Noninvasive Ventilation

Second Edition

Edited by

J-F. Muir, N. Ambrosino and A.K. Simonds

**EUROPEAN
RESPIRATORY
SOCIETY**

Noninvasive Ventilation

Second Edition

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This book is one in a series of European Respiratory Monographs. Each individual issue provides a comprehensive overview of one specific clinical area of respiratory health, communicating information about the most advanced techniques and systems needed to investigate it. It provides factual and useful scientific detail, drawing on specific case studies and looking into the diagnosis and management of individual patients. Previously published titles in this series are listed at the back of this book with details of how they can be purchased.

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CONTENTS

The Guest Editors	vii
Preface	viii
Introduction	ix
Part 1 Acute respiratory failure and NIV	
1. Physiological rationale of noninvasive mechanical ventilation use in acute respiratory failure	3
G. Prinianakis, M. Klimathianaki, D. Georgopoulos	
2. NIV: indication in case of acute respiratory failure in obstructive pulmonary diseases	24
N. Ambrosino, A. Corrado	
3. Management of acute respiratory failure in restrictive disorders (obesity excluded)	37
J.C. Winck, M. Gonçalves	
4. NIV for acute hypercapnic respiratory failure in obese patients	47
A. Cuvelier, N. Amiot, B. Lamia, L.C. Molano, J-F. Muir	
5. NIV: indication in case of acute hypoxaemic respiratory failure (pulmonary oedema and immunosuppressed patients excluded)	60
M. Ferrer, A. Torres	
6. NIV for cardiogenic pulmonary oedema	72
A. Gray, D. Schlosshan, M.W. Elliott	
7. NIV: indication in case of acute respiratory failure and immunosuppression	94
G. Hilbert	
8. NIV: indication in case of acute respiratory failure in children	110
O. Nørregaard	
9. NIV: use during the pre-hospital management of patients with acute respiratory failure	133
F. Thys, S. Spencer, F. Verschuren, N. Delvau, J. Roeseler, F. Templier	
10. NIV for weaning from mechanical ventilation and post-extubation ARF	143
C. Girault	
11. NIV for acute respiratory failure: modes of ventilation and ventilators	154
F. Vargas, A. Thille, A. Lyazidi, L. Brochard	
12. NIV in the acute setting: technical aspects, initiation, monitoring and choice of interface	173
S.M. Maggiore, G. Mercurio, C. Volpe	

13. Where to perform NIV	189
S.D.W. Miller, M. Latham, M.W. Elliott	
Part II Chronic respiratory failure and noninvasive ventilation	
14. NIV and obstructive lung diseases	203
J-F. Muir, C. Molano, A. Cuvelier	
15. NIV and neuromuscular disease	224
A.K. Simonds	
16. NIV and chronic respiratory failure secondary to restrictive thoracic disorders (obesity excluded)	240
W. Windisch, M. Dreher	
17. NIV and chronic respiratory failure secondary to obesity	251
J-P. Janssens, J-L. Pépin, Y.F. Guo	
18. NIV and pulmonary rehabilitation	265
N. Ambrosino, N. Carpenè, M. Gherardi	
19. NIV and chronic respiratory failure in children	272
B. Fauroux, G. Aubertin, F. Lofaso	
20. NIV and palliative care	287
R. Scala, S. Nava	
21. Domiciliary ventilators: from bench to bedside	307
L. Vignaux, J-P. Janssens, P. Jolliet	
22. Noninvasive mechanical ventilation in chronic respiratory failure: ventilators and interfaces	319
J.H. Storre, B. Schönhofer	
23. Interfaces and humidification in the home setting	338
P. Navalesi, P. Frigerio, C. Gregoretti	
24. Sleep and NIV: monitoring of the patient under home ventilation	350
J-L. Pépin, J.C. Borel, J-P. Janssens, R. Tamisier, P. Lévy	
25. NIV: discharging the ventilator-dependent patient	367
J. Escarrabill	
26. Cost-effectiveness of NIV applied to chronic respiratory failure	377
E.M. Clini, E. Crisafulli, M. Moretti, L.M. Fabbri	
27. Home NIV: results and lessons from a European survey	392
J. Goldring, J. Wedzicha	
28. Future trends in noninvasive mechanical ventilation in adults	400
D. Robert, L. Argaud	
Statements of interest	415

The Guest Editors

J-F. Muir

N. Ambrosino

A.K. Simonds

The Guest Editors

J-F. Muir is a Professor of Pulmonology and Head of both the Respiratory Diseases Dept and Respiratory Intensive Care unit at the Rouen University Hospital, France. He has a special interest in acute and chronic mechanical ventilation and sleep studies.

N. Ambrosino's research activity has been devoted to: chronic obstructive pulmonary disease, respiratory critical care, pulmonary rehabilitation and home respiratory care. He has also contributed to the development of the use of noninvasive mechanical ventilation techniques in acute and chronic respiratory failure with several clinical trials and original experimental studies. He was the former head of the Pulmonary Rehabilitation Working Group of the European Respiratory Society, and he currently sits on the editorial boards of several international journals.

A.K. Simonds is a Consultant in Respiratory Medicine at Royal Brompton Hospital, London. She runs the Home Ventilation service for adults and children and has a long term clinical and research interest in acute and chronic: noninvasive ventilation, new ventilatory modes, neuromuscular disorders, sleep disordered breathing, endstage lung disease, palliative care and ethics.

Preface

The view on treatment of patients with severe respiratory disorders in general, and of patients with severe chronic obstructive pulmonary disease in particular, has changed during the past decades. The former, often nihilistic, approach has changed into an attitude towards more active engagement in, and treatment of, severely ill patients. In this context, noninvasive ventilation (NIV) has been brought into focus as a valuable alternative treatment, both in acute respiratory failure and chronic respiratory diseases. The growing interest in NIV has been reflected in the *European Respiratory Monograph (ERM)* through the years and the present issue on NIV is a comprehensive review of the field. It updates areas that were covered in the previous 2001 *ERM* edition and adds a number of new aspects on how NIV may be an option in the treatment of patients with primary respiratory and nonrespiratory disorders. In the current issue there are new chapters on treatment of acute and chronic respiratory failure in obese patients. Acute respiratory failure in immunocompromised patients has been given its own chapter and there are specific chapters on the use of NIV in pre-hospital patients and in palliative care. Furthermore, treatment of cardiogenic pulmonary oedema with NIV has a devoted chapter.

The present updated and extended *ERM* on NIV, written and edited by the most appreciated experts in the field, is a must for every clinician who makes contact with patients who suffer from acute or chronic respiratory failure, in whom NIV may be considered. This issue will certainly constitute a highly appreciated source of information and knowledge, both for clinicians and scientists.

K. Larsson
Editor in Chief

INTRODUCTION

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In August 2001, the first edition of a *European Respiratory Monograph (ERM)* devoted to noninvasive mechanical ventilation (NIV) was published [1]. Now is a good time for a second edition, in order to take into account and consolidate views on the numerous developments that have occurred on a variety fronts.

NIV is not a recent concept, having been developed in the 19th century. Subsequent milestones date from the 1950s, with the iron lung in the polio era; the 1960s, with the first attempts at mask ventilation; the 1970s, when mouth ventilation was used increasingly; and the 1980s, when nasal interfaces improved and pressure support ventilation emerged. The 1990s and the first decade of the 21st century have highlighted the importance of pressure support ventilation and of sleep investigation in respiratory medicine, and have demonstrated the changing profile of the underlying causes of chronic and acute respiratory failure, the disease of this century, in particular the growing burden of morbid obesity.

The current *ERM* has been thoroughly renewed and rewritten. We hope that it will afford medical teams daily confronted with acute and chronic respiratory failure a substantial overview of the new aspects of NIV, including pathophysiological indications, technology and monitoring. It is essential that these developments are understood if, over time, we want to improve survival and also optimise ventilator–patient interaction and health-related quality of life.

We would like to warmly thank all the contributors for their enthusiasm and hard work and, in addition, acknowledge K. Larsson (Editor in Chief) and the European Respiratory Society Publications Dept for their excellent technical help.

References

1. Muir JF, Ambrosino N, Simonds AK, eds. Noninvasive Mechanical Ventilation. *Eur Respir Mon* 2001; 16.