Acta Scientific PAEDIATRICS (ISSN: 2581-883X)

Volume 6 Issue 1 January 2023

Research Article

A Study on Initial Arterial Blood Gas in Acute Asthmatic Children in Karnataka India

Edwin Dias* and Vedant Praveen Shetty

Senior Adjunct Professor, Srinivas University and Professor and HOD, SIMS and RC, Director of Research and Publication SIMS and RC, India

***Corresponding Author:** Edwin Dias, Senior Adjunct Professor, Srinivas University and Professor and HOD, SIMS and RC, Director of Research and Publication SIMS and RC, India.

Received: November 16, 2022

Published: December 30, 2022

Abstract

Arterial blood gas sampling is a very important investigation in the assessment of a patient's acid-base status and oxygenation in acute and chronic bronchial asthma. It is the gold standard test which measures amounts of oxygen and carbon dioxide as well as the pH of the blood while it also evaluates the effective delivery of oxygen to the blood by the lungs and effective elimination of the carbon dioxide by the lungs. Arterial blood gas analysis is done using a Blood gas analyzer with the blood sample (2 ml heparinized) drawn from the radial or ulnar arteries. The results are obtained within 125 seconds. The present study conducted on 40 patients aims at assessing the blood gas status in individuals with acute and chronic bronchial asthma. The cumulative analysis of all the three parameters considered in this study show a significant variation in pH between acute and chronic asthma with a P value <0.001, a significant variation in $PaCO_2$ with a P value <0.001 showing a tendency to hypercapnia in severe acute asthma and with a tendency towards hypocapnia in chronic bronchial asthma. There are very few studies on chronic bronchial asthma. A comparison between severe acute and chronic bronchial asthma showed a variable pH in acute cases depending on the severity of the airways obstruction, showing cases of both respiratory acidosis and respiratory alkalosis. While in chronic bronchial asthma the pH was within a narrow range with no cases of acidosis and a moderate number of cases showing respiratory alkalosis.

Keywords: ABG; Acute Bronchial Asthma; Chronic Bronchial Asthma; Hypercapnia; Hypocapnia Respiratory Acidosis and Respiratory Alkalosis

Introduction

In the early stages of an acute exacerbation in bronchial asthma, small airway obstruction leads to air trapping and subsequent lu ng hyperinflation. This leads to hypoxemia, hypercapnia and respiratory alkalosis [1-3] Progression of airway causes hypoxemia, hypercapnia and respiratory acidosis. The hypercapnia can frequently develop rapidly and metabolic acidosis ensues. There is also associated lactic acidosis of hypoxia which can lead to a fatal outcome [4,5]. A large study showed, all asthmatics were hypoxemia and 50% of all asymptomatic asthmatics revealed hypoxemia. The degree of hypoxemia correlated with the degree of obstruction. In the severely dyspnoeic patients, respiratory or combined respiratory and metabolic acidosis were present [6]. Another study showed most of the acute asthmatics has a PaO2 of 50mmHg without elevation of the arterial $PaCO_2$. In acute severe asthma, hypoxemia, hypercapnia and acidosis were common, and patients with less severe asthma showed disturbances in blood gas analysis as mentioned above [7].

Most patients with acute severe asthma, had hypoxemia for several days and was profound, most patients were normocapnic or hypocapnia. The changes in $PaCO_2$ were inversely related to changes in pH and in patients with severe hypercapnia which was

invariably fatal, metabolic acidosis also occurred. In a study on acute asthmatics, hypoxemia was predominant, and a base deficit was seen in 75% of them, hypercapnia noticed in these children were in some cases profound. The severity of an acute asthmatic in this study was found to correlate well with the disturbances in blood gas values, rather than the clinical signs, even when clinical scoring systems were used. The elevation of $PaCO_2$ was the major laboratory criteria for distinguishing respiratory failure. The presence of hypoxemia is almost universal, during an acute attack and is frequently present in asymptomatic patients, PaO_2 of 17 mmHg in 40% or greater may suggest the diagnosis of respiratory failure. These studies reveal that, selective uses of arterial blood gas analysis are needed for optimal management, of most acute asthmatic children.

An ABG analysis evaluates how effectively the lungs are delivering O_2 to the blood and how efficiently they are eliminating CO_2 from it. The test also indicated how well the lungs and kidneys are interacting to maintain normal blood pH [8].

Methodology

This study was conducted in a hospital setting, 40 children were included with the study suffering from acute attack of bronchial asthma. Acute on chronic asthma children were also included in the study. An initial ABG was performed on the children in the right radial artery and the results were tabulated. The results were analysed by Statistical methods for P Values. The children were treated as per protocol, and institutional ethics committee clearance was obtained. The ABG sample was subjected to ABG analyser immediately.

Arterial blood gas analysis is done using a Blood gas analyzer with the blood sample (2 ml heparinized) drawn from the radial or ulnar arteries. The results are obtained within 125 seconds.

The study was done on admitted children, with uncomplicated acute asthma from ages of 1-14 years of age, (mean age 6.7557+/- 0.9 years). The exclusion criteria included asthmatic children, below 1 year of age and above 14 years.

Out of 33 children, 5 children were excluded from the study.

The study group of 28 patients included 24 males and 4 females diagnosed as acute bronchial asthma on the basis of history and clinical findings. The assessment of the type of the asthma, and it's severity was done by the clinical asthma score. An initial arterial blood gas estimation was done in each case and the respiratory score and the blood gas tensions were noted. The child was then treated as per standard treatment protocol, ethical clearance and informed consent was obtained from parents of the children. ABG samples were collected from the right radial artery by ABL 30 as per ABG protocol. The whole clinical data was recorded on proforma.

The correlations between the various parameters were studied. The inter-relationship between asthma score and arterial blood gas stages(scores), along with relationship of these asthma scores arterial blood gas values, (stages) with duration of hospital study and duration of intensive care was statistically analysed.

Results

In a study done on children in Karnataka initial Arterial blood gases in children suffering from acute asthma were as follows.

There were 33 subjects,age group varying from 1-14 years (6.5576+/- 0.9 years+/-SEM).

24 males and 4 female children. The arterial blood gases value was as follows.

The mean pH was 7.398 +/- 0.0124 (+/-SEM) range being 7.251 to 7.523, severe acute asthma was present especially at the lower most pH. The $PaCO_2$ of all the children were below 43 mmHg and the lowest was 21mmHg, the mean $PaCO_2$ was 34.6178 +/- 1.102 mmHg (+/- SEM). The most distribution being in the 35-39 mmHg category (42.85%). Higher $PaCO_2$ values were found in more severe acute asthmatics and same was also reported by Rees., *et al*. 1968. The PaO_2 values ranging from 37-71.9 mmHg and most distribution was seen in the 50-59 mmHg (46.43%) patients. Hypoxemia was present in all the acute asthmatic children, as also reported by Tai and Read 1967, McFadden & Lyons 1968. The mean value of PaO_2 was 57.2143 +/- 1.6078 mmHg (+/- SEM), oxygen saturation ranging from 72-94% and maximum distribution was in the 80-89 group (57.14%) 16 children, and the mean was 85.76% and it was observed that more severe acute asthmatics had lower oxygen saturation (SaO_2). There was no significant clinical observation on the bicarbonate levels when co-related to the severity of the acute episode, values ranged from 11.8-24.1 mEq/L, mean was 18.676 +/- 0.5709 (+/- SEM).

ABG in acute asthma is warranted initially and as investigative follow up.

Discussion

The reason for the study is that acute asthmatic children are difficult to treat, as they may deteriorate quickly and if there is a easy and quick investigation to get the information about gas exchange then treatment will be effective.

These various points were noted in the study conducted on children with acute bronchial asthma subjected to an initial ABG. These inferences were drawn up as a result of the study in acute asthmatic children.

- PaO_2 alone was not useful to objectively assess the severity of acute Bronchial asthma.
- In severe cases, $PaCO_2$ was higher than in less severe cases observed clinically.
- In patients with $PaCO_2$ below 43 mmHg, no fatal outcome is expected, if the acute episode is managed adequately. Arterial blood gas analysis is an extremely useful investigation in assessing oxygenation, pH and $PaCO_2$ in severe acute asthma. This study demonstrated that the characteristic blood gas pattern found in severe asthma is that of hypoxaemia with respiratory acidosis in a moderate number of patients and hypoxaemia with respiratory alkalosis in the rest (i.e. among those with abnormal blood gas patterns). In the chronic bronchial asthma group the study shows that hypoxaemia with respiratory alkalosis was present in a moderate number of cases but none showed respiratory acidosis. The pH also in this group was maintained within normal limits of 7.38 to 7.49 indicating the stability of the clinical condition. This confirms that many patients with chronic bronchial asthma maintain remarkably stable arterial blood gas tensions. Most studies done on arterial blood gases in acute asthma in children reflect.

The same results more or less.

The mortality in this study group was nil, which indicated that in acute asthmatic children with $PaCO_2$ less than 43 mmHg and in patients without respiratory acidosis no mortality is expected.

Conclusion

As acute asthmatic children are difficult to treat, as they may deteriorate quickly and if there is a easy and quick investigation to get the information about gas exchange then treatment will be effective. In the Investigative follow up of Acute severe asthma and initial ABG is warranted to guide the effective treatment.

Bibliography

1. KNV Palmer and ML Diament. "Hypoxemia in Bronchial Asthma". *Lancet* 2 (1968): 318.
2. KNV Palmer and ML Diament. "Bronchodilators, blood gas tensions and spirometry". *Lancet* 1 (1968): 1372.
3. KNV Palmer and ML Diament. "Dynamic and static lung volumes and blood gas tensions in bronchial Asthma". *Lancet* 1 (1969): 591.
4. R Gilly., *et al*. "Death of the asthmatic child". *Annals of Pediatric* 30 (1983): 33.
5. Strunk., *et al*. "Physiologic and psychologic characteristics associated with deaths due to asthma in childhood a case controlled study". *J.A.M.A* 254(1985): 1193.
6. HA Rees., *et al*. "A study of the clinical course and arterial blood gas tensions in patients in status asthmaticus". *Q.J. Medicine* 37 (1986): 541.
7. Weng TR., *et al*. "Arterial blood gas tensions and acid base balance in symptomatic and asymptomatic asthma in childhood". *American Review of Respiratory Disease* 101 (1970): 274.
8. Gale Encyclopedia of Medicine, Blood gas analysis: published Dec 2002 by the Gale group.