

*Research Article***ABG in the Patients admitted on the Pediatric Intensive Care Unit, Minia University Hospital.****Mohamed Farouk, Reem Abdel Salam and Yomna Emad**

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Abstract

Background: Acid base disorders are frequently present in critically ill patients. Metabolic acidosis is associated with increased mortality, but it is unclear whether as a marker of the severity of the disease process or as a direct effector. The understanding of the metabolic component of acid base derangements has evolved over time, and several theories and models for precise quantification and interpretation have been postulated during the last century. Unmeasured anions are the footprints of dissociated fixed acids and may be responsible for a significant component of metabolic acidosis. Their nature, origin, and prognostic value are incompletely understood. This review provides a historical overview of how the understanding of the metabolic component of acid base disorders has evolved over time and describes the theoretical models and their corresponding tools applicable to clinical practice, with an emphasis on the role of ABG in general and several specific settings.

Objectives: Aim of the study : to determine the value of ABG on mortality and morbidity in Pediatric Intensive Care Unit in minia university hospital. **Methods:** This was a retrospective study done over 2 years. There were total 653 patients (1 month to 18 years), who were divided into survivals and non survivals groups. All data were collected and analyzed retrospectively including: Name, Age, sex, , length of stay in PICU, underlying etiology, cause of admission, and requirement for mechanical ventilation. **laboratory investigations;** from the patients' records, we obtained the results of routine blood samples on patients' admission to PICU which were immediately transported to the central laboratory in the hospital. These samples were arterial blood gases, Data retrieved from the medical files and statistically analyzed after permission from the ethical committee. **Results:**

There were significant difference in the outcome of patients admitted to the PICU regarding the age group, sex, length of stay in PICU, requiring mechanical ventilation, respiratory failure P-value were (<0.001, <0.001, 0.007, <0.001, and <0.001 respectively). **Conclusion:** There is no consensus regarding preferred methodology for the evaluation of acidebase derangements in critically ill patients. The physicochemical approach by Stewart does not have a clear advantage over the traditional bicarbonate-based method. Both should be regarded as complementary for optimal understanding of acidebase disorders.

Keywords; ABG, metabolic acidosis, outcome in children admitted on PICU.

Introduction

To improve the quality of intensive care unit (ICU) care, mortality prediction is important⁽¹⁾. However, estimation of mortality is difficult in critically ill patients whose condition may deteriorate⁽¹⁾. There are some invasive methods to assess the status of patients, such as pulmonary artery wedge pressure measurement, but these take time to institute and have side effects, such as infection⁽²⁾. Recently developed assessments based on physiologic variables have limitations related to the high proportion of missing data.

Therefore it is necessary to identify noninvasive, easy tools for mortality prediction in

ICUs, especially for pediatric ICU (PICU) patients⁽³⁾.

ABG is traditionally one of the most commonly used biomarkers. It is the simplest means of evaluating the acid-base status of patients. It helps to identify the presence and causes of metabolic acidosis^(4,5).

Patients and methods

This is a retrospective cohort study using data collected from the records of children admitted to the PICU at Minia University Hospital, in the period from June 2017 till June 2019.

Patient's ages ranged from 1 month to 18 years.

The study was approved by the ethical committee of the faculty of medicine, Minia University, approval was taken from the director of Minia University Hospital. Confidentiality of patients is saved by keeping their records anonymous.

Subjects:

This study included 653 child admitted to the PICU in the period from June 2017 till June 2019. Patients were divided into survivors and non-survivors on the basis of in-hospital mortality.

Data collection:

All data were collected and analyzed retrospectively included: **demographic and medical data:**

- Name, Age, sex.
- Length of stay in PICU.
- Underlying etiology, reasons for admission.
- Requirement for mechanical ventilation.
- pre, post surgical or not.
- Concomitant metabolic problems that could affect acid-base status such as liver or renal failure, were also recorded.

● **laboratory investigations:** from the patients' records, we obtained the results of routine blood samples on patients' admission to PICU which were immediately transported to the central laboratory in the hospital. These samples were arterial blood gases, complete blood counts, serum chloride levels, serum electrolytes, renal functions and serum albumin levels.

Results

Analysis of the demographic characteristics of patients admitted to our PICU and their outcome showed that out of 653 patients, 158 cases (24.2%) were improved and discharged while 495 (75.8%) died. Length of stay in the PICU varied from a one day to 22 days, with a mean of 6.6 ± 4.4 days, mean length of hospital stay was significantly lower among non survivors compared to survivals (6.5 ± 4.5 and 7.1 ± 3.9 respectively). 488 cases (74.7%) required mechanical ventilation, it was found that death rate among ventilated children was higher (86.3%). (Table 1).

Table (1): Analysis of the mortality of patients admitted to the PICU according the Demographic data

		All Cases N= 653	Mortality		P value
			Died N=495	Improved N=158	
Age	Range Mean \pm SD Median/IQR	(1-156) 15.1 \pm 26.2 6/(4-12)	(1-156) 13.9 \pm 24.6 6/(4-12)	(1-156) 18.7 \pm 30.6 6.5/(4-9)	0.376
Age group	<1 year 1-5 years > 5years	488(74.7%) 131(20.1%) 34(5.2%)	368(74.3%) 110(22.2%) 17(3.4%)	120(75.9%) 21(13.3%) 17(10.8%)	<0.001*
Sex	Male Female	325(49.8%) 328(50.2%)	267(53.9%) 228(46.1%)	58(36.7%) 100(63.3%)	<0.001*
LOS	Range Mean \pm SD Median/IQR	(1-22) 6.6 \pm 4.4 6/(4-8)	(1-22) 6.5 \pm 4.5 5/(3-9)	(1-22) 7.1 \pm 3.9 6/(5-7)	0.007*
MV	On MV Without MV	488(74.7%) 165(25.3%)	427(86.3%) 68(13.7%)	61(38.6%) 97(61.4%)	<0.001*
Respiratory failure	Yes No	283(43.3%) 370(56.7%)	272(54.9%) 223(45.1%)	11(7%) 147(93%)	<0.001*

LOS: length of stay.

MV: mechanical ventilation.

Discussion

Intensive care is predominantly concerned with the management of patients with acute life

threatening conditions in a specialized unit.⁽⁶⁾ Children having acute neurological deterioration, respiratory distress, cardiovascular

compromise, severe infections and accidental poisoning constitute the major admission in pediatric intensive care unit⁽⁷⁾. Acid-base derangements are common in critically ill patients. Although the pathogenesis is not fully understood, it is well-known that ongoing acid-base disequilibrium could reflect the severity of disease and is associated with a poor prognosis of the patient⁽⁷⁾. Many studies have observed a strong association between acidosis and increased organ dysfunction and mortality. However, it remains difficult to ensure accurate measurement of in ICU patients because of their complex and mixed clinical situations of each⁽⁸⁾⁽⁹⁾.

The first clinical reports describing acid base derangements stem from observations made during the cholera outbreaks in the nineteenth and early twentieth centuries⁽¹⁰⁾. Acid base disorders are frequently identified in critically ill patients and may be associated with increased mortality⁽¹¹⁻¹²⁾. Injury, acute or chronic disease, and therapeutic measures such as fluid resuscitation or mechanical ventilation can influence acid base status. Timely recognition, quantification, and correct interpretation of acid base disorders can aid in treatment of the underlying disease process and minimize iatrogenic morbidity⁽¹³⁾. Maintenance of the pH within physiological limits is essential for normal protein structure and enzymatic function.

Several regulatory mechanisms maintain the pH within the normal range⁽¹²⁾. The underlying mechanism causing the resultant disorder can be respiratory, metabolic, or a combination thereof. When the underlying disorder is respiratory, the resultant shift in pH is caused by a change in pCO₂. The metabolic influence on pH is more complex⁽¹⁴⁾. To better characterize no respiratory disorders, the traditional bicarbonate-based approach⁽¹⁵⁾, aided by the anion gap (AG) method^{10,11} as well as the more recent standard base excess (SBE)¹²⁻¹⁴ and the modern physical chemical strong ion-based models¹⁵ have proposed surrogates for unmeasured nonvolatile acids or bases.

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