

# Antibiotic regimens for suspected early neonatal sepsis (Review)

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**This record should be cited as:**

Mtitimila EI, Cooke RWI. Antibiotic regimens for suspected early neonatal sepsis. *Cochrane Database of Systematic Reviews* 2004, Issue 4. Art. No.: CD004495. DOI: 10.1002/14651858.CD004495.pub2.

**This version first published online:** 18 October 2004 in Issue 4, 2004.

**Date of most recent substantive amendment:** 16 June 2004

## ABSTRACT

**Background**

Early acquired infection may cause severe illness or death in the neonatal period. Prompt treatment with antibiotics has shown to reduce mortality. It is not clear which antibiotic regimen is suitable for treatment of presumed early neonatal sepsis.

**Objectives**

To compare effectiveness and adverse effects of antibiotic regimens for treatment of presumed early neonatal sepsis.

**Search strategy**

The Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 2, 2003), MEDLINE (1966 to August 2003), EMBASE (1980 to September 2003) and ZETOC (1993 to August 2003) databases were searched for possible studies. Pharmaceutical companies were contacted for any unpublished data.

**Selection criteria**

Randomised and quasi-randomised controlled studies comparing antibiotic regimens for the treatment of early neonatal sepsis (both monotherapies and combination therapies).

**Data collection and analysis**

Both reviewers screened abstracts and full reports against the inclusion criteria, appraised the quality of and extracted data from papers. For dichotomous outcomes, treatment effect was expressed as relative risk with 95% confidence interval. Meta-analysis was performed using a fixed effect model.

**Main results**

Two small studies had compared monotherapy with combination therapy. There was no significant difference in mortality, treatment failure or bacteriological resistance.

**Authors' conclusions**

There is no evidence from randomised trials to suggest that any antibiotic regimen may be better than any other in the treatment of presumed early neonatal sepsis. More studies are needed to resolve this issue.

## PLAIN LANGUAGE SUMMARY

Antibiotics for newborn infants that might have blood infections when aged less than 48 hours

Blood infection (sepsis) can make newborn infants seriously ill or even kill them. Sepsis in newborns less than 48 hours old is called early neonatal sepsis. It is usually caused by bacteria passed from the mother. Doctors often give antibiotics if they suspect this dangerous condition because it can be difficult to tell if a newborn has early neonatal sepsis. Certain antibiotics can have significant side effects and their use can also lead to antibiotic resistance, which results in worse infection and possible damage to the intestines, kidneys, liver,

or hearing. The authors of this review studied the medical literature to find out which kinds of antibiotics are best for suspected early neonatal sepsis, and what side effects these antibiotics cause. They found 15 relevant studies, but only two of these studies focused on infants less than 48 hours old. The two studies included a total of 127 newborns and compared newborns who received one antibiotic (monotherapy) to infants who received more than one antibiotic (combination therapy). There were no differences between the two groups. Both of the studies were published in the 1980s and are probably out of date. The authors of this review concluded that there is no evidence for using a particular kind of antibiotic for early neonatal sepsis.

## BACKGROUND

Infection remains a major cause of illness and death in the neonatal period (Freedman 1981; La Gamma 1983; Gladstone 1990). Newborn babies have an immature immune system and therefore may not elicit all signs of infection, and delay in treatment may lead to severe illness or death (Miller 1977; Siegel 1981). Early treatment with antibiotics has been shown to reduce mortality due to sepsis in the neonatal period (Freedman 1981). Early treatment depends on knowledge of risk factors and picking up early signs of infection in this age group (Miller 1977; Siegel 1981). However the signs of infection tend to be non-specific (Philip 1980). Suspected sepsis is therefore defined as any clinical concern for infection to warrant the starting of intravenous antibiotic therapy before laboratory or microbiological evidence of infection.

Early neonatal sepsis is mainly acquired from the mother. Vertical transmission of infection from mother to infant may take place before birth, during labour, or at the time of delivery. Most infants with peripartum acquired sepsis will develop clinical symptoms of sepsis within two days of life. After this period, nosocomial and community acquired infections start to play a bigger role. The bacteria most commonly implicated in early neonatal sepsis are Group B streptococcus and Gram-negative bacilli, and usually exclude coagulase negative staphylococcus. Neonatal intensive care units or special care baby units tend to choose empirical first line antibiotic therapy that will cover both Gram-negative and Gram-positive bacteria. A combination of an aminoglycoside such as gentamicin and a beta-lactam such as penicillin has been the treatment of choice for early neonatal sepsis in many neonatal intensive care units (NICU).

Aminoglycosides may be associated with important adverse effects and they require frequent monitoring of blood levels. Preterm infants have immature organs and therefore may not tolerate some antibiotics as well as term infants. Further to these significant disadvantages, the majority of treated babies do not have proven sepsis. A recent systematic review looking at empirical treatment for febrile neutropaenia in cancer patients found no significant difference between using beta-lactam monotherapy or beta-lactam and aminoglycoside combination, although there was a slight advantage in using third generation cephalosporins (Paul 2002). On the other hand the use of broad spectrum antibiotics in neonates may alter gut flora and may also increase antibiotic resistance in the unit (Kalenic 1993). Alteration of intestinal flora or sterilisation of

the gut with these antibiotics may increase the risk of developing necrotising enterocolitis after stopping treatment (Kenyon 2001).

## OBJECTIVES

The objectives are to compare antibiotic monotherapies, monotherapy with combination therapy, and combination therapies for empirical treatment of suspected early neonatal sepsis (within 48 hours after birth), for both effectiveness and adverse effects.

## CRITERIA FOR CONSIDERING STUDIES FOR THIS REVIEW

### Types of studies

Randomised and quasi-randomised controlled trials, published and unpublished, was considered for this review. For studies published in abstract form, the authors made every attempt to obtain full details. Studies with cluster randomisation were excluded.

### Types of participants

Newborn babies from birth to 48 hours of life, requiring treatment in hospital or community for any suspected neonatal sepsis, regardless of gestation at birth.

### Types of intervention

Comparison between the following intravenous antibiotic regimens:

- a) Any antibacterial monotherapy versus other monotherapy:
  - aminoglycoside
  - beta-lactam
  - beta-lactam plus betalactamase inhibitors
  - glycopeptide
- b) Any antibacterial monotherapy versus combination therapy of any antibiotic listed above
- c) Any antibacterial combination therapy versus another antibacterial combination therapy

### Types of outcome measures

- 1) Primary outcomes:
  - 1) Mortality in the first 28 days of life

- 2) Mortality up to the time of discharge from hospital
  - 3) Treatment failure defined as the need to change empirical antibiotic therapy
  - 4) Bacteriological resistance (isolated organisms resistant to assigned empirical treatment)
- 2) Secondary outcomes:
- 1) Adverse effects:
    - 1) Superinfection (Clinical signs of sepsis with isolation of a new pathogen or the same pathogen with different susceptibility).
    - 2) Colonisation with bacteria resistant to allocated empirical antibiotic in the follow up period
    - 3) Necrotising enterocolitis during or after treatment, Bells criteria 2 (Bell 1978)
    - 4) Serious nephrotoxicity (causing deviation from protocol, e.g. changing antibiotics)
    - 5) Ototoxicity defined as a failed hearing test
    - 6) Serious hepatotoxicity (resulting in deviating from protocol)
    - 7) Anaphylactic reactions in the treated infant (resulting in deviating from protocol)
  - 2) Length of hospital stay

## SEARCH METHODS FOR IDENTIFICATION OF STUDIES

See: methods used in reviews.

The following terms were used to search electronic databases: (antibiot\* OR antimicrob\* OR lactam\*OR aminoglycoside\* OR glycoprotein) AND (sepsis OR septic\* OR Infect\* OR bacter\* OR (gram near negative)). The Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library, Issue 2, 2003) was searched using the above terms with restriction to neonates or infants. MEDLINE search (PubMed 1966 to August 2003) was restricted to Clinical Trials, All Infant, and Human, applying the same search terms. Further searches were performed in EMBASE (1980 to September 2003) for pharmaceutical publications and ZETOC (1993 to August 2003) for abstracts of scientific conferences/symposia. No language restriction was applied. References from identified studies were cross-checked for possible additional studies. The following pharmaceutical companies were contacted for any unpublished data: Aventis, Bristol-Myers, Britania, Glaxo Smith Kline and Roche.

## METHODS OF THE REVIEW

The abstract of each reference generated by the search was examined by the reviewers for inclusion criteria and where relevant a full article was obtained. The relevant studies were reviewed

for methodological quality. Criteria for assessing methodological quality were blinding of randomisation, blinding of intervention, complete follow up, and blinding of outcome measures (The Cochrane Neonatal Review Group Guidelines). The reviewers discussed areas of disagreement and reached a consensus before analysis of the results.

The reviewers extracted data from included studies. For dichotomous outcomes, treatment effect was expressed as relative risk, with 95% confidence interval as a measure of uncertainty within the trial. For outcomes measured on a continuous scale, treatment effect was expressed as mean difference and uncertainty measured by standard deviation. Where appropriate, meta-analyses of pooled data from all contributing trials was performed using a fixed effect model to obtain a typical relative risk or weighted mean difference respectively. Then, in a sensitivity analysis to examine the effect of study quality, the meta-analyses were restricted to high quality studies, with lower quality studies being added on to see if they influenced any outcome effect. A test for heterogeneity was performed. The results from this test were used as a trigger to explore sources of heterogeneity. Subgroup analysis by gestational age, term (>37 weeks) and preterm, with a further subgroup analysis in the preterm group by birth weight (>1500 grams and <1500 grams) was considered. Data was analysed using MetaView 4.2 (Update Software).

## DESCRIPTION OF STUDIES

Fifteen studies were identified as possibly eligible for inclusion. Thirteen of these studies were excluded as the study population included neonates older than 48 hours or even older children (Adelman 1987a; Adelman 1987b; Begue 1997; de Louvois 1992; Fogel 1983; Gokalp 1990; Haffejee 1984; Hall 1988; Hammerberg 1989; Marks 1978; Tessin 1989; Umana 1990; Wiese 1988). The data for early neonatal sepsis could not be separated from that of late onset sepsis in these studies. All studies except one (Gokalp 1990) were randomised and controlled. One study was originally published in French and required translation into English (Begue 1997).

Two small studies (Miall-Allen 1988; Snelling 1983) with a total of 127 neonates, were eligible for inclusion. Both these studies enrolled neonates with suspected sepsis or with risk factors for sepsis. They are described in more detail in the table of included studies.

One study (Miall-Allen 1988) involved 72 neonates up to 48 hours of age and compared monotherapy (Timentin) with combination therapy (Piperacillin and Gentamicin). If there was only a weak suspicion of sepsis, one antibiotic alone, Piperacillin, was used in the combination therapy arm. Most of the neonates in the control group, however, received a combination therapy of piperacillin and gentamicin (32/40). This study also looked at late onset sepsis but these data were separable.

The other study included in the analysis (Snelling 1983) involved 55 neonates receiving either monotherapy (Ceftazidime) or combination therapy (Benzylpenicillin and Gentamicin). The population was neonates up to 48 hours old.

Both studies looked at mortality, treatment failure and bacteriological resistance. Neither study compared adverse effects. One study (Miall-Allen 1988) did include hypersensitivity in the protocol as a reason to stop intervention therapy (Timentin).

## METHODOLOGICAL QUALITY

The two studies included in the analysis were both randomised and controlled (Miall-Allen 1988; Snelling 1983). The method of allocation and concealment was not stated in both publications. The authors did not mention any blinding of interventions or outcomes. Contact with the authors of the study by Snelling et al (Snelling 1983) established that allocation was by sealed envelopes from pharmacy but there was no blinding of interventions and outcomes. Both studies looked at short term outcomes and accounted for all neonates in intervention and control groups.

## RESULTS

### MONOTHERAPY VS MONOTHERAPY

No studies were identified for this comparison.

### MONOTHERAPY VS COMBINATION THERAPY

Two studies were identified for this comparison (Miall-Allen 1988, Snelling 1983).

#### *Primary outcomes:*

#### 1) Mortality in the first 28 days of life

There was no death in intervention groups in one study (Snelling 1983). There was a total of 8 deaths in the other study (Miall-Allen 1988). Three deaths occurred in the monotherapy group (Timentin) and 5 deaths were in the combination therapy group (Piperacillin and Gentamicin). On meta-analysis, there was no significant difference in mortality to 28 days (typical relative risk 0.75 and 95% confidence interval 0.19 to 2.9)].

#### 2) Mortality up to the time of discharge from hospital

No data were available.

#### 3) Treatment failure defined as the need to change empirical antibiotic therapy

There were no instances of treatment failure in either group in one study (Snelling 1983). There were 2 failures in the monotherapy and 2 in the combination therapy groups in the other study (Miall-Allen 1988). On meta-analysis, there was no statistical difference

in treatment failure in the two groups (typical relative risk 1.25 and 95% confidence interval 0.19 to 8.39)]

#### 4) Bacteriological resistance (isolated organisms resistant to assigned empirical treatment)

Both studies found no bacteria resistant to assigned empirical treatment although some organism were resistant to non-assigned empirical antibiotic.

#### *Secondary outcomes:*

None of the studies evaluated the secondary outcomes of superinfection, bacteria colonisation, necrotising enterocolitis, nephrotoxicity, ototoxicity, hepatotoxicity, anaphylaxis and hospital stay.

Data were not available for any subgroup analysis by gestational age and birthweight.

## COMBINATION THERAPY VS COMBINATION THERAPY

No studies were identified for this comparison.

## DISCUSSION

This review found only two studies that specifically compared antibiotic regimens for suspected early neonatal sepsis. Both studies took place more than 15 years ago and some of the antibiotics used may no longer be in use in neonatal settings at present. The studies were randomised. There was no blinding of interventions and outcome measurements, and the outcomes were short term. These studies did not meet all the criteria set for methodological quality in this review.

There is no evidence from randomised trials at present to suggest that any antibiotic regimen is superior than another in the treatment of suspected early neonatal sepsis. Despite their wide use in the neonatal setting, antibiotics have not been broadly compared for efficacy and adverse effects in the treatment of suspected early neonatal sepsis. This is evident in the lack of studies in this review which have addressed this issue. There was a lack of positive response from drug companies.

Early neonatal sepsis is mainly acquired from maternal organisms. Knowledge of these organisms may help people involved in the care of neonates to choose the right antibiotic for treating sepsis. However, most neonates with suspected infection are not actually infected. Targeting maternal organisms can result in a broad spectrum antibiotic usage and this may risk emergency of resistant organisms in the neonatal unit. While evidence is lacking, the choice of antibiotics for suspected early neonatal sepsis may be guided by the spectrum of organisms from microbiological surveillance cultures, for example the prevalence of Group B Streptococcus and Gram negative organisms. With this approach there are still unanswered questions of adverse effects. Some antibiotics may be

more toxic than others in the early neonatal period or in the very premature neonates and others may selectively increase bacterial resistance or colonisation.

This review did not look at other issues which may influence the choice of antibiotics such as limitation of resources or monitoring drug levels.

## AUTHORS' CONCLUSIONS

### Implications for practice

There is no evidence from randomised clinical trials in favour of any particular antibiotic regimen for the treatment of presumed early neonatal sepsis.

### Implications for research

This review has highlighted lack of studies that compared antibiotic regimens for treating suspected early neonatal sepsis. Studies are needed to compare antibiotic monotherapies and various combination therapies for treating suspected early neonatal sepsis.

Early neonatal sepsis is different from late neonatal sepsis as organisms involved are more likely to be of maternal origin. Apart from efficacy, these studies should also compare significant short and long term adverse effects. Hearing loss in premature infants may be due to prematurity but equally it may be as a consequence of therapy.

## POTENTIAL CONFLICT OF INTEREST

The reviewers have no affiliations with any organisation with a financial interest in this topic.

## SOURCES OF SUPPORT

### External sources of support

- No sources of support supplied

### Internal sources of support

- No sources of support supplied

## REFERENCES

### References to studies included in this review

#### Miall-Allen 1988 *{published data only}*

Miall-Allen VM, Whitelaw AGL, Darrell JH. Ticarcillin plus clavulanic acid (Timentin) compared with standard antibiotic regimens in the treatment of early and late neonatal infection. *The British Journal of Clinical Practice* 1988;**42**:273–9.

#### Snelling 1983 *{published data only}*

Snelling S, Hart CA, Cooke RW. Ceftazidime or gentamicin plus benzylpenicillin in neonates less than forty-eight hours old. *Journal of Antimicrobial Chemotherapy* 1983;**12**:353–6.

### References to studies excluded from this review

#### Adelman 1987a

Adelman RD, Wirth F, Rubio T. A controlled study of the nephrotoxicity of mezlocillin and gentamicin plus ampicillin in the neonate. *The Journal of Pediatrics* 1987;**111**:888–93.

#### Adelman 1987b

Adelman RD, Wirth F, Rubio T. A controlled study of the nephrotoxicity of mezlocillin and amikacin in the neonate. *American Journal of Disease in Childhood* 1987;**141**:1175–8.

#### Begue 1997

Begue P, Astruc J, Francois P, Floret D. Comparison of ceftriaxone and cefotaxime in severe pediatric bacterial infections: a multicentric study [Evaluation de la ceftriaxone et du cefotaxime dans l'infection bacterienne severe en pediatrie: etude multicentrique]. *Medecine Et Maladies Infectieuses* 1997;**27**:300–6.

#### de Louvois 1992

de Louvois J, Dagan R, Tessin I. A comparison of ceftazidime and aminoglycoside based regimes as empirical treatment in 1316 cases of suspected sepsis in the newborn. *European Journal of Pediatrics* 1992;**151**:876–84.

#### Fogel 1983

Fogel D, Farfel L, Miskin A, Mogilner BM. Comparison between the combination of azlocillin-gentamicin and ampicillin-gentamicin in the treatment of nursery population. *Israel Journal of Medical Sciences* 1983;**19**:1009–15.

#### Gokalp 1990

Gokalp AS, Oguz A. Neonatal sepsis in Turkey: the comparison between penicillin plus aminoglycoside and ampicillin plus third-generation cephalosporin chemotherapies. *Journal of Tropical Pediatrics* 1990;**36**:200.

#### Haffejee 1984

Haffejee IE. A therapeutic trial of cefotaxime versus penicillin-gentamicin for severe infections in children. *Journal of Antimicrobial Chemotherapy* 1984;**14**:147–52.

#### Hall 1988

Hall MA, Ducker DA, Lowes JA, McMichael J, Clarke P, Rowe D, Gordon A, Cole DS. A randomised prospective comparison of cefotaxime versus netilmicin/penicillin for treatment of suspected neonatal sepsis. *Drugs* 1988;**35**:169–77.

#### Hammerberg 1989

Hammerberg O, Kurnitzki C, Watts J, Rosenbloom D. Randomised trial using piperacillin versus ampicillin and amikacin for treatment

of premature neonates with risk factors for sepsis. *European Journal of Clinical Microbiology and Infectious Diseases* 1989;**8**:241–4.

**Marks 1978**

Marks S, Marks MI, Dupont C, Hammerberg S. Evaluation of three antibiotic programs in newborn infants. *Canadian Medical Association Journal* 1978;**118**:659–62.

**Tessin 1989**

Tessin I, Trollfors B, Thiringer K, Thorn Z, Larsson P. Concentration of ceftazidime, tobramycin and ampicillin in the cerebrospinal fluid of the newborn infant. *European journal of Pediatrics* 1989;**148**:679–81.

**Umana 1990**

Umana MA, Odio CM, Castro E, Salas JL, McCracken GH Jr. Evaluation of aztreonam and ampicillin vs amikacin and ampicillin for the treatment of neonatal bacterial infection. *The Pediatrics Infectious Disease Journal* 1990;**9**:175–80.

**Wiese 1988**

Wiese G. Treatment of neonatal sepsis with ceftriaxone/gentamicin and with azsclillin/gentamicin: a clinical comparison of efficacy and tolerability. *Chemotherapy* 1988;**34**:158–63.

**Additional references**

**Bell 1978**

Bell MJ, Ternberg JL, Feigin RD, Keating JP, Marshall R, Barton L, Brotherton T. Neonatal necrotizing enterocolitis. Therapeutic decisions based upon clinical staging. *Annals of Surgery* 1978;**187**:1–7.

**Freedman 1981**

Freedman RM, Ingram DI, Gross I, Ehrenkranz RA, Warshaw JB, Baltimore RS. A half century of neonatal sepsis at Yale: 1928 to 1978. *American Journal of Diseases of Children* 1981;**135**:140–4.

**Gladstone 1990**

Gladstone IM, Ehrenkranz RA, Edberg SC, Baltimore RS. A ten-year review of neonatal sepsis and comparison with the previous 50 year experience. *The Pediatric Infectious Disease Journal* 1990;**9**:819–25.

**Kalenic 1993**

Kalenic S, Francetic I, Polak J, Zele-Starcevic L, Bencic Z. Impact of ampicillin and cefuroxime on bacterial colonization and infection in patients on a neonatal intensive care unit. *The Journal of Hospital Infection* 1993;**23**:35–41.

**Kenyon 2001**

Kenyon SL, Taylor DJ, Tarnow-Mordi W, ORACLE Collaborative Group. Broad-spectrum antibiotics for preterm, prelabour rupture of fetal membranes: the ORACLE I randomised trial. *The Lancet* 2001;**357**:979–88.

**La Gamma 1983**

La Gamma EF, Drusin LM, Mackles AW, Machalek S, Auld PA. Neonatal infections. An important determinant of late NICU mortality in infants less than 1,000 g at birth. *American Journal of Diseases of Children* 1983;**137**:838–41.

**Miller 1977**

Miller ME. Host defenses in the human neonate. *Pediatric Clinics of North America* 1977;**24**:413–23.

**Paul 2002**

Paul M, Soares-Weiser K, Grozinsky S, Leibovici L. Beta-lactam versus Beta-lactam-aminoglycoside combination therapy in cancer patients with neutropaenia (Cochrane Review). *The Cochrane Library* 2002, Issue 2.

**Philip 1980**

Philip AG, Hewitt JR. Early diagnosis of neonatal sepsis. *Pediatrics* 1980;**65**:1036–41.

**Siegel 1981**

Siegel JD, McCracken GH Jr. Sepsis neonatorum. *New England Journal of Medicine* 1981;**304**:642–7.

**T A B L E S**

**Characteristics of included studies**

Study	Miall-Allen 1988
Methods	Randomised controlled study. Method and blinding of randomisation are unclear. Blinding of intervention and outcome measurements is not mentioned. They looked at short term outcomes and accounted for all neonates in the study groups.
Participants	72 neonates with suspected infection up to 48 hours of age
Interventions	Timentin 80mg/kg 12 hourly or 8 hourly if >2kg (n=32) vs. Piperacillin 100mg/kg 12hourly (8) and Gentamicin 2.5mg/kg 12hourly (n=40)
Outcomes	Mortality, treatment failure and bacteriological resistance
Notes	8 control neonates received piperacillin only because they were deemed to be not seriously ill.
Allocation concealment	B – Unclear

Study	Snelling 1983
Methods	Randomised. Allocation concealment was by sealed envelopes. Blinding of intervention and outcome measurements is not mentioned. They looked at short term outcomes and accounted for all neonates in the study groups.
Participants	55 neonates with suspected serious infection within 48 hours of birth.
Interventions	Ceftazidime 50mg/kg 12 hourly (n=31) vs. Gentamicin 3mg/kg plus benzylpenicillin 15mg/kg 12 hourly (n=24) .
Outcomes	Mortality, treatment failure and bacteriological resistance.
Notes	The authors were contacted for method of allocation/concealment
Allocation concealment	A – Adequate

### Characteristics of excluded studies

Study	Reason for exclusion
Adelman 1987a	We could not separate neonates with suspected early onset of sepsis from those with late onset.
Adelman 1987b	We could not separate early from late sepsis group
Begue 1997	We could not separate early from late sepsis group
Fogel 1983	We could not identify the group of neonates less than 24 hours age randomised in this study.
Gokalp 1990	We could not separate early from late sepsis group
Haffejee 1984	We could not separate early from late sepsis group. This study included children older than one month.
Hall 1988	We could not separate early from late sepsis group
Hammerberg 1989	We could not separate early from late sepsis group
Marks 1978	We could not separate early from late sepsis group
Tessin 1989	Ineligible outcome measures (Cerebrospinal fluid concentrations of antibiotics)
Umana 1990	We could not separate early from late sepsis group
Wiese 1988	We could not separate early from late sepsis group
de Louvois 1992	We could not separate early from late sepsis group

## ANALYSES

### Comparison 02. Monotherapy vs Combination Therapy

Outcome title	No. of studies	No. of participants	Statistical method	Effect size
01 Mortality in the first 28 days of life	2	127	Relative Risk (Fixed) 95% CI	0.75 [0.19, 2.90]
02 Treatment failure	2	127	Relative Risk (Fixed) 95% CI	1.25 [0.19, 8.39]

## INDEX TERMS

### Medical Subject Headings (MeSH)

Anti-Bacterial Agents [\*therapeutic use]; Infant, Newborn; Randomized Controlled Trials; Sepsis [\*drug therapy]

Antibiotic regimens for suspected early neonatal sepsis (Review)

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**MeSH check words**

Humans

**COVER SHEET**

<b>Title</b>	Antibiotic regimens for suspected early neonatal sepsis
<b>Authors</b>	Mtitimila EI, Cooke RWI
<b>Contribution of author(s)</b>	This review was conceived, designed and coordinated by Edward Mtitimila. He developed the search strategies and undertook the searches. Richard Cooke and Edward Mtitimila screened abstracts and papers against the inclusion criteria, appraised the quality of and extracted data from papers. Data entry into RevMan was carried out by Edward Mtitimila. Both reviewers wrote the review.
<b>Issue protocol first published</b>	2003/4
<b>Review first published</b>	2004/4
<b>Date of most recent amendment</b>	03 February 2007
<b>Date of most recent SUBSTANTIVE amendment</b>	16 June 2004
<b>What's New</b>	Information not supplied by author
<b>Date new studies sought but none found</b>	Information not supplied by author
<b>Date new studies found but not yet included/excluded</b>	Information not supplied by author
<b>Date new studies found and included/excluded</b>	Information not supplied by author
<b>Date authors' conclusions section amended</b>	Information not supplied by author
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<b>DOI</b>	10.1002/14651858.CD004495.pub2
<b>Cochrane Library number</b>	CD004495
<b>Editorial group</b>	Cochrane Neonatal Group
<b>Editorial group code</b>	HM-NEONATAL

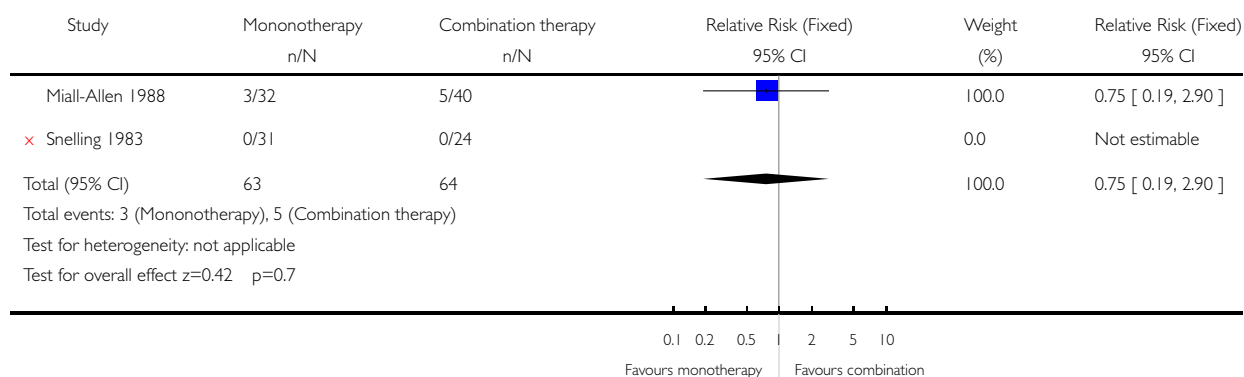
## GRAPHS AND OTHER TABLES

### Analysis 02.01. Comparison 02 Monotherapy vs Combination Therapy, Outcome 01 Mortality in the first 28 days of life

Review: Antibiotic regimens for suspected early neonatal sepsis

Comparison: 02 Monotherapy vs Combination Therapy

Outcome: 01 Mortality in the first 28 days of life



### Analysis 02.02. Comparison 02 Monotherapy vs Combination Therapy, Outcome 02 Treatment failure

Review: Antibiotic regimens for suspected early neonatal sepsis

Comparison: 02 Monotherapy vs Combination Therapy

Outcome: 02 Treatment failure

