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APICON 2025 Workshop Manual

Non-invasive Ventilation & Oxygen Therapy



Editors
Subhash Todi
Rakhi Sanyal

Foreword
Parthasarathi Bhattacharyya

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Contents

SECTION 1: NONINVASIVE VENTILATION

Rakhi Sanyal

CHAPTER 1	History and Evolution of Noninvasive Ventilation	3
CHAPTER 2	Noninvasive Ventilation and Respiratory Physiology	9
CHAPTER 3	Benefits, Indications and Contraindications of Noninvasive Ventilation	14
CHAPTER 4	Types and Modes of Noninvasive Ventilation	18
CHAPTER 5	Machine and Interfaces	37
CHAPTER 6	Initiation, Settings, Monitoring, Alarms and Troubleshooting	46
CHAPTER 7	Noninvasive Ventilation in the Acute Medical Take: Strategies and Solutions	62
CHAPTER 8	Realtime Case-based Discussion for Clinical Decision Making of Indication for NIV in AECOPD as per ERS/ATS Practice Guidelines 2017	69
CHAPTER 9	Realtime Case-based Discussion for Clinical Decision Making of Indication for NIV in CPE as per ERS/ATS Practice Guidelines 2017	72
CHAPTER 10	Realtime Case-based Discussion for Clinical Decision Making of Indication for NIV in Post-extubation and Weaning from Invasive Ventilation as per ERS/ATS Practice Guidelines 2017	75
CHAPTER 11	Realtime Case-based Discussion for Clinical Decision Making of Indication for NIV in Acute Exacerbation of Bronchial Asthma as per ERS/ATS Practice Guidelines 2017	79
CHAPTER 12	Realtime Case-based Discussion for Clinical Decision Making of Indication for NIV in De Novo Respiratory Failure as per ERS/ATS Practice Guidelines 2017	82
CHAPTER 13	Extended Uses of Noninvasive Ventilation	86
CHAPTER 14	Long-term Home Noninvasive Ventilation	90

CHAPTER 15 Noninvasive Ventilation in Obstetric Patient 100

CHAPTER 16 Noninvasive Ventilation in Pediatrics 104

CHAPTER 17 Role of Noninvasive Ventilation in Airway Clearance and Physiotherapy 110

SECTION 2: OXYGEN THERAPY

Subhash Todi

CHAPTER 18 Oxygen Therapy 115

Index *137*

CHAPTER 17

Role of Noninvasive Ventilation in Airway Clearance and Physiotherapy

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INTRODUCTION

Physiotherapy and airway clearance techniques play an important role in the management of patients with respiratory conditions, especially when they are using noninvasive ventilation (NIV). Physiotherapy interventions are generally more effective when performed during NIV therapy or immediately after, as NIV helps to optimize lung function, making airway clearance more efficient.

Noninvasive ventilation is commonly used in conditions like chronic obstructive pulmonary disease (COPD), obstructive sleep apnea (OSA), acute respiratory failure, and others. Combining physiotherapy with NIV can enhance airway clearance, improve lung function, and promote overall respiratory health.

Physiotherapy Role with Noninvasive Ventilation[1]

- **Maximizing ventilation:** NIV can improve lung compliance, reduce the work of breathing, and help in mobilizing secretions along with physiotherapy. This can be particularly beneficial for patients with neuromuscular diseases, chronic respiratory conditions, or acute exacerbations of chronic diseases.
- **Chest expansion exercises:** Encouraging full expansion of the lungs can help to enhance ventilation and promote more effective clearance of secretions. Deep breathing exercises with NIV may improve overall lung function.
- **Improving oxygenation and ventilation:** NIV helps to increase the tidal volume and reduce the work of breathing. Physiotherapists can guide patients to perform exercises that optimize the benefits of NIV.
- **Cough assistance:** For patients with weakened respiratory muscles, physiotherapists may assist with techniques such as manually assisted cough, which can be enhanced by NIV to aid in secretion clearance.

In patients presenting with acute exacerbations, requiring NIV and having large amounts of bronchial secretions, a significant improvement in the amount of sputum expectorated can be seen with use of positive expiratory pressure (PEP) and assisted coughing compared to those who use assisted coughing alone. Thus, the additional secretion clearance techniques are not only feasible but also useful in reducing the time NIV is required in patients with acute respiratory failure.

NONINVASIVE VENTILATION AS A METHOD TO IMPROVE CLEARING SECRETIONS

Few patients may spontaneously clear secretions once NIV has been optimized but some may require additional rehabilitation to augment secretion clearance. In order to maximize the benefit from physiotherapy airway clearance treatment, optimal bronchodilator management that may be administered through the NIV circuitry is advisable prior to treatment.[2]

Postural drainage may not be possible in a spontaneously breathing breathless patient. However, once breathlessness is controlled through the use of NIV, rehabilitation treatment may be re-introduced. A mouthpiece and nose clips rather than mask interface may be more suitable for airway clearance treatment at the same time as providing pressure relief to facial structures.

Humidification can be added to the NIV circuit, although this may add resistance and interfere with machine triggering or pressure delivery. Heated humidifiers are preferred to heat moisture exchangers, as the latter may increase dead space, increase the work of breathing and reduce the efficacy of NIV.

Various airway clearance techniques such as breathing exercises, postural drainage and other mechanical aids are used clinically to treat patients on NIV. Applying the active cycle of breathing techniques (ACBT) to patients with acute hypercapnic respiratory failure on NIV has shown to reduce the time NIV was required, although there was no significant difference in the total duration of NIV or length of ICU stay.

Benefits of Combining Physiotherapy and Noninvasive Ventilation[4]

- **Improved oxygenation:** NIV supports the patient's ability to breathe and maintain oxygen levels, while physiotherapy clears mucus, improving ventilation.
- **Reduced hospitalizations:** Effective airway clearance and improved ventilation may reduce the frequency of exacerbations and hospital admissions for respiratory complications.
- **Enhanced quality of life:** NIV can help improve sleep and reduce daytime symptoms, while physiotherapy can help improve mobility and reduce discomfort associated with poor lung function.
- **Prevention of respiratory infections:** Regular airway clearance reduces the risk of infections caused by mucus buildup and stagnant airways.

One of the commonly used airway clearance regimens is the ACBT and this cyclical method of treatment can be adapted for use with a patient using NIV. The majority of evidence for airway clearance with NIV is in randomized, cross-over trials in cystic fibrosis. NIV for airway clearance was compared to PEP, FET or ACBT, and the studies found that NIV was more effective than any other airway clearance regimens in patients with severe respiratory disease who had difficulty clearing sputum.

Peripheral Techniques of Airway Clearance[3]

See **Table 1**.

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TABLE 1: Peripheral techniques of airway clearance.

Sl. No.	Technique	Description	Methods of delivery
1.	Humidification of ventilator circuit	To prevent secretions from drying up during ventilation	Using humidifier attached to NIV circuit
2.	Manual techniques (like chest wall percussion, vibration and shaking)	To enhance peak expiratory flow and thereby mobilize secretions from peripheral to central airways	Manual delivery by therapist
3.	Postural drainage	Conventional technique: To achieve gravitational drainage of secretions	Breathing exercised upon patient positioning such that affected lobes and segments of lungs are superior to the carina
4.	High frequency chest wall oscillation	When air is pushed into the jacket worn by the patient, there is a compression of the chest wall with the generation of an expiratory airflow which mobilizes peripheral airway secretions via shear forces at the air-liquid interface	Specialized costly device using jacket and air pulse generator
5.	Intrapulmonary percussive ventilation	The secretion clearance occurs by achieving ventilation distal to the trapped secretions due to distension of airways by the high-frequency pulses	Specialized costly device which provides high-frequency inspiratory bursts superimposed on the patient's normal respiration
6.	Chest wall strapping	A restrictive strapping is applied around the chest which increases the elastic recoil and expiratory flow	Using restrictive strapping
7.	Positive expiratory pressure (PEP)	Improves ventilation distal to muco-obstructed peripheral airways via collateral ventilation	Specialized positive pressure device
8.	Autogenic drainage	To enable clearance of peripheral secretions based on equal pressure point (EPP), i.e. the point of dynamic airway compression where mucus may be shared. The EPP moves proximally as lung volume increases	Breathing manoeuvers performed by the patient at different levels of vital capacity to achieve high expiratory flows in various generations of bronchi by controlled breathing. The technique involves 3 stages: phase 1, unsticking; phase 2, collection; phase 3, evacuation
9.	Active cycle of breathing technique	To achieve and restore ventillation distal to muco-obstructed peripheral airways employing collateral ventilation	Breathing manoeuvers performed by patient including breathing, control, thoracic expansion exercised and forced expiratory technique (a series of huffs associated with breathing control)

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CONCLUSION

- Pulmonary rehabilitation and airway clearance techniques, when used as adjuncts with NIV, form an integrated approach that enhances respiratory function, improves secretion clearance, and supports patients with respiratory conditions in maintaining or improving their quality of life.
- This combined approach is especially beneficial in conditions where airway obstruction and poor ventilation are ongoing concerns, such as in neuromuscular diseases, chronic obstructive pulmonary disease (COPD), or acute respiratory distress.[5]

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APICON 2025 Workshop Manual

Non-invasive Ventilation & Oxygen Therapy

Salient Features

- This handbook, *Non-invasive Ventilation and Oxygen Therapy,* is designed to serve as a practical, evidence-based guide for healthcare professionals.
- It bridges the gap between theoretical knowledge and bedside application, equipping readers with the insights needed to implement these therapies effectively and safely in different clinical settings.
- Case studies and practical tips have been included to highlight real-world applications and foster a deeper understanding of patient-centered care.
- The content is organized to provide clarity and focus, covering essential topics such as:
  - Evolution of practice of non-invasive ventilation (NIV)
  - Physiological principles underpinning NIV and oxygen therapy
  - Indications and contraindications for their use as per evidences and guidelines
  - Selection of appropriate devices and interfaces
  - Management strategies for common challenges and complications
  - Real-time case-based scenarios in everyday encounters at different settings
  - Uses of NIV in extended and special settings as a modality of MDT approach of care



Subhash Todi MBBS MD(Medicine) MRCP is a renowned expert in the field of critical care medicine, currently serving as the Director of Critical Care at Manipal Hospitals in Dhakuria, West Bengal, India. He is also the Head, Department of Academics and Research at the same institution. He holds the position of Medical Advisor, contributing his vast expertise to clinical care and medical advancements in critical care. Apart from that, he is serving as the Editor of the *Indian Journal of Critical Care Case Report (IJCCR)*. He has authored over *55 publications* in indexed journals, furthering understanding and knowledge in the field of critical care. His expertise is also reflected in his authorship of more than 30 book chapters in renowned critical care textbooks, where he provides insight into cutting-edge medical practices and patient management strategies.

As an esteemed reviewer for several leading medical journals, including *Critical Care Medicine (CCM), Indian Journal of Medical Microbiology (IJMM),* and *Indian Journal of Critical Care Medicine (IJCCM)*, he plays an essential role in shaping the direction of critical care research and ensuring the quality of scientific publications



Rakhi Sanyal MBBS MD DNB MNAMS is a Professor, Department of Internal Medicine, Jagannath Gupta Institute of Medical Sciences, Kolkata, West Bengal, India, who is teaching students of both MBBS and MD (Medicine). She is an examiner of International MRCP PACES UK Examination; Medical Education Unit and Curriculum Committee Member, JIMSH; Member of Forum for Ethics Review Committees in India; Member of ISCCM; and EC member of API WB. She is Senior Consultant of Acute Care and Internal Medicine. She is the author of chapters in Progress in Medicine and API Medicine: A Clinical Compendium. She has several publications in national and international journals. At present, she is leading several clinical research studies and trials. She is also Convenor, Critical Care Subcommittee of APICON 2025, and Founder Member of SAVE (Government Registered Animal Welfare Trust).

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