Recognition and Management of Sepsis in Children

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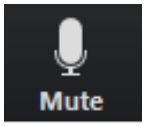
Webinar Guidelines



Use mute when you are not speaking.
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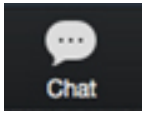
Turn video on for a more personalized/engaging experience. If internet connection is low turn on when speaking.



Use chat for additional comments/questions you'd like to share.

Avoid multitasking during the session.

Participation is encouraged.

Tell us about yourself

Objectives

Define sepsis/ septic shock

Understand key signs and symptoms of sepsis/septic shock

Recommend best practices for measuring paediatric vital signs

Identify management goals, strategies for paediatric sepsis

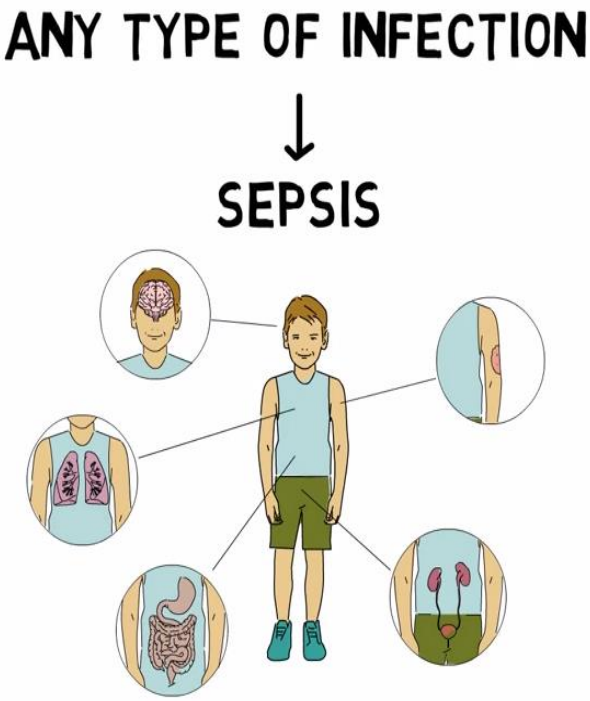
Identify post intervention assessment of patient

What is Sepsis?

Life threatening medical emergency

Can result from **any type** of infection in any part of the body

A local infection can then trigger a widespread exaggerated immune response, which injures the body's own tissues and organs



**You can have sepsis in the absence of a blood stream infection*

Severity of Sepsis

Systemic Inflammatory Response Syndrome (SIRS)

- Abnormal temperature
- Abnormal leukocyte count,
- Tachycardia,
- Tachypnea
- *At least 2/4

Sepsis

SIRS+ proven/ suspected infection

Sepsis-associated organ dysfunction:

- Severe infection leading to cardiovascular and/or non-cardiovascular organ dysfunction.

Septic Shock:

Sepsis leading to cardiovascular dysfunction

Factors that lead to poor outcomes.....

- **Delayed recognition** of suspected sepsis
- **Delayed IV fluid resuscitation** and **antibiotics**
- **Lack of** timely escalation for **IV Access**
- **Inadequate monitoring & pathways** for escalating care
- **Gaps in communication** (within teams, handoffs/transfer)

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Clinical History

Indicators of infection

- Fever, cough, sore throat, vomiting, diarrhea, skin rash, joint pain, swelling, or malaise

High risk conditions

- Young infants/neonates (< 3 months)
- Immunocompromised
- Central lines/indwelling medical devices
- Complex chronic conditions or significant neurological impairment
- Recent surgery, incisions/wounds

Case scenario

8 year old boy, high fever for 3 days, decreased oral intake, vomiting x 3 days with abdominal pain, occasional cough, parents brought to ED as he looks very unwell today. Weight is 25 kg otherwise healthy, fully immunized

- ***Do you suspect sepsis? Why/why not?***
- ***What would you do first?***

Abnormal Paediatric Vital Signs in Sepsis

	Suspect Sepsis!
Heart Rate	Tachycardia or bradycardia
Temperature	≤36C or ≥38C
Respiratory rate	Tachypnea
Blood pressure	Hypotension
Pulse pressure	Widened

Early Sign:
Tachycardia

Late Sign:
Hypotension

Measuring Vital Signs in Children

Temperature	Heart Rate	Respiratory Rate	Blood Pressure
Rectal: Birth to preschool age for precise temperature. Ensure to use rectal probe, lubricate tip and insert approx. 1.5cm **Oral: ≥ 3-5 years** Child must be developmentally capable of holding thermometer **Axilla:** All age groups. Place probe as high as possible in axilla and place arm snugly at patient's side	**Infants and young children:** at the apex of the heart using a stethoscope. **Patients who are older** with no cardiac condition may have a radial pulse taken. Should be auscultated for one **full minute**	Respiratory rate should be auscultated for **one full minute.** Assess rhythm and depth through manual assessment and observation of the patient's respiratory pattern	**Child/Adolescents:** Measured using a manual sphygmomanometer and stethoscope **or** by using an electronic BP device. **Infants** Manual or Doppler may be a better choice. ****Interpret pressure readings with caution when an electronic BP device is used for an active infant**** ****Use appropriate blood pressure cuff size****

Normal Paediatric Vital Signs

Pediatric Heart Rate Guidelines

Age	Low	Normal	High
0 to <3 mo	<95	**110 - 160**	>180
3 to <6 mo	<105	**120 - 160**	>180
6 to <12 mo	<100	**110 - 150**	>160
1 to <4 y	<75	**85 - 140**	>145
4 to <10 y	<60	**70 - 115**	>125
≥10 y	<45	**60 - 100**	>105

Used with permission from the Canadian Triage and Acuity Scale National Working Group

Pediatric Definition of Hypotension*

*Defined as <5th percentile for age

Age	Systolic BP (mmHg)
Term neonate (0-28 days)	<60
Infants (29 days - <12 mos)	<70
Children (1 - ≤10 years)	<70 + (age in years x 2)
Children (>10 years)	<90

Pediatric Respiratory Rate Guidelines

Age	Low	Normal	High
0 to <3 mo	<25	**35 - 55**	>60
3 to <6 mo	<25	**30 - 50**	>60
6 to <12 mo	<20	**30 - 50**	>60
1 to <4 y	<17	**20 - 45**	>50
4 to <10 y	<15	**17 - 27**	>30
≥10 y	<10	**13 - 22**	>25

Physical Exam

Assessment of organ perfusion

Skin/Pulses

Markers of Tissue Perfusion

- Mottling
- Cool clammy/ Flushed
- Delayed capillary refill/ Flash capillary refill
- Weak/Bounding pulses

Mental Status /Urinary Output

Marker of impaired kidney perfusion

- Decreased urine output <1 mL/kg/hr
- **Assess for decreased # of wet diapers**

Marker of impaired cerebral perfusion

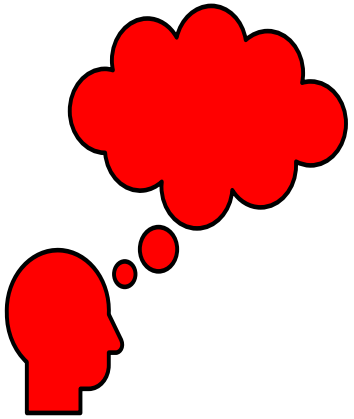
- Unexplained irritability
- Drowsiness
- Confusion, lethargy, unresponsiveness

****Pay close attention to family caregiver reports about behaviour*****

Case scenario

8 year old boy, high fever for 3 days, decreased oral intake, vomiting x 3 days with abdominal pain, occasional cough, parents brought to ED as child looks very unwell today. Weight is 25 kg, otherwise healthy, fully immunized

- T 40.2, HR 162, RR 35, BP 100/65, SPO2 94% RA
- **CNS:** irritable on assessment
- **CVS:** soft systolic murmur, cap refill 4 secs



- ***Concerned for sepsis?***
- ***What other information would you gather?***
- ***What other assessments would you perform?***

Key Points

Increase suspicion in HIGH RISK patients

Pay attention to abnormal vital signs and vital signs trend

Tachycardia is important

Hypotension is a LATE sign- assess for markers of impaired organ perfusion

Clear Communication- say that you are concerned about “Sepsis”

Listen to parents' concerns

Pediatric Sepsis Management

LEO

3-year-old boy presenting to the ED with a two day history of fever, vomiting, and decreased urine output.

VS in ED find he is Febrile 38.9, Tachycardic, Tachypneic, with cap refill 3sec. His blood pressure and pulses are normal. He is lethargic but responsive to voice.

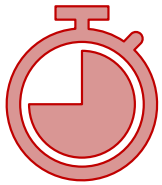
The RN calls the MRP

Are you concerned for sepsis?
What would you say to the medical provider?

Treatment Goals in Sepsis

1. Restore intravascular volume
2. Increase oxygen delivery to tissues
3. Reverse organ dysfunction
4. Treat the underlying infection

Steps in Sepsis Treatment



SEPSIS PROGRAM

- Establish a shared mental model amongst the health care team
- Apply oxygen and ECG monitoring
- Establish IV access x2
- Collect investigations
- Provide fluid resuscitation
- Start empiric antimicrobial therapy
- Transfer to the appropriate level of care
- Source control interventions when possible

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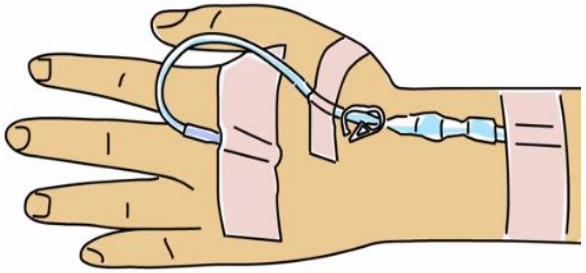
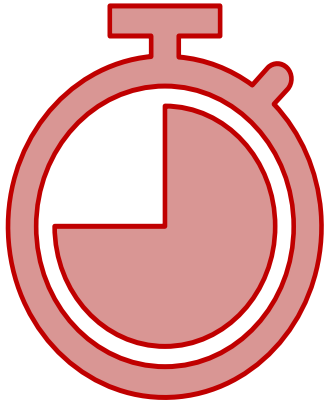
Oxygen/ Monitoring

- Continuous ECG and Oxygen saturation monitoring
- Administer supplemental O2 via high flow mask 10-15L/minute
- Target SPO2 ≥ 95%

IV access

- Sepsis management requires a second IV access point
- IV access needed for fluid resuscitation, blood work, antibiotics, vasoactive medication
- Identify your local resources/ hospital escalation protocol
- Consider IO access if cannot obtain timely IV access





Avoid preventable harm from Sepsis by using a clear escalation plan for IV access in children with SEPSIS

WITH SEPSIS - TIME COUNTS!

Investigations

To determine infectious source

- CBC+ Differential
- Blood culture—prior to, but not delaying, antibiotics
- Urine culture
- Other: Wound culture, CSF culture, viral studies as clinically indicated
- Chest or Abdominal X-ray

To assess for impaired organ perfusion and metabolic derangement

- Blood gas
- Lactate--useful biomarker in sepsis
- Creatinine/ Urea
- ALT/ Bilirubin
- Glucose--Hypoglycemia may accompany the metabolic demands in sepsis
- Electrolytes—Electrolyte disturbance may be observed as part of disease processes accompanying sepsis
- PTT/ INR-- Increased levels may point to DIC

Fluid Resuscitation

Crystalloid Solutions (LR or 0.9% NS)

20 ml/kg boluses over 5-10 minutes each.

- Consider 10ml/kg bolus for patients who will not tolerate large volumes

Max 40-60cc/kg or develops signs of fluid overload

To accomplish rapid fluid infusion through a small Peripheral IV or IO, IV infusion pumps are insufficient.

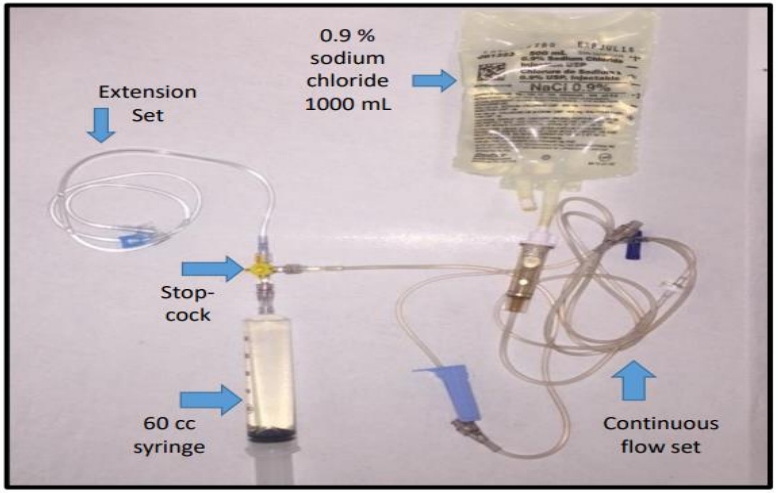
Manual syringe techniques most effective in small patients

Push Pull Bolus Method

NO!

TOO SLOW!!

YES!!



Signs of Fluid Overload

Worsening respiratory status

(increased respiratory rate, radiographic evidence of pulmonary edema in an intubated patient)

New or expanding hepatomegaly

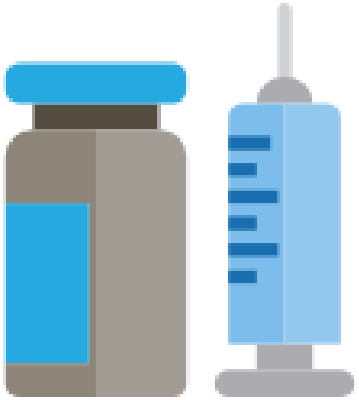
Note: In young children, crackles (rales) are often absent even in the context of gross pulmonary edema.

Antimicrobials

Empiric antibiotics should be administered as soon as possible

- Within 3 hours in cases of sepsis-associated organ dysfunction without shock
- Within 1 hour in cases of septic shock

Investigations for purpose of source identification (i.e., blood/ urine cultures) should NOT delay antibiotic administration



Consider how these targets can be best achieved at your institution

- Antibiotic access (on unit or made by pharmacy). STAT priority

Antibiotic Administration in Children

THE ANTIMICROBIAL CHOICE IS INTENDED AS EMPIRIC THERAPY AND SHOULD BE REEVALUATED ONCE MORE CLINICAL AND LABORATORY INFORMATION IS AVAILABLE.

Antibiotic	Infants > 28 days/Older Children** Dosing Guidelines	IV Administration Times
Ceftriaxone	100 mg/kg/dose MAX 2000 mg/dose IV/IO q24h	5-30 minutes
Vancomycin	15 mg/kg/dose MAX 1000 mg/dose Q6hr	1 hour – 1 hour: 20 minutes ***Watch for flushing syndrome***

Suspected/confirmed abdominal source of infection	Consider coverage for GI pathogens/ anaerobes (Piperacillin- Tazobactum OR add Clindamycin or Metronidazole)
Hospital-acquired, tracheostomy, urinary catheter/stent	Consider anti-pseudomonal coverage (Piperacillin- Tazobactum or add Tobramycin)
Neonates	Listeria coverage (ampicillin)

Back to LEO

The RN speaks to the MRP over the phone and states "I am concerned for sepsis". The RN applies ECG monitoring and supplemental oxygen. Anticipating that Leo will need bolus IV fluids, the RN primes a line with NS. In response to the RN's call, the MRP comes to assess Leo immediately and agrees with RN's assessment. Leo remains very sleepy, tachycardic, and now has a cap refill of 4 sec.

Following verbal orders from the MRP, the RN administers 2 x 20ml/kg normal saline boluses by IV pump with rate set at 999ml/hr. At the end of second fluid bolus, Leo develops increased work of breathing and desaturations.

What went well here? What might be improved?
What might be happening in Leo?
What are your next steps?

Vasoactive Medications

When do you consider them?

- After 40-60ml/kg bolus fluid with ongoing abnormal perfusion
- Earlier if fluid overload develops

Which vasoactive to start first?

- Epinephrine OR Norepinephrine- clinician preference
  - Both have inotropic and vasopressor effects
  - Epinephrine: Treat myocardial dysfunction/ low cardiac output
  - Norepinephrine: Treat vasodilatation
- Dopamine may be used if Epinephrine/ Norepinephrine not readily available

All vasoactive medications can be started by PIV, but central access should be obtained when feasible.

Ongoing Assessment during Management

- Capillary refill < 3 seconds
- Normal pulses
- Pulse pressure (diastolic BP should be 2/3 systolic BP)
- Normal/improved mental status
- Normal/improved urine output (>1ml/kg/hr)

Normotension alone is NOT reliable end point*

Source Control

Emergent source control interventions should be implemented as soon as an infectious source is identified that is amenable to intervention

- Removal of infected intravascular access devices once alternate vascular access is secured
- Drainage of larger collections containing to infected material (i.e abscesses)

Transfer to Appropriate level of Care

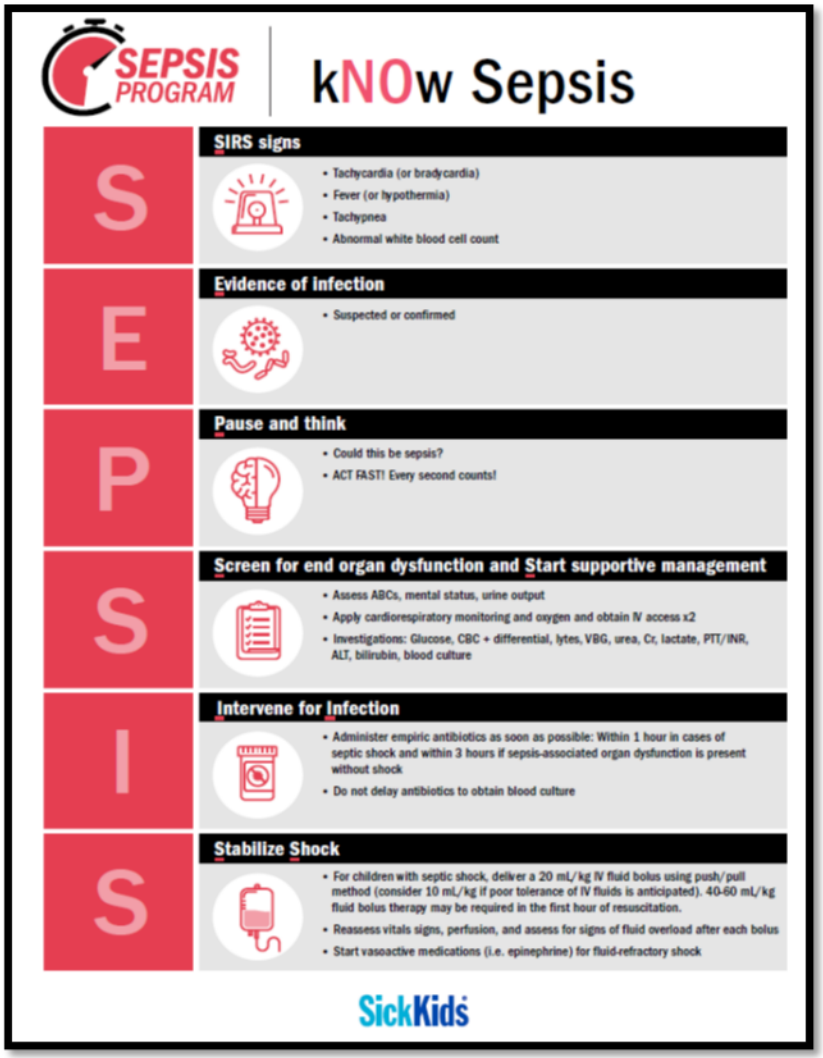
Early call to referral center/pediatrician onsite

Be prepared for…

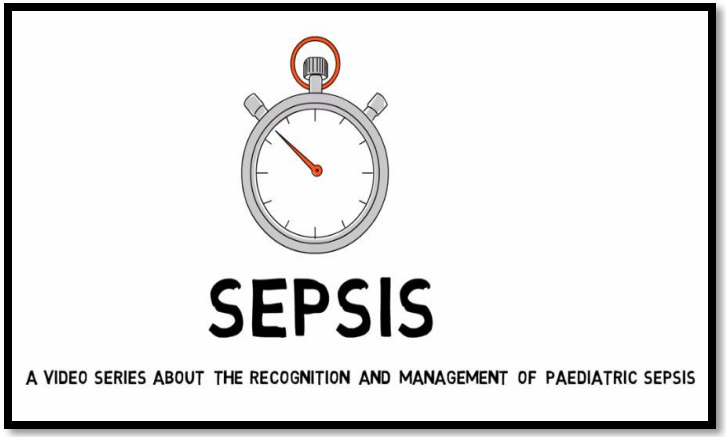
- Intubation
- Ongoing fluid resuscitation
- Addition of vasoactive medication
- Need for IV hydrocortisone if fluid/vasoactives are unable to restore hemodynamic stability

Key Points.....

Remember!!!



- Time counts
- Use the words “I’m concerned for sepsis”
- Establish a shared mental model with your team
- Have a low threshold to escalate care if there is concern for sepsis (even if you’re not sure)



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