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) subcutanuous 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

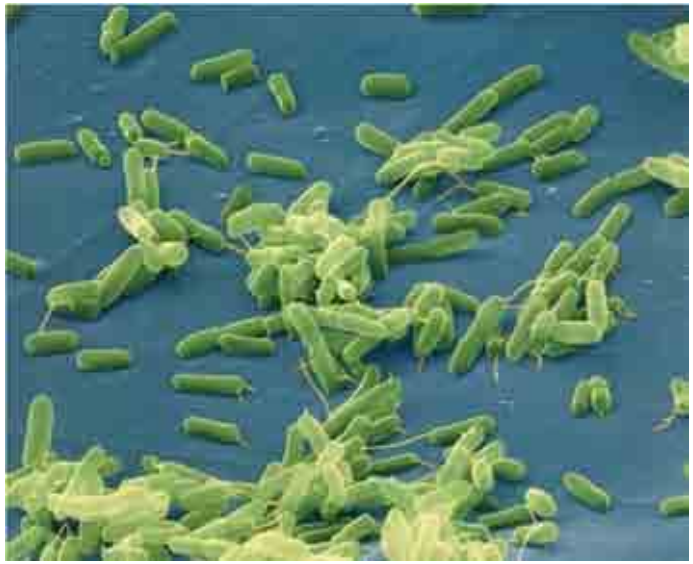
Septicaemia

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

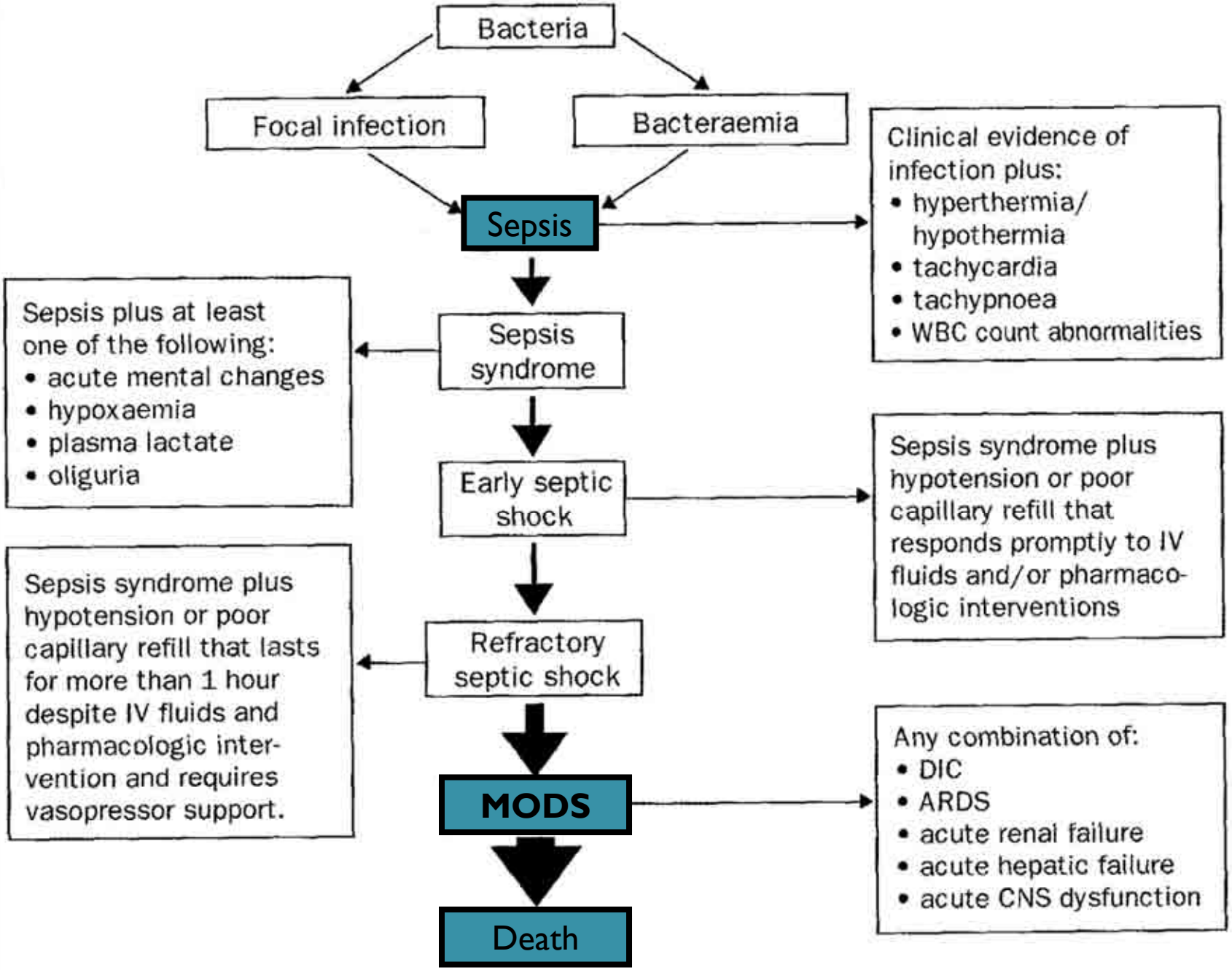


Epidemiology

- 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



Source: Sáez-Llorens, X. and McCracken, G.H. *The Journal of Paediatrics*, Vol. 123, No. 4, Oct 1993, p. 498.

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 PaO_2 and $PaCO_2$
- 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

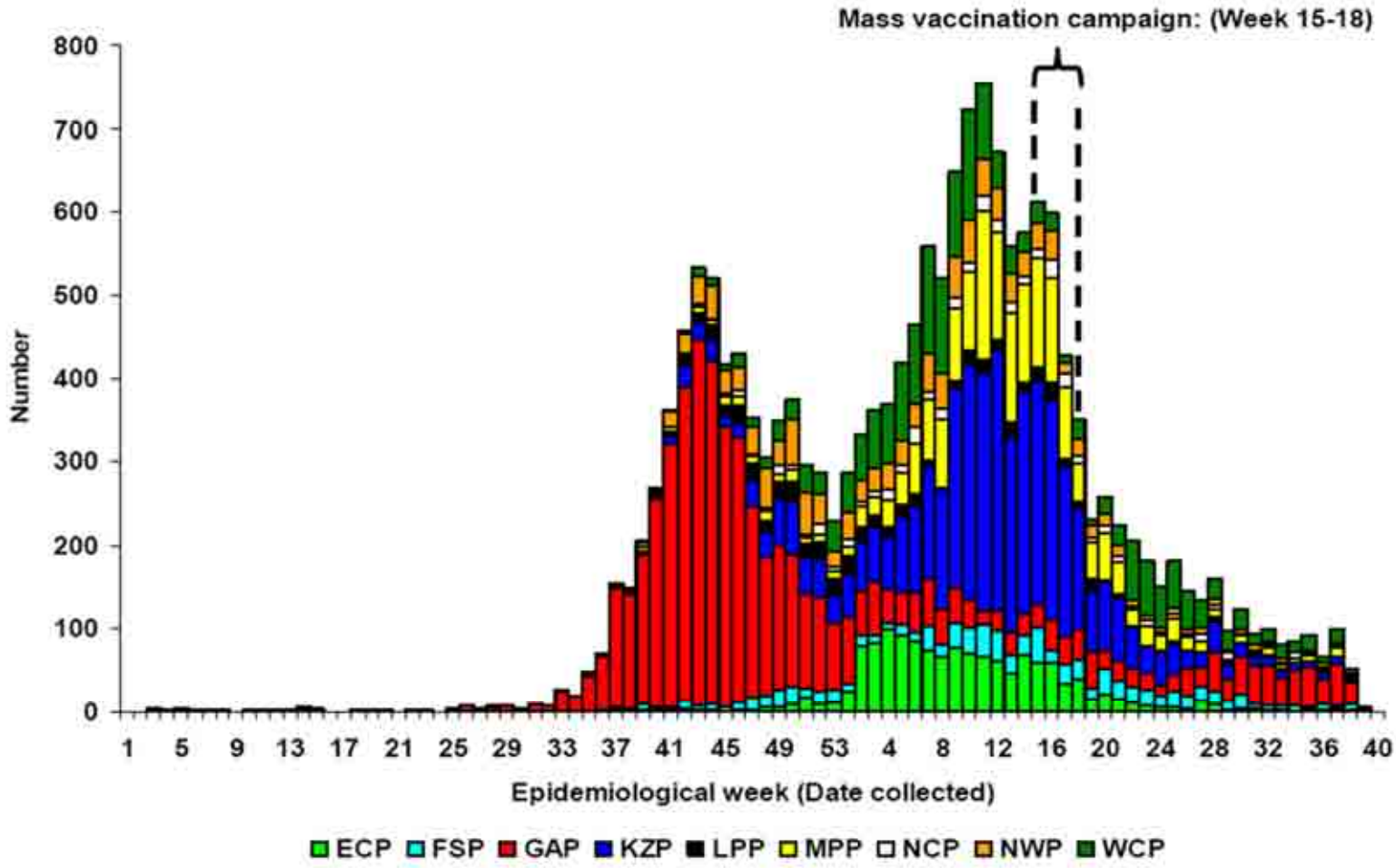
Case study

- 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

NICD

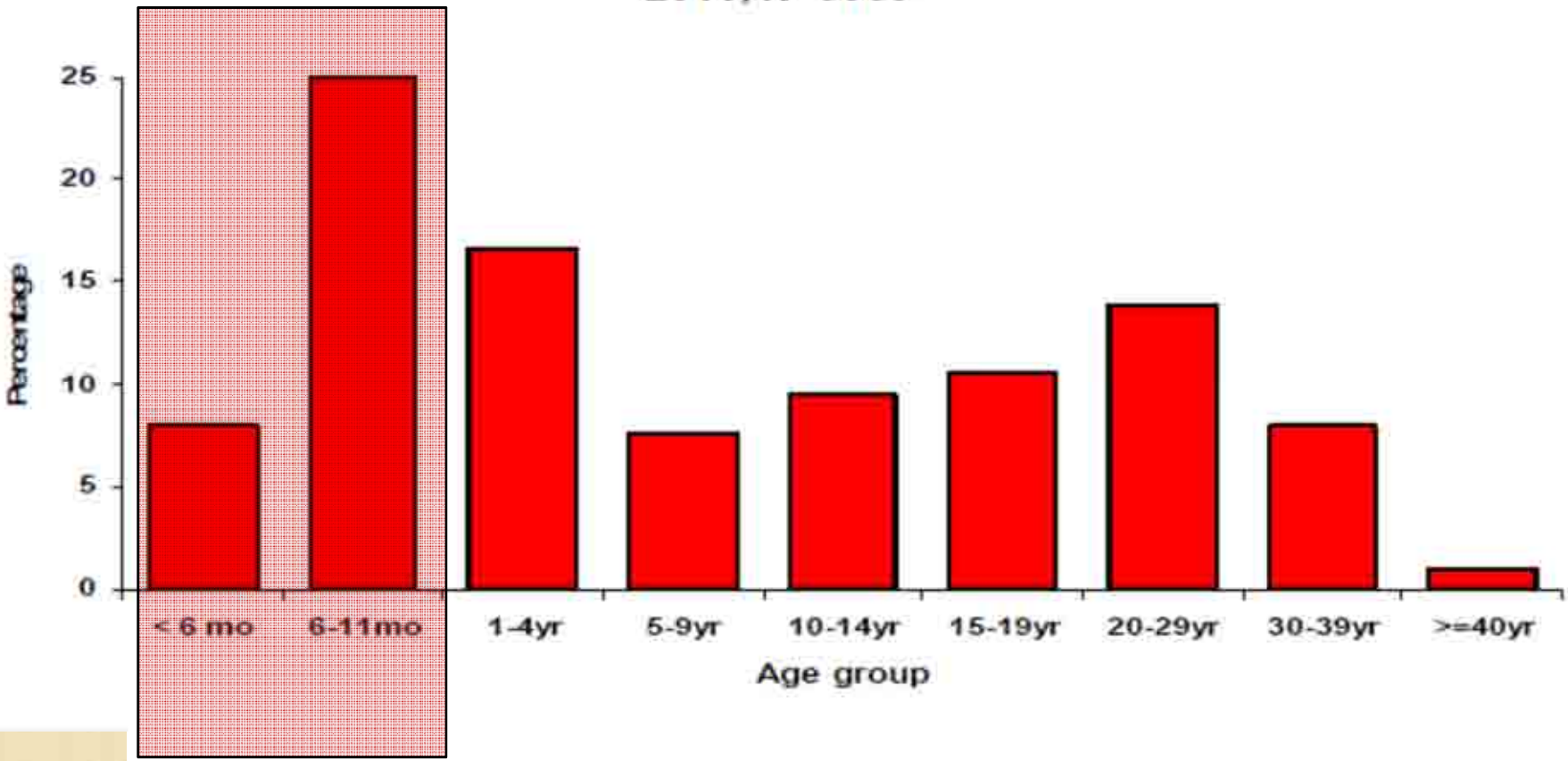


Province abbreviations: ECP=Eastern Cape; FSP=Free State; GAP=Gauteng; KZP=KwaZulu-Natal; LPP=Limpopo; MPP=Mpumalanga; NCP=Northern Cape; NWP=North West; WCP=Western Cape

Figure: Measles IgM positive results per province: South Africa, January 2009 to 29 September 2010

NICD

Age distribution of patients with measles: South Africa 2009-2010, N=6065



Measles

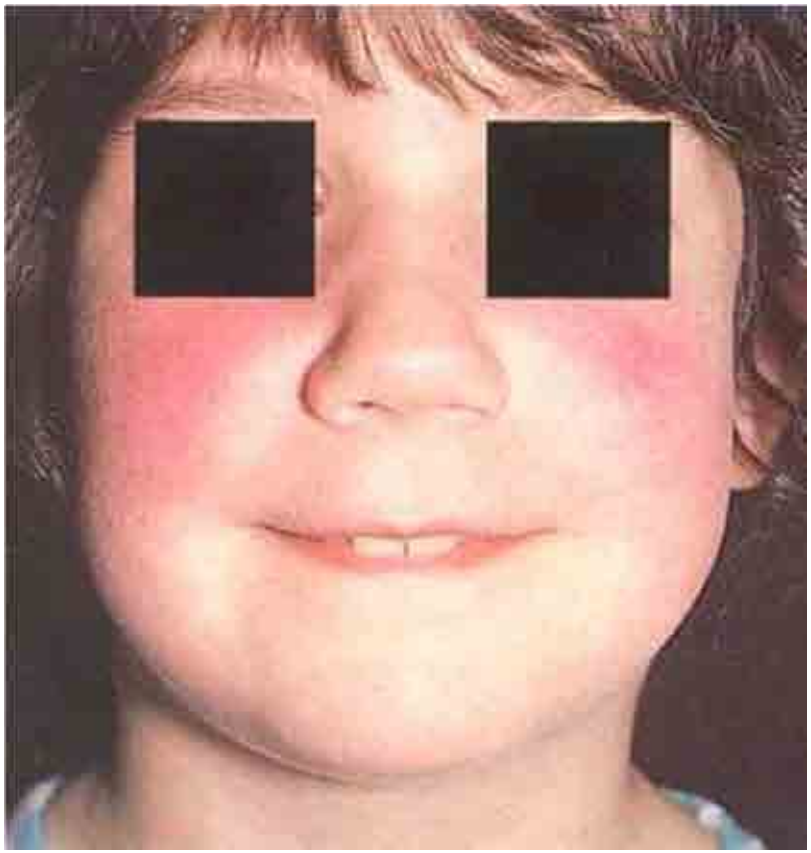
- Clinical features
  - Prodrome (catarrhal phase)
    - Fever
    - Cough
    - Coryza
    - Conjunctivitis
  - Kopliks
  - Rash
    - Erythematous, maculopapular
    - Face – trunk – limbs
    - Staining
    - Desquamation

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 I 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
    - 4-9days
    - Local analgesia, tube feeds

Herpes simplex

- Meningo-encephalitis
  - High mortality and morbididty
- 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

    To

  - 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
- Thombocytopaenia
- 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
- Ceftriaxione
  - Single dose
  - Only intramuscular route
- Azythromycin
  - Only studied in adults
  - 93% effective

Rash and Fever
*Bacterial

- Tick bite fever

Figure 2: Tick bite fever eschar (Photo: Dr J Hyslop)

Figure 1: Amblyomma hebraeum: adult male (Photo: Dr P Jupp, A Kemp)

Figure 3: Typical coarse maculopapular rash of tick bite fever (Photo: Dr B Miller)

Tick bite fever in South Africa

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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

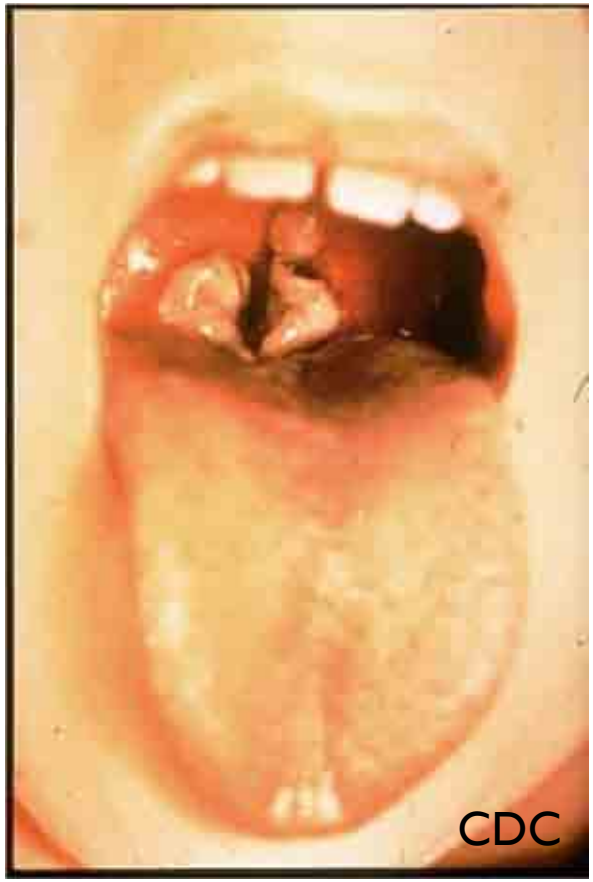
Rash – No fever

- 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
  - Thrombocytopaenia 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

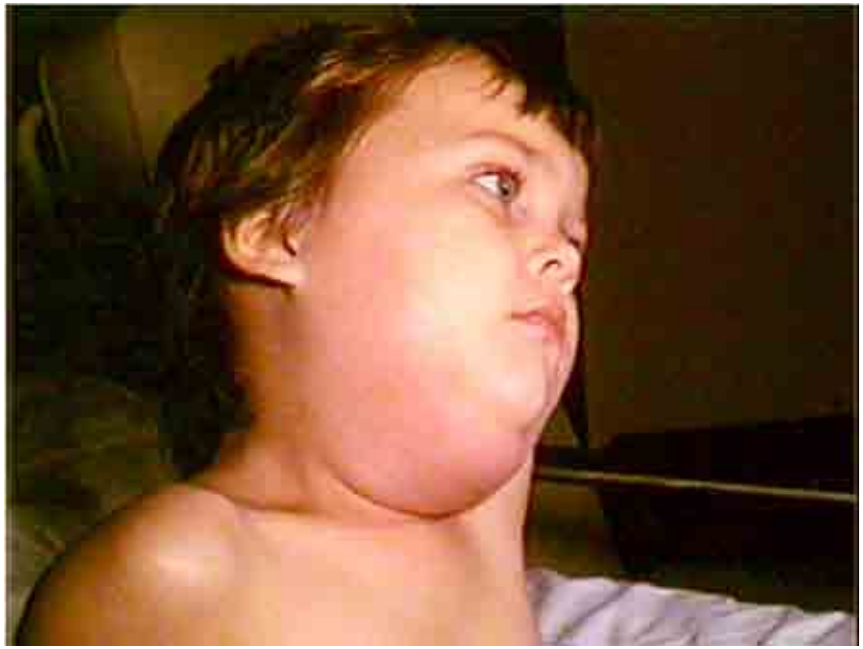
- *Bordetella pertussis*
- Whooping cough
  - Droplet spread
- Disease of infancy
  - 50% < 1 year
  - No transplacental immunity
- Clinical
  - Incubation 3 days
    - Catarrhal stage 1 - 2 weeks
    - Paroxysmal stage
    - Convalescent stage
  - In infant atypical picture
    - Whoop absent
    -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



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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 Guillian 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