Chest radiograph for acute respiratory infections (Protocol)

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[Intervention Protocol]

Chest radiograph for acute respiratory infections

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ABSTRACT

This is the protocol for a review and there is no abstract. The objectives are as follows:

To assess the effectiveness of chest X-rays in addition to clinical judgement, compared to that of clinical judgement alone, in the treatment/management of acute lower respiratory tract infections in both children and adults through measuring clinical recovery, mortality and hospital admissions.

BACKGROUND

Description of the condition

Lower respiratory tract infections are infections that occur below the level of the larynx and include pneumonia, bronchitis and bronchiolitis. These tend to be more severe in nature than upper respiratory tract infections (infections above the level of the pharynx). Lower respiratory tract infections are the third leading cause of death worldwide and are expected to be amongst the leading four causes of death by 2030, with pneumonia accounting for a significant proportion (WHO 2004). In this review we will only focus on lower respiratory tract infections.

Pneumonia is referred to as the inflammation of one or both lungs with consolidation and is classified by the causative organism, such as bacteria, virus, fungi or protozoa (Dorlands 2009). Between 2004 and 2005, the hospitalisation rate for pneumonia in England was 1.98 per 1000 population (Trotter 2008). Complications may include sepsis, meningitis and lung failure resulting in death (Bjerre 2009; Kabra 2010).

Bronchitis is the inflammation and irritation of the trachea and bronchi. It is caused by viral or bacterial pathogens as well as respiratory irritants such as dust or fumes. Nearly all cases of acute bronchitis are self-limiting (Smith 2009). In Australia this respiratory disorder is the fifth most common presentation to General Practitioners (Wark 2008). Chronic bronchitis is a type of chronic obstructive pulmonary disorder (COPD) in which there is bronchial irritation with increased secretions and a productive cough for at least three months, two years in succession (Dorlands 2009). Chronic bronchitis is mostly linked to longstanding conditions such as emphysema and asthma. In 2007, 4.4% of adults were diagnosed with chronic bronchitis in the USA (Pleis 2008). Bronchiolitis is a virally-induced acute bronchiolar inflammation associated with airway obstruction that affects infants younger than two years of age. The severity of the disease can range from mild to severe and clinically manifests with rhinorrhea, expiratory wheezing and a cough (Lozano 2007). Although it can be a life-threatening illness, the mainstay of treatment is supportive care and there is no clear evidence for effectiveness of antibiotics (Spurling 2007).

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Description of the intervention

Chest radiographs are routinely used as a tool to diagnose and screen for acute respiratory infections (ARI) of the lower respiratory system including pneumonia, tuberculosis, bronchiolitis and emphysema. For example, community-acquired pneumonia is diagnosed based on the presence of pulmonary infiltrate on chest radiographs and the clinical signs and symptoms of the patient (Ruiz 2000). However, in practice there appears to be an "undue reliance on the clinical diagnosis of community-acquired pneumonia" and a chest radiograph may be done when the diagnosis is uncertain (Mandell 2010).

Management of many lower respiratory infections, especially pneumonia, focuses on the early detection and treatment of the disease. Chest radiographs are one of the commonly used strategies. However, it has been suggested that there can be substantial differences in their interpretation by clinicians and radiologists (Hopstaken 2004). This review focuses on the efficacy of chest X-rays in treating lower respiratory tract infections and therefore we will not include studies on other strategies such as magnetic resonance imaging (MRI) or computed tomography (CT).

How the intervention might work

Chest radiographs are used as an investigation to confirm or refute possible diagnoses. They are an objective measure which can not only confirm a suspected disease such as pneumonia but can also define the severity, for example, multiple lung lobes and any associated complications such as pleural effusions and cavitations (ATS 2005). Chest radiographs are accepted as the gold standard in the diagnosis of pneumonia (Woodhead 2005). However, there is no clear radiological definition for the diagnosis of pneumonia, rather a spectrum of radiological appearances ranging from multifocal lobular consolidation to diffuse interstitial changes (Gharib 1990). Conversely, different diseases may appear similar radiologically, for example, bacterial pneumonia, pulmonary tuberculosis in HIV-positive people and pneumocystis carinii pneumonia (Boiselle 1997). Although the presence of radiographic findings is highly suggestive of a diagnosis, an absence of findings does not necessarily preclude the disease (Basi 2004).

Why it is important to do this review

Although chest X-rays are routinely used in the management of acute lower respiratory tract infections, the efficacy of this diagnostic tool in their treatment has not been determined. This is important for clinicians to know so that unnecessary chest X-rays will not be ordered which will decrease healthcare costs for the patient on an individual level and ensure better allocation of healthcare resources and funding on a population level. Furthermore, the cumulative effect of radiation from multiple chest X-rays could potentially lead to the development of malignant conditions or cause or exacerbate pre-malignant processes. This review aims to address this issue so that clinicians can weigh up the potential benefits and harms of using chest X-rays in order to achieve the best outcome for patients.

OBJECTIVES

To assess the effectiveness of chest X-rays in addition to clinical judgement, compared to that of clinical judgement alone, in the treatment/management of acute lower respiratory tract infections in both children and adults through measuring clinical recovery, mortality and hospital admissions.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials (RCTs). As double-blinding is not feasible, open studies and studies with outcome assessor blinding will be eligible.

Types of participants

Adults and children with clinical signs and symptoms of an acute lower respiratory tract infection, for example, cough, fever, dyspnoea, feeling generally unwell, etc.

Types of interventions

Chest radiograph (posterior-anterior and lateral views) compared with no chest radiograph prior to initiation of management.

Types of outcome measures

Primary outcomes

1. Mortality.
2. Time to resolution of clinical signs and symptoms (patient's presenting symptoms and findings on physical examination such as reduced breath sounds, crackles, dull percussion note, etc.)

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Secondary outcomes

1. Hospitalisation rates.
2. Any complications of the infection (for example, abscess, pleural effusion, septicaemia, respiratory failure).
3. Adverse effects from chest X-rays (for example, malignant conditions).

Search methods for identification of studies

Electronic searches

We will search the Cochrane Central Register of Controlled Trials (CENTRAL) (*The Cochrane Library*, latest issue), MEDLINE (1950 to current date), EMBASE (1974 to current date), CINAHL (1985 to current date) and LILACS (1985 to current date).

We will use the following search strategy to search MEDLINE and CENTRAL. We will combine the MEDLINE search with the Cochrane Highly Sensitive Search Strategy for identifying randomised trials in MEDLINE (Lefebvre 2009). We will adapt the search strategy to search EMBASE, CINAHL and LILACS.

MEDLINE (Ovid)

1 exp Radiography, Thoracic/
2 ((chest or lung* or thora*) adj3 (radiograph* or x-ray* or x ray* or xray*)).tw.
3 1 or 2
4 exp Respiratory Tract Infections/
5 acute respiratory infection*.tw.
6 lower respiratory infection*.tw.
7 lower respiratory tract infection*.tw.
8 exp Pneumonia/
9 (pneumon* or bronchopneumon* or pleuropneumon*).tw.
10 exp Bronchitis/
11 (bronchit* or bronchiolit*).tw.
12 exp Empyema/
13 empyema.tw.
14 Cough/
15 cough*.tw.
16 wheez*.tw.
17 Hemoptysis/
18 (hemoptysis or haemoptysis).tw.
19 Sputum/
20 sputum.tw.
21 fever/ or "fever of unknown origin"/
22 (fever* or pyrexia).tw.
23 exp Pleurisy/
24 (pleurisy or pleuritis).tw.
25 Pleural Effusion/
26 exp Dyspnea/
27 (dyspnoea or dyspnea).tw.
28 Respiratory Sounds/
29 (rales or crackles or rhonchi).tw.
30 Lung abscess/
31 (lung abscess* or pulmonary abscess*).tw.
32 or/4-31
33 3 and 32

Searching other resources

We will handsearch the reference lists of RCTs for additional studies, search the trial registers for ongoing or recent trials and contact experts in the field about any unpublished or ongoing studies. We will not apply any time or language restrictions.

Data collection and analysis

All review authors will independently perform study selection. All review authors will assess studies for trial quality and perform data extraction.

Selection of studies

Two review authors (AC, NM) will independently assess and evaluate potential studies for inclusion in this review. An independent third review author (JC) will evaluate any disagreements, discrepancies or both, and all review authors will also discuss further until a consensus is reached.

Data extraction and management

Two authors (JC, NM) will independently collect and extract the data from the studies. A third review author (AC) will resolve any disagreements through further discussion among all review authors until a consensus is reached. We will describe the data extracted in the 'Characteristics of included studies' table.

Assessment of risk of bias in included studies

We will assess the risk of bias by evaluating whether there is random sequence generation, allocation concealment, blinding of outcome assessment and incomplete outcome data addressed for short and longer-term outcomes, and whether studies are free of selective reporting and other bias, for example, conflict of interest of authors, publication bias, etc. (Higgins 2009). We will assess the following:

- selection bias i.e. sequence generation and allocation concealment;
- performance and detection bias i.e. blinding of participants and personnel;
- detection bias i.e. blinding of outcome assessment;
- attrition bias, i.e. incomplete outcome data;
- reporting bias i.e. selective reporting;

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- other sources of bias, for example, setting, conflict of interest of authors, publication bias.

Measures of treatment effect

We will present dichotomous data, such as mortality, as a risk ratio (odds ratio) with 95% confidence intervals (CIs). We will express the estimate of clinical effect as numbers needed to treat (NNT). We will present continuous data as mean differences (MD) and MD will be reported with their respective standard deviations (SD).

Unit of analysis issues

The unit of analysis will be the unit of randomisation. If cluster-RCTs are included, they will be adjusted according to the instructions in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2009).

Dealing with missing data

We will contact the trial authors to retrieve the relevant data if there is insufficient information in the included trials and data are missing. We will perform intention-to-treat (ITT) analysis, i.e. if outcome data on randomised patients are missing, these patients will be considered as treatment failures in the meta-analysis. Both ITT analysis and on-treatment analysis will be reported and compared in the Discussion section.

Assessment of heterogeneity

We will assess heterogeneity in a two-stepped process. We will first assess similarities at face value (for example, similar setting, participant population, randomisation method). Secondly, we will assess statistical heterogeneity by using the Chi^2 test with a P value of < 0.10 being statistically significant and the I^2 statistic with a cut-off value of 40% as outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins 2009). In the presence of heterogeneity we will not pool the studies (face value heterogeneity) or will use a random-effects model (presence of statistical heterogeneity). In the absence of heterogeneity we will use a fixed-effect model (Higgins 2009).

Assessment of reporting biases

We plan to perform a funnel plot analysis to assess any publication bias if sufficient studies (i.e. 25 or more) are included. We will report the conflict of interest declaration of the authors where available. We will assess detection bias, i.e. is there blinding of assessment outcomes for the assessors and the patients? We will also assess attrition bias, i.e. are the withdrawals described and is an intention-to-treat (ITT) analysis performed?

Data synthesis

We will synthesise data from the RCTs using Review Manager 5 software (RevMan 2008).

Subgroup analysis and investigation of heterogeneity

We plan to investigate the following subgroups:

1. infants under two years versus older children;
2. adults versus elderly aged > 65 years;
3. early versus later chest X-ray (i.e. before or after 48 hours since start of symptoms); and
4. ITT analysis versus on-treatment analysis.

We will attempt to obtain individual data from authors of included studies to attempt individual patient data (IPD) meta-analysis.

Sensitivity analysis

We plan to perform sensitivity analyses by investigating studies with a high risk of bias. We will add studies with a high risk of bias to studies with a low risk of bias to assess the impact of risk of bias on the overall outcome. We will also perform sensitivity analysis to analyse the impact of heterogeneity on the overall estimate of effect by adding heterogeneous studies to the homogeneous studies.

ACKNOWLEDGEMENTS

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* *Indicates the major publication for the study*

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HISTORY

Protocol first published: Issue 5, 2011

CONTRIBUTIONS OF AUTHORS

Dr Mieke van Driel and Dr Roger Bain reviewed and provided expert advice related to the field and the writing of this draft protocol.

All review authors contributed to the writing of the draft protocol.

DECLARATIONS OF INTEREST

Dr Roger Bain works for IMed/GCMI - a private radiology provider at Tweed Hospital in Australia and also at some private clinics.

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Internal sources

- Bond University, Australia.

External sources

- No sources of support supplied

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