HEATED, HUMIDIFIED AIR FOR THE COMMON COLD

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ABSTRACT

Background
Heated, humidified air has long been used by common cold sufferers. The theoretical basis is that steam may help congested mucus drain better and heat may destroy cold virus as it does in vitro.

Objective
To assess the effects of inhaling heated water vapour (steam), in the treatment of the common cold by comparing symptoms, viral shedding and nasal resistance.

Criteria for considering studies for this review
In this updated review we searched the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2005, issue 4); MEDLINE (2003 to December Week 2 2005); EMBASE (July 2003 to September 2005); and Current Contents (current five years).

Selection criteria
Randomized controlled trials (RCTs) using heated water vapor in patients with the common cold or volunteers with experimentally induced common cold.

Data collection and analysis
All the articles retrieved were initially subjected to a review for inclusion or exclusion criteria. Review articles, editorials and abstracts with inadequate outcome descriptions were excluded. Studies selected for inclusion were subjected to a methodological assessment.

Main results
Six trials were included. Three found benefits of steam for symptom relief with the common cold (odds ratio (OR) 95% confidence interval (CI) 0.31; 0.16 to 0.60; relative risk (RR) 0.56; 95% CI 0.4 to 0.79). Results on symptom indices were equivocal. No studies demonstrated an exacerbation of clinical symptom scores. One USA study demonstrated worsened nasal resistance, while an earlier Israeli one showed improvement. One study examined viral shedding and antibody titres in nasal washings: there was no change of either between treatment and placebo groups. Minor side effects (including discomfort or irritation of the nose) were reported in some studies.

Authors’ conclusions
Steam inhalation are not recommended in the routine treatment of common cold symptoms until more double-blind RCT trials are conducted.

PLAIN LANGUAGE SUMMARY

The congestion from the common cold, arising from swelling of the membranes and thickened mucus inside the nose, has been treated for decades with inhaled steam in the hope this makes the mucus drain away easier. Also there is laboratory evidence that cold virus may be sensitive to heat. However this review found that in some studies, inhaling steam helped symptoms, others did not, so there was not enough evidence to be sure. There were some adverse effects (discomfort or irritation on the nose or lips). No studies included children.
WHAT'S NEW

Last assessed as up-to-date: 6 May 2006.

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BACKGROUND

"Life is made up of sobs, sniffles and smiles, with sniffles predominating" (Adams 1967). Sniffles, common colds and other acute respiratory infections are the most frequent acute illnesses. They account for about 40% of all time lost from employees and about 30% absenteeism from school (NCHSP 1985; Predy 2005). Separate studies from families have shown that the average pre-school child has 6 to 10 colds per year and the average adult has two to four colds per year (Monto 1974). Billions of dollars are used in caring for these patients. Many remedial measures such as antihistamines, decongestants, vitamin C, interferon and traditional remedies are tried in the treatment of the common cold (De Sutter 2003; Linde 2006; Marshall 1999; Smith 1993; Taverner 2004). Inhaling warm damp air is considered to offer relief from symptoms of the common cold and other acute respiratory infections. Hot water, hot soup and tea have been used for centuries for this purpose and have become subjects of scientific investigations (Saketkhoo 1978). Lwoff (Lwoff 1969) suggested that raising the mucosal temperature to 43 degrees Celsius (C) for three periods of thirty minutes will block rhinoviral replication and so stop the common cold. Studies of the effect of heated humidified air suggest that raising nasal mucosal temperature may indeed inhibit rhinoviral replication (Forstall 1994). A standard piece of equipment to do this (Rhinotherm) was developed in Israel and it was claimed that 80% of the subjects who used this apparatus in the early stages of the cold felt better the next day. This equipment has been used in several trials involving patients and volunteers infected with common cold virus. The studies have shown conflicting results.

OBJECTIVES

The objective of this review is to access RCTs using hot humid air by rhinothermy in the treatment of the common cold and pooling data to determine the state of valid evidence in this common clinical condition. The parameters compared were:

- persistence of symptoms;
- nasal resistance;
- viral shedding after a natural or experimentally induced common cold.

METHODS OF THE REVIEW

TYPES OF STUDIES

RCTs using rhinothermy in the treatment of common cold symptoms.

TYPES OF PARTICIPANTS

The treatment group consisted of individuals of all ages, suffering from naturally or experimentally induced common cold or acute viral rhinopharyngitis, receiving warm vapor inhalation via a rhinotherm. The control group consisted of individuals suffering from similar complaints, receiving air at room temperature or humidified air at room temperature.

TYPES OF INTERVENTION

The treatment group intervention consisted of breathing from apparatus delivering hot humidified air with the help of a rhinotherm at 40 to 47 oC in order to raise the intranasal temperature.
The control group intervention consisted of breathing from an apparatus delivering humidified or ambient air at temperatures of 30°C or below.

Rhinotherm is an instrument that delivers hot humidified air at a controlled temperature. All the trials included in this review, except the two conducted by Tyrrell, used a similar rhinotherm by Netzer Sereni, Beer Yaakov, Israel which is a microprocessor controlled instrument delivering warm saturated air with the help of two exhaust nozzles. Tyrrell used a rhinotherm manufactured by Beecham. This was presumed to be an improvement over the rhinotherm manufactured by Netzer Sereni, as it was possible to mask which machine was used in the control population.

**Types of outcome measures**

Reduction in the clinical severity of the disease in terms of a decrease in the symptom score index (Forstall 1994; Macknin 1990; Ophir 1987) based on symptoms of nasal blockade, sneezing and nasal drainage which were scored on a four point scale zero to three (zero = no symptoms, one = mild, two = moderate and three = severe). These scores were averaged to a symptom index (SI). The percentage change in the SI was calculated by a formula \([(1-A)/B \times 100]\) where A is the SI value while on treatment and B is the baseline SI value. In using this formula, a positive change indicated an improvement in the symptoms and a negative value indicated a deterioration. Other scales (Hendley 1994; Tyrrell 1989a) using a four point score calculated in a standard way, based on severity of the symptoms like sneezing, rhinorrhea, nasal obstruction, sore throat, cough, headache, malaise and chills were analyzed separately.

Decrease in the weight of nasal secretions. Nasal secretions were weighed by Tyrrell 1989.

Number of patients having no symptoms.

Decrease in nasal resistance as measured by a rhinimanograph (ICS Medical Corporation, Schaumburgh Ill) (Forstall 1994; Macknin 1990). Total nasal resistance was calculated using the formula \( R = (RN \times LN) / (RN + LN) \) where \( R \) indicates total resistance; right nostril (RN) resistance; and left nostril (LN) resistance. Ophir (Ophir 1987) had used Youlten Peak Nasal Inspiratory Flow meter (Clement Clarke Ltd) to measure the nasal peak inspiratory flow. They used a MiniWright peak flow meter to measure peak expiratory flow rate through nose and calculated a blockage index (BI) calculated according to the formula \( BI = PEF(mouth) - PEF(nose) / PEF(mouth) \). A higher BI indicates more nasal blockade.

Decrease in viral culture titers in the nasal secretions. Tyrrell 1989 had collected nasal washings each day and tested for the virus. Hendley (Hendley 1994) had performed a nasal wash with 10 ml of saline at 4 AM and 8 AM. Two ml aliquots of both washings were pooled and combined with 1 ml of media containing protein and antibiotics before being stored at -70°C. The infectivity titer of the rhinovirus in the specimen was determined using fibroblast cell culture.

**Search methods for identification of studies**

In 1999 when we published the first review we searched MEDLINE using the following MeSH headings: common cold, rhinopharyngitis, inhalation, steam, heated vapor, in December, 1998. The highly sensitive search strategy for identifying randomized controlled trials as given in the Cochrane Handbook for Systematic Reviews of Interventions (Appendix 5b) was used. Different combinations of terms were used to retrieve the maximum number of studies. EMBASE, Current Contents, review articles and cross references were also searched. Letters were written to the manufacturers of the rhinotherm equipment for any unpublished trials. No replies were received.

In 2003 we updated this review to identify all recent randomized controlled trials in any language. The following databases were searched: the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library, Issue 4, 2003), MEDLINE (January 1966 to November Week 2 2003), EMBASE (January 1990 to November 2003), and Current Contents (current five years).

In this current update we searched the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2005, issue 4); MEDLINE (2003 to December Week 2 2005); EMBASE (July 2003 to September 2005); and Current Contents (current five years). No new trials were identified. MEDLINE and CENTRAL were searched using the following terms.

MEDLINE (OVID)
1 exp Common Cold/
2 exp RHINOVIRUS/
3 common cold$.mp.
4 (rhinovir$ adj infection$).mp.
5 or/1-4
Data collection and analysis

The studies were subjected to validity scoring for methodological quality by a score based on principles set by Hill (Hill 1962) and modified by Thomsen and Kramer (Thomsen 1984). Each article was scored on 11 criteria worth 13 points in total. This validity score covers the definition of subjects, allocation of subjects to the treatment groups, description of treatment and measurement of the outcome.

A quality assessment was also done (Schultz 1995) to see if the subject allocation was randomized, treatments were blinded to the patients and the investigators, drop out details were given or an intention-to-treat analysis was done. All the included studies were randomized and double blinded. Drop out rates were mentioned in all the studies. None of the studies conducted an intention-to-treat analysis.

The data from continuous variables could not be pooled due to non-availability of the detailed values of variables and the absence of standard deviation in the published data of some of the studies.

Results

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.

Please see the tables 'Characteristics of included studies' and 'Characteristics of excluded studies'.

Risk of bias in included studies

Evaluation of trials addressing inhalation of heated humidified air

1. Research goal: Is it clearly defined (that is to say, we wish to analyze the reduction in frequency of cold symptoms) or vague (that is to say, we wish to examine the effectiveness of hot humidified air in the treatment of the common cold)?
   a) clearly defined (1);
   b) poorly defined (0).

2. Subject definition: What ages and conditions were included in the study group? Were allergy, bacterial infection, septal deviation or similar conditions excluded?
   a) states criteria for entry (1);
   b) states criteria for exclusion (1);
   c) states how subjects were obtained (1);
   d) not stated (0).
3. Randomization: Were the patients allocated to each group with a known probability?
   a) yes (1);
   b) no (0).

4. Equivalence of groups: Was an attempt made to ensure similarity of treatment and control groups?
   a) yes (1);
   b) no (0).

5. Treatment definition: Were the experimental and control treatments defined?
   a) yes (1);
   b) no (0).

6. Investigator(s) blinded?
   a) yes (1);
   b) no (0).

7. Subjects blinded?
   a) yes (1);
   b) no (0).

8. Drop outs
   a) less than 10% dropouts (1);
   b) more than 10% dropouts and accounted for (1);
   c) more than 10% dropouts and not accounted for (0).

9. Outcome measures: Were they objective (for example, a decrease in cough frequency as measured by a tape recorder or decreased weight of nasal secretions or the number of paper tissues) or well-defined subjective assessments (for example, days of headache, nasal discharge and itchy eyes)?
   a) objective or well defined subjective criteria (1);
   b) vague or ill defined (0).

10. Statistical inferences: Was any attempt made to define statistical significance?
    a) yes (1);
    b) no (0).

11. Clinical significance:
    a) considered error if sample was large and differences were small (1);
    b) considered error if sample was small and differences were not statistically significant (1);
    c) not discussed (0).

NB: Number of points awarded are indicated in the parenthesis total score = y/13x100%. An arbitrary cut off point of 70% (that is to say, 9/13 ) determined which articles to be included. All the included studies scored 10 or more points.

**Effects of interventions**

A systematic review of six studies does not give unequivocal evidence supporting the use of warm vapor inhalations in the common cold. No studies demonstrated a worsening of clinical symptom scores (OR 0.31; 95% CI 0.16 to 0.60). Three studies (Forstall 1994; Macknin 1990; Ophir 1987) used a similar symptom score index. While the study by Ophir (Ophir 1987) conducted in Israel had shown a significantly improvement in the SI, the other two trials conducted in the USA failed to show any improvement in the symptom score index. The study by Macknin (Macknin 1990) conducted in Ohio, USA showed a greater change towards improvement in the symptoms from the baseline in the placebo group. These studies could not be pooled due to non-availability of standard deviations. Tyrrell et al (Tyrrell 1989a) in their general practice study and in the volunteer study showed more improvement in the steam group. A different symptom score used by Hendley (Hendley 1994) did not show any significant difference between the study and the control interventions.

Three studies (two papers) showed improvement in subjective parameters. One study demonstrated increased nasal resistance one week after steam inhalation (data skewed at entry) in contrast to an earlier study which showed improvement in the nasal resistance. There was no objective evidence of decreased viral shedding in the patients given steam inhalation.

Minor side effects reported were nasal and lip irritation, light headedness, running make up, increased congestion and discomfort from the attached mask (Macknin 1990). Forstall (Forstall 1994) reported episodes of nasal congestion, minor mucosal burns and discomfort from condensation in the attached mask. Despite the difficulty in tolerating the steam treatment, both groups reported that the treatment helped. One patient was reported to have suffered temporary dizziness for two to three minutes following treatment with saturated hot air (Ophir 1987). However, the studies reporting side effects due to thermal discomfort had used the treatment for a longer duration.

**DISCUSSION**
Discussion

There is a difference in the efficacy of warm vapor inhalation trials conducted in the UK and Israel, compared to studies conducted in the USA, even though almost similar equipment and methodologies were used. The studies from the UK and Israel reported beneficial effects of rhinothermy in individuals with rhinopharyngitis; whereas three RCTS from the USA failed to replicate the findings of these previous investigations. The slight difference in equipment was in relation to administration of warm vapor by anaesthetic mask or nozzle. There is a possibility of difference in the epidemiology of rhinoviral infections in the subjects from different geographical areas, especially in relation to the viral strains. Climatic and seasonal differences may also have affected the outcome.

There was a difference in the duration of warm vapor inhalation with a longer period (30 minutes) being associated with no benefit and increased resistance of the nasal passage. Hence, one can postulate an optimum duration of heat administration would coincide with a subjective feeling of comfort. According to the present evidence, rhinothermy cannot be recommended in the routine treatment of common cold symptoms.

Authors’ Conclusions

Implications for practice

Since the studies reporting the use of rhinothermy have shown only subjective benefits in relieving common cold symptoms in the UK and Israel, this therapy cannot be recommended universally, as results of the trials conducted in the USA are equivocal. The decision to use this therapy should be determined by a cost benefit analyses, depending on the prevailing economic variables of an area.

Implications for research

There is a need for a large multicenter study using rhinothermy in treating symptoms of the common cold, including a detailed cost benefit analysis of using this equipment. The outcome measures should be dependent upon the frequency of common cold symptoms and a definitive diagnosis on viral cultures using a uniform symptom score index and nasal resistance measurements. A large international RCT with a factorial design, powered for an interaction between factor A defined temperature 42 to 44 degrees and factor B humidity (defined) as a second factor, needs to be conducted.

Acknowledgements

The Library Service, PGIMER, Chandigarh, India. The author wishes to thank the following people for commenting on this latest update: Amy Zelmer, Ian Williamson, Robert Ware and Chris Del Mar.

References

References to studies included in this review

Forstall 1994 \{published data only\}

Hendley 1994 \{published data only\}

Macknin 1990 \{published data only\}
**Ophir 1987** *(published data only)*  

**Tyrrell 1989a** *(published data only)*  

**Tyrrell 1989b** *(published data only)*  

* indicates the major publication for the study

**References to studies excluded from this review**

**Baroody 2000** *(published data only)*  

**Grübben 2003** *(published data only)*  

**Yerushalmi 1980** *(published data only)*  

**Additional references**

**Adams 1967**  

**De Sutter 2003**  
Sutter A, Lemiengre M. Antihistamines for the common cold. Cochrane Database of Systematic Reviews 2003:-.

**Hill 1962**  

**Linde 2006**  
Linde K, Melchart D, Barrett B, Bauer R, Wolpert K. Echinacea for preventing and treating the common cold. Cochrane Database of Systematic Reviews 2006:-.

**Lwoff 1969**  

**Marshall 1999**  
Marshall I. Zinc for the common cold. Cochrane Database of Systematic Reviews 1999:-.

**Monto 1974**  

**NCHSP 1985**  

**Predy 2005**  
Saketkhoo 1978

Schultz 1995

Smith 1993

Taverner 2004
Taverner D, Draper M, Latte J. Nasal decongestants for the common cold. Cochrane Database of Systematic Reviews 2004:-.

Thomsen 1984

**Graphs and Tables**

To view a graph or table, click on the outcome title of the summary table below.

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<th>Outcome title</th>
<th>No. of studies</th>
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<td>1 Number of patients with persistent symptoms</td>
<td>2</td>
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<td>Peto Odds Ratio (Peto, Fixed, 95% CI)</td>
<td>0.31 [0.16, 0.60]</td>
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<td>1.1 Number of patients with persistent symptoms at the end of therapy</td>
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<td>Peto Odds Ratio (Peto, Fixed, 95% CI)</td>
<td>0.31 [0.16, 0.60]</td>
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<td>2 Number of patients with no improvement in symptom score</td>
<td>1</td>
<td>84</td>
<td>Peto Odds Ratio (Peto, Fixed, 95% CI)</td>
<td>0.53 [0.22, 1.26]</td>
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<td>3 Number of patients with positive nasal wash culture</td>
<td>1</td>
<td>20</td>
<td>Peto Odds Ratio (Peto, Fixed, 95% CI)</td>
<td>0.47 [0.04, 5.19]</td>
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<td>4 Subjective response: side effects were present</td>
<td>1</td>
<td>65</td>
<td>Peto Odds Ratio (Peto, Fixed, 95% CI)</td>
<td>4.73 [1.46, 15.30]</td>
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<tr>
<td>5 Subjective response to therapy: therapy did not help</td>
<td>1</td>
<td>64</td>
<td>Peto Odds Ratio (Peto, Fixed, 95% CI)</td>
<td>0.39 [0.14, 1.05]</td>
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**Cover Sheet**

Heated, humidified air for the common cold

Reviewer(s) Singh Meenu
Contribution of Reviewer(s)

Issue protocol first published  

Issue review first published  1999 issue 3

Date of last minor amendment  Information not supplied by reviewer

Date of last substantive amendment  Information not supplied by reviewer

Most recent changes

Date new studies sought but none found  Information not supplied by reviewer

Date new studies found but not yet included/excluded  Information not supplied by reviewer

Date new studies found and included/excluded  Information not supplied by reviewer

Date reviewers' conclusions section amended  Information not supplied by reviewer

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- No sources of support supplied

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COMMENTS AND CRITICISMS
Heated humidified air for the common cold

Summary of comments and criticisms

1. I am delighted to see this review: a common and important but long neglected problem - and a marvellous introductory quote! I hope my comments may help you clarify some aspects.

2. Objectives: it would be good to specify the comparisons to be made in the review.

3. Types of participants: the treatment group includes people with "acute viral rhinopharyngitis" [avr], but the control group does not. Is avr synonymous with "common cold"? Healthy volunteers inoculated with virus are not patients, nor are people with a spontaneous or 'natural' cold who have not consulted a health professional.

4. Types of intervention: "... delivering hot humidified air ... at 40-44 deg C." This should exclude the Forstall 1994 study, in which the air was delivered at 47 deg, or if it is included it must at least be analysed separately. It would be useful to add an illustration of the Rhinotherm apparatuses - say line drawings.

5. Types of outcome measures: detailed reporting and discussion of the symptom scores used in the trials is necessary. They are unlikely to have used the same scoring methods, and cannot be combined without explicit justification.

6. Methods of the review: the validity score used assumes that all the points are equally important, and is therefore misleading. As the Cochrane Reviewers' Handbook 4.0 [end of section 6.7.2] says "... it is preferable to ... report how each trial scored on each criterion".

7. Results: the results should be reported separately for each of the different comparisons to be made, and also separately for each of the 5 outcome measures. Only then will it be possible to decide whether it is appropriate to lump together any of the comparisons or the outcome measures. In the absence of such an analysis the MetaView summary cannot be interpreted.

8. Discussion: it is not clear where each trial was done. This should be noted in the table of Characteristics of included trials. Geographical differences may not only imply different epidemiology of rhinovirus infection, but also climatic and seasonal differences which could affect outcomes. The two experimental studies by Tyrrell should not be lumped with the others.

9. Characteristics of included trials: At what stage in the infection, for how long, and how many times were the inhalations used in each trial? For some trials details are incomplete, eg Ophir: source of patients, length of follow up. Tyrrell -1 and -2: length of follow up.

10. Conclusions: I think the implications for practice need to be rethought in the light of a more detailed analysis.

Reviewer's reply

Contributors to comment

Andrew Herxheimer
Feedback and reply added 27 July 2001

KEYWORDS

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