Pediatrics TeamWorK

437

Serious Pediatric Infections

Done by:

Khuloud Alwehaibi Layan Alwatban

Revised by:

Arwa AUohany

Team Leader:

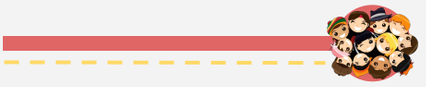
Aseel Badukhon

Objectives

- Learn special concepts pertinent to children ID
- Outline a framework for study of infectious diseases
- Enumerate examples of serious infections
- Classify episodes of bacteremia based on the clinical pattern
- Describe how the child age and other risk factors determine etiology of certain infections in pediatrics
- Appreciate utilization of knowledge of pathogenesis of diseases in the therapeutic and preventive measures

Notes Previous Notes Book Important!

Pediatric Infectious Diseases



Special consideration

❖ **First exposure**
most children will encounter the organism for the first time, whereas elderly will have had previous exposure with same or similar organism, which will cross react and form AB with less intense symptoms than pediatrics.
- Children are more liable to infection than adults, particularly in regards to respiratory infection.

❖ **Immature Immune System**
more infection in mucosal surfaces i.e. more gastroenteritis.
IgM starts forming in utero and reaches adult number by the first year of life.
IgG is not formed until 3-4 years.
IgA by 10-14 years.

Guidelines for study of infectious disease

❖ **Etiology**
❖ **Pathogenesis**
❖ **Clinical Manifestations/course**
✓ Immunocompetent
✓ Immunocompromised
❖ **Epidemiology**
✓ Mode of transmission
✓ Incubation period
✓ Reservoir
✓ Period of communicability
✓ Susceptible individuals

Serious pediatric infections

1. **Bacteremias**
2. **Meningitis and encephalitis**
3. **Neonatal jaundice**
4. **Neonatal sepsis**
5. **Epiglottitis**
6. **Osteomyelitis**
7. **Septic arthritis**
8. **Endocarditis**
9. **Tuberculosis.... Etc.**

Fever:>38.2
How accurate are different types of thermometer readings?
Ear/oral: very accurate take the reading as is
Axilla: add 0.5
Rectal: subtract 0.5

We have to consider four imp, parameter when we think of pediatric infections:
1- Age
2-Etiology
3-Host (immunocompromised vs competent)
4-Environment (community acquired vs hospital)

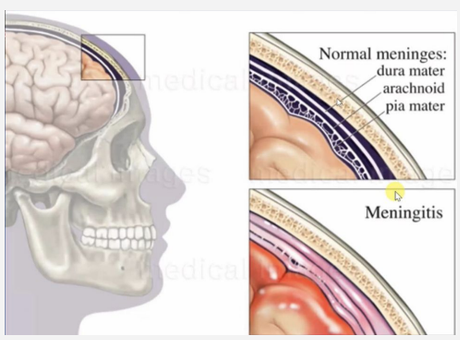
Bacterial meningitis

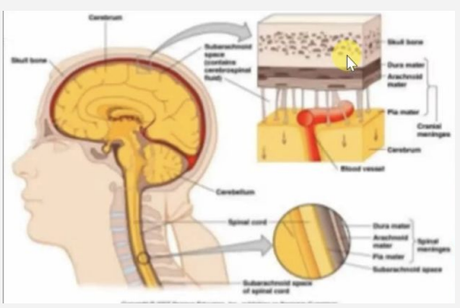
Clinical description

- Meningitis is the inflammation of the protective membranes covering the brain and spinal cord known as the meninges.
- The inflammation is usually caused by an infection of the fluid surrounding the brain and spinal cord.
- Meningitis can be life-threatening because of the inflammation's proximity to the brain and spinal cord, therefore the condition is classified as a medical emergency.

Meninges

The meninges is the system of membranes which envelops the central nervous system.
It has 3 layers:
1. Dura mater
2. Arachnoid mater
3. Pia mater
Subarachnoid space is the space which exists between the arachnoid and the pia mater, which is filled with cerebrospinal fluid.





Causative agents

It is very very important to memorize this. (all the bacterial agents). We like this question.

Bacterial agents septic meningitis.	**Neonatal**: E. coll , Group B Streptococci **Infants:** Haemophilus influenzae **Adolescents and young adults**: Neisseria meningitidis(most common), Streptococcus pneumoniae **Elderly**: Listeria monocytogenes, Streptococcus pneumoniae
Viral agents aseptic meningitis.	Enterovirus(most common), Mumps virus, Coxsackie virus, HSVII, EBV
Fungal agents	Candida albicans, Cryptococcus neoformans, Blastomyces dermatitidis, Coccidiodesimitis
Parasites	Protozoa, Nematodes, Cestodes

Neonates get it from maternal birth canal (the E.coli, GBS, haemophilus influenzae)

- usually it is less serious than the bacterial, except for HSVII.(very bad, it can cause meningoencephalitis or encephalitis) **but** it's treatable.

- fungal and parasitic usually they will happen in the sitting of immunocompromised pt. e.g. pt. with HIV.
-rare in immunocompetent patient.

- In children, it is very important to memorize 3 bacteria: 1- streptococcus pneumoniae (the most imp.nowadays, that is why we include the vaccination)2- neisseria meningitidis.3-haemophilus influenzae (till the age of 4 years we consider haemophilus influenzae one of the most important bacteria that can cause meningitis in children).
- neisseria meningitidis has the properties to cause infection and serious infection like meningitis, particularly in crowded situation eg: Hx of hajj or umrah, campaign, military sitting, neonatal daycare.
- with the vaccine, the haemophilus influenzae are not considered anymore number one.
- number one causing meningitis in all ages after neonatal age is streptococcus pneumoniae.

Etiology

Determined by:

(I) AGE

- Neonates (< 3 months) : Group B strep > E-coli (and other gram negatives)> listeria.
- 3 months – 5 years: strep. pneumoniae > N. meningitidis > HiB.
- >5 years: No HiB even in non-vaccinated children because of vaccination.

(II) SPECIAL RISK FACTORS: The route of transmission is usually hematological, but we can have other route like:

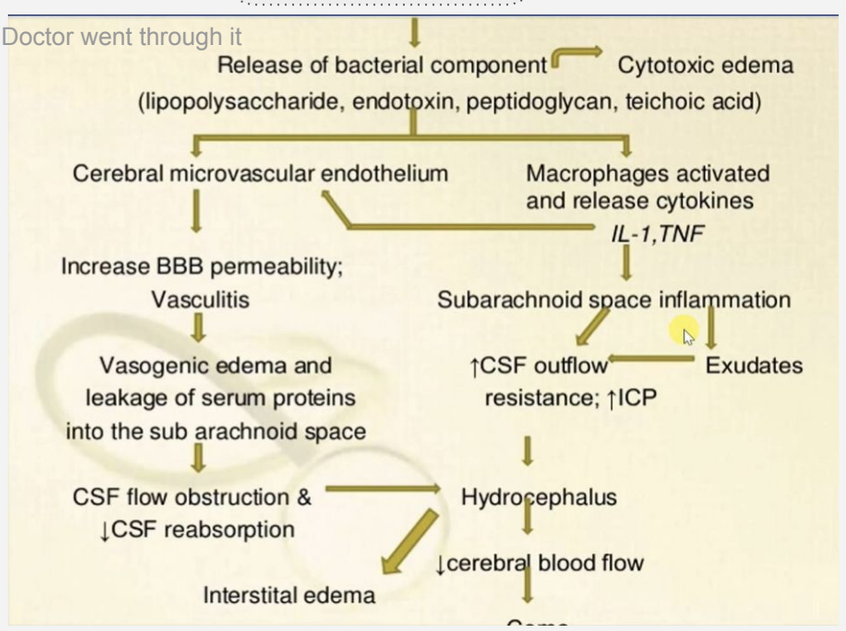
- Post-traumatic: Basal skull fractures: 80% are strep. pneumoniae.
- Post neurosurgical: staph and gram negatives the patient will be prone to other bacteria than the 3 I mentioned before. Imp.
- Ventricular shunts: staph epidermidis (coagulase negative) because staphylococcus can be a commensal flora in the skin
- Immunocompromised: depends on the organism. In addition to the 3 bacteria I just mentioned, they can have unusual organisms such as the fungal, parasitic and gram negative like salmonella and brucella etc.
- Asplenia and SCD: Salmonella and encapsulated organisms.

Pathophysiology

Causative organism enters the blood stream → Cross the blood barriers → Inflammatory reaction in meninges → Inflammation of subarachnoid space and pia meter occur → Inflammation may cause ICP → CSF flows in subarachnoid space → CF cloudness or infected → CSF cell count increase

usually it will be a mucosal infection either URTI or LRTI and the patient will have the organism coming from the mucosa entering the bloodstream

Doctor went through it



Encapsulated organisms: haemophilus influenzae, streptococcus pneumoniae…etc

Clinical presentation

- it depends whether we are dealing with a neonate or older child.in neonate, irritability, restlessness, hypothermia and sometimes hyperthermia, tachycardia, sleeplessness. so the mother will tell you that the baby is he is not feeding well. so I need to exclude CNS infection.
-older children, they can manifest with these signs and symptoms:

IN NEONATE neonate: age less than 30 days. & IN OLDER CHILDREN

Sign and symptoms

- Severe headache
- Irritability
- Restlessness
- Stiffness of neck
- Malaise
- Nausea/vomiting
- High grade fever
- Tachypnea
- Seizures
- Disorientation
- Tachycardia
- Coma
- Sleeplessness
- Phonophopia
- Photophobia
- Altered mental
- status(confusion)

-Fever is not necessary in this age group, they could be hypothermic.
-Poor feeding; when the mother wakes her baby to feed him/her. (Babies normally feed every 1-4h)

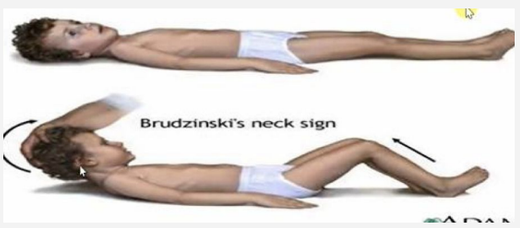
-how to asses baby's wakefulness? By carrying the baby, if the baby is fine you would notice it after carrying the baby.
If not then the baby would be still sleepy and drowsy which is a red flag.
ENT exam. is not in this age group especially tonsillitis and otitis media.

Confirmative sign:

- Positive kernig's sign: Kernig's is performed by having the supine patient, with hips and knees flexed, extend the leg passively. The test is positive if the leg extension causes pain.
- The Brudzinski's sign is positive when passive forward flexion of the neck causes the patient to involuntarily raise his knees or hips in flexion

Important they come in exams

do we need to do these tests for all patients? YES.
any child more than neonatal age, it is important to try to elicit these signs.



Diagnosis

- **CBC** - leukocytosis or leukopenia (worst prognosis signifies meningococcal disease). Never discharge a patient with normal CBC and fitting clinical picture.
- **BLOOD CULTURE** - 60-70% specific.
- **CSF Color**

➢ Cell count and differential.
➢ Chemistry: Sugar & Proteins
➢ Gram stain is positive in 70-80% of the patients.
➢ Latex agglutination or co-agglutination is used to detect the antigen instead of culture because the culture takes 24 hours. → not accurate if the pt on Abx
➢ Culture is the gold standard

very rapid test, but can only tell me about certain bacteria like haemophilus influenzae, streptococcus pneumoniae, Meningococcal meningitis, enterobacteriaceae group

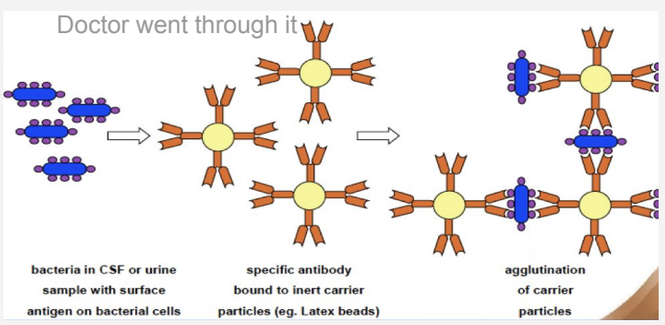
- CSF - there are three components in the CF we should look at- WBC, glucose, and protein
- For bacterial meningitis, the WBC is mainly polymorphic and the glucose is less than 50% of serum glucose (normal is 2/3 of serum glucose). If it was partially treated bacterial meningitis the lymphocyte predominates.

+ve csf WBC AND -ve csf culture has two scenarios: 1- partially ABx treatment 2- viral

- For Viral or TB, the WBC is mainly lymphocytic. Sugar is normal.
- For fungal and TB meningitis, the glucose is less than 50% the serum glucose. The protein is raised in all, but might be normal in viral.

LATEX AGGLUTINATION OR CO-AGGLUTINATION

Doctor went through it



- we should have zero WBC in CSF.
- in infants, we can accept up to 30, sometimes 40, WBC in the CSF as normal. (important)

- I have to do CT scan or MRI. why? because i do not want to preform CSF and the patient has increased ICP and he will go for coning. so important to order urgent CT or MRI in the ER before sending the patient to the word.
- the CT or MRI will show me the meningeal enhancement indicating there is inflammation.

Management

مره مهم: لو كان عندك شك ١٪ ان المريض هذا يمكن عنده meninigitis
please act accordingly.

- **Supportive care** is the most important. Careful monitoring of the patient, by checking the blood pressure for hypertension and the respiration for the RR, and pH.
- **Antibiotics**

Which one? How much? For how long?

- **Children**

Ceftriaxone + vancomycin

- **Neonates**

Cefotaxime + ampicillin
Gentamicin + ampicillin

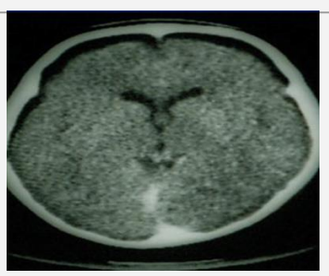
- ceftriaxone will cover haemophilus influenzae, neisseria meningitidis, and streptococcus pneumoniae.
-why vancomycin? because the patient might has streptococcus pneumoniae that is resistant to ceftriaxone.
-once the test came back from the lab and they tell me that it is streptococcus pneumoniae and it is susceptible to ceftriaxone, stop vancomycin.
-if streptococcus pneumoniae and is susceptible to penicillin, i can stop both and continue on penicillin.
- if resistant to ceftriaxone, continue on vancomycin.

- **Dexamethasone** - modulates the release of inflammatory mediated factors.
- Dexamethasone with AB gave promising results with values approaching the normal. There is still a need for more data to indicate the need for dexamethasone in every case. Dexamethasone should be given at the time of AB and not after and in some cases it can be given just before (don't give dexamethasone if it's late presentation).
- Long-term dexamethasone decreases deafness, which is a complication of meningitis.
- Steroids are important because they decrease the level of inflammatory mediators, which are the cause of complications.

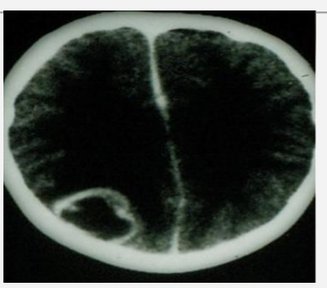
start empirical ABx (I do not know the organism, but i know the most likely ones): 1- haemophilus influenzae 2- streptococcus pneumoniae 3- neisseria meningitidis in children.
in neonate the spectrum of organisms will differ: i will include 1- enterobacteriaceae group 2- gram negative 3- listeria monocytogenes.
Ampicillin for listeria coverage
Cefotaxime covers most gram -ve and strep. pneumonea
Gentamicin covers most gram -ve and strep pneumonea

Complications

Early	Late
subdural effusion with fever resolves alone when the patient is on antibiotics. It rarely needs drainage.	brain abscess is a rare complication of meningitis and is seen in a specific age group and bacterial organism. + hearing difficulty .



subdural effusion
meningeal enhancement



complication: brain abscess
ring enhancement

Prevention

❖ **CHEMOPROPHYLAXIS**

- Rationale - If one person is infected with meningococcal meningitis, it increases the risk by an 800 to 1000 fold of the community being affected; therefore, we treat the entire family.
- Protocol

❖ **VACCINATION** - HiB, meningococcal, and some require pneumococcal vaccine. Most imp.

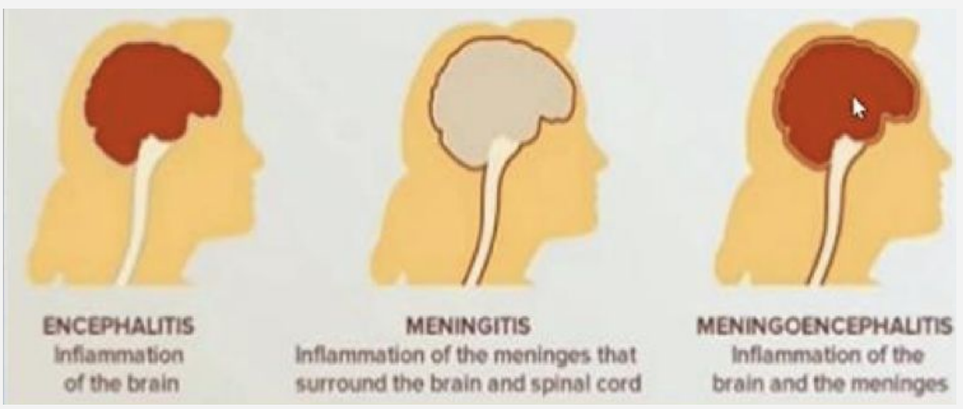
Encephalitis

Introduction

- Encephalitis is defined as an inflammation of the brain caused either by infection, usually with a virus, or from a primary autoimmune process.
- Many patients with encephalitis also have evidence of associated meningitis (meningoencephalitis) and, in some cases, involvement of the spinal cord or nerve roots (encephalomyelitis, encephalomyeloradiculitis)

Definitions

- **Meningoencephalitis** - is an acute inflammatory process involving the meninges and to a variable degree, brain tissue. Is a common term that recognizes the overlap
- **Encephalopathy** - describes a clinical syndrome of altered mental status, manifesting as reduced consciousness or altered behaviour. no fever, no signs of inflammation, non infectious caus



General

Most common pathogen in pediatrics is entero-viruses fortunately they are self-limiting, and the most serious is HSV, which increases morbidity and mortality. If I was suspecting HSV I would start empirical Acyclovir and send csf for pcr if it came positive I'll continue if negative the I'll stop Acyclovir

Diagnosis

Previously by brain biopsy but nowadays CSF PCR is the diagnostic tool. MRI shows the effects early or CT

Treatment

If HSV encephalitis is suspected, start acyclovir immediately even if the diagnosis was not yet confirmed because this type is very serious

- if in addition to signs and symptoms of meningitis, the patient will have altered consciousness so I will start the empirical treatment with ceftriaxone+vancomycin+acyclovir.

-if I suspect encephalitis, i need to add as an empirical coverage acyclovir. and send CSF PCR for HSV, if positive, continuo on acyclovir. if it is negative and the assessment does not go with encephalitis, stop acyclovir.

Osteoarticular Infections

Almost all age groups mostly bacterial and staph aureus is most common

it is a serious infection, why? the child will have limping and disability for his whole life due to wrong diagnosis and management. therefore, it is important to know how to diagnose and manage osteoarticular infections and how to approach it in pediatric age group..

Clinical presentation

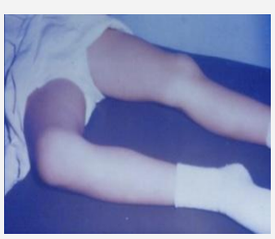
The commonest presentation

1. **Pain.** Cries every time the mother changes baby's clothes
2. **Limping.** Or avoid using that limb, or suddenly stops walking
3. **Swelling.**

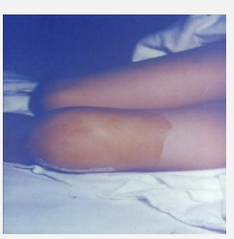
Note: Septic arthritis of the hip is very dangerous because it is a deep-seated infection and doesn't cause any swelling. It can lead to vascular necrosis because the blood supply is from the acetabulum and goes around the joint, if there is pus it will press on the vessels therefore ER drainage is important.

4. In neonates, it is not obvious because they can't complain but it is noticed when the mother changes the diaper and the baby cries. The neonates usually maintain their hip in lateral rotation and flexion to have more space in the joint and thus relieving the pressure.

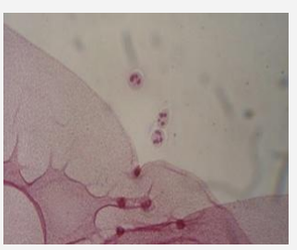
-septic arthritis of the hip is very dangerous because it is a deep infection it's easily missed, so it does not cause any swelling and it can lead to avascular necrosis (the pus press on the vessel so emergency drainage is very important).



the child is keeping his leg in flexion and lateral position (comfortable position),to keep the joint open and avoid pressing on the joint vessel, so avoiding pain



Swelling of the joint



Imaging

- Bone change (such as avascular necrosis or periosteal reaction) is not seen on X-ray until the 10th day, but it can be detect it earlier by nuclear scan. X-ray as base-line to compare with when you repeat it after 10 days
- The radionuclear scan will show increased uptake **sequestrum** by the osteoclasts and periosteal reaction, which indicates chronic infection.
- If there is any radiolucency, suspect malignancy.

do we do bone or joint aspirate to know the underlying organism? NO. unless there is a complication, not responding, or if it is diagnostic-therapeutic.

Complications

1. Avascular necrosis.
2. Joint destruction.

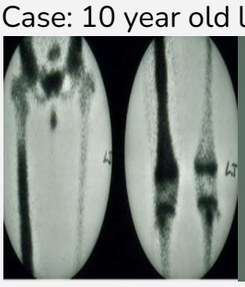
start empirical treatment immediately: ceftriaxone and anti staph like vancomycin, clindamycin, cloxacillin.
and if the patient is admitted and i have the culture, I can modify the antibiotic accordingly.
if hemophilus influenzae: ceftriaxone.| if staphylococcus aureus (which is the most common organism to cause osteomylitis and septic arthritis in pediatric age groupe): use only antistaph.

Treatment

1. **Debridement** and removal of sequestrum to prevent recurrence along with once there is complication, limping (call ortho)
2. Long-term antibiotics. Antibiotics use in acute osteomyelitis is 4-6 weeks, and 4-6 months in chronic.

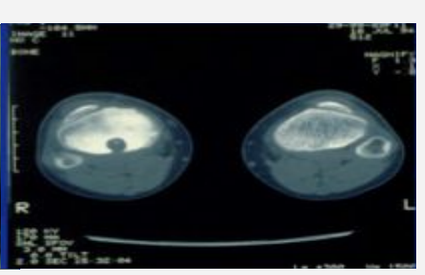
in septic arthritis: 2-4 weeks.

Case: 10 year old limping for two months



bone scan: there is high uptake

Widened intra articular space



MRI

-to diagnose, we need X-ray.
-usually we do not do x-ray for suspected arthritis, but we do it for suspected osteomylitis. we look for increased intra-articular space, periosteal reaction.
-in chronic osteomylitis, there might be formation of dead bone, it is called sequestrum
-other methods of radiology to use: bone scan, MRI (the best).

Congenital infections (TORCHES)

TORCHS and others no longer limited to TORCHS. Certain presentation common to all
1. Hydrocephlus
2. Cerebral Calcifications (seen in toxoplasmosis and CMV)
3. Blue muffin syndrome seen in all

Tetanus in Neonates

Tetanus in neonates
- Prevented by vaccination of the mother.
- Two doses if mother is not vaccinated or the doses can't be determined?
- The vaccine is safe during pregnancy but better given before.

Childhood TB

Tuberculosis is a chronic infectious disease caused by Mycobacterium tuberculosis characterized by vague constitutional symptoms and a protracted course of illness with remissions and exacerbations

TB Dx in children

Pediatric TB is the same as adult TB except for :
Index case which means there has to be a contact with TB pt. eg. house made.
In pediatrics we don't take sputum for Dx because they're constantly swallowing instead we do NGT aspiration.

➢ Bacteriologic confirmation is achieved in only about 30-40% of cases
Therefore, diagnosis often based on presence of a combination of the following characteristics:

- History of close contact with adult with TB (especially if smear positive)
- Triad of :
  - Signs and symptoms compatible with TB disease
  - A positive tuberculin skin test (TST)
  - Suggestive lab results or radiographic findings

How TB is transmitted?

• Person-to-person
➢ Through the air by a person with
pulmonary TB disease of the lungs when he or she coughs, sneezes, or speaks
• Less frequently transmitted by ingestion of Mycobacterium bovis
➢ Found in unpasteurized milk products
• Other modes of transmission
➢ Vertical transmission (rare) – congenital TB
➢ Contaminated bodily fluids (very rare)

TB: Adults vs children

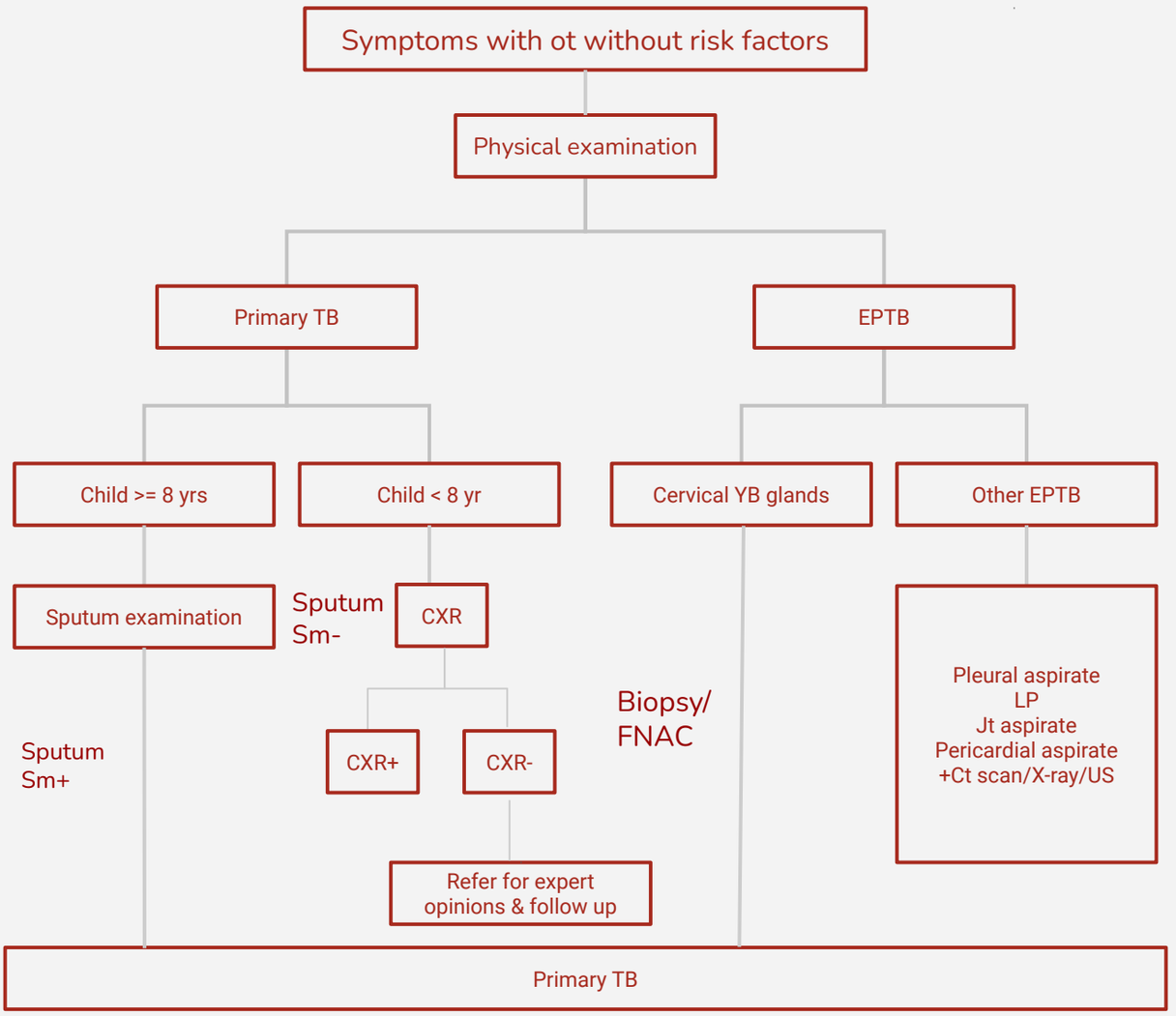
Compared to adults, children:
1. Tend to develop primary active TB more often after initial infection (0-4 years)
2. Are more likely to have extra-pulmonary disease, especially TB meningitis (0-4 years)
3. Are more likely to have extra
4. Are less contagious because their cough is not as strong as the adult's.
5. Are more difficult to diagnose because if we need a sputum for acid fast bacilli, it is difficult to tell the child to give sputum. we use other methods: nasogastric specimen, collected in 3 consecutive days in early morning.
6. A child with active TB is an indicator of unidentified contagious
adult/adolescent with TB
7. A child suspected of having active TB may not yield any positive cultures/smears
8. Need the adult contact's culture results for drug sensitivities and to determine treatment regimen for the child

TB in children

Points to remember:
➢Diagnosis may be difficult;
➢ Sputum cannot often obtained;
➢ Sputum often negative for AFB even on culture;
➢ Symptoms are atypical
➢ Diagnosis depends on clinical history, family contact history, X-ray examination and TST.

General approach to dx of TB in children

Doctor went through it



Book

Meningitis

- Serious bacterial infection must be considered if there is no focus of infection, especially urinary tract infection or septicaemia, or there are red flag features of potentially life-threatening illness.
- Purpura in a febrile child of any age should be assumed to be due to menin- gococcal sepsis, even if the child does not appear unduly
- Any febrile child with a purpuric rash should be given intramuscular benzylpenicillin immediately and transferred urgently to hospital

Assessment and investigation of meningitis / encephalitis

History
Fever
Headache
Photophobia
Lethargy
Poor feeding/vomiting
Irritability
Hypotonia
Drowsiness
Loss of consciousness
Seizures

Examination
Fever
Purpuric rash (meningococcal disease)
Neck stiffness (not always present in infants)
Bulging fontanelle in infants
Opisthotonus (arching of back)
Positive Brudzinski/Kernig signs
Signs of shock
Focal neurological signs
Altered conscious level
Papilloedema (rare)

Investigations to consider
Full blood count and differential count
Blood glucose and blood gas (for acidosis)
Coagulation screen, C-reactive protein
Urea and electrolytes, liver function tests
Culture of blood, throat swab, urine, stool for bacteria
Samples for viral polymerase chain reaction (PCRs) (e.g. throat swab, nasopharyngeal aspirate, conjunctival swab, stool sample)
Lumbar puncture for cerebrospinal fluid (CSF) unless contraindicated (see below for tests on CSF) Serum for comparison of convalescent titres
PCR of blood and CSF for possible organisms
If TB suspected: chest X-ray, Mantoux test and/or interferon-gamma release assay, gastric aspirates or sputum for microscopy and culture (and PCR if available)
Consider CT/MRI brain scan and EEG

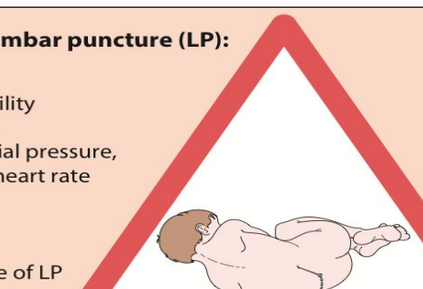
Signs associated with neck stiffness

Brudzinski sign – flexion of the neck with the child supine causes flexion of the knees and hips

Kernig sign – with the child lying supine and with the hips and knees flexed, there is back pain on extension of the knee

Contraindications to lumbar puncture (LP):

- Cardiorespiratory instability
- Focal neurological signs
- Signs of raised intracranial pressure, e.g. coma, high BP, low heart rate or papilloedema
- Coagulopathy
- Thrombocytopenia
- Local infection at the site of LP
- If it causes undue delay in starting antibiotics



Best time for LP?
Do as early as possible, but consider contraindications

Typical changes in the CSF in meningitis or encephalitis, beyond the neonatal period

	Aetiology	Appearance	White blood cells	Protein	Glucose
Normal	—	Clear	0–5/mm^3	0.15–0.4 g/L	≥50% of blood
Meningitis	Bacterial	Turbid	Polymorphs:↑↑	↑↑	↓↓
	Viral	Clear	Lymphocytes:↑ (initially may be polymorphs)	Normal/↑	Normal/↓
	Tuberculosis	Turbid/clear/ viscous	Lymphocytes:↑	↑↑↑	↓↓↓
Encephalitis	Viral/unknown	Clear	Normal/↑ lymphocytes	Normal/↑	Normal/↓

- A lumbar puncture done after antibiotics are given can still be helpful, as although cultures may be negative, polymerase chain reaction (PCR) on CSF can still be positive

- It is imperative that there is no delay in the administration of antibiotics and supportive therapy in a child with meningitis. The choice of antibiotics will depend on the likely pathogen. A third-generation cephalosporin, e.g. ceftriaxone, is the preferred choice to cover the most common bacterial causes, with the addition of amoxicillin in infants <3 months old to cover Listeria. Beyond the neonatal period, dexamethasone should be administered when antibiotics are started as it reduces the risk of long-term complications such as deafness.

- Prophylactic treatment with ciprofloxacin to eradicate nasopharyngeal carriage is given to all household contacts for meningococcal meningitis.

Toxic shock syndrome

Toxin-producing S. aureus and group A streptococci can cause this rare syndrome, which is characterized by:

- fever over 39°C
- hypotension
- diffuse erythematous, macular rash.

The toxin can be released from infection at any site, including small abrasions or burns, which may look minor. The toxin acts as a superantigen and, in addition to the aforementioned features, causes organ dysfunction, including:

- mucositis : conjunctivae, oral mucosa, genital mucosa
- gastrointestinal dysfunction: vomiting/diarrhoea
- renal impairment
- liver impairment
- clotting abnormalities and thrombocytopenia
- CNS: altered consciousness.

Intensive care support is required to manage the shock. Areas of infection should be surgically debrided. Antibiotics often include a third-generation cephalosporin (such as ceftriaxone) together with clindamycin.Intravenous immunoglobulin may be given to neutralize the circulating toxin. About 1 week to 2 weeks after the onset of the illness, there is desquamation of the palms, soles, fingers, and toes.

Necrotizing fasciitis/cellulitis

This is a rare, severe subcutaneous infection. It is an uncom- mon but serious complication of chickenpox in young chil- dren. Necrotizing fasciitis often involves tissue planes from the skin down to fascia and muscle. The area involved may enlarge rapidly, leaving poorly perfused necrotic areas of tissue, usually at the centre. There is severe pain and sys- temic illness, which usually requires intensive care. The invading organism may be S. aureus or a group A strep- tococcus, with or without another synergistic anaerobic organism. Intravenous antibiotic therapy alone is not suf- ficient to treat this condition. Without surgical interven- tion and debridement of necrotic tissue, the infection will continue to spread. Clinical suspicion of necrotizing fascii- tis warrants urgent surgical consultation and intervention. Intravenous immunoglobulin (IVIG) may also be given.

Book

Sepsis

History	Examination
Fever Poor feeding Miserable, irritable, lethargy History of focal infection, e.g. meningitis, osteomyelitis, gastroenteritis, cellulitis Predisposing conditions, e.g. sickle cell disease, immunodeficiency	Fever or hypothermia Tachycardia, tachypnoea, low blood pressure Purpuric rash (meningococcal septicaemia) Shock Multiorgan failure

Early recognition, antibiotic therapy (mostly used ceftriaxone after neonatal period) and fluid resuscitation for shock are life-saving.

Osteomyelitis

- Presents with fever, a painful, immobile limb, swelling and extreme tenderness, especially on moving the limb.
- Blood cultures are usually positive, but may be negative
- X ray usually negative in early course of the disease but mri detect inflammation earlier than plain radiographs, and allows differentiation of bone from soft tissue infection .
- Parenteral antibiotics must be given immediately.
- Surgical drainage is indicated if unresponsive to antibiotic therapy.

Septic arthritis

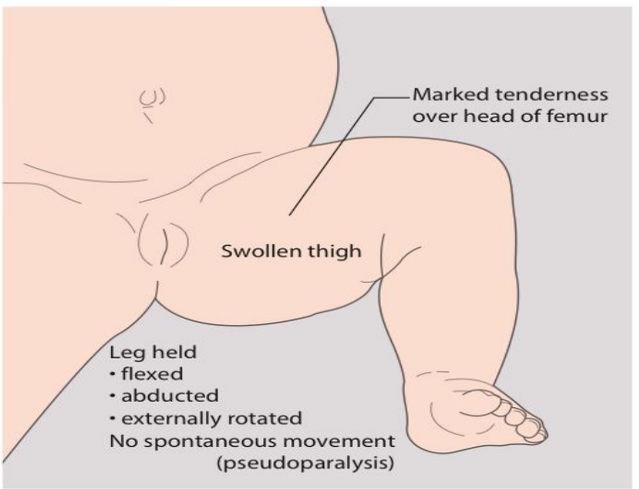


Figure 28.17 Septic arthritis of the hip in infants, showing the characteristic posture to reduce intracapsular pressure. Any leg movement is painful and is resisted.

Presentation

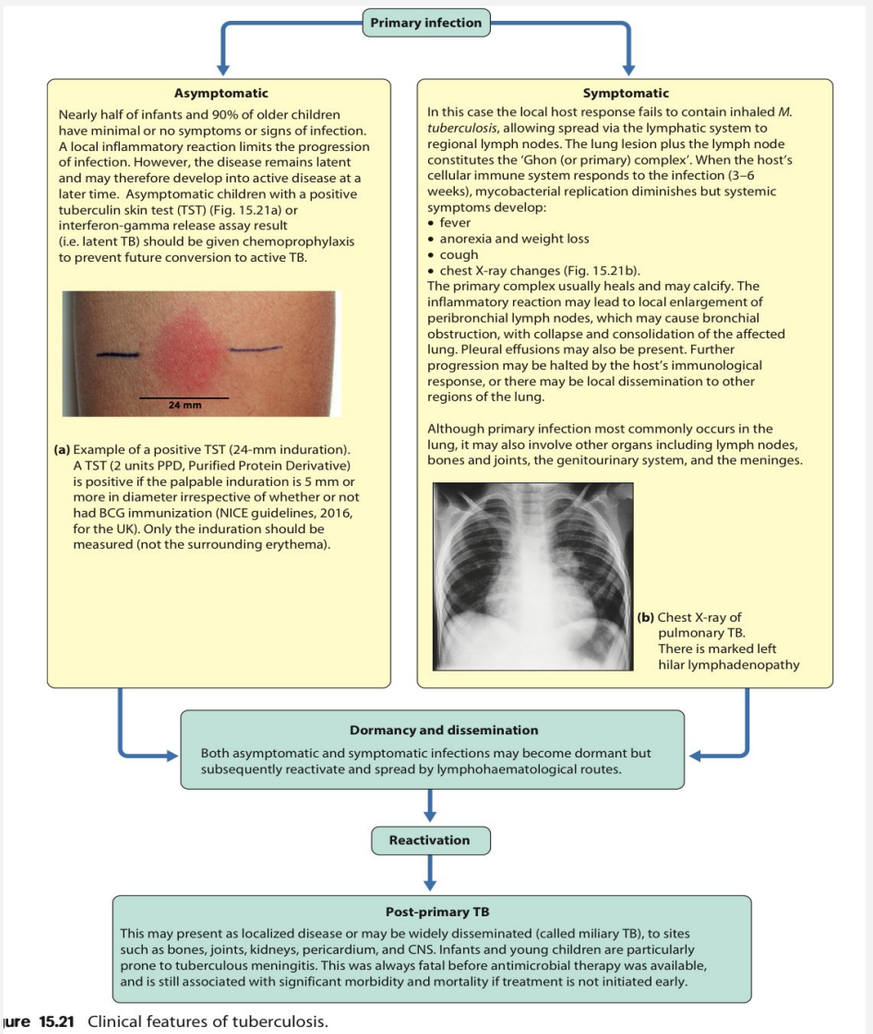
This is usually with an erythematous, warm, acutely tender joint, with a reduced range of movement, in an acutely unwell, febrile child. Infants often hold the limb still (pseudoparesis, pseudoparalysis) and cry if it is moved. A joint effusion may be detectable in peripheral joints. Although a sympathetic joint effusion may be present in osteomyelitis, in osteomyelitis it is accompanied by marked tenderness over the bone. However, in up to 15% of cases of osteomyelitis, there is coexistent septic arthritis. The diagnosis of septic arthritis of the hip can be particularly difficult in toddlers, as the joint is well covered by subcutaneous fat (Fig. 28.17). Initial presentation may be with a limp or pain referred to the knee.

Investigation and management

There is an increased white cell count and acute phase reactants. Blood cultures must be taken. Ultrasound of deep joints, such as the hip, is helpful to identify an effusion. X-rays are used to exclude trauma and other bony lesions. However, in septic arthritis, the X-rays are initially normal, apart from widening of the joint space and soft tissue swelling. Further imaging options include MRI scanning or a radioisotope bone scan may be indicated if the site of infection is unclear. Aspiration of synovial fluid should be done as soon as possible to identify the organisms and culture as the definitive investigation; this also decompresses the joint and provides symptom relief. Antibiotics should be started promptly and subsequently adjusted according to culture results; a prolonged course of antibiotics is required, initially intravenously. Washing out of the joint or surgical drainage may be required if resolution does not occur rapidly or if the joint is deep-seated, such as the hip. The joint is initially immobilized in a functional position, but subsequently must be mobilized to prevent permanent deformity.

Early treatment of septic arthritis is essential to prevent destruction of the articular cartilage and bone.

Tuberculosis



ıure 15.21 Clinical features of tuberculosis.

Diagnosis

Spontaneous sputum samples are generally unobtainable from children under about 8 years of age, but induced sputum samples can be obtained at any age. Children usually swallow sputum, so gastric washings on three consecutive mornings can be used to identify M. tuberculosis originating from the lung, using special staining techniques for acid-fast bacilli (Ziehl–Neelsen stains or auramine stains) and mycobacterial cultures. To obtain these washings, a nasogastric tube is passed and secretions are washed out of the stomach with saline (before food intake). Urine, lymph node tissue, CSF, and radiological examinations should also be performed as appropriate.

Although it is difficult to culture TB from children, the rise of MDR-TB makes it important to try to grow the organism so that antibiotic sensitivity can be assessed. PCR-based methods for the detection of M. tuberculosis are used in parallel with mycobacterial cultures, but provide limited information regarding drug resistance and do not replace cultures.

Tuberculosis

Contin

- There are two tests, tuberculin skin test and interferon gamma . TST may be positive because of past BCG vaccination rather than TB infection. Interferon-gamma release assays (IGRAs) are newer, blood-based tests for TB. They assess the response of T cells to in vitro stimulation, with a small number of antigens expressed by M. tuberculosis but not by BCG. Positive results therefore indicate TB infection rather than BCG vaccination. However, a negative IGRA result does not reliably rule out TB infection.
- Neither IGRA nor the TST can distinguish between latent TB and active TB, so correlation with clinical signs and symptoms is required.

Treatment

Quadruple therapy (rifampicin, isoniazid, pyrazinamide, ethambutol) is the recommended initial combination unless MDR-TB is strongly suspected . Treatment for uncomplicated pulmonary TB or TB lymphadenitis is usually for 6 months; longer treatment courses are required for osteoarticular TB, TB meningitis, or disseminated disease.In adolescents, pyridoxine is given weekly to prevent peripheral neuropathy associated with isoniazid therapy, a complication that does not occur in young children. In tuberculous meningitis, dexamethasone is given initially, to decrease the risk of long-term sequelae.

Asymptomatic children who are Mantoux or IGRA positive and therefore latently infected should also be treated (e.g. with rifampicin and isoniazid for 3 months or isoniazid alone for 6 months) as this will decrease the risk of reactivation (i.e. conversion to active TB) later in life.

Children under 2 years of age who had close contact with a sputum smear-positive pulmonary TB person should be started on prophylactic anti-tuberculo- sis antibiotics because of the risk of infection and progres- sion to disease is high at this age, and the immune assays are least reliable in this age group.

PedsCases!

NEONATAL SEPSIS

Early onset neonatal sepsis (EONS): sepsis within the first 7 days of life.
Late onset neonatal sepsis (LONS): sepsis from 7-28 days of life.

HISTORY

- **Prenatal, pregnancy,** and **birth** history
- **Maternal serologies**
- **Risk factors for sepsis**
- **Neonatal complications** at delivery or prior to discharge home
- **Sick contacts**
- **Events leading up to current presentation**: sleep, waking, feeding, voiding, stooling

PHYSICAL EXAM

- **ABCs, vitals**
- **Airway**: patent?
- **Breathing**: ↑ WOB, apneic episodes, cyanosis
- **Circulation**: HR, BP, pulses, perfusion
- **Disability**: LOC, infant GCS
- **Exposure**
- **DEFG = don't ever forget glucose**

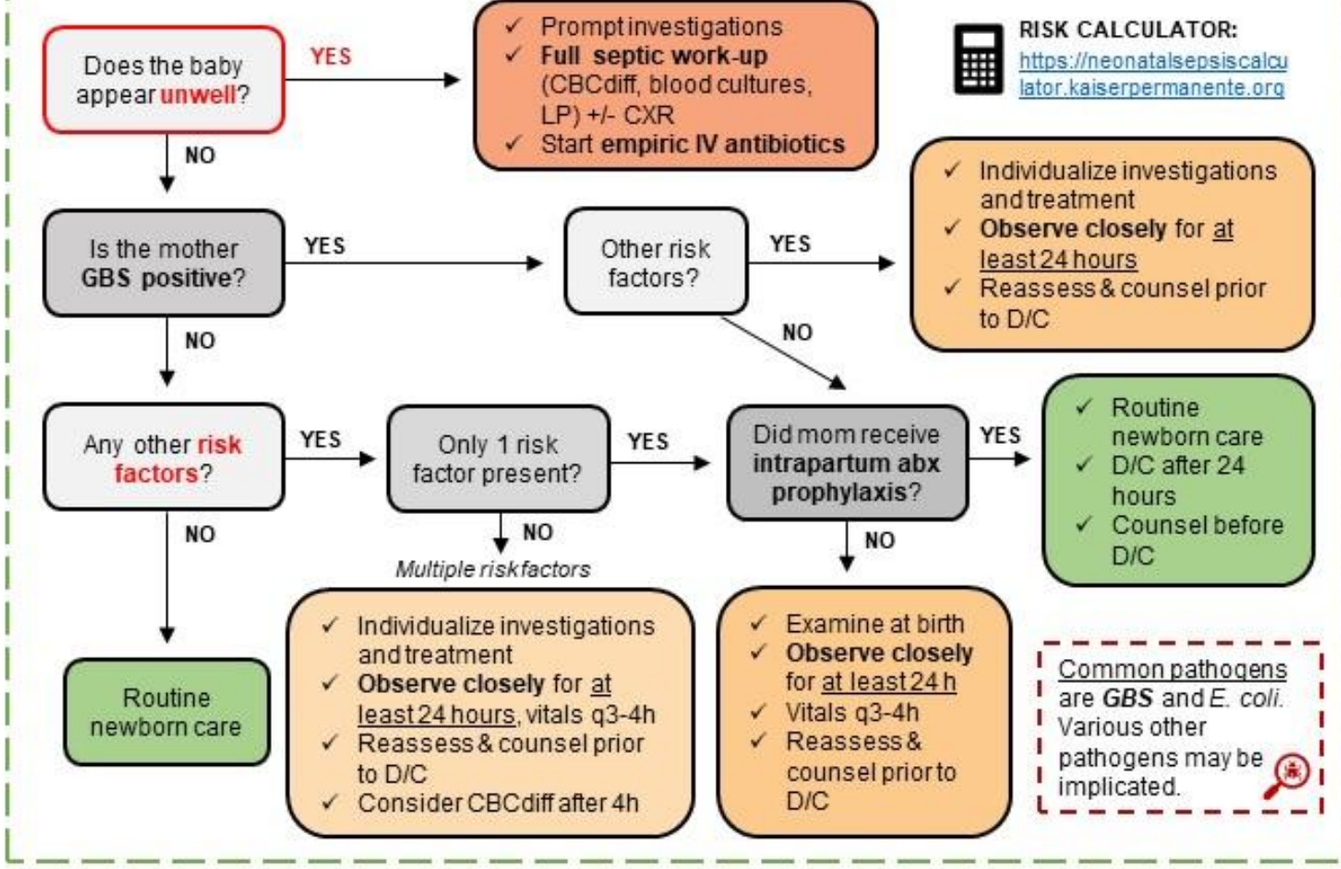
INVESTIGATIONS – FULL SEPTIC WORK-UP

- **Blood**: culture, CBC+diff, CRP
- **Urine** (catheter sample): culture, urinalysis
- **CSF**: culture, protein, glucose, cell count, viral PCR (HSV, VZV, and enterovirus).
- Consider: blood gas, CXR, respiratory virus panel, and swabs of any lesions.

RISK FACTORS FOR EONS

- **Prolonged rupture of membranes** (≥ 18 hours)
- **Maternal fever** (≥ 38°C)
- **Maternal GBS** colonization
- **GBS bacteriuria** anytime in pregnancy
- **Invasive GBS disease** in a previous infant
- **Chorioamnionitis**

MANAGEMENT OF TERM INFANTS (≥ 37 WEEKS) AT RISK FOR EARLY ONSET NEONATAL SEPSIS



IV Antimicrobial Therapy: start **ampicillin** (*GBS* and *Listeria* coverage) + **gentamicin** (*E. coli* coverage) +/- **acyclovir** (if concerned about *HSV*). Ampicillin and gentamicin are generally preferred; however, *local antibiotic resistance patterns and special circumstances must be considered.*

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Katharine V. Jensen (Medical Student, University of Alberta) and Dr. Krystyna Ediger (Neonatal Perinatal Medicine Subspecialty Resident, University of Alberta) for www.pedscases.com