysfunction
- Evolving petechial or purpuric rash
- Unexplained pain

Note: a blanching rash does not exclude meningococcaemia (can initially be macular or maculopapular)

Sepsis

- You aren't hunting a bacteria as they are all similar in presentation

  iGAS=Men=Hib=S.pneumo

- You are hunting the organ dysfunction that comes with the infection

That is how you can best look for sepsis – think about and look for organ dysfunction

SICK CHILD

Principles of Sepsis Treatment

- Early recognition/seeking senior help
- Assess airway and breathing and administer oxygen if required
- Rapid vascular access
- Empiric antibiotic therapy
- Carefully titrated fluid resuscitation
- Early initiation of inotropes
- Early involvement of critical care services
- Source control
- Frequent reassessment

First 5 minutes

Immediate actions

Call for senior help

Attach cardiorespiratory monitoring

Address airway, breathing compromise

Administer oxygen

There is no blood test to screen for sepsis – FBE, PCT and Lactate all have a role but none is definitive

First 15 minutes

Establish vascular access

Insert IO cannula if no IV access established promptly

Take bloods:

- Blood culture, VBG with lactate and glucose (priority)
- FBE, CRP, UEC, LFT, Coags, +/- Group and hold
- Urinalysis and lumbar puncture should be considered once the child has been stabilised

Administer antibiotics (via IV push administration)

- Consider IM if delays in IV/IO access

Investigations should NOT delay antibiotic administration

First 30 minutes

IV fluid administration with sodium chloride (NaCl) 0.9%

- 20 mL/kg (10 mL/kg in neonates) bolus as a push, then reassess
- If required give an additional bolus (10 mL/kg) and repeat as necessary to a maximum total volume of 40 mL/kg
- Repeated assessment of fluid status, perfusion (heart rate, CRT, urine output), clinical condition and assessment for signs of fluid overload
- Consider early commencement to inotropes for children with limited response to fluids

Children requiring 40mL/kg of fluid resuscitation should be managed in a critical care environment

First 60 minutes

Inotrope/vasopressor

For persisting circulatory failure after 40 mL/kg fluid resuscitation, give:

- Adrenaline 0.05-0.2 mcg/kg/min
  - Can be given via peripheral access (IV or IO) whilst awaiting transfer to PICU. Seek Paediatric Intensive Care input (onsite or via Retrieval Services)
  - Push dose inotropes may be used with experienced clinician

Children requiring inotrope/vasopressor support should be managed in a critical care environment

Antibiotics

Antimicrobial recommendations may vary according to local antimicrobial susceptibility patterns; please refer to local guidelines

≤7 days	benzylpenicillin 60 mg/kg IV 12H and cefotaxime 50 mg/kg IV 12H
>7 to 28 days	benzylpenicillin 60 mg/kg IV 6-8H and cefotaxime 50 mg/kg IV 6-8H
1 to ≤2 months	benzylpenicillin 60 mg/kg IV 4-6H and cefotaxime 50 mg/kg IV 6H
>2 months	ceftriaxone 100 mg/kg (max 4g) IV daily or cefotaxime 50 mg/kg (max 2g) IV 6H and flucloxacillin 50 mg/kg (max 2g) IV 6H

For oncology patients

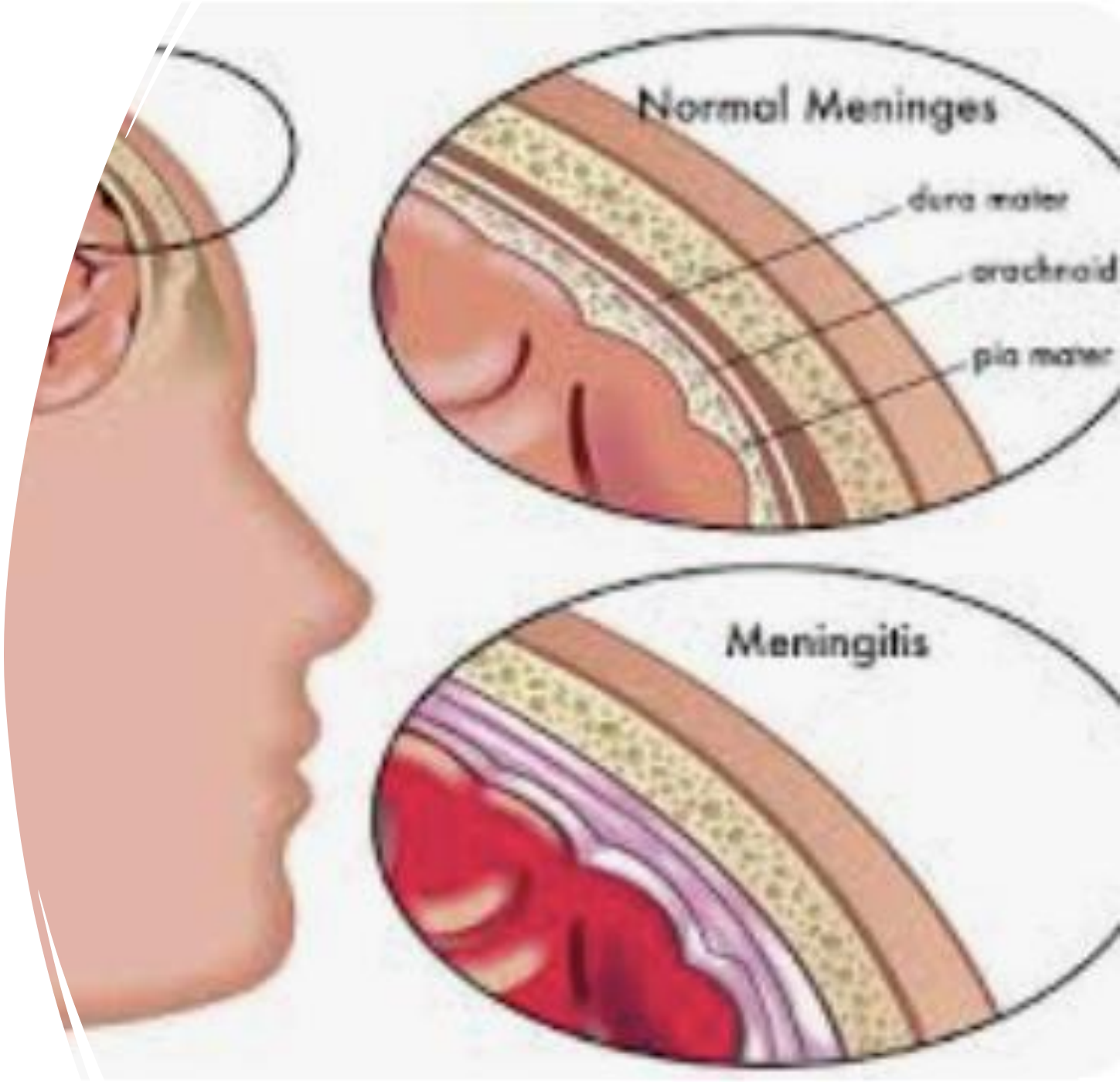
piperacillin/tazobactam 100 mg/kg (max 4g) IV 6H
Add amikacin 22.5 mg/kg (18 mg/kg if >10y) (max 1.5g) IV daily and
vancomycin 15 mg/kg (max 750 mg) IV 6H if severely unwell/high risk

For non-oncology patients with central venous access

vancomycin 15 mg/kg (max 750 mg) IV 6H and ceftriaxone 100 mg/kg (max 4g) IV daily or cefotaxime 50 mg/kg (max 2g) IV 6H

- Consider adding aciclovir 20mg/kg IV 8H if HSV suspected <3 months: skin lesions, seizures, hepatitis
- There will be situations where additional empiric cover may be warranted, based on local epidemiology and at the discretion of the senior clinician e.g. vancomycin for suspected MRSA
- For suspected toxin mediated disease: consider the addition of clindamycin 15 mg/kg (max 900 mg) IV 8H and IVIG
- If IV access unavailable, give IM ceftriaxone 100mg/kg (max 4g) daily. Can also be used ≤2 months
- For previous antibiotic anaphylaxis: seek specialist advice

Meningitis


Normal Meninges
dura mater
arachnoid
pia mater
Meningitis

Meningitis/ Encephalitis

- Meningitis is inflammation of the meninges surrounding the brain and spinal cord
- Encephalitis is inflammation of the brain parenchyma
- The two are difficult to distinguish so history and exam is important as there are features that are more prominent in each

If in doubt which disease the very sick child has – treat for both

Meningitis

- Bacterial Meningitis is now thankfully very rare due to vaccines
- It is difficult to distinguish viral from bacterial meningitis clinically
- But most meningitis we see now is in the context of viral illness
- Very sick children should be treated with empiric antimicrobials until the cause is confirmed
- Well child with mild headache/neck stiffness and mild photophobia is very unlikely to be bacterial meningitis and most won't get an LP in this scenario – common in covid and flu
- There are a few mimics – invasive sinusitis in adolescents

Risk factors for bacterial meningitis

- Unimmunised
- Immunocompromised
- History of neurosurgery or penetrating head injury
- VP shunt
- Cochlear implant
- Younger age, particularly <5 years

History and Exam

History

- lethargy or drowsiness
- vomiting
- headache
- neck pain
- **photophobia**
- nausea
- **altered conscious state**
- preceding URTI may be present

Exam

- Fever
- Hyper or hypotonia
- Neck stiffness
- Focal neurological signs

(Kernig and Brudzinski signs aren't very clinically helpful)

Hospital Treatment

- **Urgent lumbar puncture (LP) – microscopy, biochemistry (inc glucose) – incl PCR testing**
- If unsafe to perform (eg focal neurological signs, ongoing seizures, markedly reduced GCS, cardiovascular compromise or coagulopathy), defer LP and commence empiric treatment immediately.
- Do not delay antimicrobials in an unwell child if the LP will take more than 30 minutes

Neuroimaging

- Indications include:
  - focal neurological signs
  - signs of raised ICP
  - encephalopathy
  - diagnostic uncertainty eg to look for a mass
- Not routine in meningitis but may be used to look for complications eg abscess, thrombosis
- **Normal CT brain does not exclude raised ICP and should not influence the decision to perform an LP**
- MRI will provide more detailed information to guide diagnosis, but may require general anaesthetic
- EEG may be helpful in suspected encephalitis

Meningitis Antibiotics

Suggested antibiotic regimen

(if local guidelines not available)

Age group	Common organisms	Empiric antibiotic	Dexamethasone
Meningitis			
0-2 months	GBS, *Escherichia coli*, *Listeria monocytogenes* (rare)	**Benzylpenicillin** 60 mg/kg IV 12 hourly (<7 days old), 6-8 hourly (7 days to <4 weeks old), 4 hourly (>4 weeks old) ***and*** **Cefotaxime** 50 mg/kg IV 12 hourly (week 1 of life), 6-8 hourly (7 days to <4 weeks old), 6 hourly (>4 weeks old)	Not advised
≥2 months	*N meningitidis*, *S pneumoniae, HiB*	**Ceftriaxone** 50 mg/kg (max 2 g) IV 12 hourly ***or*** **cefotaxime** 50 mg/kg (max 2 g) IV 6 hourly Add **vancomycin** if Gram-positive cocci on Gram stain (see Vancomycin for dosing)	0.15 mg/kg (max 10 mg) IV 6 hourly for 4 days
Penicillin/cephalosporin hypersensitivity: **moxifloxacin** 10 mg/kg (max 400 mg) IV daily **and vancomycin** (see Vancomycin for dosing)			

Antibiotics should be given **within 30 minutes** of the decision to treat

Encephalitis

Unrecognised HSV encephalitis is a devastating illness with significant morbidity and mortality, however early treatment with aciclovir can lead to a full recovery

Fever and Encephalopathy:

- **Altered mental state** - unusual behaviour, confusion, personality change, emotional lability
- **Seizures** (common)
- Abnormal movements
- Headache
- Vomiting
- Lethargy
- Focal neurology
- Look for HSV lesions incl keratitis/corneal ulcer

Consider other causes of encephalopathy eg acute disseminated encephalomyelitis (ADEM), toxins or metabolic

Encephalitis

Encephalitis **Antibiotics as above, plus:**			
	HSV *Mycoplasma pneumoniae* *Other viruses:* EBV, CMV, HHV6, Influenza Arboviruses	**Aciclovir** 20 mg/kg IV 12 hourly (<30 weeks gestation), 8 hourly (>30 weeks gestation to <3 months corrected age) 500 mg/m2 or 20 mg/kg IV 8 hourly (3 months to 12 years) 10 mg/kg IV 8 hourly (>12 years) Consider adding **azithromycin**	Not advised

Treatment for HSV encephalitis should be added if there is clinical suspicion (altered conscious state, focal neurological signs, seizures, signs or risk of HSV infection) and/or child is obtunded

Special considerations in ATSI patients

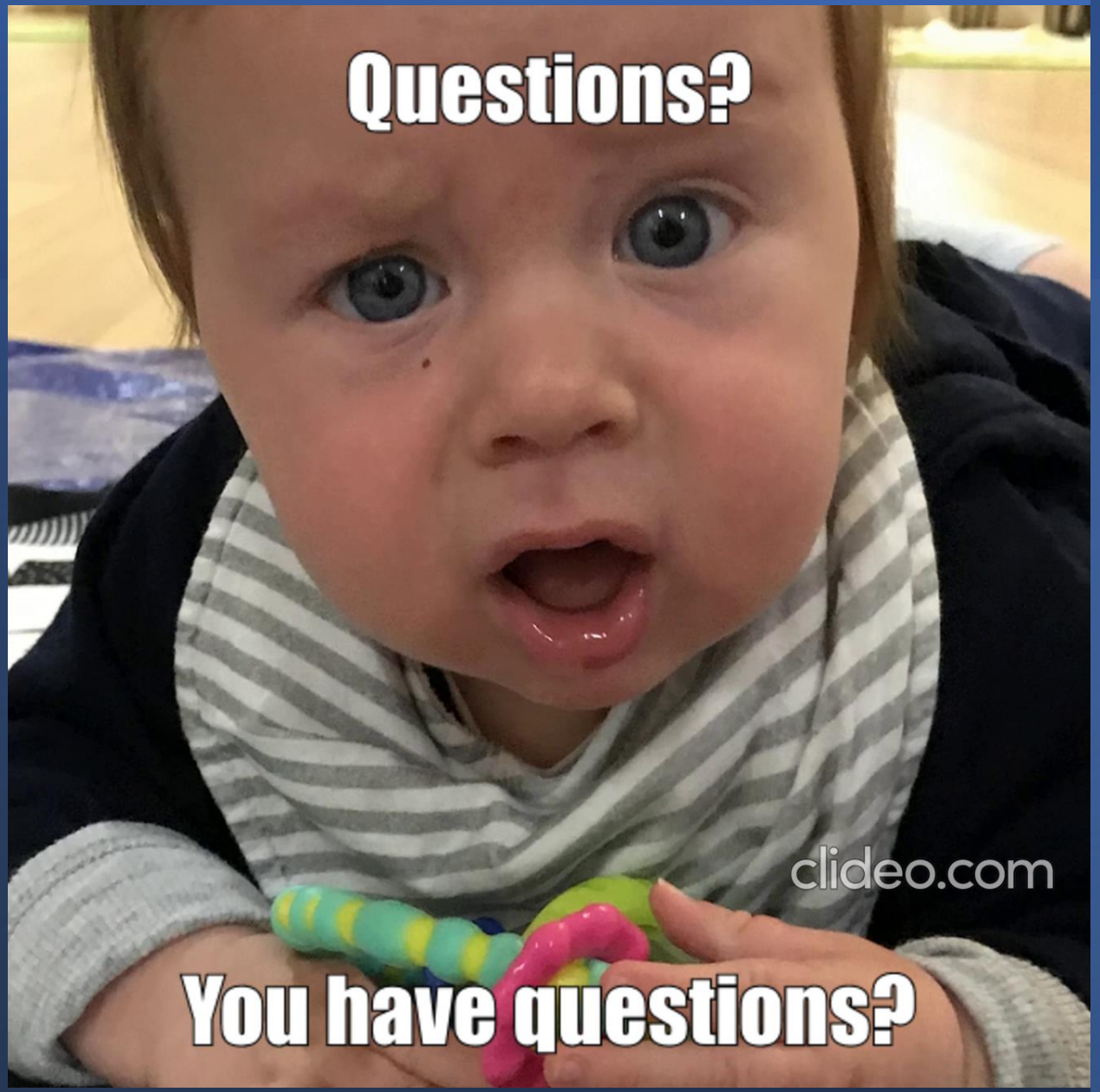
Treat GAS sore throat with antibiotics and check eradication once course complete

Low threshold for systemic antibiotic treatment of skin infections

Sepsis management is the same

Pearls

- Sepsis recognition is hard… but…..
- Most febrile children don’t have serious illness
- GAS sore throat doesn’t require Rx unless specific risk
- Petechial rash is not associated with meningitis
- SAME BUG BUT DIFFERENT DISEASE
- Meningitis is rare and mostly viral (except in at risk pts)
- In true bacterial meningitis – LP within 30mins otherwise antibiotics first
- Encephalitis – altered conscious state is the key – treat obtunded children with antibiotics and aciclovir


Questions?
clideo.com
You have questions?

Session Conclusion

We value your feedback, let us know your thoughts.

Scan this QR code

You will receive a post session email within a week which will include slides and resources discussed during this session.

Attendance certificate will be received within 4-6 weeks.

RACGP CPD will be uploaded within 30 days.

To attend further education sessions, visit,

https://nwmphn.org.au/resources-events/events/

Cultural Awareness Training – in person
26/10/2023 available to all primary care staff.
Come along this Saturday at the PHN to learn more about:-

- Identify factors that affect contemporary Aboriginal and Torres Strait Islander people as clients and families.
- Discuss how history impacts on Indigenous health.
- Discuss evidence-based strategies to assist working with Aboriginal and Torres Strait Islander people.
- Implement systems-based models and social theories of practice

Help shape the future of sepsis education in primary health care

- The Australian Commission on Safety and Quality in Health Care is calling on health professionals to participate in a quick 10-minute survey hosted by Medcast to share your thoughts on how we can improve sepsis education and training for primary health care professionals.

The survey is open until **30 October 2024.**
Survey link: Sepsis in Primary Practice Survey