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Research Article

Assessment of Nurses' Knowledge toward Neonatal blood gases in karbala city

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Abstract

Blood gas analysis plays a crucial role in assessing the physical condition of both children and adults. It is closely related to the function of major organs, such as the lungs and kidneys, and is essential for early diagnosis and treatment. Nurses working in neonatal intensive care units (NICUs) should be proficient in interpreting blood gas results to detect abnormal changes early and ensure the appropriate treatment to maintain the health and survival of neonates. This study aimed to assess nurses' knowledge of neonatal blood gases (NABG) and its relationship with selected demographic characteristics (age, sex, education level, years of experience, and courses attended) at the Karbala Children's Teaching Hospital and Woman's Teaching Hospital. A cross-sectional descriptive design was employed structured questionnaire, divided into two sections: demographic data (Part I) and knowledge of neonatal blood gases (Part II). Face validity was ensured by a panel of 12 experts. Descriptive and inferential statistics were used for data analysis. Nurses exhibited moderate knowledge about neonatal blood gases. While most demographic variables had no statistically significant relationship with nurses' knowledge, a significant correlation was found between knowledge and both years of work experience and number of courses attended. Most participants were female, married, with a second-grade nurse education and few years of professional experience. Most nurses had attended only one course on neonatal blood gases. A significant number of nurses had limited clinical experience and average exposure to specialized neonatal programs. There is inadequate nursing readiness in interpreting neonatal arterial blood gases. To address this gap, focused educational programs on neonatal blood gas interpretation should be established regularly for delivery room nurses. Continuous education is vital to enhance neonatal care quality and safety. It is essential to provide structured and continuous NABG training programs that account for demographic and professional factors to improve nurses' knowledge and competency in neonatal care.

Introduction

The Arterial Blood Gas (ABG): Its Interpretation, Diagnoses & Applications ABSTRACT The interpretation of the arterial blood gas is a crucial skill for all medical personnel [1, 2]. A systematic approach will help in making further the right diagnosis (of acid–base disorders). While multiple specific analytical approaches are available (base excess analysis, Stewart's strong ion difference), this guide is oriented towards the traditional anion gap-based approach that is used to date in routine daily clinical practice as there is no clear evidence of its inferiority compared with alternative techniques. Six-Step Approach to ABG Interpretation [3].

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Step 1: Assess Internal Consistency

Use of Henderson–Hassel Balch equation to establish that pH, $PaCO_2$, and bicarbonate (HCO_3^-) are compatible. A discrepancy between pH and calculated hydrogen (H^+) concentration values indicates a possible error in measurement or invalidity of an ABG reading [4].

Step 2: Decide on the Presence of Acidemia or Alkalemia

Acidemia: pH 7.45

Remember that combined acid–base disorders may be present even if the pH is within the normal range (7.35–7.45). Consequently, $PaCO_2$, HCO_3^- and anion gap should always be assessed [5].

Step 3: Determine the Main Disorder

Find out if the main problem is metabolic or respiratory by looking at pH and $PaCO_2$. In primary respiratory disorders, pH and $PaCO_2$ change in opposite directions; this is generally not the case with metabolic disorders [6].

Step 4: Evaluate Compensation

Act on if the compensatory is appropriate. Compensation rarely normalizes pH completely. Predicted compensation formulas aid the assessment of a single or mixed disturbances. If the measured compensation is substantially higher or lower than predicted, more than one acid–base disturbance is present.

Step 5: Consider the Anion Gap (AG)

$$AG = [Na^+] - ([Cl^-] + [HCO_3^-])$$

Equation 6 This formula is derived from measurement of the ion concentrations in plasma as reflected by their tendency to disrupt metabolic and respiratory functions.

Normal AG is about 12 ± 2 m Eq/L; with hypoalbuminemia the normal AG decreases approximately by 2.5 m Eq/L for every one g/dL fall of serum albumin. In the absence of an obvious cause for AG elevation (e.g. DKA, lactic acidosis, renal failure), think about checking osmolal gap to screen for potential toxic ingestion.

Osmolal gap = Measured osmolality - (2 $[Na^+]$+ glucose/18 + BUN/2.8), which usually is 2.0 are indicative of associated metabolic alkalosis. Also, it is important to interpret the results in relation to preoperative hypoalbuminemia.

This systematic and six-step approach forms a very useful tool for the identification of complex acid–base disorders, as well as enhanced clinical decision making in critically ill patients [4–7].

Table 1: Characteristics of Acid–Base Disturbances

Disorder	pH	Primary problem	Compensation
Metabolic acidosis	↓	↓in HCO_3^-	↓ in $PaCO_2$
Metabolic alkalosis	↑	↑in HCO_3^-	↑in $PaCO_2$
Respiratory acidosis	↓	↑in $PaCO_2$	↑in $[HCO_3^-]$
Respiratory alkalosis	↑	↓in $PaCO_2$	↓in $[HCO_3^-]$

Table 2: Selected etiologies of respiratory acidosis

Airway obstruction (Upper, Lower)
COPD Asthma, Other obstructive lung disease)
CNS depression
Sleep disordered breathing (OSA or OHS)
Neuromuscular impairment
Ventilatory restriction
Increased CO_2 production: shivering, rigors, seizures, malignant hyperthermia, hypermetabolism, increased intake of carbohydrates
Incorrect mechanical ventilation settings

Table 3: Selected etiologies of respiratory alkalosis

CNS stimulation: Fever, pain, fear, anxiety, CVA, cerebral edema, brain trauma, brain tumor, CNS infection
Hypoxemia or hypoxia: Lung disease, profound anemia, low FiO_2
Stimulation of chest receptors: Pulmonary edema, pleural effusion, pneumonia, pneumothorax, pulmonary embolus
Drugs and hormones: Salicylates, catecholamines, medroxyprogesterone, progestins
Pregnancy, liver disease, sepsis, hyperthyroidism
Incorrect mechanical ventilation settings

Table 4: Selected causes of metabolic alkalosis

Hypovolemia with Cl^- depletion
GI loss of H^+: Vomiting, gastric suction, villous adenoma, diarrhea with chloride-rich fluid
Renal loss of H^+: Loop and thiazide diuretics, post-hypercapnia (especially after institution of mechanical ventilation)
Hypervolemia with Cl^- expansion
Renal loss of H^+: Edematous states (heart failure, cirrhosis, nephrotic syndrome), hyperaldosteronism, hypercortisolism, excess ACTH, exogenous steroids, hyperreninemia, severe hypokalemia, renal artery stenosis, bicarbonate administration

Table 5: Selected etiologies of metabolic acidosis

Elevated anion gap:

- Methanol intoxication
- Diabetic ketoacidosisa,
- Alcoholic ketoacidosis,
- Starvation
- Ketoacidosis
- Paraldehyde toxicity
- Isoniazid
- Lactic acidosisa
  - Type A: Tissue ischemia
  - Type B: Altered cellular metabolism
- Ethanolb or ethylene glycolb intoxication
- Salicylate intoxication

1. Most common causes of metabolic acidosis with an elevated anion gap
2. Frequently associated with an osmolal gap

Normal anion gap: will have increase in [CI-]

- GI loss of HCO3-
  - Diarrhea, ileostomy, proximal colostomy, ureteral diversion
- Renal loss of HCO3-
  - proximal RTA
  - carbonic anhydrase inhibitor (acetazolamide)

Renal tubular disease

- ATN
- Chronic renal disease
- Distal RTA
- Aldosterone inhibitors or absence
- NaCl infusion, TPN, NH4+ administration

Methods

In the current study, a descriptive cross-sectional methodology is employed to: Evaluate the nurses' knowledge of blood gases relevant to neonatal and to determine the correlation between the nurses' knowledge ratings and the demographic factors of age, gender, educational attainment, years of experience, and training session that they choose. The study's time frame is from the investigation was conducted between December 20, 2021, and March 28, 2022. The study sample consists of a non-probability (purposive) sample of (60) nurses who work in the preterm rooms at Karbala Children's Teaching Hospital and Women's Teaching Hospital. The information is gathered using a

Table 6: Selected mixed and complex acid-base disturbances

Disorder	Characteristics	Selected situations
Respiratory acidosis with metabolic acidosis	↓in pH ↓ in HCO_3^- ↑ in $PaCO_2$	Cardiac arrest Intoxications Multi-organ failure
Respiratory alkalosis with metabolic alkalosis	↑in pH ↑in HCO_3^- ↓in $PaCO_2$	Cirrhosis with diuretics Pregnancy with vomiting Over ventilation of COPD
Respiratory acidosis with metabolic alkalosis	pH in normal range ↑in $PaCO_2$, ↑in HCO_3^-	COPD with diuretics, vomiting, NG suction Severe hypokalemia
Respiratory alkalosis with metabolic acidosis	pH in normal range ↓in $PaCO_2$ ↓in HCO_3^-	Sepsis Salicylate toxicity- Renal failure with CHF or pneumonia Advanced liver disease
Metabolic acidosis with metabolic alkalosis	pH in normal range HCO_3^- normal	Uremia or ketoacidosis with vomiting. NG suction, diuretics, etc.

well-designed questionnaire with two parts: Demographic data in Part I. Age, gender, years of experience, level of education, economic situation, residency, training course in reading blood gases chat, and amount of training courses are among the eight items that make up this component.

Moreover, Part 2 provides information on nurses' knowledge of newborn blood gases. There are 22 questions concerning newborn blood gases in this section of the questionnaire. the validity by having (12) experts from various areas examine the study instrument (Face Validity). The descriptive and inferential statistical analysis methodologies were used to analyze the data.

Results: The results of this study show that nurses' overall assessments of their knowledge of newborn blood gases are fair. Also, there is a non-significant link with the other demographic and clinical data, but there is a very significant correlation between the nurses' knowledge of newborn blood gases and their (years of experience, number of training courses).

Result

This table 7 shows statistical distribution of nurses by their socio- demographic data, it explains that the majority of the nurse subgroup are nurses with ages between (19-26) years old (68.3%), Regarding gender the study results revealed that the majority (81.7) are female, those who live urban residents (71.7%), Concerning the marital status the highest percentage (65%) are married,, Regards the nurses education the study show that (63.3%) are Secondary nursing school, those with somewhat adequate economic status (45%) are Barely sufficient, the place of training course in iraq (78.3%), the No. of training courses (48.3%), and those with (1-5) years of experience (80%), and finally those with one training courses (48.3%).

Table 8 shows the Overall mean of scores for nurses' knowledge related to reading neonatal blood gases was (1.43) which is considered (pass)this mean overall Knowledge of nurses about NABG is Fair.

Table 8: Overall mean of scores and assessment for nurses' knowledge about related to cardiopulmonary resuscitation to neonatal (60n)

Questions No.22	MS	RS	Assessment
Overall Knowledge	1.43	47.78	Fail

Table 9 reveals that there is a highly significant association between the nurses Knowledge concerning cardiopulmonary resuscitation to neonatal and their (Years of Experience, Hospital Name, No. of training course), while there is a non-significant relationship with the remaining demographic and clinical data.

Table 9: Correlation between nurses' knowledge and their demographic data

Demographic Data	Correlation Coefficient	Significance P value
Age	0.27	0.1
Gender	0.003	0.98
Residence	0.17	0.18
Marital Status	0.12	0.33
Educational Status	0.25	0.28
Economic Status	0.2	0.29
Years of Experience	0.36	0.02
Hospital Name	0.56	0.0002
Training course inneonatal resuscitation field	0.18	0.36
Places of training course	0.17	0.39
No. of training course	0.47	0.009

Table 7: Statistical Distribution of Nurses by Their Socio-Demographic Characteristics (n = 60)

Items	Sub-groups	Study group Frequency	Total = 60 Percentage
Age / Years	19-26	41	68.
	27-34	13	21.7
	35-42	6	10.0
Gender	Male	11	18.3
	femal	49	81.7
Marital Status	Married	39	65.0
	Single	21	35.0
Economic Status	Secondary nursing school	38	63.3
	Institute	10	16.7
	College	11	18.3
	M.Sc.	1	1.7
	sufficient	24	40
	Barely sufficient	27	45
	Insufficient	9	15
Years of Experience	1-5	48	80
	5-10	8	13
	11-15	4	6
Name of hospatial	Pediatric teaching hospital	30	50
	Maternity teaching hospital	30	50
Residence	Urban	43	71.7
	Rural	17	28.3
Training course in neonatal ABG I Field	yes	49	71.7
	No	11	18.3
	No	11	18.3

Discussion

The interpretation of neonatal arterial blood gas (NABG) by nurses, if improperly interpreted, could result in obstetric outcome in labour and early postnatal morbidity. The safety of the newborn must be protected and this can only occur with sufficient preparedness of the delivery room in terms of resources, personnel, and environment. Nurses and other healthcare providers caring for infants must have adequate skills in neonatal resuscitation and emergencies [8–10].

The description of socio-demographic characteristics of nurses in Table (3.1) show that most were 19-26 years old (68.3%). This is in agreement with the findings of previous studies, which showed that the majority of nurses were aged 20-30 years. With respect to gender, there were more females (53%). The dominance of female nurses may relfect our study focusing on delivery room staff, which is dominated by women. This was consistent with previous research that showed that most maternity nurses are female [10–12].

Residence-wise 71.7% of them lived in urban areas that also agrees with earlier surveys finding the majority of nurses living in city area. Moreover, 65% of the subjects were married, this is comparable with previous studies on the marital status of nurses [13–16].

In this study, there was no significant association between NABG knowledge and attending neonatal training courses, site of training course, or number of the training euro games attended. These observations are consistent with previous studies that didn't find a link between nurse knowledge scores with nurses' years of experience, working unit or formal training in NABG. However, these findings are contrary to those of other studies that described a very significant relationship between knowledge of NABG and level of education [17–19].

Conclusion

Most of the participants were female nurses, married and covered similar demographics as observed in previous studies. A large proportion of the nurses had a second-grade nurse education and few professional years' experience, most having only one single course within neonatal blood gases. Similar findings have been reported elsewhere; for example, it has been demonstrated in the literature that a significant number of nurses have limited nurse clinical experience and had average exposure to specialized neonatal programs.

Moreover, the relation between knowledge of nurses and some variables such as work experience, training courses and hospital affiliation was statistically significant. Nevertheless, no significant associations were found between NABG knowledge and certain demographic variables such as age or sex. In certain analyses, educational level had a significant effect on NABG knowledge.

Recommendations

- There was inadequate nursing readiness in the interpretation of neonatal Arterial blood gases, so nurses need focused educational programs.
- NABG training programs should be instituted for the delivery room nurses on a regular and structured basis.
- The nursing prenatal period, the blood gas results from training in experts to improve vocational skills and emergency treatment Competence: in a new born.
- Subsequent training programs should take these demographic and professional factors into account for knowledge learning.
- Continuous education is necessary to improve the quality and safety of neonatal care.

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