Original Article

Efficacy of Non-Invasive Positive Pressure Ventilation (NIPPV) combined with mini-tracheostomy in the management of difficult-to-wean patients

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Abstract

Background: *To investigate the efficacy of NIPPV in combination with minitracheostomy as weaning adjunct in difficult to wean patients.*

Method: *Prospective analysis of 10 non-consecutive patients with respiratory failure of various etiologies in 20 bedded adult multidisciplinary Intensive Care Unit of a tertiary care hospital. These patients were ventilator dependent and were difficult to extubate and wean off. They were subjected to NIPPV through facemask in combination with minitracheostomy using 4.5 mm percutaneous minitracheostomy tube (Minitrach II SIMS Portex, Hythe, Kent, UK) for removal of tracheobronchial secretions. Mortality, duration of treatment with NIPPV with minitracheostomy and duration of ICU stay were evaluated.*

Results: *Mean age of the study group was 55± 20 years and M: F was 1:1. Average duration of intubation was 21.8 days. Minitracheostomy was performed after mean duration of 2.8 days of NIPPV support following extubation. Average period of NIPPV with in situ minitracheostomy tube was 8.2 days. 90% of the patients those underwent minitracheostomy could be discharged successfully from the ICU after a mean stay of 12.8 days following their last extubation.*

Conclusion: *NIPPV in combination with minitracheostomy may be considered as safe and effective weaning adjunct to wean off difficult to wean patients.*

Introduction

Despite the advances of last decades much research remains to be performed in order to optimize weaning of difficult patients such as elderly and those with chronic respiratory insufficiency of multifactorial origin. Patients with poor ventilatory capacity, with impaired cough mechanism and who cannot clear respiratory secretions are account for the largest group in weaning failure. Weaning of these patients from mechanical ventilatory support remains a challenge.

In current practice, ventilation with tracheostomy is considered as the conventional approach for managing these patients. However tracheostomy has several disadvantages including tracheal injury, inability to speak, difficulty in swallowing, increased risk of infection, psychological and life threatening intraoperative complications.

Non-invasive ventilation has been useful in weaning of patients from mechanical ventilation and avoid need of tracheostomy.(1,2) Presence of excessive tracheo-bronchial secretions and poor cough mechanisms decrease efficacy of NIPPV and further delay weaning. Minitracheostomy reported by Matthews and Hoplins in 1984(3) is a minimally invasive method to facilitate the clearing of tracheobronchial secretions.

We conducted this pilot study to investigate the efficacy of combining minitracheostomy with NIPPV for management of difficult to wean patients.

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Materials and Methods

This was a prospective study conducted from March 2002- September 2003 in a 20-bedded multidisciplinary intensive Care Unit of Sir Ganga Ram Hospital, India. Ethics approval for the study was obtained from the ethical committee of Sir Ganga Ram Hospital.

Non-consecutive mechanically ventilated patients of respiratory failure due to various etiologies were considered to participate in the study. To begin with, all those patients who met weaning and extubation criteria (maximum inspiratory pressure ≤ -25CmH2O, minute ventilation ≤10 L/min, Tidal volume>5ml/Kg, respiratory frequency≤35/min., Rapid shallow breathing index≤105 cycles/min/L and SaO2 >90% with FiO2 of 0.4(4) were selected to participate in the study. In the presence of above mentioned criteria as well physician decision these patients were weaned off and extubated successfully. Out of these extubated patients, those who failed to maintain on spontaneous respiration and required reintubation within 72 hours of their extubation were included in the study. Reasons for failed extubation were either excessive bronchial secretions or incapability of the patients to clear bronchial secretions because of poor cough mechanism. They also failed to tolerate the NIPPV trial with face mask. These reintubated patients were restabilized and again subjected to the trial of weaning and extubation. Those patients who could not tolerate extubation for the second time and required reintubation remained in the study. Those who were successful after extubation were excluded from the study. The process of weaning and extubation was continued for the third time. To all these patients appropriate trial of NIPPV was also given after extubation. Patients who failed weaning and extubation for the third time and again deteriorated because of the excessive secretions and inability to clear the secretions were remained in the study for further intervention. At this time elective reintubation or tracheostomy was seriously considered in all these patients but instead of doing reintubation or tracheostomy, mini-tracheostomy was performed by putting a flanged reclosable 4.5 mm internal diameter percutaneous minitracheostomy tube (Minitrach II SIMS Portex, Hythe Kent, UK) through cricothyroid membrane into the distal trachea. Minitracheostomy was used for frequent suctioning of tracheobronchial secretions with continued NIPPV support through facemask interface. Other Standard medical therapy was continued as appropriate including the use of antibiotics, bronchodilators, deep venous prophylaxis etc.

At baseline, demographic data and diagnosis were recorded for all these finally selected patients. Duration of mechanical ventilation before final extubation, duration after which minitracheostomy was done and total duration of minitracheostomy with NIPPV was recorded. Patients were followed up throughout their ICU stay. Final outcome and any complications that occurred were recorded.

Results

Total 10 patients were included in the study. Base line characteristic is shown in table 1.

Table 1. Baseline characteristics of the study group.

Total no. of patients		10
Age		55 ± 20 years
Male: Female		1:1
Diagnosis	COPD with respiratory failure	3 (30%)
	Primary Pneumonia	3 (30%)
	Sepsis with Hypoxemic respiratory failure	2 (20%)
	Malaria with ARD	1 (10%)
	Head injury with aspiration pneumonia	1 (10%)
Mean duration of invasive ventilation		21.8 days

Mean age of study group was 55±20 years with male female ratio of 1:1. Diagnosis of the patients included COPD with respiratory failure (30%), primary pneumonia (30%), sepsis with hypoxemic respiratory failure (20%), malaria with ARDS (10%) and head injury with aspiration pneumonia (10%). Mean duration of mechanical ventilation with endotracheal tube before minitracheostomy was done was 21.8 days. The response to NIPPV with minitracheostomy is shown in table 2. Nine patients (90%) receiving NIPPV with minitracheostomy responded well and were successfully discharged from the ICU. The mean duration of NIPPV with minitracheostomy was 8.2 days and mean ICU stay after the intervention was 12.8 days.

Table 2. Outcomes of the study

Total no. Of patients	10
Avg. duration of NIPPV with minitracheostomy	8.2 days
ICU stay after minitracheostomy	12.8 days
No. Of Patients discharged from ICU	9 (90%)
Complications	Tracheal Bleeding (1)
Readmission to ICU	Nil

The facemask was well tolerated by all the patients and did not produce any significant side effects. Minitracheostomy was uneventful in 9 patients and one patient developed life threatening tracheal bleeding because of vascular injury, and required reintubation.

Discussion

For the majority of mechanically-ventilated patients (70–80% in various series) weaning can be accomplished quickly and easily. There is, however, a smaller group of ventilated patients (20–30%) who repeatedly fail attempts at weaning and remain ventilator-dependent for prolonged periods. These difficult to wean patients account for a significant amount of health care costs and pose a great challenge for clinicians.

Minitracheostomy is a technique to assist the removal of airway secretions while maintaining glotic function. In various studies it has been used successfully as an adjunct for secretion removal without serious adverse .(5,6)

To our knowledge this is the first study evaluating the efficacy of combining NIPPV with minitracheostomy as a modality of weaning and extubation in difficult to wean patients. In our study, presence of excessive tracheobronchial secretions and inability to clear these secretions is responsible for the repeated weaning and extubation failure. It should be emphasized that NIPPV in combination with minitracheostomy was successfully administered to the patients showing severe inability to eliminate tracheobronchial secretions. The need for constant access to bronchial tree for suction and removal of secretion is generally considered as a factor contraindicating the application of NIPPV. Nevertheless in our experience by providing direct access to the upper airway, minitracheostomy made the NIPPV via facemask possible in patients with the profuse bronchial secretions and ineffective cough thus avoiding mucus plugging and atalactasis. This intervention helped in these patients to maintain their ventilation without the need of reintubation or tracheostomy.

We encountered severe life threatening tracheal bleeding in one of our patient managed conservatively. In the study by Wain and colleagues out of 56 patients who underwent minitracheostomy two patients has bleeding requiring endotracheal intubation.(5)

We believe that these result support the extended use of NIPPV in combination with minitracheostomy in difficult to wean patients.

Conclusion

The findings of our study provide support for considering NIPPV in combination with minitracheostomy as a safe and effective modality for weaning and extubation. However controlled studies

with elaborated parameter analysis are needed to assess the benefit.

Acknowledgements: None
Sources of funding: None
Conflict of interest: The authors declare no conflict of interest.

The findings of this paper were presented at the National Conference on Pulmonary Diseases (NAPCON), India, November 12-16, 2003.

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