ClinicalEvidence

Neonatal infections: group B streptococcus

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ABSTRACT

INTRODUCTION: One in three women carry group B streptococci vaginally, which can infect the amniotic fluid even if the membranes are intact, or can infect the baby during delivery, causing sepsis, pneumonia, or meningitis. Very-low-birthweight infants are at much higher risk of infection or mortality, with up to 3% infected, and mortality rates of up to 30% even with immediate antibiotic treatment. Late-onset group B streptococcal infection begins after 7–9 days, and usually causes fever or meningitis, but is less often fatal compared with early infection. METHODS AND OUTCOMES: We conducted a systematic review and aimed to answer the following clinical question: What are the effects of prophylactic treatment of asymptomatic neonates less than 7 days old with known risk factors for group B streptococcal infection? We searched: Medline, Embase, The Cochrane Library and other important databases up to March 2007 (BMJ Clinical Evidence reviews are updated periodically, please check our website for the most up-to-date version of this review). We included harms alerts from relevant organisations such as the US Food and Drug Administration (FDA) and the UK Medicines and Healthcare products Regulatory Agency (MHRA). RESULTS: We found twelve systematic reviews, RCTs, or observational studies that met our inclusion criteria. We performed a GRADE evaluation of the quality of evidence for interventions. CONCLUSIONS: In this systematic review we present information relating to the effectiveness and safety of the following interventions: different antibiotics, monitoring and selective treatment, and routine antibiotic prophylaxis.

QUESTIONS

What are the effects of prophylactic treatment of asymptomatic neonates less than 7 days old with known risk factors for early-onset group B streptococcal infection? 3

INTERVENTIONS

PROPHYLACTIC TREATMENT OF AT-RISK NEONATES: GBS

Unknown effectiveness

Different antibiotics 5

Unlikely to be beneficial

Routine antibiotic prophylaxis (no more effective than monitoring and selective treatment) 3

Key points

- Early-onset neonatal sepsis, typically caused by group B streptococcal infection, usually begins within 24 hours of birth, affects up to 8 infants per 1000 live births, and leads to death if untreated.

  One in three women carry group B streptococci vaginally, which can infect the amniotic fluid even if the membranes are intact, or infect the baby during delivery, causing sepsis, pneumonia, or meningitis.

  Very low-birthweight infants are at much higher risk of infection or mortality, with up to 3% infected, and mortality rates of up to 30%, even with immediate antibiotic treatment.

  Late-onset group B streptococcal infection begins after 7–9 days and usually causes fever or meningitis, but is less often fatal compared with early infection.

  We don't know which antibiotic regimen is most effective at preventing group B streptococcal infection in high-risk neonates.

  Routine antibiotic prophylaxis given to low-birthweight babies after birth does not seem to be beneficial in reducing neonatal infection or mortality compared with monitoring and selective antibiotics.

  Increasing peripartum antibiotic prophylaxis is associated with a shift in pathogens causing neonatal sepsis, with *Escherichia coli* becoming a more prevalent cause.

DEFINITION

Early-onset neonatal sepsis usually occurs within the first 7 days of life, and is typically caused by infection with group B streptococcus. About 90% of cases present within 24 hours of birth. [1] One in three women carry group B streptococcus, which exists as part of the normal bacterial flora in the vaginal and anal areas. Infection can be transmitted by aspiration of group B streptococcus-positive amniotic fluid by the fetus. [2] Symptoms of early-onset group B streptococcal infection may be non-specific, including temperature instability, poor feeding, excessive crying or irritability, and respiratory distress. Early-onset group B streptococcal infection typically presents with sepsis (69% of cases), leukopenia (31% of cases), pneumonia (26% of cases), respiratory distress (13% of cases), and, rarely, meningitis (11% of cases). [3] [4] [5] Late-onset group B streptococcus infection occurs from 7–9 days of age, through to the end of the second month of life, and differs from early-onset group B streptococcal infection in terms of group B streptococcus serotype, clinical manifestations, and outcome. Late-onset infection typically presents with fever (100% of cases) and meningitis (60% of cases). [3] [4] This review deals with full-term and premature asymptomatic babies born with a known risk factor for group B streptococcal infection, but in whom a specific diagnosis of group B streptococcus (either by blood, urine, or cerebrospinal fluid) has not yet been

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made. The antenatal or intrapartum treatment of women with known group B streptococcal colonisation or infection is outside the scope of this review.

INCIDENCE/ PREVALENCE

The overall incidence of neonatal bacterial infections is between one and eight infants per 1000 live births, and between 160 and 300 per 1000 in very low-birthweight infants. [6] Group B streptococcal infection accounts for nearly 50% of serious neonatal bacterial infections. [7] One survey conducted in 2000–2001 estimated that there were 0.72 cases of group B streptococcal infection per 1000 live births in the UK and Ireland and that, of these, 0.48 cases per 1000 live births were early onset, and 0.24 cases per 1000 live births were late-onset infection. [5] Although the estimated incidence of early-onset group B streptococcal infection is 0.5 per 1000 births in the UK overall, incidence varies geographically from 0.21 per 1000 live births in Scotland to 0.73 per 1000 live births in Northern Ireland. [8] Overall, the USA and the UK have relatively similar incidences. [8] One population-based study (427,000 live births) carried out in the USA in 2004 found that the prevalence of early-onset group B streptococcus infections in the USA has decreased from 2.0 per 1000 live births in 1990 to 0.3 per 1000 live births in 2004. [1] This is thought to be a result of the increasing use of maternal intrapartum antibiotic prophylaxis.

AETIOLOGY/ RISK FACTORS

The main risk factor for group B streptococcal infection in the baby is maternal group B streptococcal infection, which is transmitted *in utero*. [9] Bacteria originating in the maternal genital tract can infect the amniotic fluid via intact or ruptured membranes. Neonatal infection can result from fetal aspiration or ingestion of the infected amniotic fluid. [1] Infection of the neonate can also occur during birth, when the neonate moves through the vagina, with systemic infection occurring via the umbilical cord, respiratory tract, or skin abrasions. [1] Other risk factors for group B streptococcal infection include prematurity, low birthweight, prolonged rupture of membranes, intrapartum fever, chorioamnionitis, maternal ethnicity (black and hispanic mothers are at increased risk compared with white mothers), endometritis, heavy maternal colonisation, and frequent vaginal examinations during labour and delivery. [1] [10] [11] [12] [8] Lower maternal age (less than 20 years) and cigarette smoking have been suggested to be associated with an increased risk of early onset group B streptococcal infection, but these associations have not been proven. [11] Other factors that may increase the risk of group B streptococcal infection include lower socioeconomic status, and maternal urinary tract infection during the third trimester (quantitative estimates of the increase in risk are not available). The role of group B streptococcal colonisation of fathers, siblings, and close household contacts in the development of late-onset group B streptococcal infection is unclear. [13] For further details of risk factors for early-onset group B streptococcal infection, see table 1, p 7. Late-onset group B streptococcus sepsis is predominantly associated with serotype 3, with cases evenly distributed, presenting from 8 to 90 days after birth. [8]

PROGNOSIS

Group B streptococcal infection is a frequent cause of neonatal morbidity and mortality. Untreated, mortality from symptomatic early-onset group B streptococcal infection approaches 100%. The combined morbidity and mortality in early-onset group B streptococcal infection exceeds 50%, despite the use of appropriate antibiotics and supportive treatment. [7] In the UK, one study has estimated that early-onset group B streptococcus infection causes more than 40 neonatal deaths and around 25 cases of long-term disability every year, whereas late-onset group B streptococcus infection causes around 16 deaths and 40 cases of long-term disability every year. [1] Even with immediate initiation of antibiotic treatment, mortality with early-onset group B streptococcal infection has been reported to be as high as about 30%. [14] Mortality is particularly high: among babies born prematurely, with low birthweight; after prolonged rupture of membranes; and in babies who develop respiratory distress, sepsis, meningitis, or leukopenia. Even with aggressive interventions, premature infants have a 4–15 times higher risk of mortality compared with term infants with early-onset group B streptococcus disease. [15] One population-based study (427,000 live births) carried out in the USA in 2004 found that the mortality rate for preterm infants with early-onset group B streptococcus infection was 23%. [16] The morbidity rate in late-onset group B streptococcal infection has been estimated at 4–6%. [3] [4] Late-onset group B streptococcus infection typically presents as bacteraemia or meningitis. Less frequently, late-onset group B streptococcus infection may cause septic arthritis, cellulitis, or focal infections such as osteomyelitis. [8] Late-onset group B streptococcal infection tends to have a less fulminant onset and is less often fatal than early-onset infection. [14] One observational study reported a mortality rate of 14% with early-onset group B streptococcal infection compared with 4% with late-onset infection. [3] Infants with a blood pH of below 7.25, birthweight below 2500 grams, absolute neutrophil count of below 1500 cells per mm^3, hypotension, apnoea, and pleural effusion may be at higher risk of mortality. Little information is available concerning long-term sequelae for survivors of neonatal group B streptococcal infection.

AIMS OF INTERVENTION

To prevent morbidity, mortality, and complications associated with group B streptococcal infection, with minimal adverse effects of treatment.

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OUTCOMES Primary outcomes for this review are mortality, development of infection or sepsis, hospital length of stay or rehospitalisation rates, and adverse effects of treatments, such as ototoxicity, renal toxicity, and phototoxicity. Secondary outcomes are sequelae of infection (such as developmental delay or neurological abnormality, seizures, neurological sequelae, renal dysfunction, pulmonary disorders, immune dysfunction, necrotising enterocolitis, and malabsorption).

METHODS *BMJ Clinical Evidence* search and appraisal March 2007. We have included only studies of the prophylactic treatment of neonates with known risk factors for group B streptococcal infection. For this review, sources used for the identification of studies were: Medline 1966 to March 2007, Embase 1980 to March 2007, and The Cochrane Library 2007, issue 1. Additional searches were carried out on the NHS Centre for Reviews and Dissemination (CRD), Database of Abstracts of Reviews of Effects (DARE), Health Technology Assessment (HTA), Turning Research into Practice (TRIP), and NICE websites. Abstracts of studies retrieved in the search were assessed independently by two information specialists. Pre-determined criteria were used to identify relevant studies. Study design criteria included: systematic reviews, RCTs. We included single- and double-blinded studies, as well as all studies described as "open", "open label" or non-blinded. The minimum number of individuals in each trial was 20. The minimum length of follow-up was at least 2 weeks, with any proportion of participants lost to follow-up. In addition, we use a regular surveillance protocol to capture harms alerts from organisations such as the FDA and the UK Medicines and Healthcare products Regulatory Agency (MHRA), which are added to the review as required. We have performed a GRADE evaluation of the quality of evidence for interventions included in this review (see table, p 7).

QUESTION **What are the effects of prophylactic treatment of asymptomatic neonates less than 7 days old with known risk factors for early-onset group B streptococcal infection?**

OPTION ROUTINE ANTIBIOTIC PROPHYLAXIS VERSUS MONITORING AND SELECTIVE TREATMENT FOR EARLY-ONSET GROUP B STREPTOCOCCAL INFECTION

Incidence of infections

Early antibiotic prophylaxis compared with monitoring and selective antibiotic treatment Routine early prophylaxis with penicillin may be no more effective than monitoring and selective antibiotic treatment at reducing the incidence of early-onset group B streptococcal infections in asymptomatic infants born to mothers with risk factors for neonatal infection (very low-quality evidence).

Early antibiotic prophylaxis compared with monitoring and selective antibiotic treatment Routine early prophylaxis with penicillin is no more effective than monitoring and selective antibiotic treatment at reducing the incidence of early-onset group B streptococcal infections in low-birthweight infants and preterm infants (moderate-quality evidence).

Mortality

Early antibiotic prophylaxis compared with monitoring and selective antibiotic treatment Routine early prophylaxis with penicillin may be no more effective than monitoring and selective antibiotic treatment in asymptomatic infants born to mothers with risk factors for neonatal infection (very low-quality evidence).

Early antibiotic prophylaxis compared with monitoring and selective antibiotic treatment Routine early prophylaxis with penicillin is no more effective than monitoring and selective antibiotic treatment at reducing mortality in low-birthweight infants and preterm infants (moderate-quality evidence).

For GRADE evaluation of interventions for neonatal infections: group B streptococcus, see table, p 7 .

Benefits: We found two systematic reviews (search date 2003 [17] and 2004 [18]) of the effect on neonatal infection in newborn infants of prophylactic versus selective antibiotics. The first systematic review, which identified two RCTs, compared the effects of prophylactic antibiotics versus selective antibiotics in asymptomatic infants born to mothers with one or more risk factors for neonatal infection, who had not received intrapartum antibiotics. Maternal risk factors for neonatal infection included: confirmed maternal group B streptococcal infection; fever (at least 38 °C during labour); prelabour or intrapartum rupture of membranes more than 18 hours previously; and chorioamnionitis or amnionitis. [18] The first RCT identified by the review was quasi-randomised, and compared routine early penicillin prophylaxis versus delayed penicillin treatment (50,000–100,000 units/kg/day). [18] [19] The routine-prophylaxis group all received penicillin immediately after birth, whereas the delayed-treatment group received penicillin only if bacterial culture revealed group B streptococcus contamination of the external auditory canal, gastric aspirate, or fetal side of the placenta, with treatment usually starting 24–48 hours after birth. The RCT found that there were no cases of group B streptococcal infection and no neonatal deaths in either group (67 infants born to group B streptococcus-positive mothers; AR for neonatal infection and neonatal mortality: 0/29 [0%] with early prophylactic penicillin *v* 0/38 [0%] with delayed penicillin). [18] [19] The second RCT identified by

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the review compared prophylactic antibiotics (im penicillin G 50,000 units/kg/day and kanamycin 10 mg/kg/day) versus monitoring for 7 days. Infants in the monitoring group received antibiotics only if there was clear evidence of infection. The RCT found no significant difference between treatment regimens in neonatal infection or neonatal mortality (49 term and preterm infants; AR 0/24 [0%] with antibiotic prophylaxis *v* 4/25 [16%] with selective antibiotics; RR 0.12, 95% CI 0.01 to 2.04). [18] There were no neonatal deaths in either group (AR 0/24 [0%] *v* 0/25 [0%]). The second systematic review (search date 2003) assessed the effect of prophylactic intramuscular penicillin (administered within 4 hours of birth) versus placebo or no treatment. [17] The review identified one unblinded RCT, which compared routine early penicillin prophylaxis (im penicillin G 100,000 units/kg every 12 hours for 3 days, given within 60 minutes of birth) versus monitoring for temperature stability, respiratory status, and other markers of sepsis, in low-birthweight, preterm infants. [17] [20] Infants who showed signs of sepsis were given antibiotics (gentamicin plus penicillin or ampicillin). The RCT found no significant difference between treatments in the incidence of early-onset group B streptococcal infection, mortality in infants with early group B streptococcal infection, or overall neonatal mortality (1187 infants with a birthweight between 501 and 2000 g; early-onset group B streptococcal infection: AR 10/589 [1.7%] with penicillin prophylaxis *v* 14/598 [2.3%] with monitoring, RR 0.73, 95% CI 0.32 to 1.62; neonatal mortality in infants with early group B streptococcus infection: AR 6/10 [60.0%] with routine penicillin prophylaxis *v* 8/14 [57.1%] with monitoring, P = 0.39; overall neonatal mortality: AR 49/589 [8.3%] with penicillin prophylaxis *v* 64/598 [10.7%] with monitoring, RR 0.78, 95% CI 0.55 to 1.11). [17] [20]

Harms: The RCTs identified by the first systematic review did not report adverse effects. [18] [19] The second systematic review reported that the included RCT found no local or systemic adverse reactions to penicillin (results not reported). [17] Penicillin may cause allergic reactions, although the risk in neonates is low. [7] [21] [22] [23] [24] The estimated incidence of penicillin-triggered anaphylaxis is 1 in 10,000 people treated, and may be fatal in as many as 10% of occurrences. [8]

Comment: The two small RCTs identified by the first systematic review had weak methods, and may have been underpowered to detect clinically important differences in outcomes. [18] The first RCT identified by the first review found that most neonates became symptomatic during the first hour of life, which supports the opinion that the group B streptococcal infection was transmitted *in utero*. [19] Infections transmitted *in utero* may be less susceptible to single-dose prophylaxis at birth. Three neonates in the RCT identified by the second review (one in the prophylaxis group and two in the monitoring group) [20] tested negative for group B streptococcus on initial blood culture (taken within 1 hour of birth), but developed symptoms of sepsis within 4 hours of birth and had group B streptococcal infection confirmed on repeat culture (taken within 3 and 70 hours of birth).

Clinical guide:

One overview of the antenatal prevention of neonatal group B streptococcal infection, reviewing two studies published in 1990 and 1999, reported that some strains had developed resistance to macrolide and lincosamide antibiotics (erythromycin and clindamycin), and one of these studies reported an increased resistance to clindamycin associated with an increased use of intrapartum antibiotics. [8] Although we found no evidence of ampicillin resistance among group B streptococcus, resistance to macrolides and clindamycin appears to be emerging. Intrapartum antibiotic prophylaxis aims to prevent early-onset neonatal infection, by passage of the antibiotic to the neonate via the placenta and by reducing the bacterial density in the birth canal. [2] This review, however, does not currently examine intrapartum antibiotic prophylaxis given to the mother to prevent group B streptococcal infection in the neonate. The alternative is to administer antibiotics directly to the infant after birth. However, this approach is not commonly used because of the disadvantages of postpartum administration in the infant — including the fact that infection may already be established before birth, causing an added delay in reaching effective serum and tissue antibiotic concentrations in the infant. [1] Routine prophylaxis may encourage the evolution of ampicillin- and penicillin-resistant group B streptococcus organisms. However, studies have not yet shown this to be a significant risk. [22] [23] [25] Judicious and selective use of antibiotics, based on clinical findings and the presence of specific risk factors, may reduce this risk. [23] Avoiding the use of unnecessarily broad-spectrum antibiotics solely for prophylaxis will also help reduce the risk of antibiotic resistance. [26] Prophylaxis may lead to falsely negative body fluid culture results, which may delay the recognition and prompt treatment of group B streptococcus bacteraemia. However, findings from one large non-randomised controlled trial (18,738 neonates) suggested that neonatal penicillin prophylaxis did not result in underdiagnosis of group B streptococcal infection. [21] As a result of increasing peripartum prophylaxis against group B streptococcus in colonised/at-risk mothers, we are beginning to see a shift in pathogens causing neonatal sepsis, with *Escherichia coli* becoming an increasingly prevalent cause of neonatal sepsis.

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OPTION COMPARISON OF DIFFERENT ANTIBIOTICS FOR ROUTINE ANTIBIOTIC PROPHYLAXIS FOR GROUP B STREPTOCOCCAL INFECTION

We found no clinically important results about different antibiotics compared with each other for routine prophylaxis against group B streptococcal infection in neonates with known risk factors for group B streptococcal infection.

For GRADE evaluation of interventions for neonatal infections: group B streptococcus, see **table, p 7** .

Benefits: We found no systematic review or RCTs.

Harms: We found no systematic review or RCTs.

Comment: **Antibiotic resistance:**
See comment on routine antibiotic prophylaxis versus monitoring and selective treatment for group B streptococcal infection, p 3 .

GLOSSARY

Moderate-quality evidence Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Very low-quality evidence Any estimate of effect is very uncertain.

REFERENCES

1. Law MR, Palomaki G, Alfirevic Z, et al. The prevention of neonatal group B streptococcal disease: a report by a working group of the Medical Screening Society. *J Med Screen* 2005;12:2:60–68.
2. Dermer P, Lee C, Eggert J, et al. A history of neonatal group B streptococcus with its related morbidity and mortality in the United States. *J.Pediatr Nurs* 2004;19:357–363.[PubMed]
3. Chung MY, Ko DJ, Chen CC, et al. Neonatal group B streptococcal infection: a 7-year experience. *Chang Gung Med J* 2004;27:501–508.[PubMed]
4. Ho MY, Wu CT, Huang FY, et al. Group B streptococcal infections in neonates: an 11-year review. *Acta Paediatr Taiwan* 1999;40:83–86.[PubMed]
5. Heath PT, Balfour G, Weisner AM, et al. Group B streptococcal disease in UK and Irish infants younger than 90 days. *Lancet* 2004;363:292–294.[PubMed]
6. Lott JW. Neonatal bacterial infection in the early 21st century. *J Perinat Neonat Nurs* 2006;20:62–70.
7. Haft RF, Kasper DL. Group B streptococcus infection in mother and child. *Hosp Pract (Off Ed)* 1991;26:111–122;125–128;133–134.
8. Beal S, Dancer S. Antenatal prevention of neonatal group B streptococcal infection. *Rev Gynaecol Perinatal Practice* 2006;6:218–225.
9. Dillon HC, Khare S, Gray BM. Group B streptococcal carriage and disease: a 6-year prospective study. *J Pediatr* 1987;110:31–36.[PubMed]
10. Zaleznik DF, Rench MA, Hillier S, et al. Invasive disease due to group B streptococcus in pregnant women and neonates from diverse population groups. *Clin Infect Dis* 2000;30:276–281.[PubMed]
11. Schuchat A, Zywicki SS, Dinsmoor MJ, et al. Risk factors and opportunities for prevention of early-onset neonatal sepsis: a multicenter case-control study. *Pediatrics* 2000;105:21–26.[PubMed]
12. Benitz WE, Gould JB, Druzin ML. Risk factors for early-onset group B streptococcal sepsis: estimation of odds ratios by critical literature review. *Pediatrics* 1999;103:e77.[PubMed]
13. Weindling AM, Hawkins JM, Coombes MA, et al. Colonisation of babies and their families by group B streptococci. *BMJ* 1981;283:1503–1505.[PubMed]
14. Knox JM. Group B streptococcal infection: a review and update. *Br J Vener Dis* 1979;55:118–120.[PubMed]
15. Carlough MC, Crowell K. How should we manage infants at risk for group B streptococcal disease? *J Fam Pract* 2003;52:406,408–409.[PubMed]
16. Centers for Disease Control and Prevention. Early-onset and late-onset neonatal group B streptococcal disease—United States, 1996–2004. *MMWR Morb Mortal Wkly Rep* 2005;54:1205–1208.[PubMed]
17. Woodgate P, Flenady V, Steer P. Intramuscular penicillin for the prevention of early onset group B streptococcal infection in newborn infants. In: The Cochrane Library, Issue 1, 2007. Chichester, UK: John Wiley & Sons, Ltd. Search date 2003: primary sources the Oxford Database of Perinatal Trials, MEDLINE, and the Cochrane Central Register of Controlled Trials.
18. Ungerer RLS, Lincetto O, McGuire W, et al. Prophylactic versus selective antibiotics for term newborn infants of mothers with risk factors for neonatal infection. In: The Cochrane Library, Issue 1, 2007. Chichester, UK: John Wiley & Sons, Ltd. Search date 2004: primary sources MEDLINE, EMBASE, LILACS electronic database from the Latin American and Caribbean Information System for Health Sciences, Cochrane Central Register of Controlled Trials, and Centers for Disease Control and Prevention (CDC) protocols and guidelines.
19. Gerard P, Vergote-D'Hulst M, Bachy A, et al. Group B streptococcal colonization of pregnant women and their neonates. Epidemiological study and controlled trial of prophylactic treatment of the newborn. *Acta Paediatr Scand* 1979;68:819–823.[PubMed]
20. Pyati SP, Pildes RS, Jacobs NM, et al. Penicillin in infants weighing two kilograms or less with early-onset group B streptococcal disease. *N Engl J Med* 1983;308:1383–1389.[PubMed]
21. Siegel JD, McCracken GH, Threlkeld N, et al. Single-dose penicillin prophylaxis against neonatal group B streptococcal infections. *N Engl J Med* 1980;303:769–775.[PubMed]
22. Ghaey K, Tolpin M, Schauf V, et al. Penicillin prophylaxis and the neonatal microbial flora. *J Infect Dis* 1985;152:1070–1073.[PubMed]
23. Gotoff SP, Boyer KM. Prevention of early-onset neonatal group B streptococcal disease. *Pediatrics* 1997;99:866–869.[PubMed]
24. Cirko-Begovic A, Vrhovac B. Intensive monitoring of adverse drug reactions in infants and preschool children. *Eur J Clin Pharmacol* 1989;36:63–65.[PubMed]
25. Siegel JD, McCracken GH, Threlkeld N, et al. Single-dose penicillin prophylaxis of neonatal group-B streptococcal disease. *Lancet* 1982;1:1426–1430.[PubMed]
26. Saez-Llorens X, Ah-Chu MS, Castano E, et al. Intrapartum prophylaxis with ceftriaxone decreases rates of bacterial colonization and early-onset infection in newborns. *Clin Infect Dis* 1995;21:876–880.[PubMed]

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TABLE 1 **Risk factors for early-onset group B streptococcal infection**

Study type	Risk factor	Risk for group B streptococcus infection
Systematic review [7]	Maternal infection (group B streptococcus-positive vaginal culture at delivery)	OR 204, 95% CI 100 to 419
	Birthweight 2500 grams or less	OR 7.4, 95% CI 4.5 to 12.1
	Gestation 37 weeks or less	OR 5.8, 95% CI 2.2 to 15.7
	Rupture of membranes more than 18 hours	OR 7.3, 95% CI 4.4 to 12.0
	Intrapartum fever greater than 37.5 °C	OR 4.1, 95% CI 2.2 to 7.6
	Chorioamnionitis	OR 6.4, 95% CI 2.3 to 17.8
Prospective observational study [1]	Maternal ethnicity:	
	Black	RR 2.1, 95% 1.3 to 3.4
	Hispanic	RR 2.0, 95% CI 1.1 to 3.6
Retrospective observational study [2]	Cigarette smoking	OR 1.46, 95% CI 0.52 to 4.11
	Maternal age below 20 years	OR 2.57, 95% CI 0.96 to 8.61
	Frequent (more than 6) vaginal examinations during labour and delivery	OR 2.9, 95% CI 1.1 to 8.0

TABLE **GRADE evaluation of interventions for neonatal infections: group B streptococcus**

Important outcomes	**Development of infection, mortality, hospitalisation, adverse effects**								
Number of studies (participants)	**Outcome**	**Comparison**	**Type of evidence**	**Quality**	**Consistency**	**Directness**	**Effect size**	**GRADE**	**Comment**
What are the effects of prophylactic treatment of asymptomatic neonates less than 7 days old with known risk factors for early-onset group B streptococcal infection?									
2 (116) [18] [19]	Infection incidence	Early prophylaxis antibiotics *v* monitoring/selective antibiotic	4	–3	0	0	0	Very low	Quality points deducted for sparse data, methodological weaknesses and inclusion of quasi-randomised RCT
2 (116) [18] [19]	Mortality	Early prophylaxis antibiotics *v* monitoring/selective antibiotic	4	–3	0	0	0	Very low	Quality points deducted for sparse data, methodological weaknesses and inclusion of quasi-randomised RCT
1 (1184) [17] [20]	Infection incidence	Early prophylaxis antibiotics *v* monitoring/selective antibiotic (low-birthweight infants)	4	–1	0	0	0	Moderate	Quality point deducted for lack of blinding
1 (1184) [17] [20]	Mortality	Early prophylaxis antibiotics *v* monitoring/selective antibiotics (low-birthweight infants)	4	–1	0	0	0	Moderate	Quality point deducted for lack of blinding

Type of evidence: 4 = RCT; 2 = Observational; 1 = Non-analytical/expert opinion. Consistency: similarity of results across studies
Directness: generalisability of population or outcomes
Effect size: based on relative risk or odds ratio

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