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ASSESSMENT OF OUTCOME WITH RESPECT TO NON INVASIVE VENTILATOR IN TYPE 1 AND TYPE 2 RESPIRATORY FAILURE IN INTENSIVE CARE UNIT

Pulmonary Medicine

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ABSTRACT

Noninvasive ventilation (NIV) represents the delivery of positive pressure to the lungs without inserting an endotracheal tube. Noninvasive ventilation has been successfully used in patients with acute respiratory failure. It is imperative to watch for outcome of NIV in patients with acute respiratory failure. **Aim & Objective:** To compare the clinical, radiological and laboratory parameters of patients being treated by non invasive ventilation in type1 and type 2 respiratory failure. **Materials and Methodology:** This was a prospective study performed at tertiary care centre over period of 1.5 year. **Conclusions:** Study indicates that a trial of NIV is effective in improving gas exchange, reducing intubation, and length of stay in hospital in patients with acute respiratory failure.

KEYWORDS

Noninvasive ventilation, respiratory failure

INTRODUCTION

Noninvasive ventilation has been effectively applied in patients with acute respiratory failure with a significant reduction in mortality rate, need for endotracheal intubation, and length of stay compared with standard therapy. Noninvasive ventilation is widely used to treat acute respiratory failure due to different etiologies. The advantages of NIV over endotracheal intubation are obvious. Speech, airway defense mechanisms and swallowing functions are left intact. Respiratory failure is defined as a failure to sustain adequate gas exchange and is characterized by abnormalities of arterial blood gas tensions. There are two types of respiratory failure—type I respiratory failure is defined by arterial PO_2 (PaO_2) of <8 kPa (60 mm Hg) with normal or low arterial PCO_2 ($PaCO_2$). Type II respiratory failure is defined by PaO_2 of <8 kPa (60 mm Hg) and $PaCO_2$ of >6 kPa (45 mm Hg).

Acute respiratory failure is usually characterized by life-threatening derangements in arterial blood gases and acid–base status. Acute respiratory failure may be classified as hypercapnic or hypoxemic. Hypercapnic and hypoxemic respiratory failure is defined as $PaCO_2$ greater than 45 mm Hg and PaO_2 less than 55 mm Hg, respectively, when the fraction of oxygen in inspired air (FiO_2) is 0.60 or greater.

AIM AND OBJECTIVE

1. To identify predictors of Mortality.
2. To identify predictors of success of weaning from NIV in patients of Respiratory Failure.
3. To understand difference in course in Type I and Type II Respiratory Failure with respect to NIV.

MATERIAL & METHODS

This was a prospective study performed at tertiary care centre over period of 1.5 year.

1. Data was collected from the patients admitted in respiratory medicine department with chief respiratory complaints, in SAMC and PGI, Indore.
2. Thorough history taking and physical examinations, radiological findings, hematological and serum biochemical profiles were recorded.

RESULTS

Respiratory failure is characterized by failure to sustain gas exchanges and abnormalities of arterial blood tensions. There are typically two types of respiratory failures – Type-I and Type-II. According to Kramer et al. most of the studies have shown encouraging results with the use of non-invasive ventilation in patients with acute respiratory failure. With its use, the need for intubation has reduced and there was an improvement in respiratory rate and gas exchange. George et al. showed that with the use of non-invasive ventilation, there was a reduced need for invasive mechanical ventilation, decreased mortality and shorter hospital stay.

We had included 120 patients with respiratory failure, of whom, 60 patients had type-I respiratory failure and 60 patients had type-II respiratory failure.

Most of the patients in both the groups were in the age ranges 41-60 years, followed by 61- 80 years. The mean age of the patients in type-I respiratory failure group was 56.47 ±13.02 years, and in type-II respiratory failure group was 59.97 ± 11.88 years. The difference was found to be statistically not significant (P=0.127). Both the groups arecomparable with respect to the mean age of the patients. In Arsudeet al. study, the mean age of the patients was 56.16 ± 12.7 years. Most of the patients were in the age range 61- 70 years, followed by 51-60 years. There were 70% males and 30% females in Type-I respiratory failure group and 71.7% males and 28.3% females in Type-II respiratory failure group. In both the groups, males outnumbered the females and we found no significant association between the groups and the sex of the patients (P=0.841). Both the groups were comparable with respect to sex of the patients. In Arsudeet al. study, there were56% males and 44% females. The findings are similar to our study's findings.

In Type-I respiratory failure group, 15% patients had comorbidities, while in Type-II respiratory failure group, 10% patients had comorbidities. No statistically significant association was seen between the presence of comorbidities and the groups (P=0.408). Both the groups were comparable with respect to the comorbidities. In Arsudeet al. study COPD was seen in 46%, pneumonia in 24%, bronchiectasis in 12%, obstructive airway disease in 8%, interstitial lung disease in 6%, parapneumonic effusion in 2% and bronchial asthma in 2%.

In Type-I respiratory failure group, the mean Heart rate on Day-1 was 113.33 ± 11.11 per minute, on Day-5, it was 88.28 ± 16.04per minute and on Day-10, it was 82.15 ± 14.46 per minute. In Type-II respiratory failure group, the mean Heart rate on Day-1 was 110.57 ±15.97 per minute, on Day-5, it was 94.43 ± 17.48 per minute and on Day-10, it was 86.11± 18.45 per minute. In both the groups, the mean Heart rate decreased over the course of 10 days. The mean Heart rate was comparable between the two groups on Day-1 (P=0.273), on Day-5 (P=0.068) and on Day-10 (P=0.241).

In Type-I respiratory failure group, the mean Systolic blood pressure

on Day-1 was 116.40 ± 18.75 mmHg, on Day-5, it was 120.87 ± 9.91mmHg and on Day-10, it was 113.63 ± 8.42 mmHg. In Type-II respiratory failure group, the mean Systolic blood pressure on Day-1 was 128.33 ± 15.25 mmHg, on Day-5, it was 121.97 ± 11.09 mmHg and on Day-10, it was 113.54 ± 10.26 mmHg. In Type-I respiratory failure group, the mean systolic blood pressure increased on Day-5 and then decreased by Day-10, but remained low in comparison to Day-1. In Type-II respiratory failure group, the mean Systolic blood pressure decreased over the course of 10 days. The mean systolic blood pressure was significantly lower in Type-I respiratory failure group on Day-1 (P=0.001), when compared with Type-II respiratory failure group. While the mean systolic blood pressure was comparable between the two groups on Day-5 (P=0.601) and on Day-10 (P=0.961).

In Type-I respiratory failure group, the mean Diastolic blood pressure on Day-1 was 72.90 ± 10.89 mmHg, on Day-5, it was 78.61 ± 7.72mmHg and on Day-10, it was 72.78 ± 5.79 mmHg. In Type-II respiratory failure group, the mean Diastolic blood pressure on Day-1 was 79.13 ± 8.93 mmHg, on Day-5, it was 76.86 ± 8.37 mmHg and on Day-10, it was 72.74 ± 7.59 mmHg. In Type-I respiratory failure group, the mean diastolic blood pressure increased on Day-5 and then decreased by Day-10 but remained slightly low in comparison to Day-1. In Type-II respiratory failure group, the mean Diastolic blood pressure decreased over the course of 10 days. The mean diastolic blood pressure was significantly lower in Type-I respiratory failure group on Day-1 (P=0.001), when compared with Type-II respiratory failure group. While the mean diastolic blood pressure was comparable between the two groups on Day-5 (P=0.277) and on Day-10 (P=0.976).

In Type-I respiratory failure group, the mean Respiratory rate on Day-1 was 27.63 ± 2.45 per minute, on Day-5, it was 22.72 ± 2.07per minute and on Day-10, it was 20.37 ± 2.63 per minute. In Type-II respiratory failure group, the mean Respiratory rate on Day-1 was 26.57 ± 3.21 per minute, on Day-5, it was 22.41 ± 2.41 per minute and on Day-10, it was 21.13 ± 3.43 per minute. In both the groups, the mean Respiratory rate decreased over the course of 10 days. The mean Respiratory rate was significantly higher in Type-I respiratory failure group, when compared with Type-II respiratory failure group on Day-1, while the mean respiratory rate was comparable between the two groups on Day-5 (P=0.499) and on Day-10 (P=0.222).

In Type-I respiratory failure group, there was 12 (20%) mortality and in Type-II respiratory failure group, there was 6 (10%) mortality. Mortality rate was slightly lower in Type-II respiratory failure group, but the difference was found to be statistically not significant (P=0.200).

In Type-I respiratory failure group, failure to wean off from ventilator was seen in 16 (26.7%) of patients and in Type-II respiratory failure group, failure to wean off from ventilator was seen in 14 (23.3%) of patients. Failure rate was slightly higher in Type-I respiratory failure group, when compared with Type-II respiratory failure group, but the difference was found to be statistically not significant (P=0.833). In Arsudeet al. study, in Type-I respiratory failure group, 87.5% patients did not require endotracheal intubationwith clinical and ABG improvement (success), while 12.5% did not improve clinically and on ABG parameters with NIPPV and needed intubation (failure). In Type-II respiratory failuregroup, 88.23% patients were successful, and 11.76% patients were failure.

Chandra et al. in their study reported that use of non-invasive ventilation in patients with COPD was associated with a 42% reduction in the invasive mechanical ventilation. They also showed an increase in mortality rate in patients who failed non-invasive pressure support ventilation.

In a study done on use of NIV in patients with ARDS, Bellaniet al. found that NIV failure occurred in 22.2% of mild, 42.3% of moderate and 47.1% of patients with severe ARDS. Hospital mortality was higher in ICU patients on NIV, compared to those on invasive ventilation with PaO2/FiO2 lower than 150 mmHg.

LIMITATIONS

- Single center study (the way the NIV service is delivered will depend on the model of hospital care that varies greatly).
- The relatively small sample size and lack of a control group imposed limited value to statistical analysis of group differences between patients with type I respiratory failure and type II respiratory failure. This type of analysis in a small sample sizes may seem inconclusive.

SUMMARY & CONCLUSION

The study provides strong evidence for the use of NIV (BIPAP) as a first line intervention in patients with acute respiratory failure, irrespective of the type and the cause of acute respiratory failure. However, further studies are required to evaluate other potential predictors of outcome of NIV in acute respiratory failure patients for further improving the success rate of NIV.

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