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[Intervention Review]

# Oxygen therapy for lower respiratory tract infections in children between 3 months and 15 years of age

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## ABSTRACT

### Background

Treatment for lower respiratory tract infections (LRTIs) includes administering complementary oxygen. The effectiveness of oxygen therapy and of different delivery methods remains uncertain.

### Objectives

To determine the effectiveness and safety of oxygen therapy and oxygen delivery methods in the treatment of LRTIs and to define the indications for oxygen therapy in children with LRTIs.

### Search methods

For this update, we searched CENTRAL, MEDLINE, EMBASE and LILACS from March 2008 to October 2014.

### Selection criteria

Randomised controlled trials (RCTs) or non-RCTs comparing oxygen versus no oxygen therapy or different methods of oxygen delivery in children with LRTI aged from three months to 15 years. To determine the indications for oxygen therapy, we included observational studies or diagnostic test accuracy studies.

### Data collection and analysis

Three review authors independently scanned the search results to identify studies for inclusion. Two authors independently performed the methodological assessment and the third author resolved any disagreements. We calculated risk ratios (RRs) and their 95% confidence intervals (CIs) for dichotomous outcomes and adverse events (AEs). We performed fixed-effect meta-analyses for the estimation of pooled effects whenever there was no heterogeneity between included RCTs. We summarised the results reported in the included observational studies for the clinical indicators of hypoxaemia.

### Main results

In this review update, we included four studies (479 participants) assessing the efficacy of non-invasive delivery methods for the treatment of LRTI in children and 14 observational studies assessing the clinical sign indicators of hypoxaemia in children with LRTIs.

Three RCTs (399 participants) compared the effectiveness of nasal prongs or nasal cannula with nasopharyngeal catheter; one non-RCT (80 participants) compared head box, face mask, nasopharyngeal catheter and nasal cannula. The nasopharyngeal catheter was the

control group. Treatment failure was defined as number of children failing to achieve adequate arterial oxygen saturation. All included studies had a high risk of bias because of allocation methods and lack of blinded outcome assessment.

For nasal prongs versus nasopharyngeal catheter, the pooled effect estimate for RCTs showed a worrying trend towards no difference between the groups (two RCTs; 239 participants; RR 0.93, 95% CI 0.36 to 2.38). Similar results were shown in the one non-RCT (RR 1.0, 95% CI 0.44 to 2.27). The overall quality of this evidence is very low. Nasal obstruction due to severe mucus production was different between treatment groups (three RCTs, 338 participants; RR 0.20, 95% CI 0.09 to 0.44;  $I^2$  statistic = 0%). The quality of this evidence is low.

The use of a face mask showed a statistically significant lower risk of failure to achieve arterial oxygen > 60 mmHg than the nasopharyngeal catheter (one non-RCT; 80 participants; odds ratio (OR) 0.20, 95% CI 0.05 to 0.88).

The use of a head box showed a non-statistically significant trend towards a reduced risk of treatment failure compared to the nasopharyngeal catheter (one non-RCT; OR 0.40, 95% CI 0.13 to 1.12). The quality of this evidence is very low.

To determine the presence of hypoxaemia in children presenting with LRTI, we assessed the sensitivity and specificity of nine clinical signs reported by the included observational studies and used this information to calculate likelihood ratios. The results showed that there is no single clinical sign or symptom that accurately identifies hypoxaemia.

### Authors' conclusions

It appears that oxygen therapy given early in the course of pneumonia via nasal prongs at a flow rate of 1 to 2 L/min does not prevent children with severe pneumonia from developing hypoxaemia. However, the applicability of this evidence is limited as it comes from a small pilot trial.

Nasal prongs and nasopharyngeal catheter are similar in effectiveness when used for children with LRTI. Nasal prongs are associated with fewer nasal obstruction problems. The use of a face mask and head box has been poorly studied and it is not superior to a nasopharyngeal catheter in terms of effectiveness or safety in children with LRTI.

Studies assessing the effectiveness of oxygen therapy and oxygen delivery methods in children with different baseline risks are needed.

There is no single clinical sign or symptom that accurately identifies hypoxaemia in children with LRTI. The summary of results presented here can help clinicians to identify children with more severe conditions.

This review is limited by the small number of trials assessing oxygen therapy and oxygen delivery methods as part of LRTI treatment. There is insufficient evidence to determine which non-invasive delivery methods should be used in children with LRTI and low levels of oxygen in their blood.

## PLAIN LANGUAGE SUMMARY

### Oxygen therapy as part of the treatment for respiratory infections in children

#### Review question

We reviewed the evidence about the beneficial effect of oxygen supplementation therapy as part of the treatment for children with acute lower respiratory tract infection (LRTI). As oxygen may be administered using different delivery methods, we reviewed the most commonly used methods to deliver oxygen in children. As a secondary question, we reviewed the evidence regarding which signs or symptoms could indicate the need for oxygen therapy in children presenting with acute LRTI.

#### Background

Acute LRTI is the most frequent cause for hospitalisation out of all respiratory infections and one of the leading causes of morbidity and mortality in children aged under five in low-income countries. Oxygen therapy plays an important part in treating severe LRTIs but we need to determine its effectiveness at preventing children from developing more severe disease. Oxygen can be delivered by non-invasive methods (nasal prongs, nasal cannula, nasopharyngeal catheter, face mask and head box) and we wanted to discover how effective these methods are as they have not been adequately evaluated.

#### Studies characteristics

For our primary question we included experimental studies assessing the use of oxygen versus no oxygen and studies comparing oxygen delivery systems in children aged from one to five years with acute LRTI. We identified one pilot study (58 children) assessing oxygen therapy in children with pneumonia and four studies (479 participants) assessing the effectiveness of different non-invasive oxygen delivery systems.

For our secondary question, we included 14 observational studies conducted to determine the clinical indicators of hypoxaemia in children with acute LRTIs.

### **Key results**

It appears that oxygen therapy given early in the course of pneumonia via nasal prongs at a flow rate of 1 to 2 L/min does not prevent children with severe pneumonia from developing hypoxaemia. However, the applicability of this evidence is limited as it comes from a small pilot trial. Clinicians caring for children must make their decision to use supplemental oxygen on an individual basis.

Nasal prongs and nasopharyngeal catheter are similar in effectiveness when used for children with acute LRTI. Nasal prongs are associated with less nasal obstruction. The use of a face mask and head box has been poorly studied and appears not to be superior to nasopharyngeal catheter in terms of effectiveness or safety when used in children with acute LRTI.

There is no single clinical sign or symptom that accurately identifies hypoxaemia in children with acute LRTI. However, the summary of results presented here can help clinicians to identify children with more severe conditions.

Studies assessing the effectiveness of oxygen therapy in children with different baseline risks are needed, as well as studies that aim to identify the most effective and safe oxygen delivery method.

Our evidence is current to October 2014.