|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2020: 79.44
Volume 6, Issue 01; January: 2022; Page No. 115-121

Original Research Article

COMPARATIVE ANALYSIS ON NON-VENTILATORY MANAGEMENTS IN ACUTE ASTHMA

Dr Natraj Shankar Sadafule
Dep of Emergency Medicine Assistant Professor, Vedantaa Institute of Medical Science, Saswand, Dhundalwadi, Palghar, Maharashtra

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

Abstract

Introduction: Acute asthma attacks, also known as acute asthma, are periods of escalating shortness of breath, cough, wheezing, chest tightness, or a combination of these symptoms. The bronchial tubes, which allow air to pass through the lungs, become irritated, inflamed, and obstructed. The majority of exacerbations are managed in an outpatient environment. In 2004, there were 14.7 million visits to doctor's offices and clinic outpatient divisions in the United States for acute asthma. A scoring rubric called the Young Respiratory Assessment Measure (PRAM) was developed for pediatric patients to assess the severity of their acute asthma using a combination of scalene muscle compression, suprasternal withdrawals, wheezing, air admission, and oxygen saturation. In comparison to intubation and intrusive ventilation, noninvasive ventilation has a many advantages. The most advantageous points is that the complication like throat soreness, arrhythmia, bleeding, mucosal damage, damage to other organs like thyroid, etc can be avoided.

Aims and Objectives: The study intended to compared 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 Asthma is the acute condition of breathlessness accompanied by the typical wheezing and characterized by productive cough, tight chest, fall in SpO_2. These symptoms can come singly or in combinations. Clinical studies confirmed that the expiratory flow also reduced significantly in acute state revealed by Lung Function Tests [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). Patients are distressed by these episodes, which result in a considerable use of medical resources, as well as a loss of work efficiency and school attendance [4]. The majority of exacerbations are managed in an outpatient environment. In 2004, there were 14.7 million visits to doctor's offices and clinic outpatient divisions in the United States for acute asthma; nonetheless, 1.4 million people required emergency center treatment for their asthma exacerbation[5].

More extreme intensifications bring about hospitalization, which establishes around 33% of the total 15 billion dollar is spent annually on asthma-related medical services use in the US itself . The Agency for Healthcare Research and Quality (HRQ) patrons the Nationwide Inpatient Sample (NIS), the biggest wellspring of information on hospitalized patients in the United States, and information from the year 2000 shows that there were prevalance of more than 65000 cases of asthma in children of more than 5 years old [5,6].

In majority of respiratory failure due to acute severe asthma, intubations are used. According to additional data from the NIS, all age groups suffered similar rates of hospitalization, with a minor prevalence of the 35 to 55 years age group accounting for 31.7% of acute asthma cases. Regardless, the NIS reveals that mortality increases dramatically as one gets older. Children and teenagers have the lowest death rate (0.02%), while the elderly have the highest asthma mortality rate (1.9 percent for those over 75). Surprisingly, the majority of the 4210 asthmatic patients who die from acute asthma in the United States each year (roughly 2/3) do so outside of an 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 are also important factors in the risk of asthma exacerbation. Patients with asthma who are African American or Hispanic are more likely than Caucasians to be admitted to an emergency clinic for an exacerbation[9]. In children under the age of six, a comprehensive clinical history, physical examination, and objective evaluations of lung function (spirometry preferred, both before and after bronchodilator) are used to record fluctuating expiratory airflow constraint and confirm the diagnosis of asthma. Bronchoprovocation challenge testing and screening for indicators of airway irritation and inflammation may also be helpful in identifying asthma, particularly when objective lung function estimates are normal 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 general approach of dealing with a patient with acute asthma in the crisis division starts with a quick assessment to see if the patient has any of the risk factors for indicators or side effects of potentially fatal asthma[6,8,10]. Patients who match these criteria should be triaged to a closely monitored environment in the emergency department for one to two hours after their arrival[8].Because acute asthma is a highly unstable and uncommon illness, an intravenous line should be inserted and oxygenation monitored and recorded on a regular basis using pulse oximetry. It is critical to obtain objective estimates of lung function at this time; as a result, all patients should undergo either gauge spirometry (to determine constrained expiratory volume in 1 second [FEV1]) or estimation of pinnacle expiratory stream rate, with these estimates being rehashed every 30-60 minutes to aid in treatment planning. Treatments with supplemental oxygen and breathing in 2-adrenergic bronchodilators should begin with the underlying assessment, and consideration should also be made to overseeing an oral or intravenous dose of corticosteroids straight away, according to the requirements of simultaneous delivery[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 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 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	0	1	2	3
Suprasternal retractions	No		Yes	
Scalene contraction	No		Yes	
Air entry[a]	Normal	Decreased at bases	Widespread decrease	Absent or minimal
Wheezing[a]	Absent	Expiratory only	Inspiratory and Expiratory	Audible without stethoscope or silent chest
O_2 saturation	≥ 95%	92–94%	< 92%	

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.

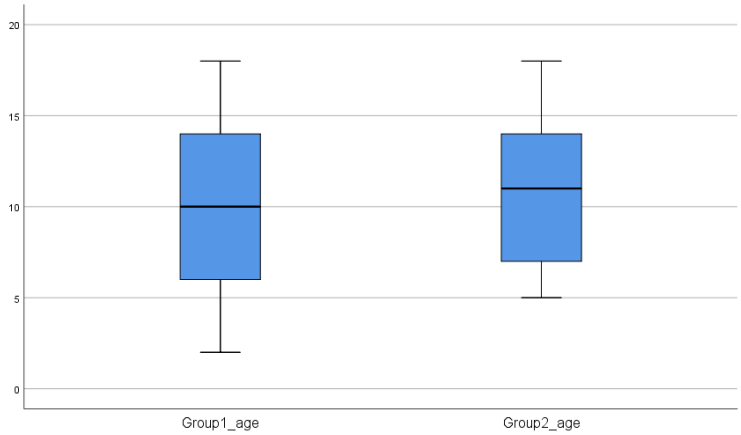

Figure 1: The boxplot diagram showing the age characteristics of the patients in each group

The study also found that there are similar percentages of males and females in Group1 and Group 2.

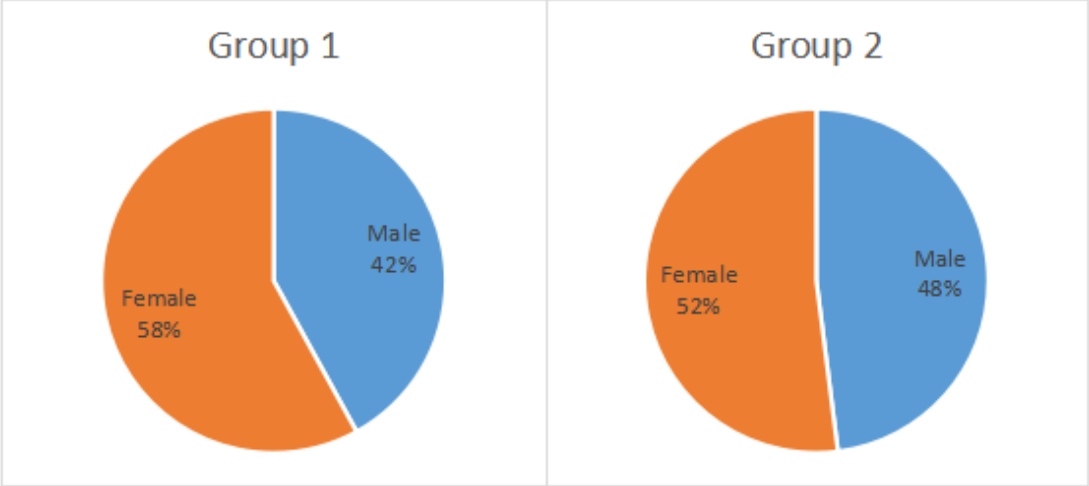

Figure 2: The pie-diagram showing the males and females in each group

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.

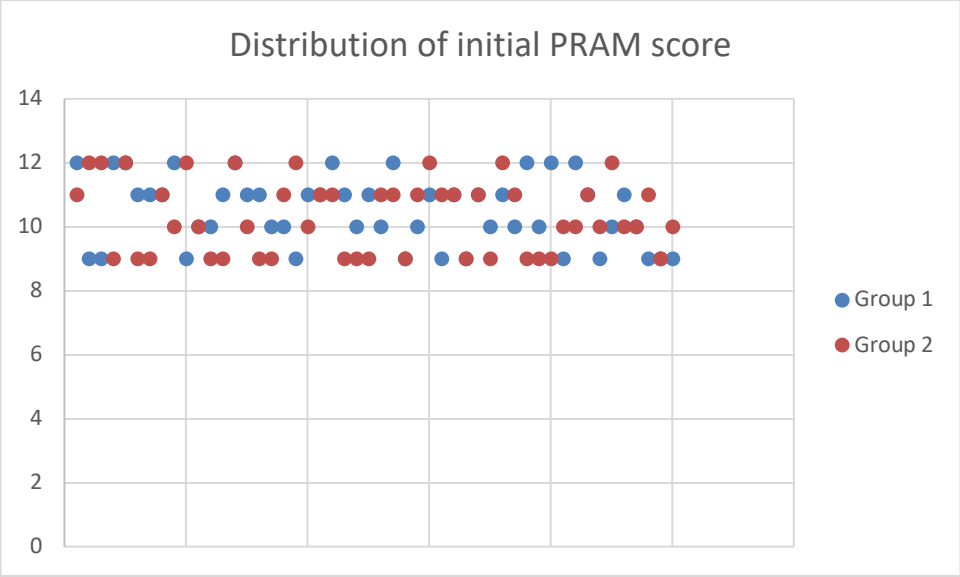

Figure 3: The scatter diagram showing the distribution of initial PRAM score in each group

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.

Table 2: Initial and Post-Interventional PRAM score in each group

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.

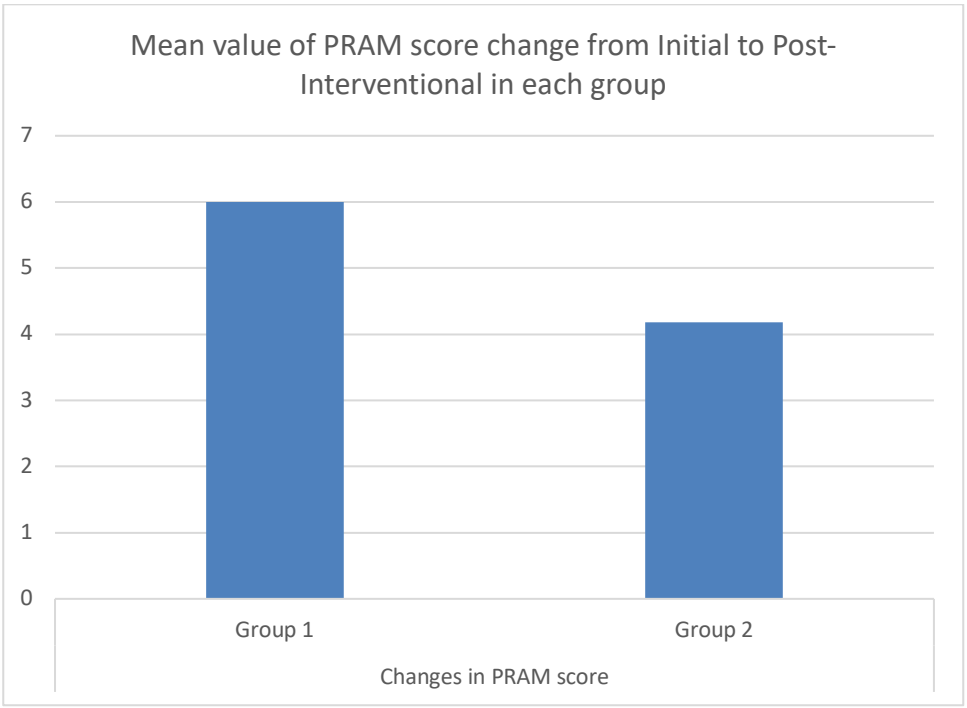

Figure 4: The mean value of PRAM score change (initial to post-interventional) in Group 1 and Group 2

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].

Our search resulted in no guidelines available from any institution which can help us to select patients with acute asthma who can benefit from non-invasive ventilation. Excessive exertion of the patient due to heavy breathing is likely to have beneficial effect if their overall status is not debilitating. Response of vigorous therapy within first few hours can be significantly beneficial. In a controlled studies, the patients were found to have airflow restriction (FEV1 was less than 60%) but the patients did not show hypercapnia. In other side, oxygenation was found to be effective with more than 90% oxygen saturation under room pressure [4]. Forced bronchodilation with nebilizers or inhaler into the airway during the obstruction of non-invasive ventilation. Bronchodilator dosing should be titrated. The primary objective of non-invasive ventilation in acute asthma is to avoid intubation or other ventilation techniques so that the patient can have rest and does not experience complication later. Sedation with short acting narcotics and tranquilizers can be used if required. During non-invasive ventilation, continuous monitoring for possible hypoxemia and acidemia should be done [3,4]. Intubation can give rise to complications like hypoxemia, hemodynamic instability, hypoventilation or even Hypotension which may occur few minutes after the intubation procedure. These complications are aggravated by the use of sedatives [14-16], dehydration due to decreased intravascular fluid, scattering of tube like intubation of the right main bronchus or intubation of the esophagus and pneumothorax. This results in positive ventilation and later can leads to hyperinflation of the lung [16]. The psychological features can arise like agitation, obstructed mechanical ventialtion due to mispositioning of the tube or while removing the tube. To alleviate this difficulty, many institutions use AMBU bag containing absolute oxygen. Hyperinflation of the lung is common in patients with restricted expiratory airflow. Excessive inflation can get exacerbated due to this and can contribute in mortality rate [15]. Tachypnea for restricted airflow results in short exhalation which increase the tidal volume. This, ultimately, can lead to air trapping and excessive hyperinflation [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.

References

1. Quirt, J., Hildebrand, K. J., Mazza, J., Noya, F., & Kim, H. (2018). Asthma. Allergy, Asthma & Clinical Immunology, 14(S2). https://doi.org/10.1186/s13223-018-0279-0
2. Hellings PW, Hens G, Meyts I, Bullens D, Vanoirbeek J, Gevaert P, Jorissen M, Ceuppens JL, Bachert C. Aggravation of bronchial eosinophilia in mice by nasal and bronchial exposure to Staphylococcus aureus enterotoxin B. Clin Exp Allergy. 2006 Aug;36(8):1063-71. doi: 10.1111/j.1365-2222.2006.02527.x. PMID: 16911362.
3. Kudo M, Ishigatsubo Y, Aoki I. Pathology of asthma. Front Microbiol. 2013;4:263. Published 2013 Sep 10. doi:10.3389/fmicb.2013.00263
4. Grainge C. L., Lau L. C., Ward J. A., Dulay V., Lahiff G., Wilson S., et al. (2011). Effect of bronchoconstriction on airway remodeling in asthma. N. Engl. J. Med. 364 2006–2015 10.1056/ NEJMoa

1014350
5. Dougherty, R. H., & Fahy, J. V. (2009). Acute exacerbations of asthma: epidemiology, biology, and the exacerbation-prone phenotype. Clinical & Experimental Allergy, 39(2), 193–202. https://doi.org/10.1111/j.1365-2222.2008.03157.x
6. Tierney WM, Roesner JF, Seshadri R, Lykens MG, Murray MD, Weinberger M. Assessing symptoms and peak expiratory flow rate as predictors of asthma exacerbations [published correction appears in J Gen Intern Med. 2004 Aug;19(8):903]. J Gen Intern Med. 2004;19(3):237-242. doi:10.1111/j.1525-1497.2004.30311.x
7. Coffey R, Barrett M, Houchens R, Moy E, Andrews R, Coenen N. Methods Applying AHRQ Quality Indicators to Healthcare Cost and Utilization Project (HCUP) Data for the Eleventh (2013) National Healthcare Quality Report (NHQR) and National Healthcare Disparities Report (NHDR). U.S. Agency for Healthcare Research and Quality; Nov 12, 2012. [December 4, 2013]. HCUP Methods Series Report #2012-03
8. Guilbert TW, Denlinger LC. Role of infection in the development and exacerbation of asthma. Expert Rev Respir Med. 2010;4(1):71-83. doi:10.1586/ers.09.60
9. Hodder, R., Lougheed, M. D., Rowe, B. H., FitzGerald, J. M., Kaplan, A. G., & McIvor, R. A. (2009). Management of acute asthma in adults in the emergency department: nonventilatory management. Canadian Medical Association Journal, 182(2), E55–E67. https://doi.org/10.1503/cmaj.080072
10. Hodder, R., Lougheed, M. D., FitzGerald, J. M., Rowe, B. H., Kaplan, A. G., & McIvor, R. A. (2010). Management of acute asthma in adults in the emergency department: assisted ventilation. CMAJ : Canadian Medical Association Journal, 182(3), 265–272. https://doi.org/10.1503/cmaj.080073
11. Alansari K, Ahmed W, Davidson BL, Alamri M, Zakaria I, Alrifaai M. Nebulized magnesium for moderate and severe pediatric asthma: A randomized trial. Pediatr Pulmonol. 2015 Dec;50(12):1191-9. doi: 10.1002/ppul.23158. Epub 2015 Feb 4. PMID: 25652104; PMCID: PMC7167999.
12. Simon MR, Chinchilli VM, Phillips BR, et al. Forced expiratory flow between 25% and 75% of vital capacity and FEV1/forced vital capacity ratio in relation to clinical and physiological parameters in asthmatic children with normal FEV1 values. J Allergy Clin Immunol. 2010;126(3):527-34.e348. doi:10.1016/j.jaci.2010.05.016
13. Rose, L., & Gerdtz, M. F. (2009). Review of non-invasive ventilation in the emergency department: clinical considerations and management priorities. Journal of Clinical Nursing, 18(23), 3216–3224. https://doi.org/10.1111/j.1365-2702.2008.02766.x
14. Chalut, D. S., Ducharme, F. M., & Davis, G. M. (2000). The Preschool Respiratory Assessment Measure (PRAM): A responsive index of acute asthma severity. The Journal of Pediatrics, 137(6), 762–768. https://doi.org/10.1067/mpd.2000.110121
15. Shah, Ria & Uppe, Abhay & Nair, Girija & Das, akanksha & Mathew, Aleena. (2016). Eminence of non invasive ventilation in a mixed ICU setup. indian journal of basic medicine and research. 6. 206-215.
16. Medjo B, Vunjak N, Atanaskovic-Markovic M, et alINDICATIONS AND COMPLICATIONS OF MECHANICAL VENTILATION IN PEDIATRIC INTENSIVE CARE UNIT PATIENTSArchives of Disease in Childhood 2008;93:ps491.