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CLINICAL UTILITY OF NON-INVASIVE VENTILATION IN VARIOUS INDICATIONS OF ACUTE HYPOXIC RESPIRATORY FAILURE AT THE TERTIARY CARE RURAL HOSPITAL IN WESTERN MAHARASHTRA

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Abstract:

Background : Non-invasive ventilation (NIV) refers to delivery of mechanical ventilation with techniques that do not need an invasive endotracheal airway. Compared with invasive mechanical ventilation, this type of ventilation achieves the same type of physiological benefits of decreased work of breathing and improved gaseous exchange. NIV is also used for cardiogenic pulmonary oedema (CPE) a form of acute hypoxemic respiratory failure (AHRF). The successful application of NIV in AHRF of varied aetiologies has been extensively described but the success rate seems to be strictly dependent on AHRF aetiology.

Objectives: To assess clinical utility of NIV for the various indications in patients of Acute Hypoxic Respiratory Failure.

Materials and methods: This was a descriptive, longitudinal study done in department of Medicine at Pravara Rural Hospital, Loni over a period of 2 years. All patients admitted to ICU were screened and enrolled for Acute Hypoxic Respiratory Failure (AHRF). Study commenced after the approval from Institutional Ethics Committee (IEC-RMC) .All patients satisfying the the inclusion and exclusion criteria (n=50) were assessed for Proportion of various indication for NIV in patients of AHRF, Success and Failure of NIV therapy, PaO2/FiO2 levels, Duration of NIV required in hours and Duration of ICU stay in days.

Results: The most common indications for the use of Non Invasive Ventilation in patients of Acute Hypoxic Respiratory Failure was Cardiogenic Pulmonary Oedema-CPE (46%) . The Mean PaO2/FiO2 ratio from Baseline to 2 hours Post NIV treatment showed increase in the PaO2/FiO2 ratio for all the indications.

Conclusion: Proportion of success with NIV treatment was highly significant in all the indications namely CPE, CAP, BA with consistent increase in PaO2/FiO2 ratio and less duration of ICU stay except for ARDS where results were not encouraging for the utility of NIV treatment

Key words: Non-invasive ventilation (NIV), Acute hypoxic respiratory failure (AHRF), Cardiogenic Pulmonary Oedema (CPE), Community Acquired Pneumonia (CAP), Acute Exacerbation of Bronchial Asthma (BA) , Acute Respiratory Distress Syndrome (ARDS)

INTRODUCTION

The use of non-invasive ventilation (NIV) in patients with acute respiratory failure as a potential alternative to endotracheal intubation began in late 1980s [1]**.** Non-invasive ventilation refers to delivery of mechanical ventilation with techniques that do not need an invasive endotracheal airway. Compared with invasive mechanical ventilation, this type of ventilation achieves the same type of physiological benefits of decreased work of breathing and improved gaseous exchange [2]. **The benefits of** non-invasive ventilation include avoidance of the complications of endotracheal intubation and the risks of ventilator-associated pneumonia and sinusitis, especially in immunocompromised patients or in patients with co morbidities [3]. Non-invasive ventilation is used mainly for exacerbations of chronic obstructive pulmonary disease (COPD) and the utility of NIV in COPD patients has been proved beyond doubt. NIV is also used for cardiogenic pulmonary oedema (CPE) a form of acute hypoxemic respiratory failure (AHRF). The use of NIV for other forms of AHRF is still infrequent and is mainly done in specialized centres or as part of a research protocol. The successful application of NIV in AHRF of varied aetiologies has been extensively described but the success rate seems to be strictly dependent on AHRF aetiology and until today the application of NIV strategies in the setting of AHRF is controversial except for acute cardiogenic pulmonary edema [4].

Hence it was thought prudent to evaluate use of NIV in terms of various indications of AHRF..

AIMS:

To study the Clinical Utility of non-invasive ventilation in various indications of acute hypoxic respiratory failure at the tertiary care rural hospital in Western Maharashtra.

OBJECTIVES:

1. To assess clinically the various indications for the use of Non Invasive Ventilation in patients of Acute Hypoxic Respiratory Failure
2. To find out the proportion of success and failures with NIV treated patients of patients of Acute Hypoxic Respiratory Failure
3. To compare the changes in mean PaO2/FiO2 ratio from baseline to 2 hours Post NIV treatment in various indications of Acute Hypoxic Respiratory Failure
4. To compare the duration of NIV required and length of ICU stay for various indications in patients of Acute Hypoxic Respiratory Failure

MATERIAL AND METHOD

This was a descriptive, longitudinal study done in department of Medicine at Pravara Rural Hospital, Loni over a period of 2 years. All patients admitted to ICU were screened and enrolled for Acute Hypoxic Respiratory Failure (AHRF). All the enrolled patients were subjected to the following inclusion and exclusion criteria.

Inclusion Criteria

1. Patients admitted to ICU with moderate to severe dyspnoea with use of accessory muscles for respiration and respiratory rate more than 25/ min with low SpO2 labelled as Acute Hypoxic Respiratory (AHRF)
2. Patients admitted to ICU at PRH with PaO2 low oxygen mask on venturi at 60% FiO2 less than 60mm Hg or oxygen saturation by pulse oximetry (SpO2) less than 90%
3. Patients of either gender and adult age with AHRF on NIV
4. Patients or parents ready to give consent

Exclusion Criteria

1. Hypercapnia (PaCO2 of more than 45 mm Hg)
2. Need for emergency intubation at the time of admission
3. Recent facial, oesophageal, facial, or cranial trauma or surgery
4. Severely decreased consciousness (GCS less than 8)
5. Patients who are non cooperative
6. Active upper gastrointestinal bleeding
7. Blood pressure of <90 mmHg despite adequate volume resuscitation

Study commenced after the approval from Institutional Ethics Commitee (IEC-RMC) .All patients satisfying the

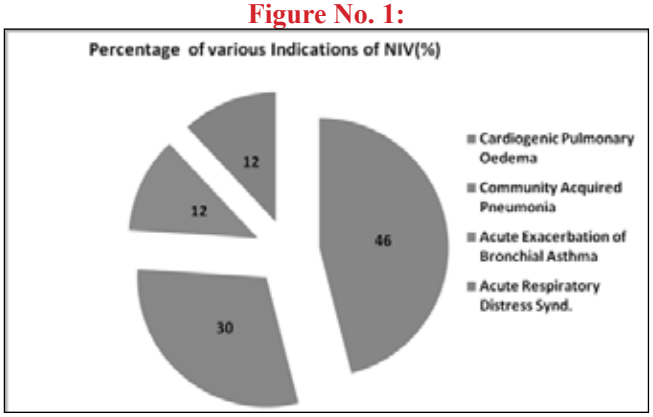
above inclusion and exclusion criteria (n=50) were assessed for the following variables:

1. Proportions of Various indications for NIV in patients of Acute Hypoxic Respiratory Failure (AHRF) according to NIV guidelines laid by ISCCM[39]:
2. Success and Failure of NIV therapy was assessed by the requirement of endotracheal intubation (failure of NIV) in various indications in patients of Acute Hypoxic Respiratory Failure (AHRF)
3. PaO2/FiO2 levels at baseline and at 2hours after NIV treatment
4. Duration of NIV required in hours and Duration of ICU stay in days

Statistical analysis was carried out using descriptive statistics of proportion for the ratio variables and inferences were drawn using *Non-parametric Mann-Whitney Test is used to test the difference in mean values*

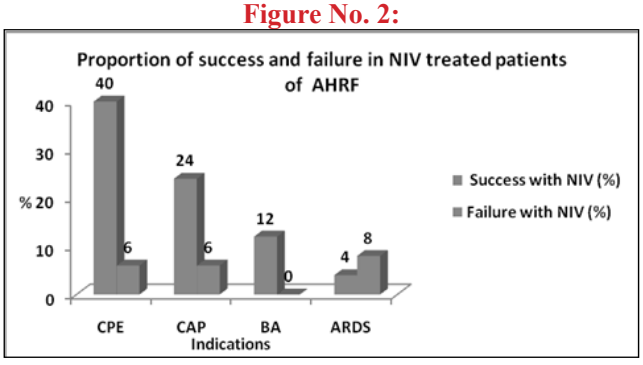
OBSERVATIONS AND RESULTS

Figure No. 1:



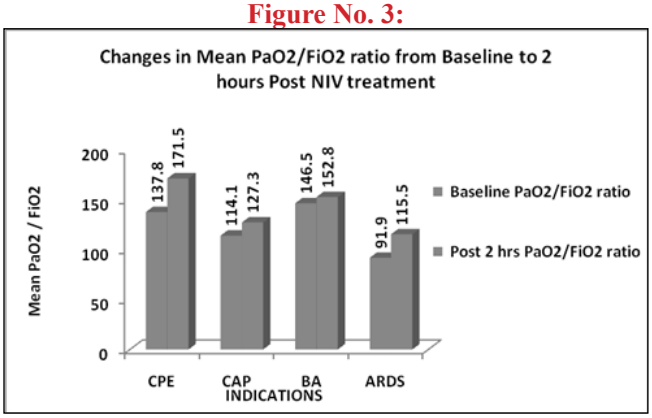
The most common indications for the use of Non Invasive Ventilation in patients of Acute Hypoxic Respiratory Failure was Cardiogenic Pulmonary Oedema (46%) .

Figure No. 2:



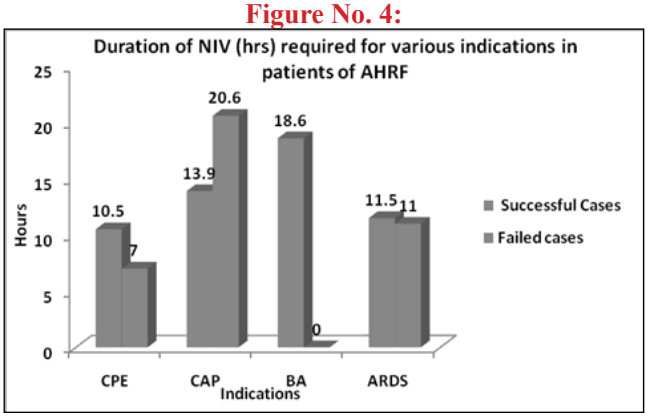
Proportion of success with NIV treatment was highly significant in all the indications except ARDS.

Figure No. 3:



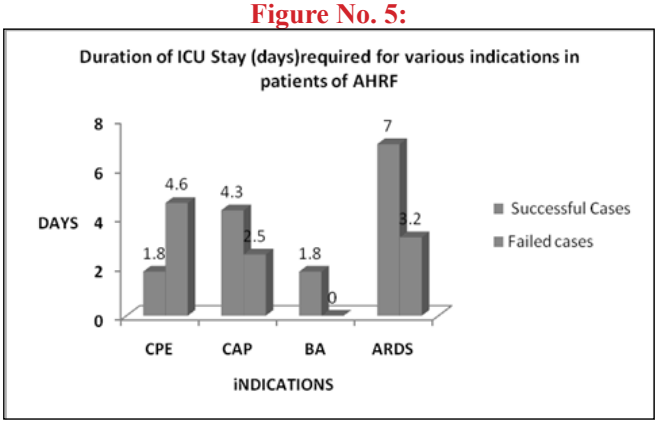
The Mean PaO2/FiO2 ratio from Baseline to 2 hours Post NIV treatment showed increase in the PaO2/FiO2 ratio for all the indications.

Figure No. 4:



BA was successful with NIV treatment requiring 18.6 hours mean NIV therapy. Duration of NIV required in hours was least in CPE than other indications whereas the failure cases of CAP required maximum hours of NIV but still failed and had to be intubated. All cases of.

Figure No. 5:



Duration of ICU stay in days was least in successful cases

of CPE and BA than other indications whereas the ARDS cases required mean 7 days stay in ICU which was more than any other indication.

DISCUSSION

The present observational study was undertaken to assess the utility of Non Invasive Ventilation (NIV) in patients of Acute Hypoxic Respiratory Failure (AHRF). Total 50 patients satisfying the eligibility criteria for AHRF were studied for the various indications (causes). The most common indications for the use of Non Invasive Ventilation in patients of Acute Hypoxic Respiratory Failure was Cardiogenic Pulmonary Oedema-CPE (46%) which was considered as Level I indication for NIV use as per the NIV guidelines laid by ISCCM . The other indications recorded were Community Acquired Pneumonia- CAP(30%), Acute Exacerbation of Bronchial Asthma- BA (12%), Acute Respiratory Distress Syndrome – ARDS (12%) which can be considered as Non level I indications**. (Figure 1).** These results were similar to a study by Purwar S et al from Chennai [5] where 59.4% patients were of Non Level I indications. Our findings of greater percentage of non level I indications for NIV was also similar to two other Indian studies by Sharma S et al and Agarwal R et al looking at NIV use in North India [6] [7].

The Proportion of success with NIV treatment was highly significant in all the indications namely 40% cases of CPE, 24% cases of CAP, 12% BA, except ARDs (4% success whereas 8% Failure). The total failure of NIV for the various indications in patients of AHRF was 20% signifying that NIV can be a better option for the above mentioned indications. **(Figure2).** There is a wide variety of NIV failure rates across many studies ranging from 53.9% reported by Sharma et al [6] to as low as 15% reported by George et al.[8]. The failure of NIV therapy depends on the etiology and severity of ARF**.**

The Mean PaO2/FiO2 ratio from Baseline to 2 hours Post NIV treatment showed increase in the PaO2/FiO2 ratio for all the indications. Thus it can be very well said that use of NIV in patients of AHRF is justified by the increase in the partial arterial pressure of oxygen and diminished fractionated oxygen levels in breath. **(Figure 3)**

NIV requirement was calculated as hours for which the patient was on Non invasive ventilation treatment and all cases of BA were successfully treated with 18.6 hours mean NIV therapy. Duration of NIV required in hours was least in CPE than other indications whereas the failure cases of CAP required maximum hours of NIV but still failed and had to be intubated. Thus NIV treatment was found to be successful for indications like BA, CPE. **(Figure no.4)**

Duration of ICU stay in days was least in successful cases of CPE and BA than other indications whereas the ARDS cases required mean 7 days stay in ICU which was more than any other indication. **(Figure no. 5).**

The results of this study proved the clinical utility of NIV for the various indications of AHRF. NIV therapy proved effective for indications like CPE, CAP, BA, which was in accordance with studies of Bersten et al [9] evaluated the use of NIV in 19 patients with CPE, Domenighetti G et al [10] also did a trial on NIV use in CAP, whereas Meduri et al [11] and Soroksky et al [12] studied utility of NIV in BA.

The utility of NIV in ARDS in our study is doubtful because the results showed higher percentage of failures and more days of ICU stay in NIV treated patients of ARDS. The role of NIV in patients of Acute Respiratory Distress Syndrome has been controversial. This subset of patients has the worst outcome when they receive NIV as a support measure for severe AHRF, with high rates of NIV failure. [13][14][15].

CONCLUSION

The most common indications for the use of Non Invasive Ventilation in patients of Acute Hypoxic Respiratory Failure were Cardiogenic Pulmonary Oedema-CPE. Proportion of success with NIV treatment was highly significant in all the indications namely CPE, CAP, BA with consistent increase in PaO2/FiO2 ratio and less duration of ICU stay except for ARDS where results were not encouraging for the utility of NIV treatment .

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