Peer reviewed article

Appropriateness of respiratory care: evidence-based guidelines

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Summary

Principles: Respiratory care is universally recognised as useful, but its indications and practice vary markedly. In order to improve the appropriateness of respiratory care in our hospital, we developed evidence-based local guidelines in a collaborative effort involving physiotherapists, physicians and health service researchers.

Methods: Recommendations were developed using the standardised RAND appropriateness method. A literature search was conducted based on terms associated with guidelines and with respiratory care. A working group prepared proposals for recommendations which were then independently rated by a multidisciplinary expert panel. All recommendations were then discussed in common and indications for procedures were rated confidentially a second time by the experts. The recommendations were then formulated on the basis of the level of evidence in the literature and on the consensus among these experts.

Results: Recommendations were formulated for the following procedures: non-invasive ventilation, continuous positive airway pressure, intermittent positive pressure breathing, intrapulmonary percussive ventilation, mechanical insufflation-exsufflation, incentive spirometry, positive expiratory pressure, nasotracheal suctioning and non-instrumental airway clearance techniques. Each recommendation referred to a particular medical condition and was assigned to a hierarchical category based on the quality of the evidence from the literature supporting the recommendation and on the consensus among the experts.

Conclusion: Despite a marked heterogeneity of scientific evidence, the method used allowed us to develop commonly agreed local guidelines for respiratory care. In addition, this work fostered a closer relationship between physiotherapists and physicians in our institution.

Key words: respiratory care; chest physiotherapy; appropriateness; recommendations; guidelines; consensus

Introduction

The usefulness of respiratory care in the acute care hospital is widely recognised. However, in spite of its generally undisputed value, the indications for and practice of respiratory care vary markedly among different hospitals, and even within the same institution [1–3]. Respiratory care is labour-intensive and its development is inevitably limited by institutional budget constraints. Hence the appropriateness of care delivered is important, since unnecessary care wastes resources and undelivered indicated care may adversely affect patient outcome. A recent study conducted in an acute care hospital found that this was not always the case: 25% of respiratory care procedures delivered were not indicated, whereas 12% of patients were not receiving respiratory care that was indicated [4].

In view of an increasing number of demands for respiratory care and the variety of habits and practices in our institution, the Department of Physiotherapy decided to establish scientifically sound local guidelines for respiratory care. The field was limited to respiratory care procedures in the adult patient, excluding invasive ventilation. In addition to classic chest physiotherapy, the project included non-invasive ventilatory support since the latter procedures represent an increasing part of the chest physiotherapists' work in our hospital.

No conflict of interest.

Material and methods

Setting

This study was conducted at Lausanne University Hospital, a 900-bed acute care teaching hospital. The project was initiated in collaboration with the Institute of Social and Preventive Medicine, the Department of Respiratory Medicine, and the Department of Adult Intensive Care Medicine in our hospital. The institutional Ethical Committee does not require approval for studies that do not directly involve patients.

Composition of working group and of expert panel

A working group piloting the project was composed of five physiotherapists and four physicians. A multidisciplinary expert panel of 13 members was consulted (11 members from Lausanne University Hospital, and two from Geneva University Hospital). The panel was composed of three specialists in respiratory medicine, two physiotherapists, two specialists in intensive care medicine, two specialists in internal medicine, one thoracic surgeon, one cardiovascular surgeon, one abdominal surgeon, and one specialist in otorhinolaryngology.

Respiratory care procedures

- *Non-invasive ventilation (NIV):* in this document, NIV refers to positive pressure ventilation applied through a facial or a nasal mask.
- *Continuous positive airway pressure (CPAP):* breathing mode by which the patient spontaneously breathes through a pressurised circuit that maintains a preset positive airway pressure during both inspiration and expiration.
- *Intermittent positive pressure breathing (IPPB):* short-term ventilation technique involving patient-triggered delivery of positive airway pressure during inspiration.
- *Intrapulmonary percussive ventilation (IPV):* airway mucus clearance technique involving internal thoracic percussion through the delivery of pulsatile air flow during inspiration.
- *Mechanical insufflation-exsufflation (MIE) (Cough Assist®):* technique of mechanical cough assistance involving a positive pressure insufflation followed by a rapid negative pressure exsufflation.
- *Incentive spirometry (IS):* technique encouraging the patient to perform sustained maximal inspirations by providing a feedback according to a predetermined flow or volume.
- *Positive expiratory pressure (PEP):* the *PEP-mask* is an airway mucus clearance technique involving a face mask or a mouthpiece and a one-way valve to which an expiratory resistance is attached. The *blow bottle* creates a PEP when the patient exhales through an underwater tube. The *Flutter VRP1®* is a technique of airway mucus clearance involving a pipe-shaped device containing a steel ball. During expiration through the device, the rise and fall of the steel ball creates an oscillatory positive pressure and vibration of the airways.
- *Nasotracheal suctioning:* airway mucus clearance technique involving the insertion of a suction catheter through the nose into the trachea without a tracheal tube.
- *Non-instrumental airway clearance techniques: Autogenic drainage* consists of breathing at different lung volumes and maximising expiratory flow to clear airway secretions. Initially the patient breathes for a few minutes below functional residual capacity and then progressively breathes at higher lung volumes. *Active cycle of breathing techniques (ACBT)* combines diaphragmatic breathing, deep breathing and forced expiration. *Manual chest percussion* consists of rapid hand clapping onto the chest.

Literature search

A literature search was performed for the period between January 1995 and March 2009 based on terms associated with guidelines and with respiratory care. The following databases were used: Medline, Biosis, Cinhal, Embase, Web of sciences, Pubmed, Cochrane Library, National Guideline Clearinghouse, links to Evidence Based Medicine websites (www.guideline.gov; www.ahrq.gov; www.anaes.fr), Altavista, Google, textbooks and consensus conferences in chest physiotherapy, references quoted by existing guidelines, by systematic reviews and by original studies.

Quality of evidence

The Oxford quality of evidence classification was used (www.cebm.net/levels_of_evidence.asp). This classification consists of five levels of evidence which are presented in table 1. For each respiratory care procedure the best evidence was sought, considering literature in the following order: 1) evidence mentioned in high quality guidelines using the AGREE framework (5); 2) evidence mentioned in high quality systematic reviews; 3) evidence found in studies of various types.

Table 1

Levels of evidence of publications.

Evidence level I:
– Randomised controlled trials – Systematic reviews of randomised controlled trials (homogeneous) – Systematic reviews
Evidence level II: Non-randomised controlled trials
Evidence level III: Prospective cohort studies
Evidence level IV: Retrospective cohort studies, case-control studies
Evidence level V: Case studies, published expert opinions

Table 2

Categories of recommendations.

A: Strong evidence supporting recommendation or acceptable evidence with strong consensus among experts Evidence level I (randomised controlled trials, systematic reviews of randomised controlled trials or systematic reviews) or Evidence level II (non-randomised controlled trials) or III (prospective cohort studies) with strong consensus among experts
B: Acceptable evidence supporting recommendation or sufficient evidence with strong consensus among experts Evidence level II (non-randomised controlled trials) or III (prospective cohort studies) or Evidence level IV (retrospective cohort studies, case-control studies) or V (case studies, published opinions of experts) with strong consensus among experts
C: Sufficient evidence supporting recommendation Evidence level IV (retrospective cohort studies, case-control studies) or V (case studies, published opinions of experts) and Consensus within the expert group to formulate recommendations
I: Insufficient evidence supporting recommendation or evidence considered globally uncertain by the expert group When there is insufficient evidence, for instance in the case of conflicting studies or divergent expert opinions, no recommendation is formulated and the decision has to be made in the light of specific circumstances, essentially according to the clinician's judgement

Strength of recommendations

In this study the strength of recommendations was based both on the quality of evidence extracted from the literature and on the expert consensus, as detailed further on. The categories of recommendations used are presented in table 2.

Development of recommendations

Recommendations were developed using the standardised procedures of the RAND appropriateness method [6, 7]. A synthesis of the literature on the appropriateness of each respiratory care procedure in various medical conditions was drawn up, and on its basis the working group established proposals for recommendations. These proposals and the relevant literature were mailed to the members of the expert panel. Each procedure for respiratory care was rated separately for several conditions on a 9-point scale (1 = extremely inappropriate, 5 = uncertain, 9 = extremely appropriate) by the 13 experts.

After this the experts met with the working group and were provided with reports showing their initial ratings and the anonymous distribution of other experts' ratings. All recommendations were discussed and the experts rated indications for procedures confidentially a second time. Following the procedure for the RAND appropriateness method, each indication was classified as appropriate, uncertain, or inappropriate, on the basis of the panel median rating (1–3 = inappropriate; 4–6 = uncertain; 7–9 = appropriate) and the degree of intra-panel agreement. All indications for which there was disagreement were classified as uncertain, irrespective of the panel's median score.

The recommendations were then formulated on the basis of the level of evidence in the literature and on the consensus of experts, as per table 2.

Table 3
Recommendations for obstructive disorders.

Condition	Technique	Recommendation	Comments	References
COPD				
Hypercapnic respiratory failure	NIV	Recommended (A)	Indication: pH 7.25–7.35 and $PaCO_2$ ≥50 mm Hg	[9–15]
Secretion retention	Non-instrumental airway clearance	Recommended (A)		[2, 16–22]
	Nasotracheal suctioning	Recommended (B)	If other techniques fail	[2, 23–25]
	PEP	Uncertain (I)		[19, 21, 26]
	IPV	Uncertain (I)		[27]
	IPPB	Not recommended (C)		[28]
	MIE	Not recommended (C)		[29]
Asthma	NIV	Not recommended (A)		[10, 11, 13]
	IPPB	Not recommended (C)		[28, 30]
Cystic fibrosis				
Hypercapnic respiratory failure	NIV	Recommended (C)		[10, 13, 14, 31, 32]
Secretion retention	Non-instrumental airway clearance	Recommended (A)		12, 16–22]
	PEP-mask	Recommended (A)		[18, 19, 22]
	Flutter VRP1	Recommended (C)		[19, 21, 26, 33]
	Nasotracheal suctioning	Recommended (C)	If other techniques fail	[2, 23–25]
	IPV	Uncertain (I)	If other techniques fail	[18, 19, 21, 22, 26, 33]
	IPPB	Not recommended (C)		[21, 30]
	MIE	Not recommended (C)		[29]
Upper airway obstruction	NIV	Recommended (C)	Indication: glottal oedema following extubation	[13]
Aerosol delivery	IPPB	Not recommended (C)		[30]

COPD: chronic obstructive pulmonary disease; IPPB: intermittent positive pressure breathing; IPV: intrapulmonary percussive ventilation; MIE: mechanical insufflation-exsufflation; NIV: non-invasive ventilation; PEP: positive expiratory pressure

Table 4
Recommendations for restrictive disorders.

Condition	Technique	Recommendation	Comments	References
Obesity hypoventilation syndrome	NIV	Recommended (C)		[9, 10, 13, 14]
Central hypoventilation	NIV	Recommended (C)		[9, 10, 13, 14]
Chest wall deformity with hypercapnic respiratory failure	NIV	Recommended (C)		[9, 10, 13, 14]
Neuromuscular disease				
Hypercapnic respiratory failure	NIV	Recommended (C)		[9, 10, 13, 14]
Impaired cough	MIE	Recommended (C)		[2, 19, 34, 35]
Spinal cord injury	IPPB	Not recommended (A)	For C5 – T6 lesions	[36]

IPPB: intermittent positive pressure breathing; MIE: mechanical insufflation-exsufflation; NIV: non-invasive ventilation

Results

Recommendations were established for each respiratory care procedure, as validated in different medical conditions. To facilitate the use of recommendations by physicians prescribing respiratory care, they are presented here using the medical condition as entry. Each recommendation is associated with its degree of strength (A, B, C, or I), with references, and in some cases with additional comments pertaining either to the evidence in the literature or to local implementation of recommendations in our hospital. The recommendations are presented in tables 3–6.

Table 5
Recommendations for pulmonary oedema and pneumonia.

Condition	Technique	Recommendation	Comments	References
Cardiogenic pulmonary oedema	CPAP	Recommended (A)	As adjunct to drug therapy	[9, 10, 14, 28, 37–41]
	NIV	Recommended (A)	If CPAP fails. Indication: PaO_2/FiO_2 ≤200 mm Hg and RR ≥35/min Employed in ICU	[9, 10, 13, 14, 41]
ARDS	NIV	Uncertain (I)	Employed in ICU	[42–44]
Pneumonia				
Hypoxaemic respiratory failure	CPAP	Recommended (A)		[10, 45]
	NIV	Recommended (A)	Indication: PaO_2/FiO_2 ≤200 mm Hg and RR ≥35/min Employed in ICU	[9, 10, 12–14]
Hypercapnic respiratory failure	NIV	Recommended (A)	Employed in ICU	[10, 46]
Secretion retention	Non-instrumental airway clearance	Recommended (A)		[16–18, 20–23, 25, 47]
No secretion retention	Chest physiotherapy	Not recommended (A)		[48, 49]

ARDS: acute respiratory distress syndrome; CPAP: continuous positive airway pressure; ICU: intensive care unit; NIV: non-invasive ventilation; RR: respiratory rate

Table 6
Recommendations for atelectasis, hypoxaemia and severe dyspnoea.

Condition	Technique	Recommendation	Comments	References
Pulmonary atelectasis	CPAP	Recommended (A)		[10, 28, 47, 50–52]
	NIV	Not recommended (A)	Not superior to CPAP	[53]
	IS	Recommended (B)	As adjunct to CPAP	[54]
	PEP	Uncertain (I)		[22]
Chest trauma with hypoxaemia	CPAP	Recommended (A)		[10, 13]
	NIV	Recommended (C)	Applied in ICU	[13]
Postoperative hypoxaemia	CPAP	Recommended (A)		[52]
	NIV	Recommended (A)	Post lung resection or solid organ transplantation Applied in ICU	[10, 13, 55, 56]
Bronchoscopy in cases of hypoxaemia	CPAP	Recommended (A)	Indication:PaO_2/FiO_2 ≤200 mm Hg	[57]
	NIV	Recommended (A)	Indication:PaO_2/FiO_2 ≤200 mm Hg	[58]
Postoperative prophylactic physiotherapy	PEP	Uncertain (I)		[59, 60]
	IS	Uncertain (I)		[59, 61–63]
	CPAP	Uncertain (I)		[59]
	NIV	Uncertain (I)		[64, 65]
Terminal disease with severe dyspnoea	NIV	Recommended (C)	As part of an integrated palliative care project To be discontinued in the absence of subjective benefit	[66]

CPAP: continuous positive airway pressure; IS: incentive spirometry; NIV: non-invasive ventilation; PEP: positive expiratory pressure

Discussion

The decision to implement guidelines for respiratory care in our hospital arose from the observation of increasing demand and from the perception that some procedures were not always prescribed on rigorous grounds. While scientifically based guidelines exist for certain respiratory care procedures, we felt that for several reasons developing local guidelines would be more beneficial than importing existing ones. Firstly, the expertise and role of various professionals – physicians, physiotherapists and nurses – differs between hospitals for historical reasons. Secondly,

the structure and tasks of different care units, such as the intensive care unit (ICU), intermediate care units and general ward, also vary from institution to institution [3]. Finally, because the prescription and delivery of respiratory care is often influenced by local habits, we anticipated that changes would be facilitated by a sense of identification with homegrown guidelines [8]. With this aim, the expert panel was composed of 13 members originating from eight different specialities and was intended to represent the variety of physicians prescribing respiratory care procedures. The majority of experts originated from our institution, but two were invited from another similar university hospital to have the benefit of an outside view.

The scientific evidence supporting the different respiratory care procedures was found to be very heterogeneous. The usefulness of and indications for recent techniques such as non-invasive ventilation were found to rest on a wealth of randomised controlled trials, systematic reviews and meta-analyses. In contrast, the usefulness of more longstanding procedures, such as airway clearance techniques, was affected by a lack of scientific support. This is in part explained by the methodological problems of studying chest physiotherapy techniques, such as the absence of appropriate sham procedures and the difficulty of blinding participants to physiotherapy interventions. Use of the RAND appropriateness method was particularly effective in enabling us to reach a consensus and formulate recommendations in the face of scant scientific evidence. This procedure was easy to follow for professionals of various backgrounds who were experiencing it for the first time.

The development of guidelines for respiratory care inevitably raised the question of their relevance and implementation in our hospital. For instance, non-invasive ventilation is now a well established technique which is employed in different settings: in the emergency room, in the ICU, in intermediate care units, and even in the general ward for patients preparing for home mechanical ventilation. For each medical condition, the appropriate clinical setting for this therapy has to be decided in the light of local facilities and infrastructure, and personnel expertise [3]. Thus, for some indications the expert panel recommended that the use of non-invasive ventilation must be restricted to the ICU or must be discussed with the ICU's physician if it was intended to employ it outside the ICU. Although not valid beyond our institution, these comments illustrate a case of local implementation. Beyond the initial goal of publishing recommendations for respiratory care procedures, the joint development of guidelines had the valued advantage of building a common culture and a closer relationship between physiotherapists and physicians.

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