COMPARATIVE ANALYSIS ON NON-VENTILATORY MANagements IN ACUTE ASThma

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Article Info: Received 21 December 2021; Accepted 17 January 2022
DOI: https://doi.org/10.32553/ijmbs.v6i1.2464
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Conflict of interest: No conflict of interest.

Abstract

Introduction: Acute asthma attacks or acute asthma can be defined as episodes of progressive increase in shortness of breath, cough, wheezing, chest tightness, or some combination of these symptoms. It includes the aggravation, inflammation, and obstruction of the bronchial tubes, which permit air all through the lungs. Most exacerbations are overseen in the outpatient setting. In the United States in 2004 there were 14.7 million visits to doctor workplaces and clinic outpatient divisions for acute asthma. In pediatric patients, a scoring rubric called the Pediatric Respiratory Assessment Measure (PRAM) has been created to evaluate a patient's acute asthma seriousness utilizing a mix of scalene muscle compression, suprasternal withdrawals, wheezing, air entry, and oxygen saturation. Noninvasive ventilation has a few possible upper hands over intubation and intrusive mechanical ventilation: there are fewer requirements for sedation, the patient is allowed to talk, ventilation can be briefly suspended to permit the patient to take tastes of liquid or to cough and expectorate, and there is a lower hazard of ventilator-related pneumonia.

Aims and Objectives: The study intended to compare the efficiency of using oxygen inhalation and rapid-acting bronchodilator as first line management of acute exacerbant asthma.

Materials and Methods: The study design is retrospective cross-sectional which was conducted during the period of 7 Months. The study has considered 100 patients, among which 45 patients are male and 55 patients are female. The patients who visited the Emergency Department were considered. The patients on arrival to the emergency department was assessed for PRAM score (Initial PRAM score) and was interpreted. Then either oxygen or Short-Acting Beta Agonist (Salbutamol) inhalation was given. Then again, after a fixed interval, the patient’s PRAM score was assessed (Post-Interventional PRAM score). PRAM score was assessed and interpreted.

Result: The study found that, after intervention, Group 1 achieved PRAM score of 4.48±1.41 in Group 1 (Oxygen group) while Group 2 (Short-Acting Beta Agonist inhalation) achieved 6.12±1.47. It was found that in patients of Group 1, the mean of changes in all the patients was 6 while in the patients of Group 2 was 4.18.

Conclusion: The study concludes that the acute asthmatic episode in emergency department can be managed by oxygen inhalation better than Short-Acting Beta Agonist inhalation. Oxygen inhalation is easier to give as compared to intubation and is also efficient in lowering PRAM score and hence, evidently showed the efficacy for proper management of severe acute asthma in emergency setting.

Keywords: pram, acute asthma, oxygen, salbutamol, non-ventilatory

Introduction

Acute exacerbations (asthma attacks or acute asthma) can be defined as episodes of progressive increase in shortness of breath, cough, wheezing, chest tightness, or some combination of these symptoms, accompanied by decreases in expiratory airflow that can be quantified by measurement of lung function[1].

Asthma includes the aggravation, inflammation, and obstruction of the bronchial tubes, which permit air all through the lungs. Acute asthma alludes to an expansion in side effects that happen when the muscles encompassing the bronchial tubes tighten, which limits the airflow. It is otherwise called an asthma attack, or acute asthma exacerbation[2]. During an asthma attack, mucus creation increments and can discourage the air routes, making it challenging to breathe and relax. The attack might change in severity and span. Mild attacks might last a couple of moments, while extreme ones might endure from hours to days [3].

Asthma exacerbations are acute or subacute episodes of dynamically deteriorating windedness, cough, wheezing, and chest tightness, or a mix of these side effects, described by diminishes in expiratory airflow and goal proportions of lung function (spirometry and pinnacle stream). These episodes are distressing to patients and result in significant usage of medical care assets and loss of work efficiency and school participation [4]. Most exacerbations are overseen in the outpatient setting. In the United States in 2004 there were 14.7 million visits to doctor workplaces and clinic outpatient divisions for acute asthma; however, that left 1.4 million patients who required emergency center administration of their asthma exacerbation[5].
More extreme intensifications bring about hospitalization, which establishes around 33% of the all-out $14.7 billion in the US yearly asthma-related medical services use. The Agency for Healthcare Research and Quality patrons the Nationwide Inpatient Sample (NIS), the biggest all-payer wellspring of information on hospitalized patients in the United States, and information from 2000 shows that there were 65 381 confirmations for asthma (ages>5 years [5,6].

Among these, there were 2770 intubations for respiratory failure related to acute severe asthma. Further information from the NIS exhibits that all age bunches experienced hospitalization at comparative rates, with a slight prevalence of the 35-54-year age range, addressing 31.7% of affirmations for asthma. Notwithstanding, the NIS shows that mortality increments drastically with expanding age. Kids and youths have the least death rate (0.02%) and the old have the most noteworthy mortality from asthma (1.9% for ages>75). Remarkably, among the roughly 4210 asthmatic patients who die from acute asthma every year in the United States, the greater part (around 2/3) happens outside the emergency clinic [7].

Asthma exacerbation occurs more in females than in males, and females are two times as probable as males to be hospitalized for asthma. Nonetheless, asthma commonness is higher in post-pubertal females than post-pubertal males and this reality is an enormous piece of the clarification for the larger quantities of grown-up females looking for care for acute asthma. This distinction in orientation inclination for asthma in adulthood versus youth probably mirrors the muddled impacts of sex hormones in asthma pathogenesis [8].

Race and nationality additionally assume a significant part in the hazard of asthma exacerbation. African American and Hispanic patients with asthma are at higher risk than Caucasians to be owned up to the emergency clinic for the board of an exacerbation[9]. The diagnosis of asthma includes a careful clinical history, physical assessment, and objective evaluations of lung function in those ≥ 6 years old (spirometry liked, both before and after bronchodilator) to record variable expiratory airflow constraint and affirm the finding. Bronchoprovocation challenge testing and evaluating for markers of air route irritation and inflammation may likewise be useful for diagnosing the illness, especially when objective estimations of lung function are typical despite the presence of asthma symptoms [8,9].

In pediatric patients, a scoring rubric called the Pediatric Respiratory Assessment Measure (PRAM) has been created to evaluate a patient's acute asthma seriousness utilizing a mix of scalene muscle compression, suprasternal withdrawals, wheezing, air entry, and oxygen saturation. This apparatus has been approved in children from 0 to 17 years old and is most usually utilized in acute consideration settings like emergency divisions, pediatric intensive care units, and inpatient units[10,11].

The overall way to deal with really focusing on a patient with acute asthma in the crisis division begins with an underlying speedy appraisal to decide if the patient has any of the risk factors for signs or side effects of possibly lethal asthma[6,8,10]. Patients meeting these standards ought to be promptly triaged to a firmly checked setting inside the emergency department for something like one to two hours after appearance[8]. Since acute asthma is an intrinsically unstable and unusual condition, an intravenous line ought to be embedded and oxygenation persistently surveyed and recorded by pulse oximetry. It is vital to acquire objective estimations of lung function here; accordingly, all patients ought to go through either gauge spirometry (to decide constrained expiratory volume in 1 second [FEV1]) or estimation of pinnacle expiratory stream rate, and these estimations should be rehashed each 30-60 minutes to assist with directing treatment. Following the standards of simultaneous administration, treatments with supplemental oxygen and breathing in β2-adrenergic bronchodilators should start all the while with the underlying appraisal, and thought should likewise be given to overseeing an oral or intravenous dose of corticosteroids right away [12].

Noninvasive ventilation for acute asthma is best conveyed utilizing a tight-fitting, full-facial mask. As a general rule, noninvasive ventilation has a few possible upper hands over intubation and intrusive mechanical ventilation: there are fewer requirements for sedation, the patient is allowed to talk, ventilation can be briefly suspended to permit the patient to take tastes of liquid or to cough and expectorate, and there is a lower hazard of ventilator-related pneumonia [13].

**Aims and Objectives**

The study intended to analyze the first management options in acute asthma. The study has compared the efficiency of using oxygen inhalation and rapid-acting bronchodilator as first line management of acute exacerbarnt asthma.

**Materials and Methods**

The study design is retrospective cross-sectional which was conducted during the period of 7 Months. The study has considered 100 patients, among which 45 patients are male and 55 patients are female. The patients who visited in the Emergency Department of our hospital, have only been considered in this study. The assessment of Acute Asthma have been done by determining the Pediatric Respiratory Assessment Measure (PRAM) score. The patients aged between 4 years old and 18 years old have been considered only. The patients with other underlying conditions have been excluded from this study.
Table 1: The Pediatric Respiratory Assessment Measure (PRAM) with its parameters and respective values [14]

| Component values | Signs | Suprasternal retractions | Scalene contraction | Air entry | Wheezing | O₂ saturation |
|------------------|-------|--------------------------|--------------------|-----------|----------|---------------|
|                  | 0     | No                       | No                 | Normal    | Absent   | ≥ 95%         |
|                  | 1     | Yes                      | Yes                | Decreased at bases | Expiratory only | 92-94%        |
|                  | 2     |                          |                    | Widespread decrease | Inspiratory and Expiratory | < 92%         |
|                  | 3     |                          |                    | Absent or minimal | Audible without stethoscope or silent chest |               |

Interpretation: 1-3 is mild, 4-8 is moderate and 9-12 is severe [14]

The patients were given either Oxygen inhalation or Short-Acting Beta Agonist (Salbutamol) inhalation. These patients, then, were assessed by comparing the improvement in their PRAM score. The patients on arrival to the emergency department was assessed for PRAM score (Initial PRAM score) and was interpreted. Then either oxygen or Short-Acting Beta Agonist (Salbutamol) inhalation was given. Then again, after a fixed interval, the patient’s PRAM score was assessed (Post-Interventional PRAM score). PRAM score was assessed and interpreted as given in Table 1 [14]. This current study has classified the patients who received Oxygen inhalation as Group 1 and the patients who received Short-Acting Beta Agonist as Group 2.

Results

The patients were given Interventions (Oxygen inhalation or Short-Acting Beta Agonist inhalation) randomly. According to their interventions, the study has classified them. The figure below shows the mean, minimum and maximum value of the distribution of ages in each groups.

Figure 1: The boxplot diagram showing the age characteristics of the patients in each group

The study also found that there are similar percentages of males and females in Group 1 and Group 2.
Figure 2: The pie-diagram showing the males and females in each group

The figures below (Figure 3) shows the distribution of PRAM score when the patients arrived in Emergency Department. This shows the PRAM score was almost similar in both the groups. Hence, the comparison of the PRAM score reduction between the groups was done effectively.

Figure 3: The scatter diagram showing the distribution of initial PRAM score in each group

Table 2 shows the comparison between the initial PRAM score and PRAM score assessed after applying the intervention in each group. The study found that, after intervention, Group 1 achieved PRAM score of 4.48±1.41 in Group 1 (Oxygen group) while Group 2 (Short-Acting Beta Agonist inhalation) achieved 6.12±1.47.

| Initial | Post-Intervention |
|---------|-------------------|
| Group 1 | Group 2 | Group 1 | Group 2 |
| Mean    | 10.48 | 10.3 | Mean | 4.48 | 6.12 |
| SD      | 1.073616813 | 1.129384879 | SD | 1.417672712 | 1.479657986 |
It was observed that at the arrival of the patients, all of them had PRAM score of 50 which implies the severe form. The patients of both the groups was scored at 50 (Severe). After applying the intervention, PRAM score improved but with significant difference in each group. In group 1 (oxygen group), 13 patients PRAM score dropped to Mild status while 37 patients dropped to Moderate status. In group 2, there was no reduction to Mild status while 4 patients still remained had severe acute distress. Table 3 represents the summary of the improvement in PRAM score in each group.

| Table 3: Initial and Post-Interventional PRAM score in each group |
|---------------------------------------------------------------|
| **Initial Interpretation**                                   |
| Group | Mild | Moderate | Severe |
|-------|------|----------|--------|
| 1     | 0    | 0        | 50     |
| 2     | 0    | 0        | 50     |
| **Final Interpretation**                                    |
| Group | Mild | Moderate | Severe |
|-------|------|----------|--------|
| 1     | 13   | 37       | 0      |
| 2     | 0    | 46       | 4      |

The study also analyzed the changes of PRAM score in each patient. It was found that in patients of Group 1, the mean of changes in all the patients was 6 while in the patients of Group 2 was 4.18. Figure 4 depicts the mean value for comparison. This shows that the PRAM score and hence, the acute asthma, can be well managed by oxygen inhalation more efficiently as compared to Short-Acting Beta Agonist inhalation.

**Figure 4: The mean value of PRAM score change (initial to post-interventional) in Group 1 and Group 2**

**Discussion**

Non-invasive ventilation is a type of ventilatory help that doesn't need endotracheal intubation and is utilized in the early administration of acute respiratory failure in cases of emergency. Safe conveyance of this mediation requires a talented group, taught and experienced in proper patient determination, accessible medical equipment, and checking priorities[15].

The terms used to depict parts of non-invasive ventilation is vague. Two worldwide rules share the conveyance regarding this intercession, nonetheless, much exploration has been attempted since various publications. Solid proof exists for harmless ventilation for patients with acute exacerbation of congestive cardiovascular failure and ongoing obstructive pulmonary infection. non-invasive ventilation might be conveyed with different points of
interaction and modes; little proof is accessible for the predominance of individual connection points or modes [5,6]. Early utilization of non-invasive ventilation for the administration of acute respiratory failure might decrease mortality and morbidity. However global rules exist, explicit proposals to direct the choice of modes, settings, or connection points for different aetiologies are missing because of the shortfall of observational proof. Observing of non-invasive ventilation should zero in on appraisal of reaction to treatment, respiratory and hemodynamic steadiness, patient solace, and presence of air leaks. Intricacies are connected with mask-fit and high air flows; genuine inconveniences are not many and happen inconsistently. The utilization of non-invasive ventilation has asset suggestions that should be considered to give successful and safe administration in the emergency department[4,6].

No proof put together rules are accessible concerning the choice of patients with acute asthma for whom non-invasive ventilation might be appropriate. The patients probably going to benefit are the individuals who are becoming exhausted due to the high work of breathing, yet whose condition remains generally steady and whose asthma is relied upon to answer aggressive treatment inside a couple of hours or less. In the controlled trials showing accomplishment with noninvasive ventilation for acute asthma, the patients had critical airflow obstruction (FEV1 < 60% anticipated) yet didn't have hypercapnia. These patients likewise had great oxygenation (oxygen saturation > 90% on room air) and were ready, agreeable, and ready to perform spirometry. [4]Bronchodilators can be controlled during brief periods when the noninvasive ventilation is hindered and the mask is taken off, or by presenting either a nebulizer or a metered-dose inhaler into the ventilation circuit. The dosing of bronchodilators ought to be empiric and titrated to straightforward clinical results like more slow, more calm breathing with relaxing. Likewise, with patients with acute asthma who are not getting helped ventilation, the presence or absence of wheezing is ineffectively related to dispassionately estimated airflow hindrance [11,12,14]. The presence or nonattendance of wheezing ought not to be utilized to titrate the portion of the bronchodilator. The principal objective of noninvasive ventilation for acute asthma is to keep away from the requirement for intubation and intrusive ventilation by lessening the heap on the respiratory muscles, subsequently permitting the patient to rest and having time for different parts of treatment to have an impact. Likewise, if the patient doesn't relax inside 15-30 minutes in light of the noninvasive ventilation, the setup and method ought to be rethought to guarantee the right use [3,4]. If the set-up is fitting however the patient is as yet in trouble, prudent sedation with short-acting narcotics and tranquilizers might be thought of and the patient evaluated for conceivable intubation and intrusive ventilation. In many instances of respiratory failure complicating acute asthma, the most secure methodology is to oversee sedation, intubate and begin obstructive mechanical ventilation. In conditions where intubation is beyond the realm of possibilities or is unavoidably postponed, noninvasive ventilation might be kept on revising perilous hypoxemia and severe acidemia while authoritative help is being organized [4]. Complications of invasive mechanical ventilation usually happen, regularly the following intubation. Deterioration not long after intubation, described by hypotension, hypoxemia, hemodynamic instability, or hypoventilation, may have a few expected causes, including the sedative drugs utilized for intubation[14-16], previous exhaustion of the intravascular volume (lack of hydration); scattering of the tube, like intubation of the right fundamental stem bronchus or esophageal intubation; abrupt deteriorating of a prior however unnoticed pneumothorax incidental with the inception of positive tension ventilation; significant deteriorating of dynamic hyperinflation brought about by exorbitant hand-bagging; or unseemly set-up of the ventilator [16]. Without sufficient sedation and pharmacologic loss of motion, the patient might become fomented and may genuinely impede mechanical ventilation or create different issues by clenching down on or in any event, eliminating the endotracheal tube. Dyssynchrony between the patient and the ventilator ("fighting the ventilator") ought to be managed at first by disengaging the ventilator and helping the patient's ventilation through a self-inflating bag with 100% oxygen. Patients with acute and possibly fatal asthma experience dynamic hyperinflation since the deterrent of the expiratory airflow prompt the catching of air. Excessive inflation can likewise be aggravated when the inspiratory cycle is permitted to start before the first exhalation and expiratory stream have wrapped up. Conditions leaning toward the advancement of air-trapping and dynamic hyperinflation incorporate unreasonably fast breathing rates (for both unconstrained breathing and machine ventilation) prompting improperly short exhalation times, and the setting of too enormous a tidal volume on the ventilator when there is lacking time for exhalation [15-16].

Conclusion

In clinical practice, it can be observed that in the management of acute asthma, oral drugs and ventilatory techniques are inefficient and difficult, respectively. So, both the efficiency and spontaneity is essential in the management of acute condition in the emergency setting. The study concludes that the acute asthmatic episode in emergency department can be managed by oxygen inhalation better than Short-Acting Beta Agonist inhalation. The study suggests that there is a need to conduct more researches with larger sample and in varied population. The study has evidently showed the efficacy of
oxygen inhalation for proper management of severe acute asthma in emergency setting.

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