Home intravenous antibiotics for cystic fibrosis

Review information

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Dates

Assessed as Up-to-date:	03 December 2009
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Protocol First Published:	Issue 1, 2000
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What's new

Date / Event	Description
03 December 2009 Updated	A search of the Group's Cystic Fibrosis Trials Register did not identify any trials eligible for inclusion in this review.

History

Date / Event	Description
04 February 2009 Amended	Contact details for both authors updated.
07 April 2008 Amended	Converted to new review format. The plain language summary has been updated in line with current guidance from the Cochrane Collaboration. The methods section 'Data collection and analysis' and the section on 'Risk of bias' of the included study have been updated.
07 April 2008 Updated	A search of the Group's Cystic Fibrosis Trials Register found one new trial which is only available in Swedish and has been listed as 'Awaiting classification' until a translation can be obtained. Additional searches by the authors identified nine studies, none of which were eligible for inclusion in the review.
07 April 2008 New citation: conclusions not changed	There has been a change in lead author - Dr Oscar Asensio has stepped down and Dr Albert Balaguer has taken on lead authorship. The original co-authors have also stepped down and Dr Javier González de Dios is the new co-author.
14 February 2007 Updated	One new reference was identified by the search (Romano 1991) and has been excluded.
19 August 2005 Updated	Change of lead author from Dr Teresa Marco to Dr Oscar Asensio. A new search was run in April 2005, but no new references have been found. Some minor amendments have been made in light of comments from the Group's medical statistician. The 'Types of outcome measures' have been divided into primary and secondary outcome measures as per guidance received from the editorial base.
19 May 2004 Updated	The Group's trials register was searched in April 2004. One new trial has been identified (Amelina 2000) which has been published as an abstract. This trial is currently listed under 'Studies awaiting assessment'. The review is currently being updated in light of comments from the Cystic Fibrosis and Genetic Disorders Group's medical statistician.
13 November 2002 Updated	The Group's trials register was searched in April 2002. Excluded Studies One study - Ramström 2000 has been incorporated into the review. Included Studies An additional reference [abstract] was added to the existing Wolter 1997 study ID. Studies Awaiting Assessment

	An additional reference [abstract] was added to the existing Klettke 1999 study ID.

Abstract

Background

Recurrent endobronchial infection in cystic fibrosis (CF) requires treatment with intravenous antibiotics for several weeks usually in hospital, affecting health costs and quality of life for patients and their families.

Objectives

To determine whether home intravenous antibiotic therapy in CF is as effective as inpatient intravenous antibiotic therapy and if it is preferred by individuals or families or both.

Search methods

We searched the Cochrane Cystic Fibrosis and Genetic Disorders Group Trials Register comprising references identified from comprehensive electronic database searches and handsearches of relevant journals and abstract books of conference proceedings.

Most recent search of the Group's Trials Register: 02 December 2009.

Selection criteria

Randomized and quasi-randomized controlled studies of intravenous antibiotic treatment for adults and children with CF at home compared to in hospital.

Data collection and analysis

The authors independently selected studies for inclusion in the review, assessed methodological quality of each study and extracted data using a standardised form.

Results

Seventeen studies were identified by the searches. Only one study could be included which reported results from 17 participants aged 10 to 41 years with an infective exacerbation of *Pseudomonas aeruginosa*. All their 31 admissions (18 hospital and 13 at home after two to four days of hospital treatment) were analysed as independent events. Outcomes were measured at 0, 10 and 21 days after initiation of treatment. Home participants underwent fewer investigations than hospital participants ($P < 0.002$) and general activity was higher in the home group. No significant differences were found for clinical outcomes, adverse events, complications or change of intravenous lines,or time to next admission. Home participants received less low-dose home maintenance antibiotic.

Quality of life measures showed no significant differences for dyspnoea and emotional state, but fatigue and mastery were worse for home participants, possibly due to a higher general activity and need of support. Personal, family, sleeping and eating disruptions were less important for home than hospital admissions.

Home therapy was cheaper for families and the hospital. Indirect costs were not determined.

Authors' conclusions

Current evidence is restricted to a single randomized clinical trial. It suggests that, in the short term, home therapy does not harm individuals, entails fewer investigations, reduces social disruptions and can be cost-effective. There were both advantages and disadvantages in terms of quality of life. The decision to attempt home treatment should be based on the individual situation and appropriate local resources. More research is urgently required.

Plain language summary

Intravenous antibiotics given at home for people with cystic fibrosis

Cystic fibrosis (CF) is a serious genetic disease linked with recurrent lung infections. As a result of these, the person's lung disease becomes progressively worse. Lung infections are often treated with intravenous (IV) antibiotics in hospital for a number of weeks. This is costly and disrupts the life of people with CF. Treatment can be received at home if individuals and their carers are given enough training and support. We looked for randomised controlled trials which compared IV antibiotic treatment in hospital with treatment at home. We found one study of 17 people. There were no differences for clinical outcomes, adverse events, or complications linked to IV treatment. People at home were more tired and found the treatment more difficult to master. This may be due to them being more active and needing more support. Home therapy was cheaper for families and the hospital. There were no details about indirect costs. We conclude that treatment at home does not harm people in the short term and does reduce social disruption. However, the decision in favour of this option must be made on an individual basis. The evidence is very limited and more research is strongly needed to recommend its use.

Background

Description of the condition

Cystic fibrosis (CF) is the most common life-threatening autosomal recessive genetic disorder in Caucasians (Kosorok 1996). It is characterised by recurrent endobronchial infection leading to progressive pulmonary deterioration. This colonisation of the airways occurs, firstly with *Staphylococcus aureus*, and then with *Pseudomonas aeruginosa (P. aeruginosa)* (Davis 1996) and requires treatment with combination antibiotics.

Description of the intervention

Most of these combination antibiotics need to be given intravenously for several weeks (David 1986) and, until recently, were generally required to be given as an inpatient. As the lung disease progresses, individuals may require more frequent hospitalizations. This greatly increases healthcare costs and may adversely affect the individual's quality of life.

Home IV therapy with antibiotics are usually commenced for exacerbations of chest disease. They can begin in hospital or as an outpatient and require the training of individuals and their carers and suitable medical support.

How the intervention might work

Home intravenous (IV) therapy in CF is a response to both increasing demand for hospital beds, and the need for treatment to interfere as little as possible with the individual's normal lifestyle and quality of life. Home IV therapy may also cut costs by avoiding hospital admission or reducing length of stay. Staying in hospital may be hazardous for people with CF because of the risk of contracting *Burkholderia cepacia (B. cepacia)*, methicillin-resistant *Staphylococcus aureus* (MRSA), and other multiresistant organisms (Jones 2003).

Why it is important to do this review

It is not known if people receiving home IV have better or equivalent health outcomes compared with people receiving inpatient care, whether the provision of home IV results in reduction in costs to the health service (Bosworth 1997; Davis 1990; Donati 1987; Pond 1994; Rucker 1974; Strandvik 1992), or whether people prefer this form of treatment.

Objectives

To determine whether home IV antibiotic therapy in CF is:

1. as effective as inpatient IV antibiotic therapy, for exacerbation of lung disease;
2. preferred by individuals and/or families to inpatient IV antibiotic therapy.

Methods

Criteria for considering studies for this review

Types of studies

Randomized and quasi-randomized controlled studies.

Types of participants

The review includes adults and children with CF diagnoses defined clinically and by sweat or genetic testing, including all ages and all degrees of severity, and who receive IV antibiotic treatment.

Types of interventions

Studies comparing home with acute hospital inpatient antibiotic therapy for people with CF requiring IV antibiotic treatment. This includes interventions where the entire course of IV antibiotic is administered at home, either by the individual, their carer, or a healthcare professional, as well as interventions where home IV follows an inpatient stay but the majority of IV therapy was delivered at home. It includes home IV where there is little or no contact with healthcare professionals, as well as home IV where a variety of methods of support is offered by healthcare professionals, including home visits and administration of the IV injections or infusions. Any duration of antibiotic courses were considered.

Studies were stratified by those where treatment was initiated in hospital but completed at home, or those where all treatment was given at home, and by severity of exacerbations.

Types of outcome measures

Primary outcomes

1. Lung function
   a. Change in percent predicted or absolute change in forced expiratory volume in one second (FEV_1)
   b. Change in forced vital capacity (FVC)
   c. Any other lung function parameters
2. Lung infection (conversion of sputum from culture positive to culture negative, reduction in colony forming units (CFU) counts for *P. aeruginosa* and other micro-organisms)
3. Improvement of clinical score, by validated instruments

Secondary outcomes

1. Weight gain
   a. absolute weight gain
   b. change in percentage of ideal body weight
   c. weight standard deviation score
2. Quality of life measures examined in participants or carers or both

3. Clinical complications (this does not include adverse events which are specified below)
    a. acquisition of new microbial infection with *B. cepacia*, MRSA or other organism
    b. haemoptysis
    c. pneumothorax
    d. acute distal intestinal obstruction syndrome
    e. development of diabetes mellitus during the follow-up period
    f. any other clinical complication
4. Re-admissions (unplanned re-admissions and administration of additional antibiotic courses within three months, and within any time period during the follow-up period, and time to next admission or next course of antibiotic treatment)
5. Mortality
6. Cost
    a. direct: stay in hospital, visits of and to a general practitioner or hospital, community nursing services, drug costs, etc.
    b. indirect: work time lost for patients or parents, travelling expenses to or from hospital, any other support (for example, domestic aids), etc.
    c. hospital days saved from the provision of treatment at home: days on treatment with home IV that would otherwise have been spent in hospital
7. Duration of treatment
    a. Less than 10 days
    b. 10 days or more
8. Adverse effects
    a. those related to the antibiotics including gastrointestinal symptoms, reduced appetite, abdominal bloating, urticaria and itching
    b. those associated with IV treatment such as thrombophlebitis, infection, number of change of IV lines required
    c. other adverse effects, if reported, will also be examined
9. Compliance with other treatment measures (such as chest physiotherapy, nutritional regimens etc., if measured, by objective or subjective criteria)

We planned to group outcome data into those measured at the end of the antibiotic course, one, three, six, twelve months and annually thereafter. If outcome data were recorded at other time periods then consideration would given to examining these as well.

Search methods for identification of studies

Electronic searches

Relevant studies were identified from the Group's Cystic Fibrosis Trials Register using the terms: antibiotics AND home.

The Cystic Fibrosis Trials Register is compiled from electronic searches of the Cochrane Central Register of Controlled Trials (Clinical Trials) (updated each new issue of *The Cochrane Library*), quarterly searches of MEDLINE, a search of EMBASE to 1995 and the prospective handsearching of two journals - *Pediatric Pulmonology* and the *Journal of Cystic Fibrosis*. Unpublished work is identified by searching the abstract books of three major cystic fibrosis conferences: the International Cystic Fibrosis Conference; the European Cystic Fibrosis Conference and the North American Cystic Fibrosis Conference. For full details of all searching activities for the register, please see the relevant sections of the Cystic Fibrosis and Genetic Disorders Group Module.

Date of the most recent search of the Group's Cystic Fibrosis Trials Register: 02 December 2009.

Searching other resources

The authors searched the abstracts books of all Spanish Conferences on CF and the European Conference in Stockholm (2000).

Data collection and analysis

Selection of studies

For the original review, three authors (Marco T, Gracia de J, Serra C) independently selected the studies to be included in the review. For the update, two authors (Balaguer A, González de Dios J) independently sought new studies and assessed them for inclusion in the review. Minor disagreements were resolved by discussion.

Data extraction and management

Each author independently extracted data using a standardised form, adapted from that proposed by the Cochrane Cystic Fibrosis and Genetic Disorders Group. Any disagreements were resolved by discussion.

Assessment of risk of bias in included studies

For the original review, three authors (Marco T, Gracia de J, Serra C) independently assessed the methodological quality of each study, based on a method described by Schulz (Schulz 1995). In particular, the authors examined details of the randomization method and allocation concealment (categorised as adequate, unclear or inadequate), the level of blinding, whether intention-to-treat analyses were possible from the available data and if the number of participants lost to follow up or subsequently excluded from the study was recorded.

For the update, two authors (Balaguer A, González de Dios J) re-assessed the methodological quality of the included studies using criteria described by Jüni (Jüni 2001). In particular they looked into internal validity by evaluating possible selection bias, performance bias, detection bias and attrition bias. There were no disagreements between the authors.

Measures of treatment effect

For binary outcomes we planned to calculate a pooled estimate of the treatment effect for each outcome across studies.

For continuous outcomes, we planned to record either mean change from baseline for each group or mean post-treatment or intervention values and the standard deviation or standard error for each group. We planned to calculate a pooled estimate of treatment effect by calculating the weighted mean difference.

For summarizing time-to-event data, like time to next admission or time to next course of antibiotic treatment, we planned to use methods of survival analysis and express the intervention effect as a hazard ratio.

Unit of analysis issues

The adjusted effect sizes computed for cross-over trials, and the usual ones computed for parallel trials, were planned to be combined by means of the inverse-variance method, under a random-effects model.

Dealing with missing data

We planned to seek data for an intention-to-treat analysis, that is, data on the number of participants by allocated treated group, irrespective of compliance and whether or not the participant was later thought to be ineligible or otherwise excluded from treatment or follow up.

Assessment of heterogeneity

If there had been sufficient studies included in the review, we would have tested for heterogeneity between study results with the index I^2 (Higgins 2003). We would have considered that values over 30% indicate substantial heterogeneity. If clinically relevant and statistically signicant heterogeneity were detected, causes of heterogeneity were have been sought a posteriori.

Assessment of reporting biases

We have assessed whether the primary authors reported data for all the outcomes and timepoints they stated they had measured during the trial.

We have planned to use a funnel plot to explore publication bias (Egger 1997; Macaskill 2001).

Data synthesis

We planned to use both a random-effects model (DerSimonian 1986) and a fixed-effect model (DeMets 1987). In case of discrepancy between the two models we have reported both results; otherwise we have reported only the results from the fixed-effect model.

Subgroup analysis and investigation of heterogeneity

In order to investigate any heterogeneity identified, we planned to carry out subgroup analyses based on the different indications for IV antibiotics (exacerbation or elective), the type of programme (without paramedical support) and partly at home versus completely at home.

Sensitivity analysis

We planned to perform a sensitivity analysis based on the methodological quality of the studies, excluding quasi-randomized studies.

Results

Description of studies

Results of the search

Seventeen studies were identified by the searches. Only one study reporting results from a total of 17 participants met our inclusion criteria and was included in the review (Wolter 1997). A total of fifteen studies were excluded (see below). One study has only been published in Swedish and is currently listed as 'Awaiting classification' until we are able to obtain a translation of this and assess its eligibility for inclusion in the review (Hjelte 1988).

Included studies

Summary details of the only included study are given in the Characteristics of included studies table.

The included study was carried out in two hospitals in Brisbane (Australia) (Wolter 1997). This study provides data from a total of 17 adolescents and adults with CF, with a respiratory infective exacerbation by *P. aeruginosa*. No definition criteria are provided for the diagnosis of CF. A respiratory exacerbation was defined as an increase in dyspnoea with or without increased sputum production, fever or a drop in forced expiratory volume in one second (FEV_1). All participants had colonisation of their sputum with *P. aeruginosa*. Those with unstable disease, dwelling outside the city, a history of non-compliance, or an inability to learn treatment techniques were excluded. Participants were randomized in blocks of four, by sealed envelope, to home or hospital therapy. After initial randomization, those with recurrent episodes received alternated treatment arms.

The antibiotic therapy for both arms was ceftazidime 2 g every 12 hours and tobramycin 4 to 6 mg/kg daily as a single bolus for a minimum of 10 days. All participants received physiotherapy twice daily, plus 20 minutes of aerobic exercise. Participants assigned to home therapy spent two to four days in hospital before discharge and were taught how to prepare and administer their own IV antibiotics. Assessment days were: admission (Day 0), Day 10 of therapy and 10 days after cessation of IV therapy and treatment (Rx).

Excluded studies

Fifteen studies were excluded for a variety of reasons, as listed in the table Characteristics of excluded studies.

Two studies potentially could meet our inclusion criteria (Amelina 2000; Davis 1990). In both cases we have contacted the authors and we could not get further information and so they are currently listed as excluded. Nine studies were not randomized (Donati 1987; Esmond 2006; Girón 2004; Girón 2006; Graf 1997; Horvais 2006; Nazer 2006; Riethmueller 2002; Thornton 2005). One study was an observational retrospective study (Bosworth 1997). A further study compared two different ways of preparing antibiotics, but did not compare the administration of them at home to hospital (Ramström 2000). Another study compared two oral antibiotic treatment regimens both given at home (Romano 1991). The final study was not suitable for inclusion because the participants had a range of conditions, not just CF, and we were not able to obtain individual data for just the participants with cystic fibrosis from the authors of the study after contacting them (Wolter 2004).

Risk of bias in included studies

We assessed the methodological quality of the included randomized controlled study (Wolter 1997) based on criteria discussed by Jüni (at most recent update stage) and Schulz (for the original review) (Jüni 2001; Schulz 1995). Despite the quality of the study, some methodological problems were identified as listed below. Some of them may affect its internal validity, some others limit us for generalisation to other circumstances. As a result of these limitations, we have attempted only narrative synthesis at this stage.

Allocation

After initial randomization in blocks of four, participants were alternatively assigned to home or hospital arms for subsequent episodes of respiratory infections, all episodes (initial and subsequent) being considered independent and treated equally in the analysis.

The method of allocation concealment was considered adequate. However, as stated by the contacted author, if the same person was randomizing consecutive participants, it was possible to guess by simple observation the last card in each sealed envelope.

Blinding

The researcher participated in the selection of participants and outcome measures assessment, and this was not blinded.

Incomplete outcome data

A response rate of 31% (17 out of 54 participants) was obtained. Intention-to-treat analysis was not carried out, but analysis was based on the 17 participants recruited and their 31 admissions.

Selective reporting

We did not detect any selective reporting of results.

Other potential sources of bias

No information is given on the time span between episodes to differentiate episodes from recurrences. Outcomes were measured only in the short term (21 days after admission).

Effects of interventions

The results are based on the Wolter study (Wolter 1997). Seventeen participants were enrolled and had 31 admissions: nine participants were admitted once; five participants were admitted twice; one was admitted three times; one was admitted four times; and one was admitted five times. Each admission was considered in the analysis as an independent event. There were 18 hospital admissions and 13 home admissions. Home and hospital participants were similar at baseline regarding gender, age, admission FEV_1 and type of IV line.

Ages ranged from 10 to 41 years (median 22 years).

Summary details of main results are given in the 'Additional tables' (Table 1).

Primary outcomes

1. Lung function

There were significant differences over time in changes from baseline noted for FEV_1 (4% to 7%; P = 0.006) and FVC (2% to 8%; P = 0.02). However, there were no statistical differences between home and hospital arms in overall improvement in lung function (Wolter 1997).

2. Lung infection

Sputum weight was not different between the groups. Sputum cultures were not performed at follow up (Wolter 1997).

3. Improvement of clinical score

This outcome was not reported in the study (Wolter 1997).

Secondary outcomes

1. Weight gain

No significant differences were found between the groups for improvements in body weight (Wolter 1997).

2. Quality of life

This was measured by the Chronic Respiratory Disease Questionnaire (CRDQ), with mean score changes from baseline to Day 21 being lower for home participants than for inpatients (16.5 versus 29.5; P = 0.03). There were no significant differences for dyspnoea (P = 0.25), emotional scores (P = 0.11), but mean fatigue score change was lower for home participants (3.6 versus 6.8; P = 0.04) as were mastery scores (2.6 versus 5.5; P = 0.03). Absolute values for personal, family, sleeping and eating disruptions scores were reported at end of treatment where higher scores indicate a better state of well-being. These scores were higher for home than hospital admissions (total disruption score 23.9 versus 18.3; P < 0.001) at Day 21. (Wolter 1997).

3. Clinical complications

One participant in the hospital group had a pneumothorax associated with central line insertion. There were no significant changes in serial serum creatinine or serial audiometric measurements. A lower proportion of home participants continued on low-dose home-maintenance antibiotic until the final assessment day as compared with inpatients (46% versus 71%, P = 0.14) and home participants had fewer investigations performed (P = 0.002) (Wolter 1997).

4. Re-admissions

Time to the next admission was not significantly different between home and hospital therapies (Wolter 1997).

5. Mortality

There were no deaths and no short-term re-admissions reported. No events were attributable to the antibiotics used (Wolter 1997).

6. Cost

a. Direct costs

Direct costs were measured by calculating the hospital cost, the cost of antibiotics and equipment used by home therapy, the cost spent on education or home visits or physiotherapy, and travelling costs. At the time of the study in 1997, home therapy was cheaper for families: AUS $15.08 (standard deviation (SD) AUS $13.48) per day of home therapy compared to AUS $23.77 (SD AUS $17.77) per day of hospitalization. The savings to the hospital for home therapy were AUS $2552.00 for each 10-day admission (Wolter 1997).

b. Indirect costs

Indirect costs were not determined since most participants were students or impaired pensioners and did not suffer financially as a result of loss of income from hospitalization (Wolter 1997).

7. Duration of treatment

The median duration of treatments was similar for the home arm to the hospital arm of the study (12 versus 11 days, P = 0.20; range 10 days to 24 days versus 7 days to 26 days). No significant differences were found in time to next admission between both arms, or for doses of tobramycin. Use of home maintenance antibiotics was lower for home treatment (46% versus 71%). Home participants had fewer investigations performed than hospital participants (P < 0.002) and general activity was higher in the home group (Wolter 1997).

8. Adverse effects

Most participants had peripheral IV lines. Three hospital participants had a central line compared to none in the home group. No differences were found for complications of IV lines nor for the number of line changes required (Wolter 1997).

9. Compliance with other treatment measures

This outcome was not reported (Wolter 1997).

Discussion

This review is based only on one study including 17 participants and some important methodological limitations were identified. Assessment was not blinded but seven out of nine outcome measures were assessed by objective instruments. Two important outcome measures were not used: the culture of sputum to assess remission of lung infection; and improvement of clinical scores. Some participants in the hospital arm did not complete a 10-day course of treatment. All these factors make it difficult to draw any conclusions for practice from this review. Only adults and adolescents were included, so the results cannot be extrapolated to children. The study did not address whether the participants or their families preferred home or hospital treatment.

In the light of the available evidence, home therapy does not seem to harm individuals in the short term since clinical outcomes gave similar results at all time points used. In the short term, home IV therapy is less expensive, particularly when compared to hospital admission and treatment. Quality of life measures are especially important in this context. The results of this review suggest that quality of life seems to be better when the treatment is administered at home. However, these results need to be interpreted with caution, as assessment of dyspnoea, fatigue, emotion and mastery gave worse results for home treatment. Two factors may have contributed to this: fatigue, which could possibly be due to a higher general activity (housework and social duties); and feelings of lower level of control over the disease and its consequences. On the other hand,

no validated instruments were used for family, social, sleep and eating disruptions which may have given beneficial results for home therapy.

Finally, more studies are needed with better designs, including more participants, longer follow-up periods (one year and more) and a broad range of outcome measures. Due to the relatively small number of people with CF, well-conducted multicenter studies may shed more light on the current evidence. Cross-over designs might not be the best approach since assessment of long-term results, such as prognosis and survival is difficult.

Authors' conclusions

Implications for practice

The current evidence is too limited to draw conclusions for practice. The limited evidence available is from participants who commenced treatment in hospital and suggests that, in the short term, home therapy is associated with less social disruption and no serious adverse events. The decision to commence home therapy should be based on the individual and be co-ordinated from units with appropriate outpatient resources.

Implications for research

More research is strongly required, ideally a multicenter, properly designed RCT including a sufficient number of participants to increase statistical power and allow assessments of outcomes in the long term.

Acknowledgements

The authors of the original review (up to April 2008) would like to thank Marta Roqué for assessing the evaluation of quality and analysis, and her methodological support in the update of the review. To M. José Martinez for her support in the writing of the first version of the review. To contacted authors Drs. Joanne Wolter, Scott H Davis and Wolfgang Greiner for additional information they provided about their studies.

The new review team (Dr Albert Balaguer and Dr Javier González de Dios) would like to acknowledge the significant input from the original review team: Dr Oscar Asensio; Dr Montserrat Bosque; Dr Theresa Marco; Dr Javier de Gracia; and Dr Consol Serra.

Contributions of authors

April 2008
Change of lead author

Dr Oscar Asensio has stepped down as lead author and Dr Albert Balaguer has taken on the lead authorship. The previous co-authors have also stepped down and Dr Javier González de Dios is the new co-author on the review. This new review team have updated the review in April 2008.

From this point on Dr Albert Balaguer is guarantor for the review.

August 2005
Change of lead author

Dr Teresa Marco has stepped down as lead author and Dr Oscar Asensio has taken on lead authorship.

All authors have participated in writing the protocol and the review. Consol Serra, Oscar Asensio and Montserrat Bosque have participated in the search, and Javier de Gracia, Teresa Marco and Consol Serra in the evaluation of studies and extraction of data.

Oscar Asensio and Consol Serra have updated the review. The remaining authors have reviewed this updated

version. The guarantor of the review is Oscar Asensio.

Declarations of interest

None known.

Differences between protocol and review

Published notes

Please see related review:

Shepperd S, Iliffe S. Hospital-at-home versus in-patient hospital care (Cochrane Review). In: The Cochrane Library, Issue 4, 2001. Oxford: Update Software.

Characteristics of studies

Characteristics of included studies

Wolter 1997

Methods	RCT and cross-over open study. Participants were initially randomized in blocks of four by sealed envelopes, to home or hospital therapy. Participants experiencing recurrent episodes automatically alternated treatment arms after initial randomization.
Participants	17 participants with a mean age of 22 years, with an infective exacerbation of cystic fibrosis.
Interventions	1. Home therapy: spent 2 - 4 days in hospital before discharge and were taught to prepare and administer their own intravenous antibiotics; participants were discharged with medication and equipment for the duration of the proposed course of treatment; home visits were conducted. 2. Control group: whole treatment was administered in the hospital. All participants received the same antibiotic therapy with ceftazidime 2 g 12 hourly and tobramycin 4 to 6 mg/kg daily as a single bolus for a minimum of 10 days in hospital or at home. Participants were randomly allocated to either groups at the first episode. For subsequent episodes they were alternatively allocated to home or hospital arm.
Outcomes	1. Lung function (spirometry) 2. Pulse oximetry (spot reading on room air) 3. 12 minute walking distance 4. Sputum production over 12 hours 5. Weight gain 6. Chronic Respiratory Disease Questionnaire (CRDQ) 7. Serum creatinine levels 8. Aminoglycoside levels 9. Audiology 10. Hospital costs

	11. Projected diagnostic-related group (DRG) 12. Reimbursement figures 13. Cost of antibiotics and equipment used in home therapy 14. Staff costs spent on education or home visits; travel costs 15. Indirect costs to the patient and family
Notes	All episodes, initial or recurrent, were analysed together. The statistical analysis considered recurrent episodes as independent events. Data on first randomized episodes are not currently available.

Risk of bias table

Item	Judgement	Description
Adequate sequence generation?	Yes	Randomized in blocks of four.
Allocation concealment?	Yes	Randomization used sealed envelopes.
Blinding?	No	Participants and clinicians could not be blinded due to the nature of the treatment. No information given on whether outcome assessors were blinded.
Incomplete outcome data addressed?	Yes	Reasons for exclusions given.
Free of selective reporting?	Yes	We were unable to detect any selective reporting.

Footnotes

RCT: randomized controlled trial

Characteristics of excluded studies

Amelina 2000

Reason for exclusion	Unclear from publication whether study meets inclusion criteria, authors of study failed to clarify details.

Bosworth 1997

Reason for exclusion	Observational retrospective study comparing a group of participants who undertook intravenous treatment at home with a group of participants treated at the hospital.

Davis 1990

Reason for exclusion	Unclear from publication whether study meets inclusion criteria, authors of study failed to clarify details.

Donati 1987

Reason for exclusion	Controlled but not randomized trial. Participants selected to either group (home or hospital) by the distance from home to hospital. Also, those meeting inclusion criteria to receive home therapy were allocated to home treatment by their own preference. Characteristics at baseline were similar for home and hospital participants.

Esmond 2006

Reason for exclusion	Controlled but not randomized trial. Thirty adults with CF (15 hospital and 15 home) were included. Participants were able to choose hospital or home intravenous treatment in discussion with their CF team.

Girón 2004

Reason for exclusion	Non-randomized or quasi-randomized controlled study. Observational descriptive study in 56 people (children and adults) with CF who needed 90 home IV antibiotic treatments.

Girón 2006

Reason for exclusion	Non randomized or quasi-randomized controlled study. Single centre in Spain. Economic evaluation (cost-analysis) in 22 consecutive adults with CF who needed 85 IV antibiotic treatments (43 at home, 14 in hospital and 28 combined).

Graf 1997

Reason for exclusion	Controlled but not randomized, intra-individual cross-over trial. This was confirmed after contact with author. Fourteen participants were included to receive either intravenous treatment at home or at the hospital.

Horvais 2006

Reason for exclusion	Non randomized or quasi-randomized controlled study. Study at 2 centres in France. Economic evaluation (cost-analysis) in 65 people (children and adults) with CF; global economic study, included IV antibiotic treatment.

Nazer 2006

Reason for exclusion	Non randomized or quasi-randomized controlled study. Observational retrospective study in 50 children with CF needing 143 IV antibiotic treatments (79 at home and 64 in hospital).

Ramström 2000

Reason for exclusion	Randomised cross-over trial on the effect of two different ways of preparation of antibiotics in people with CF with indication of home IV antibiotic treatment. No comparison was made between the administration of antibiotics at home versus in hospital.

Riethmueller 2002

Reason for exclusion	Controlled but not randomized study. Observational prospective study in people with CF and with chronic *P. aeruginosa* infection: 30 consecutive home IV antibiotic treatments were compared with 28 hospital courses.

Romano 1991

Reason for exclusion	Trial of two oral antibiotic treatment regimens both given at home. Trial was cross-over, but not blinded.

Thornton 2005

Reason for exclusion	Non-randomized or quasi-randomized controlled study. Single centre UK study. Economic evalutation (cost-analysis) in 116 adults with CF who needed 454 IV antibiotic treatments (213 with intention-to-treat at "home" and 241 with intention-to-treat in the "hospital").

Wolter 2004

Reason for exclusion	Controlled but not adecuate randomized study. Patients included had variaty of infectious diseases, only 9 participants have CF.

Footnotes

CF: cystic fibrosis

IV: intravenous

P. aeruginosa: *Pseudomonas aeruginosa*

Characteristics of studies awaiting classification

Hjelte 1988

Methods	Randomized cross-over study.
Participants	Children and adults with CF (diagnosed with sweat test) with chronic *P. aeruginosa* needing IV antibiotics and living within a radius of 10 miles of the hospital.
Interventions	IV antibiotics (a ß-lactam and an aminoglycoside)

Outcomes	Lung function, oxygen saturation, weight, psychological evaluations, ecomomic evaluations
Notes	Full paper, but only available in Swedish

Footnotes

CF: cystic fibrosis

IV: intravenous

P. aeruginosa: *Pseudomonas aeruginosa*

Characteristics of ongoing studies

Footnotes

Summary of findings tables

Additional tables

1 Description of Results

Study ID	Participants	Outcomes	Results	Comments
		1. Mean duration treatment 2. Lung function	1. Hospital 11.0 days (range 7 to 26) versus home 12.0 days (range 10 to 24) (P = 0.2). For the outcomes 2. to 6. results are given home versus hospital at 3 time intervals: Day 0; Day 10; Day 21 (post-treatment) 2. FVC (%predicted): Day 0 (56 versus 58); Day 10 (58 versus 64); Day 21 (58 versus 66); P = 0.30 FEV1 (% predicted): Day 0 (56 versus 39); Day 10 (45 versus 50); Day 21 (43 versus 51); P = 0.27 3. Day 0 (53.7 versus 52.5); Day 10 (54.1 versus 53.4); Day 21 (53.9 versus 53.2); P = 0.10	

Wolter 1997	Adolescents and adults with an infective exacerbation of CF	3. Weight gain (kg) 4. Oximetry (%) 5. Sputum weight (g) 6. 12 minutes walk 7. Quality of life (mean scores) 8. Direct costs	4. Day 0 (93 versus 94); Day 10 (94 versus 95); Day 21 (94 versus 96); P = 0.44 5. Day 0 (54.7 versus 32.5); Day 10 (37.4 versus 19.3); Day 21 (29.2 versus 30.6); P = 0.09 6. Day 0 (1254 versus 1163); Day 10 (1363 versus 1267); Day 21 (1363 versus 1326); P = 0.11 7. Home versus hospital change between Day 0 and 21 are given, except for family, personal, sleep and eating disruptions for which only values at Day 21 are provided: Dyspnoea: 5.9 versus 8.2; P = 0.25 Fatigue: 3.6 versus 6.8; P = 0.04 Emotional: 4.4 versus 8.6; P = 0.11 Mastery: 2.6 versus 5.5; P = 0.03 Family disruption: 6.2 versus 4.5; P = 0.001 Personal disruption: 5.1 versus 3.8; P = 0.004 Sleep disruption: 6.0 versus 4.4; P = 0.005 Eating disruption: 6.6 versus 5.9; P = 0.007 Total disruption: 23.9 versus 18.3; P < 0.001 8. Home versus hospital: mean (SD) - Cost for families 7 day: $15.08 ($13.48) versus $23.77 ($17.77). - Savings for hospital by 10 days of home therapy: $2552.00	The unit of analysis is the admission. The analysis is based on 17 participants and 31 admissions. 9 participants had 1 admission, 5 had 2 admissions, 1 had 3 admissions, 1 had 4 admissions, and 1 had 5 admissions. It is not known whether admissions were different episodes or recurrences.

Footnotes

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Other published versions of this review

Data and analyses

Figures

Sources of support

Internal sources

- Universitat Internacional de Catalunya. Barcelona., Spain

External sources

- No sources of support provided

Feedback

Appendices