

Paediatric Meningitis

Ben McKenzie

- Inflammation of the meninges

Death

Neurological deficit

Hearing loss

Hydrocephalus

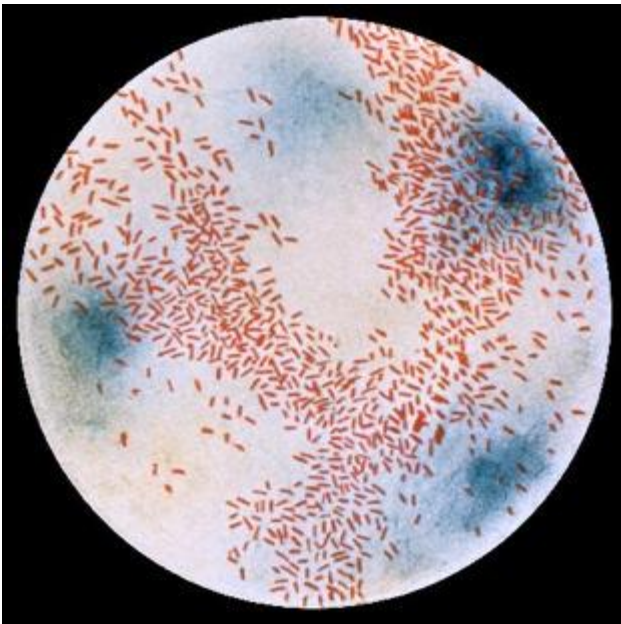
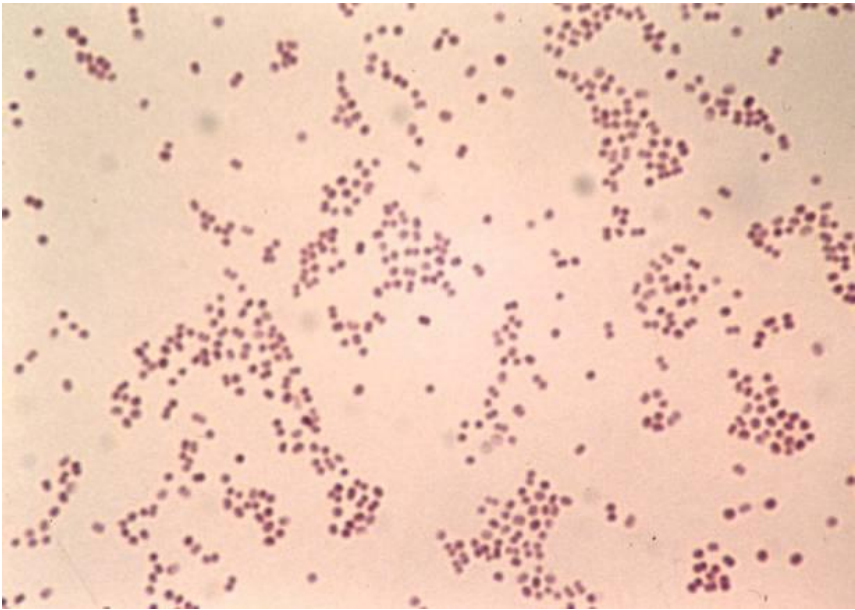
Under 2 months

- E Coli (and other gram negatives)
- Group B Strep
- Lysteria

- Streptococcus Pneumoniae (pneumococcus)
- Neisseria Meningitidis (meningococcus)
- Haemophilus Influenza Type B

Over 2 months

- Streptococcus Pneumoniae (pneumococcus)
- Neisseria Meningitidis (meningococcus)
- Haemophilus Influenza Type B



Immunisations

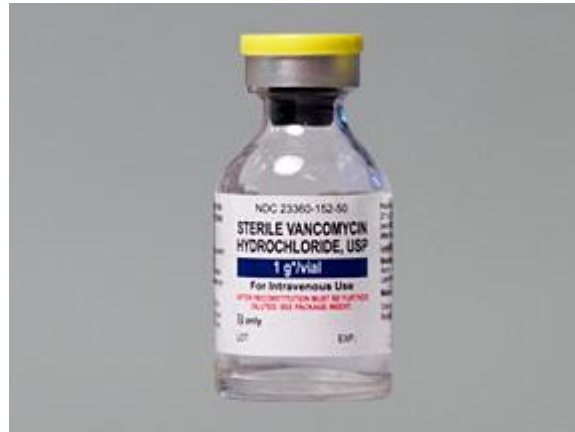
- HIB – 1993
 - conjugated vaccines available and in clinical use
- Meningococcal (Group C) – 2003
- Pneumococcus
 - 7 valent (7vPCP – Prevenar)
 - High risk children from 2001
 - All Children from 2005
 - 23 Valent Polysachharide (23vPPV – Pneumovax 23)
 - Indigenous > 50 program - 1999
 - Non indigenous > 65 2005 - (Victoria 1998)
 - Children with medical problems and Aboriginal Children at 18 months

Management

Therapy (summary)

Age	Antibiotics	Steroids
>2 months	Cefotaxime 50 mg/kg (2 g) iv 6H	<u>Dexamethasone</u> 0.15 mg/kg, iv 6H
4 weeks-2 months	Cefotaxime 50 mg/kg (2 g) iv 6H, Benzylpenicillin 60 mg/kg iv 4H and Gentamicin	<u>Dexamethasone</u> 0.15 mg/kg, iv 6H
< 4 weeks	Cefotaxime 50 mg/kg (2 g) iv 6H, Benzylpenicillin 60 mg/kg iv 12H (wk 1 of life) 6-8H (wk 2-4 of life), Gentamicin	No

- What about vancomycin?



Steroids

Steroids

2 RCTs in 1960's – No benefit

Steroids

- 5 RCTs in the late 80's early 90's showed benefit in hearing loss but mainly in Hib patients. Probably benefit in pneumococcal disease but not enough numbers.
- Results were conflicting.
- 4 out of 5 American paediatricians in 1993 were using steroids.

Late 1990/2000's

- Then Hib was immunised against

But that was where the benefit was so what
now??

Adults

2000

- Dutch RCT – NEJM De Gans Nov 2002
 - Adults
 - 10mg dexamethasone 6/24 for 4 days
 - Given 15 minutes prior to antibiotics
 - Mortality and neurological deficits less
 - Particularly in the pneumococcal group.

2007

- Nguyen, Vietnam, NEJM
- 0.4mg dexamethasone 12/24 for 4 days
- Decreased mortality and neurological deficit

What about Paediatrics?

- Has been more complicated because of changing pathogens with immunisation.

Cochrane Review – September 2010

- 24 studies included

Cochrane Review

- Mortality benefit in pneumococcal disease.
- Reduced hearing loss and short term neurological sequelae.
- No mortality benefit seen in children
- No overall mortality benefit

Sub Groups

- High vs Low income countries
- Paediatrics vs adults
- Haemophilus vs Pneumococcal disease

Cochrane Review – Sep 2010

- Paediatrics:
- Reduced hearing loss even in Non Hib disease.
- Reduced hearing loss benefit present even when you leave in low income country studies
- Lower short term neurological deficits if low income country studies taken out.

Steroids – Are they Harmful?

- Bleeding – Cochrane - no
- Persisting fever – Cochrane - yes
- No increased neurological deficits in children
- No increase in mortality

- Reduced antibiotic penetration due to decreased meningeal inflammation – CSF studies show adequate concentrations of antibiotics.

Steroids

How Long?

- 4 days but further studies needed to clarify if a shorter duration appropriate – conflicting evidence to date.

How Much?

- 0.4 to 0.6mg/kg per day
- More studies required to see if lower dose possible.

When?

RCH Guideline

Steroids

- Current evidence suggests that steroids protect against neurological sequelae from bacterial meningitis (particularly deafness) and may reduce mortality.
- The benefit is probably greatest if steroids are given at least 15 minutes before the first dose of antibiotics.

Accordingly, children (>4 weeks old) who are being treated for possible meningitis (who have not yet received parenteral antibiotics, or who have received their first dose less than 1 hour ago) should be given dexamethasone.

- Give Dexamethasone 0.15mg/kg iv 6 hourly for 4 days
- Wait 15 minutes before giving antibiotics after the first dose.
- Antibiotics must not be delayed more than 30 minutes after a decision is made to treat.

Steroids should be ceased if a decision is made to cease antibiotic treatment for meningitis before 4 days (eg if cultures are negative at 48 hours, and CSF microscopy not supportive).

From a practical point of view, it may be appropriate to give dexamethasone at the time of lumbar puncture in children who are felt to be very likely to have meningitis.

**TIMELY APPROPRIATE ANTIBIOTICS
IS MOST IMPORTANT**

What about neonates

- Different pathogens and no evidence about steroids.
- No steroids
- Treatment for gram –ve bacillary disease is longer than the usual 10 days.

General measures

- **Neurological observations** including blood pressure should be performed 15 minutely for the first two hours and then at intervals determined by the child's conscious state.
- **Weight and head circumference** should be monitored on a daily basis.
- **Control seizures** Early consultation with intensive care unit is necessary for any child who is experiencing a deterioration in conscious state, haemodynamic instability or seizures.
- **Electrolytes and glucose** should be checked 6-12 hourly until the serum sodium is normal (and/or the child is no longer on IV fluids).
- **Ensure adequate analgesia** (eg paracetamol) for children in the recovery phase who may have significant headache.
- **Fever persisting for more than 7 days** This may be due to nosocomial infection, subdural effusion or other foci of suppuration. Uncommon causes include inadequately treated meningitis, a parameningeal focus or drugs.

Fluid management for the severely ill child who is not feeding during first 24-48 hours of treatment

Refer to the table for initial fluid volume recommendations (ml per hour)

Decide if the child has:

Normal serum [Na⁺] and no signs of hypovolaemia, dehydration or raised intracranial pressure

- Fluid guideline based on giving 3ml/kg/hour up to a weight of 10kg (about 70% of 'maintenance fluid requirements') as 0.9% (normal) saline + 5% dextrose.

Hyponatraemia ([Na⁺] $<$ 135) but no signs of hypovolaemia, dehydration or raised intracranial pressure

- Fluid guideline based on giving 2ml/kg/hour up to a weight of 10kg (about 50% of 'maintenance fluid requirements') as normal saline + 5% dextrose. If the serum [Na⁺] is very low ($<$ 130mmol/L) refer to the ICU.

Signs of dehydration or hypovolaemia at presentation

- Give repeated boluses of 10ml/kg of normal saline until hypovolaemia is corrected. Refer to ICU if signs of hypovolaemia persist. Ongoing fluid guideline based on giving 3ml/kg/hour up to a weight of 10kg as 0.9% (normal) saline + 5% dextrose.

Signs of raised intracranial pressure or generalised oedema

- Fluid guideline based on giving 1-2ml/kg/hour up to 10kg (about 25-50% of 'maintenance fluid requirements') as normal saline + 5% dextrose. A child with any clinical signs of raised intracranial pressure (e.g. very bulging fontanelle, unresponsiveness to painful stimuli or papilloedema) or of over hydration (e.g. facial or generalized oedema) should have fluids restricted and referred to the ICU. Development of generalised oedema is a major risk factor for serious adverse outcomes in meningitis, and is at least in part due to excessive fluid administration.

In all children with meningitis, regardless of the presence of intracranial hypertension it is essential to ensure normal blood pressure and adequate circulating volume.

When do you do an LP?

- In a neonate?
- In a sick looking child with an altered conscious state?
- In a miserable 5 month old who is not consolable but not extremely sick looking and no focus for infection?

Results from 27/02/2012 23:05 Episode# 12G202945

***INTERIM ONLY** Cerebro Spinal Fluid

CSF

MACROSCOPIC APPEARANCE:

CSF - Clear, Supernatant is colourless.

MICROSCOPY:

		Bacteria	NIL
Polymorphs	845 / μ L		
Lymphocytes	45 / μ L		
Erythrocytes	8 / μ L		

India Ink NOT DETECTED

BIOCHEMISTRY:

Glucose: 2.5 mmol/L (2.2-3.9)
 Protein: 1.10* g/L (0.12-0.60)

CULTURE:

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