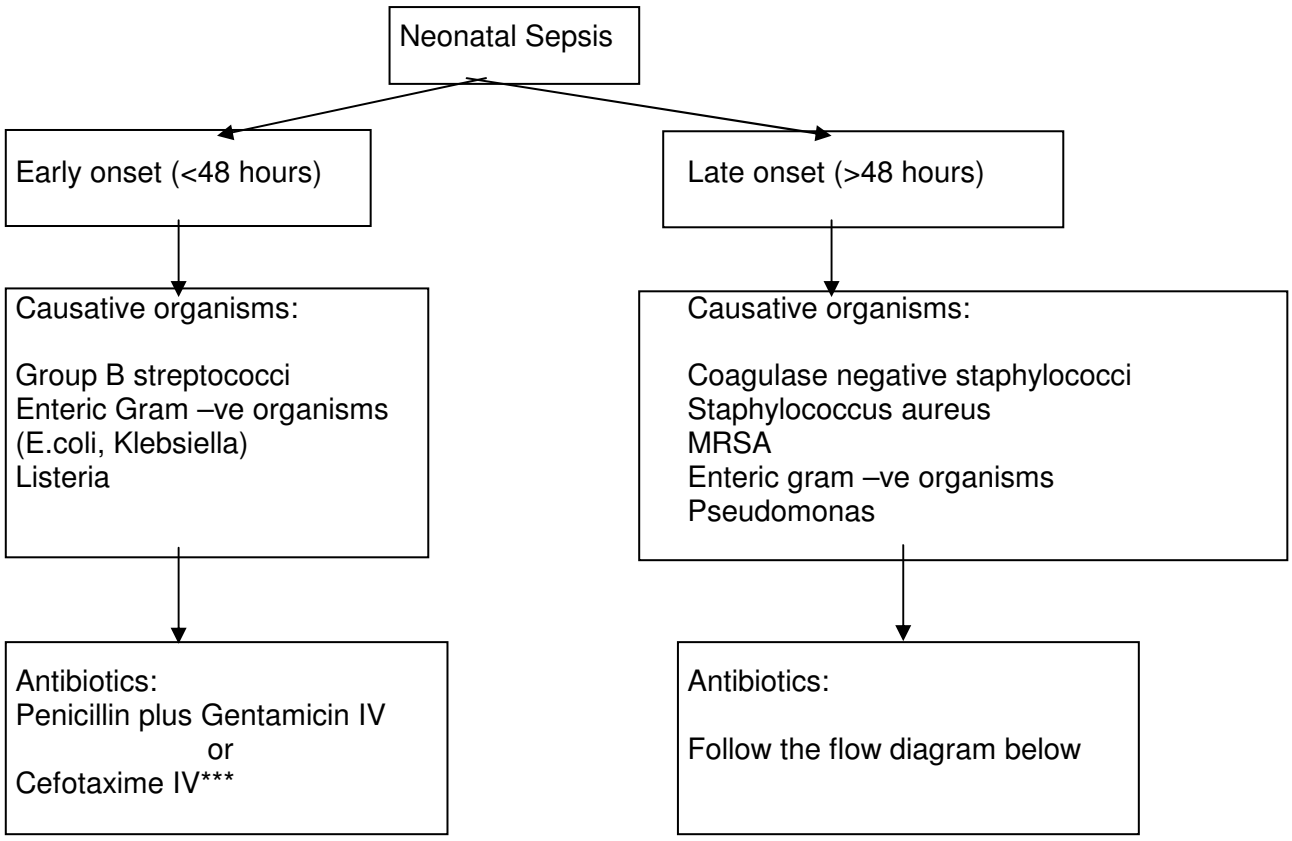
INFECTION

Bacterial Sepsis

Antibiotic Guidelines for Neonatal Sepsis



***** Please note: Cefotaxime will only be used to treat suspected neonatal sepsis on the postnatal ward. Any baby admitted to the neonatal unit will change to penicillin and gentamicin to reduce the possible risk of bacterial resistance with cephalosporin use. NB cefotaxime does not cover Listeria.**

Management guide for symptomatic infants with late onset sepsis (> 48 hours of age)

In the event of clinical signs consistent with sepsis i.e.:

- pyrexia/unstable temperature
- poor colour/perfusion
- respiratory distress
- irritability
- hypoglycaemia
- apnoea/bradycardia
- abnormal movements/seizures

admit to the NNU for full infection screen :

- clinical examination
- FBC and differential
- blood cultures
- CXR
- urine
- LP
- swab of any broken skin areas

Antibiotic therapy for late onset sepsis

Antibiotic use for late sepsis must be guided by the following principles to minimise development of antibiotic resistance

1. Use the narrowest spectrum antibiotic possible
2. Antibiotics must be given for the shortest possible duration[1]

Antibiotics Used in Neonatal Sepsis

Flucloxacillin

Use flucloxacillin and an amino glycoside as first line treatment,

Flucloxacillin will cover most staphylococci except MRSA
(methycillin resistant staphylococci) or CONS (coagulase negative staphylococcus)
Rarely if there is clinical suspicion of systemic MRSA infection (previous known colonisation with signs of systemic infection) it may be necessary to use vancomycin instead of flucloxacillin

Coagulase negative staphylococci very rarely cause fulminant sepsis, so there is almost always time to change treatment when cultures are positive. Central lines must be removed wherever possible when CONS is grown in a blood culture. If this is not possible (discuss with consultant) then Vancomycin is to be used instead of Flucloxacillin.

Aminoglycosides have some anti-staphylococcal activity, which may help limit the severity of infection.

Amino glycosides:

Aminoglycosides are cheap and effective. However, there is a problem with resistance. Aminoglycoside resistant Gram negative bacilli have caused outbreaks,[2,3] Aminoglycoside resistant organisms are thought to be selected by high level use of antibiotics, but spread of resistant organisms to other babies occurs with increased workload, and is thus preventable by improved hand washing. Secondly, amino glycosides penetrate uninflamed meninges poorly, in contrast to third generation cephalosporins, and this has been used as a rationale for using cephalosporins in preference to aminoglycosides.

Third generation cephalosporins:

Third generation cephalosporins are broad spectrum antibiotics, active against most Gram negative and many Gram positive organisms (but do not cover Listeria). Broad spectrum antibiotic use, especially if prolonged, is associated with fungal infections, [4,5] and the selection of cephalosporin resistant Gram negative bacilli.[6] Furthermore, in 1983 extended spectrum beta lactamase (ESBL) producing strains of Gram negative bacteria were first reported from Germany, apparently selected by excessive use of third generation cephalosporins.[7 8] These organisms carry a plasmid mediated beta lactamase which confers not only resistance to cephalosporins, but also resistance to most amino glycosides and many other antibiotics. Some ESBL strains are sensitive to amikacin, but many are sensitive only to the new carbapenems, imipenem and meropenem.

Vancomycin:

Vancomycin is a glycopeptide antibiotic, it is active against methicillin resistant strains of Staphylococcus aureus (MRSA) and coagulase negative staphylococci. Vancomycin is active against most Gram positive organisms, but not against Gram negative organisms or anaerobes. It penetrates most body fluids reasonably well, but enters the CSF well only when the meninges are inflamed.

The mortality from coagulase negative staphylococcal sepsis is low. In a recent Australian series, two of 124 babies with sepsis caused by coagulase negative staphylococci died, possibly but not definitely due to sepsis,[8] while in an American multicentre study of very low birth weight babies, the eventual mortality was 10% in babies with coagulase negative staphylococcus sepsis and 7% in babies who never became septic.[10]

Central lines must be removed wherever possible when CONS is grown in a blood culture. If this is not possible (discuss with consultant) then Vancomycin should be used.

Vancomycin resistant organisms such as VRE (vancomycin resistant enterococci) will be selected if vancomycin is used too frequently or for too long

Vancomycin	No loading dose		
	<29/40 (PCA)	15mg/kg	**24 hourly**
	29-35/40 (PCA)	15mg/kg	**12 hourly**
	>35/40 (PCA)	15mg/kg	**8 hourly**

Vancomycin levels should be checked immediately before and 2 hours after completion of the 1 hour infusion following the 3rd dose.

Trough should be 5-10mg/l Peak should be 18-28mg/l

Tazocin (Piperacillin/Tazobactam)

Tazocin is relatively new antibiotic, in which Tazobactam, a new potent inhibitor of beta-lactamase, is combined with Piperacillin, a well-established beta-lactam antibiotic, at the ratio of 1:4. [11] There are very few studies on its use in neonatal sepsis. One study has shown reduction in multiresistant nosocomial infections in neonatal sepsis compared to ceftazidime. [12] Tazocin is very effective even against beta-lactamase producing Gram-negative bacilli. [13] It penetrates poorly to uninflamed meninges. [11] It will cover sensitive staph aureus but not MRSA.

Meropenem

Meropenem is a very valuable, recently introduced broad spectrum antibiotic. **There is general agreement that it should be held reserve and used at the bottom end of hierarchy**. It is a carbapenem beta-lactam antibiotic active against a very wide range of Gram positive and Gram negative aerobic and anaerobic bacteria. [11] Methicillin resistant staphylococci and Enterococcus faecium are resistant to meropenem, as are some strains of Pseudomonas aeruginosa. It is active against multiple antibiotic-resistant Klebsiella species in neonates. [14] Meropenem is as effective as ceftazidime in the empiric treatment of severe infections in infants. [15] One German study has shown meropenem to be very effective in the treatment of neonatal multiple subdural abscesses. [16] There is very little published data on the clinical use of meropenem in the neonatal period. [17,18]

Linezolid

A new oxazolidininone, it is active against staphylococci, streptococci and enterococci (including MRSA and VRE) and has been shown to be effective and well tolerated in children with serious gram positive infections19

Duration of treatment

Blood cultures are reliable using current techniques [20 21]

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a) Negative blood cultures at 48-72 hours:
Antibiotics can be stopped [22 23]

Exceptions for not stopping antibiotics in the face of negative cultures

1. Early or late onset pneumonia because the sensitivity of blood cultures is only 50%
2. Infant heavily colonised with listeria or GBS (group B streptococcus)
3. If clinical suspicion was very high at the time of starting treatment and septic markers still abnormal then 5 days treatment MAY be considered

b) Positive blood cultures

Sepsis with positive blood cultures ~ treat for 7 days
Exceptions: 14 days for listeria septicaemia; 2-3 weeks for GBS meningitis; 21 days for gram neg meningitis
NB/CONS infection is unlikely to be eradicated if the line remains in situ

INVESTIGATIONS FOR INFECTION

1) Haematological investigations for infection

1. Total White cell count:
least useful index as the normal range is wide and events other than infection (IVH/asphyxia /fits) cause it to rise
2. Neutrophils:
a. Count is valuable:
within the first 48 hrs of life neutropenia (<2-2.5x10^9/l) suggests bacterial infection
after 48 hrs of age neutropenia and neutrophilia (>7.8-8.0x10^9/l) are useful predictors
b. Ratio of immature to total neutrophil counts useful: (I/T)

Age	I/T
First 24 hours	0.16
Between 24 and 48 hours	0.14
Between 48 hours and 5 days	0.13
Between 5 days and 1 month	0.12

I/T>0.2 suggests infection
<0.2 infection unlikely
High ratio in presence low overall neutrophil count makes infection more likely [24]
c. toxic granulation of neutrophils on film suggests infection [25]

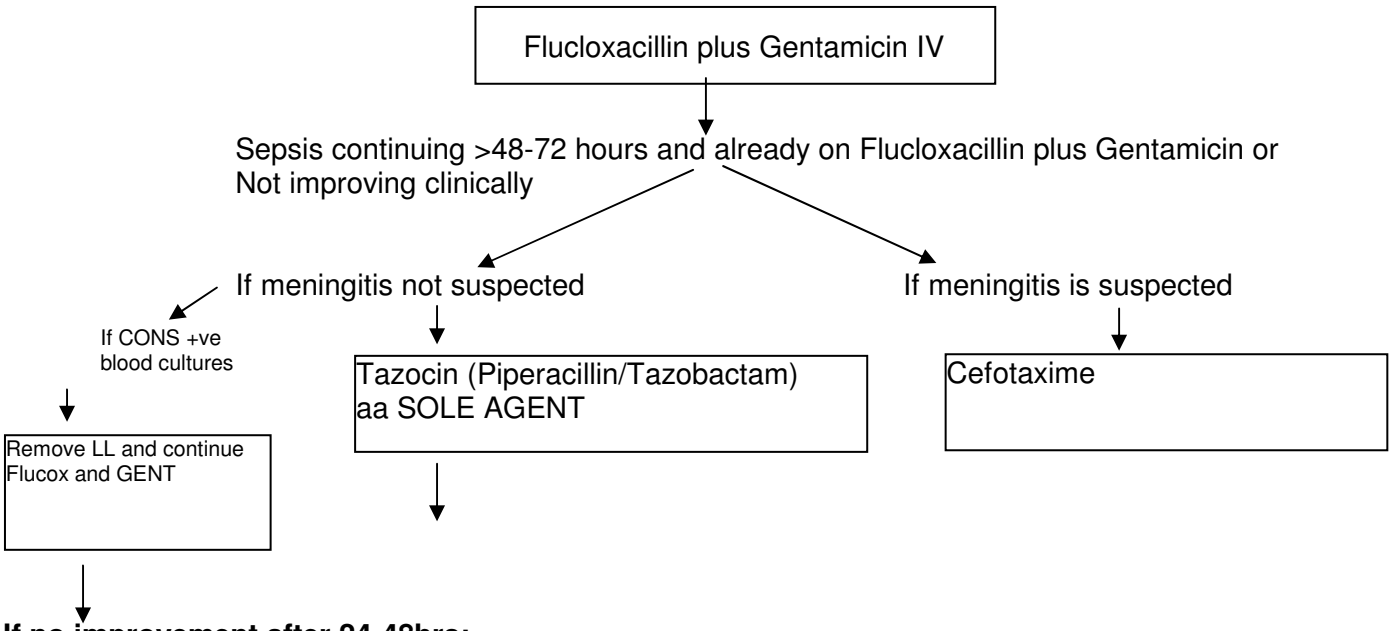
3. Platelet count : in 50% of babies the platelet count will fall below 100x10^9/l but this is often a late finding. Viral infections such as CMV cause profound thrombocytopenia

1) Acute Phase Proteins

CRP-C-reactive protein
Better indicator than WBC numbers [26 27] especially if serial measurements are made, however it takes several hours for CRP to rise in infection so it is little help in deciding when to start antibiotics. Most useful retrospectively after starting treatment.
Culture proven sepsis is unlikely if the CRP doesn't rise in 24-48 hours of onset of illness. The combination of normal CRP and negative blood cultures is a safe basis to stop antibiotics.
Persistent raised CRP during antibiotic therapy should alert to the possibility of fungal infection/resistant organisms or development of complications eg endocarditis or abscess.
IT IS NOT NECESSARY FOR A CRP TO RETURN TO NORMAL COMPLETELY BEFORE STOPPING ANTIBIOTICS IF THERE IS CLINICAL IMPROVEMENT AND THE TREND IS DOWN THEN ANTIBIOTICS CAN BE STOPPED

Cytokines
TNF ? IL-6 and IL-8
TNF ? and IL6 induce CRP in infection. IL8 is involved in neutrophil activation. A recent review showed there was insufficient clinical evidence at present due to small study sizes but combination of CRP and IL-6 may be useful [28 29] in the future.

Which antibiotics to use for suspected late sepsis?



If no improvement after 24-48hrs:

Consider adding vancomycin ONLY IF :
1. MRSA IS SUSPECTED

2. If a central line infection is suspected, the line MUST be removed where ever possible. (this may need to be discussed with the consultant) Vancomycin must only be used when it is impossible to remove the line

Sepsis continuing >48 hours and already on Tazocin
Not improving clinically

Meropenem

Consider adding vancomycin ONLY IF :
If MRSA IS SUSPECTED

If a central line infection is suspected the line MUST be removed where ever possible –this may need to be discussed with the consultant. Vancomycin must only be used when it is impossible to remove the line.

Summary:

1. Stop antibiotics at 48-72 hours if cultures negative (unless pneumonia or heavy GBS/listeria colonisation)
2. If cultures positive 7 days treatment is sufficient
3. CRP useful as a marker of success when treatment started CRP DOES NOT NEED TO RETURN TO NORMAL BEFORE TREATMENT CAN BE STOPPED
4. The correct treatment for a line infection is to remove the line – if this is not possible Vancomycin may be used but should be stopped as quickly as possible
5. Cephalosporins should be reserved for the post natal wards and suspected meningitis

Meningitis

The persistence of bacteria in the CSF correlates with outcome in Gram negative meningitis. Cefotaxime produces rapid sterilisation of CSF (i.e. greater number of patients with sterile CSF at 24 hours). No specific trials in neonates have been performed. Most include infants and children. Meningitis occurs in about 25% of infants less than one month old with sepsis. The mortality rate is up to 50%. The morbidity amongst survivors is high, 30-50% of those with GBS or Gram negative meningitis will have sequelae. Combination chemotherapy of Cefotaxime with Gentamicin for Gram negative infection or Ampicillin for Listeria infection should be considered. Supportive treatment includes the management of ventilation , blood pressure , control of seizures and correction of metabolic derangement.

GBS Infections

(see algorithm)
The most common cause of infection in neonates is GBS. About 0.7% infants of GBS colonised mothers develop neonatal infection. As maternal colonisation during pregnancy is intermittent antenatal screening is difficult. There is no widely available rapid screening test for use in labour , therefore GBS infection should be suspected in any symptomatic infant

Intrapartum Ampicillin given to colonised mothers reduces neonatal colonisation and possibly infection with GBS as colonisation and infection are related. There is no evidence that routine intrapartum antibiotics reduce neonatal infection/mortality , UNLESS there are additional risk factors for infection.

Neonatal prophylactic therapy does not reduce overall mortality from infection as there is an increased mortality from other infections , including antibiotic resistant organisms. The majority of neonates who develop GBS infections are symptomatic at birth or within 48 hours.

Necrotising Enterocolitis

Flucloxacillin and gentamicin and metronidazole
Second line therapy :
Tazocin plus **Vancomycin** plus Metronidazole

Purulent Conjunctivits

Chloramphenicol ointment.

Chlamydia eye infection or pneumonitis

Erythromycin PO 3 weeks

Anti-virals

Varicella zoster – Aciclovir IV for 10 days

Herpes simplex - Aciclovir IV for 5 days

Protocol for Administration of IV Cefotaxime on the Postnatal Ward:

First doses will be prescribed at 50mg/kg Cefotaxime and given on TMBU as currently following cannulation on level 12.

Second and subsequent doses will be prescribed at 25mg/kg BD Cefotaxime and given on level 12 by a neonatal nurse from TMBU, assisted by a midwife. All these doses must be prescribed to be given at **1100hrs and 2300hrs**.

The time interval between first and second dose will therefore be variable, but should be **no less than 5 hrs and no more than 16hrs**.

Antibiotics will be discontinued as normal. Infants requiring admission will have their prescriptions changed to Benzylpenicillin and Gentamicin.

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Guidelines For Urine Collection

Indications

A specimen of urine may be required for:

1. **Ward testing**: testing for the presence of protein, glucose, other reducing substances, ketones, urobilinogen, bilirubin, blood and the measurement of pH

2. **Laboratory testing** for metabolic/biochemical investigations including measurement of osmolality, electrolytes, amino-acids, organic acids and drug metabolites

3. **Microbiological analysis** for microscopy, culture and sensitivity testing for metabolites

4. **Microbiological analysis** for microscopy, culture and sensitivity testing for bacteria or for "multistix testing"

Urine collected for routine ward testing or for metabolic/biochemical tests (as indicated in section 1 and 2) does not have to be sterile. The method of obtaining unsterile sepcimens is to place one or two cotton wool balls between the thighs so that when urine is passed it is soaked up in the cotton wool balls. The urine may then be aspirated into a syringe and transferred into a specimen bottle or onto a urine testing stick.
When a clean specimen of urine is required for bacterial culture and sensitivity (as indicated in section 3) it may be collected by:
a. Urine bag
b. Clean catch
c. Suprapubic aspiration

Indications for urine collection for microscopy and culture

Microscopy and culture of urine as part of an **early** infection screen (within first 48 hours of life) on every infant is questionable and research has shown it is not necessary (Isaacs and Moxon 1991). Within this group of infants a small number may be identified where there is a strong suspicion of sepsis. Detection of the aetiological organism from these infants is pertinent and a supra-pubic aspiration to obtain a urine sample, using ultrasound guidance **prior to antibiotic treatment** is indicated. However in a sick infant antibiotic treatment should not be deferred if an attempt at supra aspiration is unsuccessful.

The policy of urine screening for possible urinary tract infection as part of a **late** infection screen is essential. The primary objective of microbiological urine screening is to identify the abacteriuric specimens. The secondary consideration is the differentiation of a bacteriuria which is clinically significant and not due to skin or bowel contamination.

Urine collection for Microbiological Analysis

1. EARLY INFECTION SCREEN

Routine urine culture does not form part of the early infection screen (<48 hours) unless there are specific indications, namely:

a) known renal tract abnormality
b) strong clinical suspicion of septic infant

In these circumstances the optimum method for urine collection is suprapubic aspiration before antibiotics are given. These specimens are always sent to the laboratory for microscopy, culture and sensitivity.

2. LATE INFECTION SCREEN

Microbiological analysis forms part of the late infection screen, including a screen for prolonged jaundice.

If an infant is sick and considered in urgent need of antibiotic treatment aim for a suprapubic sample to be sent for microscopy and culture.

If clinical circumstances allow obtain a bag urine sample.
Test aliquot of this sample with Multistix 10SG for two markers of infection, leucocytes and nitrites.

- if positive for both markers this suggests almost certain urine infection. Send sample for microscopy and culture, obtain 2nd sample ideally SPA and initiate antibiotic treatment to cover common urinary pathogens
- if positive for either marker the result is equivocal. Send specimen for microscopy and culture and obtain further specimen by SPA
- if negative for both markers this excludes urinary tract infection and no further action is required. Do not send sample for culture.

Request for microscopy and culture of a urine specimen from a specific infant may be indicated on the basis of clinical signs of infection.

SPECIMENS COLLECTED BY URINE BAG

Indications

As outlined above

Equipment

1. Water for cleaning perineum
2. Sterile cotton wool balls
3. Urine bag

Procedure

1. Wash the perineum with water and dry the skin with cotton wool balls before attaching the urine bag.

2. Stick the urine bag onto the perineum, making sure that there is no risk of contaminating the contents of the bag with faeces. **Do not cover perineum and bag with nappy but leave exposed.**

3. **Immediately** after the urine is voided, aspirate the urine with a syringe or empty the bag into a sterile universal container and send immediately to the laboratory.

Precautions

If it is not possible for the specimen to be processed within 4 hours of collection, the sample should be refrigerated at 4^0C to avoid multiplication of bacteria.

SUPRAPUBIC ASPIRATION

Indications

Suprapubic aspiration should be performed in:

1. Infants in whom a urinary infection is suspected and/or positive multistix SG10 (nitrites and leucocytes) and where bag collection has revealed equivocal or positive results on at least one occasion.

2. Infants from whom an urgent specimen of urine is required (e.g. early infection screen in an infant with sepsis).

Equipment

1. A2 or 5ml syringe
2. A23 or 21 gauge needle
3. Sterile urine containers
4. Alcohol swabs
5. Water to wash the perineum
6. Sterile cotton wool balls

Procedure

An assistant is required for this procedure. Suprapubic aspirations should be attempted 1-2 hours after the baby last voided urine when the bladder is most likely to be full. Check that the nappy is not already wet again, and preferably check that the bladder is full by ultrasound.

1. Explain the procedure to the assistant. Life the infant supine. The assistant washes the perineum with water and dries the skin and is ready to catch **"clean catch" urine** as micturition often occurs during preparation. The assistant needs to hold the infant's legs and restrain the arms.

2. Thoroughly clean a wide area of skin above the symphysis pubis with an alcohol swab.

3. Place the needle attached to the syringe approximately 1.0cm above the symphysis pubis in the midline held at right angles to abdominal skin,

pierce the skin, and abdominal wall and bladder rapidly. The bladder is normally entered 1-2 cm from the skin. Gentle suction on the syringe will enable urine to be aspirated.

4. After obtaining 2-3 ml of urine, withdraw the needle and immediately transfer the urine into a sterile container which is then sent to the laboratory.

Precautions

1. Do not attempt a suprapubic aspiration of the bladder in an infant with:
   a. Dilated bowel causing abdominal distension
   b. A bleeding disorder

2. Transient haematuria may occur after the procedure. This is usually of no significance but should be noted.

Chickenpox

Guidelines To Clinical Management

Spots appear on mother more than 7 days before delivery

Baby at low risk of acquiring chickenpox at or after delivery but may have acquired infection transplacentally.
Check maternal and cord blood Varicella-Zoster Virus (VZV) antibody levels.
Isolate mother and baby on Postnatal Ward and observe closely. Allow normal mother/baby contact. (Preferably nursed by staff who have had chickenpox.)
Treat baby if signs of infection develop.

Sports appear on mother 7 days or less before delivery and 5 days or less after delivery

Baby at **significant** risk of developing chickenpox as maternal Antibody not transmitted yet.
Check maternal and cord blood VZV antibody levels.
Give Zoter-Immune-Globulin (ZIG) 250 mg IM to baby as soon as p[ossible after delivery.
Admit to NNU. Isolate and observe closely for signs of infection. CXR to exclude pneumonitis.
If signs of infection develop (raised respiratory rate, poor handling, fever, spots) start Acyclovir 10 mg/kg 8 hourly.
Mother to wear gloves, gown and apron and mask for contact with baby for 5 days after rash has developed.
Breastfeeding should be avoided for 5 days after the rash has erupted. The mother may continue to express and discard milk during this period.

Sports appear more than 5 days after delivery

The baby is at significant risk of developing chickenpox, but the disease is likely to be less severe, as the infant will be older when affected. Give ZIG 250 mg IM as soon as possible after the diagnosis is made in the mother.
If remaining in hospital isolate on the Postnatal Ward.
If at home no further precautions need to be taken except if there are immuno-compromised patients in the household.
The baby should be carefully observed for signs of infection especially in the period 10-21 days after eruption of the rash in the mother. Treatment with Acyclovir should be started promptly if there are signs of serious illness.

General notes

The administration of ZIG is not a guarantee that infection of the baby will be avoided.
VZ immuno-fluorescence can be performed by the Virology Department.

Maternal Chickenpox
CLINICAL GUIDELINES FOR MANAGEMENT

SPOTS APPEAR MORE THAN 4 DAYS BEFORE DELIVERY, OR MORE THAN 4 DAYS AFTER DELIVERY

↓

BABY AT LOW RISK

↓

CHECK MATERNAL/CORD CHICKENPOX ANTIBODY LEVELS IF UNCERTAIN DISCUSSING SIGNIFICANCE WITH VIROLOGIST

↓

ISOLATE MOTHER AND BABY ON POSTNATAL WARD AND OBSERVE

↓

ALLOW NORMAL MOTHER/BABY CONTACT

SPOTS APPEAR 4 DAYS BEFORE DELIVERY, OR 4 OR LESS AFTER DELIVERY

↓

BABY AT SIGNIFICANT RISK
ADMIT TO NNU AND ISOLATE

↓

CHECK MATERNAL/CORD CHICKENPOX ANTIBODY LEVELS, DISCUSSING SIGNIFICANCE WITH VIROLOGIST

↓

GIVE ZIG 250mg. IM AS SOON AS POSSIBLE

↓

START ACYCLOVIR 10 mg/kg 8 HOURLY INTRAVENOUSLY, IMMEDIATELY IF ANY SIGN OF FEVER OR RAISED RESPIRATORY RATE IS NOTED

↓

MOTHER TO WEAR GLOVES AND GOWN FOR BABY CONTACT AND TO AVOID BREASTFEEDING FOR 5 DAYS OR UNTL MATERNAL ANTIBODIES ARE CONSIDERED TO BE ADEQUATE. DONOR BREAST MILK MAY BE GIVEN

Herpes Simplex Virus Guidelines

Introduction

75% of congenital herpes is type 2 (congenital) herpes, acquired during vaginal delivery. Only 30% of mothers whose infants develop neonatal herpes have had symptomatic primary genital herpes with a history of sexual contact with a partner with recognised herpes simplex infection. However, if a mother has symptomatic primary herpes the baby has an approximately 50% risk of developing herpes if born by the vaginal route. If mother has secondary herpes the risk is approximately 3%.

Neonatal herpes simplex infection can be: 1) localised; 2) encephalitis plus minor skin, eye or mouth lesions; 3) disseminated. Localised infection and encephalitis can progress to become disseminated. There is a high mortality and morbidity in survivors.

Management of pregnant women with proven genital herpes in the past

Sequential genital cultures are not useful for detecting asymptomatic and reactivation. Only one in 200,000 pregnancies developed an intra-uterine infection. Asymptomatic reactivation occurs in 2% and the attack rate of their exposed infants is 3%.

Recommendation: careful vaginal examination at presentation. If there are signs of symptoms of active recurrent genital herpes present at the onset of labour a caesarean section may be considered, however it is not of proven value in recurrent herpes. Viral swabs should be taken from the baby's conjunctiva, nasopharynx and any lesions seen at 24 to 48 hours. Viral swabs should also be taken for culture of HSV from the mother's lesions.

Management of pregnant women with suspected primary herpes infection at onset of labour

A caesarean section performed within 24 hours of rupture of membranes is thought to reduce the incidence of neonatal infection from 50 to 20%. At 24 to 48 hours viral swabs for HSV culture should be taken from the conjunctiva, nasopharynx and any lesions suspicious of HSV infection.

Further management of infants of mothers with genital herpes

If the mother has no evidence of infection no investigations need to be performed. If mother has active lesions, the infant should be isolated with the mother for up to four weeks and the baby should be watched for non-specific signs of infection, i.e. an unwell baby, and specific signs. Further cultures should be obtained weekly for the first four weeks. If the cultures are positive the baby should be carefully evaluated with additional specimens (CSF, urine) and treatment should be commenced with Acyclovir.

For mothers: 1) meticulous handwashing each time the baby is touched; 2) if she has oral lesions she should not kiss the baby; 3) if she has breast lesions she should not breastfeed the baby.

Management of infant with suspected congenital herpes infection

20% of congenital herpes simplex infections have no visible lesions. If there is evidence of congenital herpes, even if the child is born by caesarean section, it is still at risk. All vesicles must be tested for herpes virus by:

1. Preferred method is to draw some vesicular aspirate into a capillary tube, any sort will do, and send it direct to virology for immuno fluorescence.
2. If the vesicle is too small or there seems little vesicular fluid it is better to inject a little saline into the vesicle and aspirate this before sending the syringe off to virology for the above investigations.
   Look for the vesicles at
   - any site of trauma
   - eyes
   - mouth
3. In addition send throat swab and urine for virology, in viral cultures medium. Eye swabs at 24 hrs of age.
4. If the child has a lumbar puncture a sample should be sent to virology again for viral culture and HSV PCR.
5. Take a clotted sample for serology.
6. In an unwell child with no obvious cause for a bacterial infection always try to take a fourth CSF sample to send to virology.

Treatment of Neonatal Herpes Simplex

10m/kg Acyclovir IV after dilution over one hour every 12 hours in the first week of life, every 8 hours thereafter. Increase the dose interval to 24 hourly if the plasma creatinine is >150 mcmol/l.

Sticky Eyes In The Newborn

Aims

1. To identify the spectrum of infective organisms found in sticky eyes, with particular reference to chlamydia trachomatis.

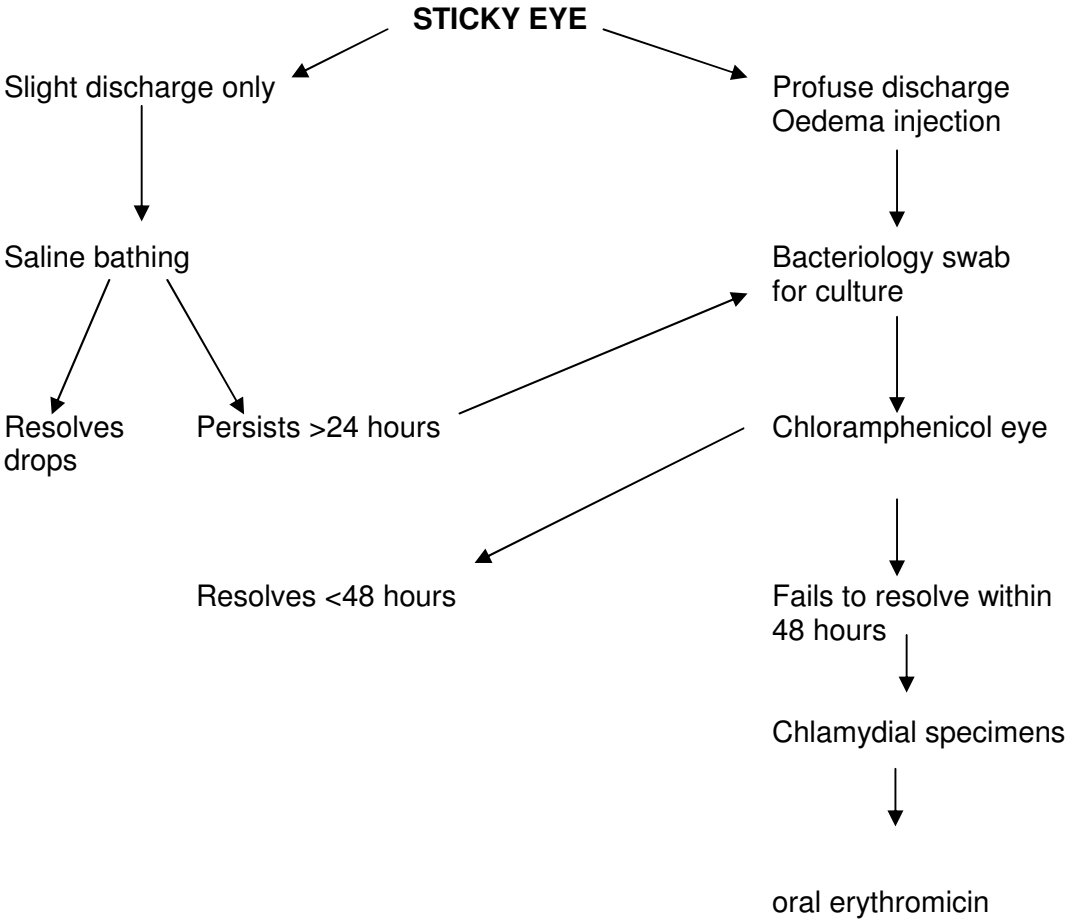
2. To rationalise our treatment of sticky eyes in the newborn.

At present sticky eyes are identified by nurses/midwives or mothers and referred to the Paediatric SHO/ANNP.

The majority of eyes exhibit slight discharge only and need only saline bathing to clear.
If this fails, or if the signs are more marked at time of first examination, then a swab should be taken into Stewart's medium and sent for standard culture and sensitivity. **Chloramphenicol eye drops** should then be commenced.

If 48 hours treatment with Chloramphenicol fails to clear evidence of infection, take Chlamydial swabs and commence oral erythromicin as per drugs protocol.

NB: 1. Profuse discharge in first 48 hours suggests gonococcal conjunctivitis which demands urgent diagnosis (Gram stain) and treatment (Penicillin topically and systemically).
2. Chlamydial infections are often present in conjunction with bacterial pathogens.



PREPARATIONS & DOSAGE

Once Chlamydial infection is confirmed, baby should have a three week course of oral Erythromycin. Refer parents to genitourinary medicine (GUM) clinic.

Chlamydia Investigations

INFORMATION FROM OPHTHALMOLOGY

1. Neonatal Conjunctivitis

Swab for chlamydia using a blue 'male' swab. The laboratory test is a molecular test called SDA.

2. Young Adult Conjunctivitis/trachoma in Visitors

Where oculo-genital infection is suspected, chlamydial investigations may be helpful if all three methods are used, and the patient has not had Tetracycline/Erythromycin in the preceding fortnight.

Swab as above.

PROTOCOL FOR THE MANAGEMENT OF THE UMBILICAL CORD

Routine Care of the Term Infant

Umbilical cord infections are rare in the developed world. Routine care of the cord stump was the subject of a Cochrane review in 2004. The review aimed to assess the difference between antiseptic / antibiotic care and no routine care in preventing neonatal infection. Primary outcome measures included clinical evidence of cord infection, disseminated bacterial infection and death.

More than 40 combinations of antiseptics, antibiotics, placebos and no treatment were compared. The use of antiseptics and antibiotics reduced the frequency of bacterial colonisation but resulted in no reduction in clinical infections.

Mean cord separation time was 9 days in the no treatment groups. Cord separation occurred earlier in the antiseptic groups and later in the alcohol and antibiotic treated groups.

Summary

Routine care of simply keeping the cord stump clean and dry is adequate. There is no advantage in treating the cord with antiseptics, antibiotics or alcohol.

Umbilical cord sepsis (omphalitis)

The umbilicus becomes colonised with organisms from the maternal genital tract or the environment soon after birth. The establishment of infection prevents obliteration of the cord vessels and thereby allows direct invasion of the systemic circulation.

The incidence of omphalitis in the developed world is approximately 0.7%

Risk factors

Risk factors include prolonged labour, non-sterile delivery, PROM, prematurity, low birth weight and the use of umbilical catheters. There may be genetic factors.

Identification

Early omphalitis is characterised by periumbilical oedema, redness and tenderness with or without a discharge. Infection spreads in the following directions:

- Intra-abdominal
    - Abdominal distension and tenderness
    - Bile-stained vomiting and diarrhoea
- Local
    - Purulent discharge
    - Cellulitis and lymphangitis of the abdominal wall

Causative organisms

- Staphylococcus aureus (may cause epidemics)
- Staphylococcus epidermidis (may cause epidemics)

- Streptococcus groups A and B
- E. Coli
- Klebsiella sp.
- Pseudomonas
- Clostridium difficile

Complications

- Septicaemia
- Necrotising fasciitis
- Abscesses
- Peritonitis
- Small bowel obstruction
- Hepatic vein thrombosis

Management

Any infant with periumbilical erythema should be managed as follows:

- Umbilical swab
- Umbilical exudate Gram stain and culture
- FBC, CRP and blood culture
- Start IV Flucloxacillin and Gentamicin and treat for:
    - 5 days if blood culture sterile
    - 7 days if blood culture positive
- Observe for signs of systemic infection

References

Zupan J, Garner P. Omari AAA 2004, Topical umbilical cord care at birth (Cochrane review). In: The Cochrane Library, Issue 3, 2004, Chichester, UK: John Wiley and Sons Ltd.
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