Common Childhood Infections
T Avenant
Outline

- Definitions
- Septicaemia and shock
- Rash and fever
  - Infectious
  - Non-infectious
  - Rash – no fever (Lecture 3 today))
- Other childhood infections
Definitions

- Hemorrhage
  - Rupture of blood vessel
- Hematoma
  - Blood trapped in tissue
- Petechiae
  - Minute hemorrhages into the skin (1-3mm)
- Purpura
  - Slightly larger, groups of adjoining petechiae
- Ecchymosis
  - Large (>1-2cm) subcutaneous hematoma
    - e.g. common bruise
Vasculitis

- Vascular inflammatory injury often with necrosis of blood vessels
- Most common mechanisms are
  - injury by infectious pathogens
  - immune–mediated inflammation
- Other
  - Physical
  - Chemical
  - Toxins
Bleeding disorders

- Vessel wall
  - Infections
    - Meningococcemia, septicaemia, measles, rickettsiosis (damage to microvasculature/DIC)
  - Drug reactions
    - Deposition of immune complexes
  - Abnormal vessel walls

- Thrombocytopenia
- Defective platelets
- Clotting factors
- Combinations
Urticaria and Angio-oedema

- Pathophysiology incompletely understood
  - Release of inflammatory mediators
  - Local vasodilatation
  - Exudation from post-capillary venules
  - Variable accumulation of mononuclear cells
  - Stimulation of local nerve endings cause itching or burning
Septicaemia
Introduction

- **Bacteremia**
  - recovery of bacteria in blood culture
    - transient, no disease
    - serious extension of infection elsewhere
- **Local infections usually concomitant or follow bacteremia**
  - meningitis, osteomyelitis, endocarditis, epiglottitis etc.
- **Instrumentation**
- **No or very few symptoms**
- **If bacteremia not cleared – systemic inflammatory response**
  - can progress independently of original disease
Sepsis

- Systemic response to infection with bacteria, viruses, fungi, protozoa and rickettsiae
- One of the causes of systemic inflammatory response syndrome (SIRS)
- If not recognized and treated, may progress to
  - severe sepsis
  - septic shock
  - multiple organ dysfunction syndrome
  - death
Epidemiology

- Complication of localized community acquired infections
- Follow colonization and local mucosal invasion
  - meningococci, pneumococci, H. influenzae
- Other common causes in children
  - E. coli, Klebsiella, S. aureus, Salmonella
- Occult bacteremia, may progress to sepsis
  - 3 months to three years
- Hospitalized patients
  - S. aureus, CONS
Epidemiology

- Immunocompromised patients
  - nosocomial infections
    - gram negative, fungemia
    - polymicrobial sepsis
- Unusual pathogens
  - immunocompromised, travel
- Pseudobacteremia
Sepsis

- Focal infection
- Bacteraemia

Sepsis

- Clinical evidence of infection plus:
  - hyperthermia/hypothermia
  - tachycardia
  - tachypnoea
  - WBC count abnormalities

Sepsis syndrome

- Early septic shock

Sepsis syndrome plus hypotension or poor capillary refill that lasts for more than 1 hour despite IV fluids and pharmacologic intervention and requires vasopressor support.

Refractory septic shock

MODS

- Any combination of:
  - DIC
  - ARDS
  - acute renal failure
  - acute hepatic failure
  - acute CNS dysfunction

Death

Pathogenesis

- Systemic inflammatory response syndrome results from
  - tissue damage due to host response to bacterial products
  - cardiopulmonary manifestations of gram negative sepsis mimicked by injection of
    - TNF
    - Endotoxin
Pathogenesis

- Shock
  - disruption in circulatory function leading to poor perfusion and inadequate delivery of oxygen nutrients to tissues
- Not diagnosed by low blood pressure
  - compensatory mechanisms maintain BP
- Low BP ominous sign
Pathogenesis

- **Early phase**
  - decrease systemic vascular resistance, decline in preload – tachycardia, increased cardiac output
- **Endothelial damage, third space losses**
  - warm, bounding pulses
  - later cool extremities, poor perfusion
  - lactic acidosis
- **Pulmonary function impaired**
  - development of ARDS poor prognosis
- **Renal failure, hepatic failure, CNS dysfunction, DIC**
  - alone
  - part of MODS
Clinical Manifestations

- **Primary signs and symptoms**
  - fever, chills, hyperventilation, tachycardia, hypothermia, cutaneous lesions, changes in mental status

- **Secondary manifestations**
  - hypotension, cyanosis, gangrene, oliguria or anuria, jaundice, signs of heart failure

- **Evidence of local infection**
  - meningitis, pneumonia, arthritis, cellulitis, pyelonephritis

- **Immunocompromised status**
  - splenectomy, malignancy, HIV
Laboratory findings

- Blood cultures
- Stains
  - blood
  - skin lesions
- Metabolic acidosis
- Thrombocytopenia
- Abnormal clotting
- Fibrinogen
- Anemia
- Decreased PaO2 and PaCO2
- Neutrophils
  - number and morphology
- CSF
Management

- Cultures and stains
  - blood, urine, csf, exudates, abscesses, cutaneous lesions
- Blood count and platelets, PT and PTT, fibrinogen, ABG, CXR
- ICU
- Broad spectrum antibiotics
  - community acquired
  - nosocomial
  - immunocompromised
  - resistant S. pneumoniae
Management

- Oxygen
- Intubation and ventilation
- Circulation
  - Saline or Ringer solution 20ml/kg
  - 5% albumin
- Sodium bicarbonate?
- Calcium and Potassium monitored
- Inotropics
- DIC
  - FFP
Management

- **Modification host responses**
  - IVIG, monoclonal antibodies against endotoxin, anti TNF-alpha, IL-1 receptor antagonists, granulocyte transfusions

- **Corticosteroids**
  - Not beneficial in adults with septic shock
  - Useful
    - ARDS
    - *H. influenzae* type b
    - Adrenal hemorrhage
  - SIRS in children, further research required
Prognosis

- Mortality for septic shock depends
  - initial site of infection
  - bacterial pathogen
  - presence of MODS
  - host immune response
- 40-60% mortality in gram negative enteric sepsis

- Meningococcal sepsis, poor prognostic signs
  - Hypotension
  - Coma
  - Leukopenia
  - Thrombocytopenia
  - Low fibrinogen level
  - Absence of CSF pleocytosis with bacteria on gram stain
  - Rapid appearance of petechiae
  - Hypothermia
Prevention

- Immunization
  - H. influenza type b
  - Streptococcus pneumoniae
- High risk patients
  - pneumococcal vaccine
  - meningococcal vaccine
- Penicillin prophylaxis
  - splenic dysfunction, splenectomy
- Rifampicin prophylaxis for contacts
  - H. influenzae, meningococcal disease
- Immunocompromised
  - antibiotics, interferon, antivirals, isolation, etc.
Conclusion

- Septicaemia should be considered in any child with an acute, severe illness and pyrexia in whom no cause for the fever can be found.
- If untreated, sepsis can lead to shock, multiple organ failure and death.
Infectious Causes of Rash and Fever
Erythematous Rashes
Case study

- NN, 10 months old
- Admitted
  - Severe respiratory distress, fever and cough
- Previously healthy
- Clinical picture
  - One week ago: URTI
    - Conjunctivitis, runny nose, cough and fever
  - Photophobic, red sore mouth, maculopapular rash
    - Started behind ears
    - Spread to trunk and limbs
    - Red becoming brown, scaling
Case study

- Cough
  - Gradually worse
  - Fever hasn’t subsided
  - Progressively worsening respiratory distress and indrawing
- Very ill and not feeding
- Immunisations
  - Last appointment forgotten
Mass vaccination campaign: (Week 15-18)

Proportion of children with positive Measles antibodies by week of epidemiological collection and province:

Province abbreviations: ECP=Eastern Cape; FSP=Free State; GAP=Gauteng; KZP=KwaZulu-Natal; LPP=Limpopo; MPP=Mpumalanga; NCP=Northern Cape; NWP=North West; WCP=Western Cape

Figure: Measles IgM positive results per province: South Africa, January 2009 to 29 September 2010
Age distribution of patients with measles: South Africa 2009-2010, N=6065
Measles

- **Clinical features**
  - Prodrome (catarrhal phase)
    - Fever
    - Cough
    - Coryza
    - Conjunctivitis
  - Kopliks
  - Rash
    - Erythematous, maculopapular
    - Face – trunk – limbs
    - Staining
    - Desquamation
Complications

- Pneumonia
  - Bacterial superinfection
    - Gm + and –
  - Viral
    - Measles
    - Adenovirus
    - Herpes
  - Later
    - Bronchiolitis obliterans or bronchiectasis

- Others
  - Immune suppression
  - LTB
  - Acute encephalitis
  - Encephalopathy
  - SSPE
  - Diarrhoea
  - Otitis media
  - Corneal ulceration
  - Herpes simplex gingivostomatitis
Rash and Fever

*Viral*

- Erythema infectiosum
  - Parvovirus B19
Rash and Fever

*Viral*

- Roseola infantum
  - Human Herpesvirus 6, 7
Rash and Fever
*Viral

- Infectious Mononucleosis
Rash and Fever

*Viral

- Infectious Mononucleosis
Rash and Fever
*Viral

- German Measles
Rash and Fever

*Viral*

- Enterovirus
Rash and Fever

*Bacterial

- Scarlet fever
  - Group A Streptococcus
Rash and Fever

*Bacterial

- Scarlet fever
Rash and Fever
*Bacterial

- Scarlet fever
Rash and Fever

* Bacterial

- Toxic shock
  - Staphylococcus
  - Streptococcus
Vesicular and Blistering Rashes
Rash and Fever

*Viral

- Chicken-pox
Herpes simplex

- Primary infection between 1 and 5 years of age
- Infection by contaminated saliva
- Dissemination in immunosuppressed
- Clinical
  - **Gingivostomatitis**
    - Fever salivation and refusal to eat
    - Vesicles-rupture-shallow ulcers with red margin
    - 4-9 days
    - Local analgesia, tube feeds
Herpes simplex

- Meningo-encephalitis
  - High mortality and morbidity
- Conjunctivitis
- Recurrent disease
  - “fever blisters”
- Disseminated disease
  - Immunosuppressed
Eczema herpeticum

- Infection of eczematous skin
  - May have systemic reaction with fever
Rash and Fever

*Viral

- Hand, foot and mouth disease
Impetigo

- Staphylococci and streptococci
- Round confluent blisters
- Rupture and forms crusts
- Topical antibiotics
- If severe, systemic antibiotics
Petechial or Purpuric Rashes
Rash and Fever

*Bacterial

- Meningococcal disease

- Ranges
  - Asymptomatic transient bacteraemia
    - Clears spontaneously
  - Fulminant sepsis
    - Death in few hours
Meningococcaemia/Meningitis

- Variable
- Early
  - Signs of upper respiratory infection
  - Fever, headache, lethargy, vomiting, myalgia, joint pain

- Typical
  - URTI, fever, haemorrhagic rash
  - Circulatory collapse, purpura, shock
Meningococcaemia/Meningitis

- Skin
  - Diffuse mottling to extensive purpuric lesions
  - Petechiae in 50 – 60%
  - Less than 7 petechiae in 12%
  - No rash in 1-2
  - Maculopapular rash in 13% in one study
  - Purpura – not from petechiae but from thrombosis and haemorrhage
Meningitis

- Typical meningitis signs

- Complications
  - Hydrocephalus, cranial nerve palsies, subdural effusion or empyema, cerebral oedema, cortical vein thrombosis, cerebral infarction
  - Hearing loss in 5 – 10%
Laboratory Diagnosis

- Leukopaenia
- Thombocytopenia
- Inappropriate ADH secretion
- Abnormal coagulation (DIC)
- Abnormal LFT
Laboratory Diagnosis

- Gold standard
  - **Culture**
    - Blood-, CSF- or petechiae culture
- Rapid diagnosis
  - Gram stain
- Antigen detection
  - CSF, urine, serum
    - Cross reaction esp *E coli*
- PCR
  - Sensitivity and specificity 91%
  - Useful in partially treated meningitis
  - **Not available yet**
Treatment

- PROMPT INITIATION OF ANTIBIOTIC THERAPY MAY BE LIFESAVING

- Empiric
  - May need to take into account other causes of meningitis e.g. *S. pneumoniae, H. influenzae*
  - Ceftriaxone/ Cefotaxime/ Penicillin
  - In penicillin allergy
    - Choramphenicol
  - No conclusive advantage – use of steroids
    - Exception (WF)

- Eradicate carrier state if treated with Penicillin
Prevention

- **Primary prevention**
  - Vaccination

- **Secondary prevention**
  - Notify
  - Chemoprophylaxis
  - Vaccination
Chemoprophylaxis

Chance of infection

- House hold contacts and roommates
  - 1000X rest of population
- Pre school contacts
  - 50X
- Medical personnel not in close contact with oral secretions
  - Similar to general population
Chemoprophylaxis

- Close Contacts
  - Household contacts
  - Other contacts
    - Week before onset of symptoms until 24 hours after appropriate antimicrobial therapy
    - Within 3 feet of patient
    - At least 8 hours contact
  - Day care centre contacts
  - Significant contact with oral secretions
    - Kissing, sharing toothbrush
  - Medical personnel
    - Intensive contact with oral secretions
Antibiotics Used

- **Rifampicin**
  - Suitable for all ages
  - Easy to administer
  - Efficacy of 90 – 95% eradication of nasopharyngeal carriage
  - Disadvantages
    - Teratogenic
    - Decreases reliability of contraceptives
    - Colours secretions and contact lenses
Antibiotics Used

- **Ciprofloxacin**
  - Single oral dose
  - Not for use in pregnancy or lactation

- **Ceftriaxone**
  - Single dose
  - Only intramuscular route

- **Azythromycin**
  - Only studied in adults
  - 93% effective
Rash and Fever
* Bacterial

- Tick bite fever
Non-infectious causes
Case study - Juvenile idiopathic arthritis

- 10 year boy
- Intermittent fever and skin rash 6 months
  - Evening or early morning, up to 39°
  - Feeling unwell
  - Skin rash
    - Pale pink macules
    - Trunk and proximal extremities
- In between attacks well
- Intermittent joint pains
- Hepatosplenomegaly otherwise well
Rash and Fever

*Non infectious

- Kawasaki Disease
Rash and Fever

*Non infectious

- Erythema nodosum
Rash and Fever

*Non infectious

- Erythema multiforme
Case study

- 5 year old girl
- Rash on legs
- URTI and fever
  - 1 week ago
- Bad abdominal pain
- Rash on legs
  - Buttocks to ankles
  - Prominent on back of legs
  - Not painful/itchy
  - Raised, do not blanch on pressure
- Diffuse abdominal pain
- Urine dipstick: blood
Henoch Schönlein Purpura

- Clinical features
- Rash on legs
  - Distribution
  - Not painful or itching
  - Raised
- URTI
- Fever
- Abdominal pain
- Nephritis
Henoch Schönlein Purpura

- Clinical features
  - Arthritis
    - Large joint
  - Hepatosplenomegaly
  - Lymphadenopathy

- Abdominal pain
  - Edema and damage to the vasculature of the GIT
  - Intermittent
  - Colicky
  - Occult heme-positive stools in half of the patients
  - Diarrhea
  - Intussusception may occur
Rash – No fever

- Molluscum contagiosum
Selected other childhood infections
Diphtheria

- *Corynebacterium diphtheriae*
- Rare
- Clinical
  - Sore throat, fever, toxaemia
  - White to grey membrane in nose or oropharynx
    - Attempts to remove results in bleeding
  - Cervical lymphadenopathy and periadenitis (“bull neck”)
  - Myocarditis
  - Neuritis
    - Palatal and pharyngeal
    - Ocular muscles
    - Intercostal
    - Peripheral nerves
Diphtheria

- Complications
  - Pneumonia
  - Thrombocytopenia and DIC
  - Renal failure
  - Airway obstruction
- Diagnosis
  - Culture
- Management
  - Penicillin for ten days
  - Airway
  - Antitoxin
- Prevention

CDC
Tetanus

- *Clostridium tetani* (Toxin)
  - Neonatal tetanus
  - Wound contamination

- Clinical features
  - Muscle rigidity
  - Muscle spasms
  - Trismus (lock jaw)
  - Facial muscle rigidity (risus sardonicus)
  - Pharyngeal and laryngeal spasms
  - Opisthotonus
  - Alert and conscious
Tetanus

- Complications
  - Respiratory
  - Cardiac
    - Catecholamine release
  - Other
- Diagnosis
- Management
  - Supportive
  - HTIG
  - AB
  - Spasms
- Prevention
Pertussis

- *Bordetella pertussis*
- Whooping cough
  - Droplet spread
- Disease of infancy
  - 50% < 1 year
  - No transplacental immunity
- Clinical
  - Incubation 3 days
    - Catarrhal stage 1 - 2 weeks
    - Paroxysmal stage
    - Convalescent stage
  - In infant atypical picture
    - Whoop absent
    - Paroxysms less frequent
Pertussis

- **Diagnosis**
  - Clinical
  - Leucocytosis
  - Culture and serology
  - PCR

- **Management**
  - Hospitalize, Oxygen during spells
  - Minimize stimuli
  - Salbutamol
  - Erythromycin
    - Eradicate organism, Prevent relapse

- **Complications**
  - Pneumonia, atelectasis, encephalopathy, subconjunctival haemorrhage, epistaxis

- **Prevention**
Mumps

- Droplet infection
- Infectivity
  - 6 days before symptoms to subsidence of swelling
- Clinical features
  - Incubation 14 – 21 days
  - 30% sub-clinical
  - Enlargement of parotid and other salivary glands
  - Headache, malaise, anorexia
- Complications
- Diagnosis, Treatment, Prevention
Poliomyelitis

- **Eradication 2005**
- **Justification**
  - There is no non-human reservoir
  - There is no long-term carrier state
  - The highly effective oral vaccine is cheap, available, and easy to administer
  - Immunity is life-long, following either vaccination or natural infection
- **No country can be certified free of wild poliomyelitis before it has met the minimum surveillance indicators.**
Poliomyelitis

- AFP Case Definition
- Professional
  - Any case of **Acute Flaccid Paralysis** including Guillain Barré syndrome, that is not caused by injury
  - In a child less than 15 yrs of age
- Lay
  - Sudden weakness in the leg(s) and or arm(s), not caused by injury
Poliomyelitis

Role of clinicians

- To notify all cases with sudden paralysis in children <15 years
- Investigate the case thoroughly
  - By completing a case investigation form.
  - By recording accurate address information, to facilitate tracing and follow-up.
  - By ensuring that 2 stool specimens are collected and shipped frozen to NICD in JHB
The End