

PRACTICAL AND CLINICAL EVIDENCE FOR NURSING CARE IN INTENSIVE CARE: INTEGRATIVE REVIEW

EVIDENCIA PRÁCTICA Y CLÍNICA PARA LOS CUIDADOS DE ENFERMERÍA EN CUIDADOS INTENSIVOS:
REVISIÓN INTEGRATIVAEVIDÊNCIAS PRÁTICAS E CLÍNICAS PARA O CUIDADO DE ENFERMAGEM NA TERAPIA INTENSIVA:
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ABSTRACT

Introduction: Arterial blood gas analysis is an invasive test frequently performed on critically ill patients and assesses lung function, alveolar ventilation, blood oxygenation, and acid-base disorders by analyzing the gases present in arterial blood. **Objective:** To analyze the scientific evidence about the knowledge, skills, and attitudes of nurses working in the Intensive Care Unit when performing and interpreting arterial blood gas analysis. **Method:** This is an integrative review. The search for articles was carried out in the following databases: ScIELO, LILACS, BDNF, and MEDLINE, between January and March 2024. The inclusion criteria used were full-text publications, available in full, free of charge, in Portuguese, English, and Spanish. The descriptors used were: arterial blood gas analysis; nursing; and intensive care unit. A total of 09 articles were included to compose the sample. **Results:** Among the articles analyzed, 04 are descriptive studies with a quantitative approach; 01 is descriptive field research with a qualitative approach; 01 is observational field research with a quantitative approach; 01 is a longitudinal study; 01 is descriptive observational; and 01 is analytical observational. Three categories emerged: 1. Nurses' knowledge about blood gas analysis and interpretation of results; 2. Nursing care related to arterial blood gas analysis; and 3. Effects of pain during arterial puncture and identified nursing diagnoses. **Conclusion:** Many nurses still demonstrated weaknesses in collecting arterial blood samples and interpreting results, and the absence of Allen's test may be related to a lack of understanding of its relevance.

Keywords: Arterial Blood Gas Analysis; Nursing Care; Nursing; Intensive Care Units.

RESUMEN

Introducción: La gasometría arterial es una prueba invasiva que se realiza frecuentemente en pacientes críticos y evalúa la función pulmonar, la ventilación alveolar, la oxigenación sanguínea y los trastornos ácido-base, a través del análisis de los gases presentes en la sangre arterial. **Objetivo:** analizar la evidencia científica sobre los conocimientos, habilidades y actitudes de las enfermeras que trabajan en la Unidad de Cuidados Intensivos en la realización e interpretación del análisis de gases en sangre arterial. **Método:** Se trata de una revisión integradora. La búsqueda de artículos se realizó en las bases de datos: ScIELO, LILACS, BDNF y MEDLINE, entre los meses de enero a marzo de 2024. Los criterios de inclusión utilizados fueron publicaciones de texto completo, disponibles íntegramente, de forma gratuita, en portugués, inglés, y español. Se utilizaron los siguientes descriptores: análisis de gases en sangre arterial; enfermería; y unidad de cuidados intensivos. Se incluyeron 09 artículos para componer la muestra. **Resultados:** Entre los artículos analizados, 04 son estudios descriptivos con enfoque cuantitativo; 01 es una investigación de campo descriptiva con enfoque cualitativo; 01 es una investigación de campo observacional con enfoque cuantitativo; 01 es un estudio longitudinal; 01 es descriptivo observacional; y 01 es observacional analítico. Surgieron tres categorías: 1. Conocimiento de las enfermeras sobre el análisis de gases sanguíneos y la interpretación de los resultados; 2. Cuidados de enfermería relacionados con el análisis de gases en sangre arterial; y 3. Efectos del dolor durante la punción arterial y diagnósticos de enfermería identificados. **Conclusión:** Muchas enfermeras aún demuestran debilidades en la recolección de muestras de sangre arterial e interpretación de los resultados, y la ausencia de la realización de la prueba de Allen puede estar relacionada con una falta de comprensión de su relevancia.

Palabras clave: Análisis de Gases en Sangre Arterial; Atención de Enfermería; Enfermería; Unidades de Cuidados Intensivos.

RESUMO

Introdução: Gasometria Arterial é um exame invasivo realizado com frequência nos pacientes críticos, e avalia a função pulmonar, a ventilação alveolar, a oxigenação sanguínea e os distúrbios ácido-básicos, através da análise dos gases presentes no sangue arterial. **Objetivo:** analisar as evidências científicas acerca do conhecimento, habilidades e atitudes dos enfermeiros que atuam na Unidade de Terapia Intensiva na realização e interpretação da gasometria arterial. **Método:** Trata-se de uma revisão integrativa. A busca dos artigos foi realizada nas bases de dados: ScIELO, LILACS, BDNF e MEDLINE entre os meses de janeiro a março de 2024. Os critérios de inclusão utilizados foram publicações em texto completo, disponíveis na íntegra, gratuitamente, nos idiomas português, inglês e espanhol. Utilizou-se os descritores: gasometria arterial; enfermagem; e unidade de terapia intensiva. Foram incluídos 09 artigos para compor a amostra. **Resultados:** Dentre os artigos analisados, 04 são estudos descritivos com abordagem quantitativa; 01 é pesquisa de campo descritiva com abordagem qualitativa; 01 é pesquisa de campo observacional com abordagem quantitativa; 01 é estudo longitudinal; 01 é descritivo observacional; e 01 é observacional analítico. Emergiram três categorias: 1. Conhecimento dos enfermeiros sobre gasometria e interpretação dos resultados; 2. Cuidados de enfermagem relacionados à gasometria arterial; e 3. Efeitos da dor durante a punção arterial e diagnósticos de enfermagem identificados. **Conclusão:** Muitos enfermeiros ainda demonstraram fragilidades na coleta da amostra de sangue arterial e na interpretação do resultado e a ausência da realização do teste de Allen pode estar relacionada à falta de compreensão sobre sua relevância.

Palavras-chave: Gasometria Arterial; Cuidados de Enfermagem; Enfermagem; Unidades de Terapia Intensiva.



INTRODUCTION

Arterial blood gas analysis (ABG) is an invasive test frequently performed to assess lung function, alveolar ventilation, blood oxygenation, and acid-base disorders in critically ill patients by analyzing the gasses present in arterial blood. In clinical practice, its importance is evident in the diagnosis and monitoring of lung disease progression, as well as in the assessment of acid-base balance. Blood pH, partial pressure of carbon dioxide (PaCO_2), oxygen (pO_2), bicarbonate ion (HCO_3), and oxyhemoglobin saturation (SpO_2) were measured. The parameters considered normal are pH 7.35–7.45, pO_2 from 80 to 100 mmHg, pCO_2 from 35 to 45 mmHg, and HCO_3 from 22 to 26 mmHg^{1,2}. This test can be performed in clinics, emergency rooms, and intensive care units (ICUs).

Nurses and medical staff collect and analyze ABG from patients admitted to the ICU. However, according to Resolution No. 703/2022 of the Federal Nursing Council (COFEN), arterial puncture for blood gas collection, as well as for invasive blood pressure monitoring, is one of the activities considered exclusive to nurses within the nursing team. Therefore, these professionals must be equipped with the knowledge, competencies, and skills necessary to ensure their technical and scientific rigor³.

According to Law No. 7,498 of July 25, 1986, regulating the practice of nursing, as amended by Decree No. 94,406 June 8, 1987, nurses are professionals responsible for

providing highly complex nursing care using techniques that require extensive technical and scientific knowledge. Therefore, nurses working in the ICU must have technical knowledge and specific skills for making timely decisions and ensuring the quality and effectiveness of care provided to critically ill patients⁴.

Critically ill patients are common in the ICU, as it is the hospital area designated for treating seriously ill and/or high-risk patients with hemodynamic changes. Imbalances in acid-base balance and metabolic and pulmonary functions are the main factors that cause these changes, and such dysfunctions are analyzed according to the parameters obtained in ABG. Therefore, its performance is essential in the context of monitoring critically ill individuals, given that the assessment of these disorders indicates the diagnosis and prognosis^{5,6}.

Arterial puncture should be performed by a trained professional using the appropriate technique to prevent complications and make the procedure less painful and more accurate so that there is no change in the result and no harm to the patient. Changes in results may be related to sample collection, storage, and transport, as well as changes related to the blood gas analyzer. Therefore, nurses must perform the Allen test to assess collateral blood flow before attempting the puncture, in addition to technical and scientific knowledge, among other precautions¹.

Given that arterial blood sampling for ABG purposes is an activity exclusive to nurses, professionals must be qualified to both perform the procedure and interpret its results².

Therefore, this study aimed to analyze the scientific evidence concerning the knowledge, skills, and attitudes of ICU nurses related to arterial blood gas analysis.

METHODS

This is an integrative review developed in the following steps: Narrowing of the topic and elaboration of the guiding question, definition of inclusion and exclusion criteria for articles for the literature search, consideration of the information to be extracted from the selected articles, database search, evaluation with critical analysis of the studies included in the review, discussion of the results and presentation of the integrative review⁷.

After defining the topic, the PCC strategy was used to determine the initial question, which was: P: nurses; C: arterial blood gas analysis; C: context. Based on this strategy, the following guiding questions can be constructed: Do ICU nurses have the technical and scientific knowledge to perform arterial blood gas analysis? Do the nurses interpret the results correctly and in time to perform an immediate intervention?

To support the research, a search for scientific articles was carried out in the following electronic databases: Scientific Electronic Library Online (SCIELO), Latin American and Caribbean Health Sciences Literature (LILACS), Specific Nursing Database (BDENF) and Medical Literature Analysis and Retrieval System Online (MEDLINE). The

terms included in the Descriptors for the Health Sciences (DeCS) were used, followed by the Boolean operator “AND”, which formed the following chain: “arterial blood gas analysis” AND “nursing” AND “intensive care unit” between January and March 2024.

The inclusion criteria were publications that are available in full text and in their entirety, free of charge in Portuguese, English, and Spanish. As this is a topic that is rarely covered in academic publications, it was decided not to set a time frame. Duplicate articles, editorials, dissertations, review articles, commentaries, prefaces, manuals, books, book chapters, manuscripts, and studies that did not address the topic or did not answer the key question were excluded (Figure 1).

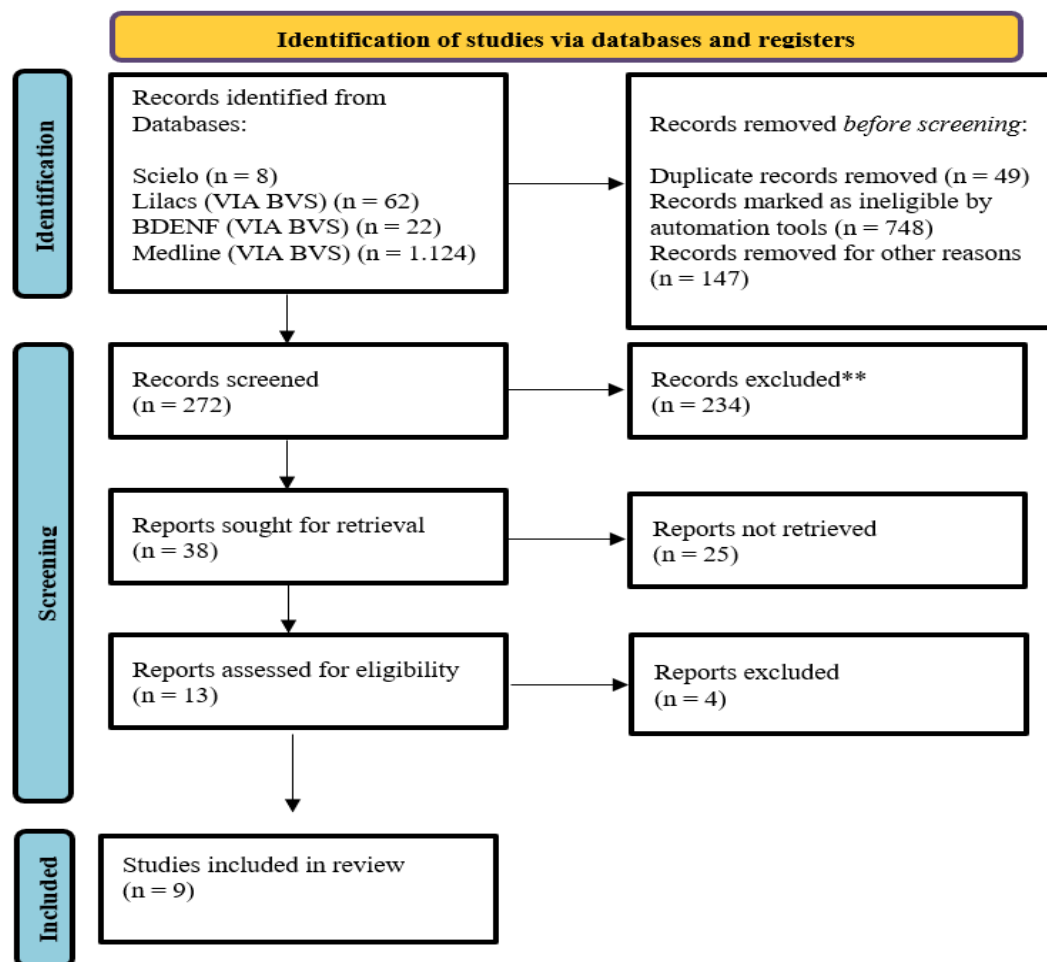
The Evidence Hierarchy Assessment System defined by Melnyk and Fineout-Overholt (2005) used is an important tool for classifying and assessing the quality of evidence in research. It comprises seven levels: 1 - Evidence from systematic reviews or meta-analyses of relevant randomized controlled clinical trials or clinical guidelines based on systematic reviews of randomised controlled clinical trials; 2 - Evidence from at least one well-designed randomized controlled clinical trial; 3 - Evidence from well-designed clinical trials without randomization; 4 - Evidence from well-designed cohort and case-control studies; 5 - Evidence from systematic reviews of descriptive and qualitative studies; 6 - Evidence from a single descriptive or qualitative study; 7 - Evidence

from expert opinion and/or expert committee reports⁸ (Figure 1).

After reading the articles in their entirety and reviewing which articles should be included in this review article, the information on which

to base the results of this review was entered into a spreadsheet. Throughout the process, the ethical rules for reviews were followed and good practice in scientific research was adhered to.

Figure 1 – Description of the selected articles, read and included in the review. Fortaleza, Ceará/2025.



Source: adapted and translated from PRISMA (2024)

RESULTS

Nine articles were selected, analyzed, and arranged in tables highlighting the most important aspects of the studies. The information in each article includes: identification, title, authorship, journal, year of publication, type of study, and level of evidence (Table 1).

Among the articles analyzed, 04 (44.4%) were descriptive studies with a quantitative approach, 01 (11.1%) were descriptive field research with a qualitative approach, 01 (11.1%) were observational field research with a quantitative approach, 01 (11.1%) was a longitudinal study, one (11.1%) was a descriptive observation and one (11.1%) was an

analytical observation. All the articles analyzed

were published in Portuguese.

Table 1 - Presentation of the selected publications by title, authorship, journal/year/type of study and level of evidence. Fortaleza, CE, Brazil, 2024.

Art.	Title	Authors	Journal / Year / Type of study	Level of evidence
A1	Nurses' knowledge of the interpretation of arterial blood gas analysis in the intensive care unit	Lopes <i>et al.</i>	<i>Medicus</i> . 2023. Field study, descriptive, analytical with a qualitative approach.	Level 5
A2	Nurses' knowledge of arterial blood gas sampling in the intensive care unit of a public hospital in the western Amazon region	Krause <i>et al.</i>	Brazilian Journal of Development. 2022. Cross-sectional observational study with a quantitative approach.	Level 5
A3	Assessment of neonatal pain during arterial puncture: an analytical observational study	Alberice <i>et al.</i>	School of Nursing, Federal University of Minas Gerais. 2021. Analytical observational study.	Level 5
A4	Knowledge of nursing students in the interpretation of arterial blood gas analysis at a college center in the interior of Pernambuco	Costa <i>et al.</i>	Research Society and Development. 2020. Descriptive, cross-sectional study with a quantitative approach.	Level 5
A5	Changes in blood gas values depending on the exposure time of the sample	Malheiros <i>et al.</i>	<i>Nursing Journal</i> . 2019. Descriptive, exploratory study with a quantitative approach.	Level 5
A6	Prevalence of respiratory nursing diagnoses in neonatal intensive care units	Sousa <i>et al.</i>	Electronic Nursing Journal. 2018. Cross-sectional study with a quantitative approach.	Level 5
A7	Pain assessment during blood sampling in sedated infants receiving mechanical ventilation	Dantas <i>et al.</i>	Brazilian Journal of Intensive Care. 2016.	Level 5

			Descriptive and observational study.	
A8	Changes in physiologic parameters of neonates undergoing oxygen therapy during blood gas sampling	Barbosa; Cardoso.	Acta Paul Nursing. 2014. Longitudinal study.	Level 4
A9	ICU nurses' knowledge of arterial blood gas analysis	Rolim <i>et al.</i>	UFPE online nursing journal. 2013. Descriptive study with a quantitative approach.	Level 5

Source: Authors, 2024.

The articles were selected according to the research question, read and organised with the most important results of the studies (Table 2) as follows:

Table 2 - Presentation of the results of the selected studies. Fortaleza, CE, Brazil, 2024.

Art.	Results
A1	Knowledge of GA: 11.1% of nurses reported having little knowledge, 66.7% had intermediate knowledge, and 22.2% had full knowledge. Allen test performance: 3.27% did not perform it, 11.1% rarely performed it, 7.4% performed it when there was difficulty with local perfusion, and 77.8% performed it in all collections. Interpretation of a test for respiratory acidosis: 74.1% correctly identified the disorder, and 25.8% incorrectly identified it.
A2	100% chose the recommended syringe; 93% used the correct amount of heparin; 86% did not assess the puncture site; 71% performed the Allen test; 36% used the correct needle angle according to the chosen artery; 29% performed the puncture with the needle lateralized; 50% collected the recommended amount of blood; 100% pressed the puncture site after collection; 14% removed air bubbles from the sample; 14% homogenized the sample by rotating the syringe; and 100% of the samples were not sent immediately for analysis but were stored on ice.
A3	Saturation dropped in 46.8% of procedures. Heart rate changes (bradycardia/tachycardia) in 58.1% of procedures. All newborns reacted with crying during and after the arterial puncture procedure. Pain assessment using the Premature Infant Pain Profile (PIPP) scale: absence of pain in 30.6%. Mild and moderate pain in 24.2% and severe pain in 45.2%.

A4	The correct choice of first-choice artery was the radial artery (92.1 %). Allen test performed: 78.1% had already performed it, and 21.9% had never performed it. Angulation for puncture: Only 59.6% understood that the correct angulation for radial artery puncture is 45°. Post-puncture compression time: 44.7% stated that it was 5 min. Interpretation of a test: Respiratory alkalosis - 38.6% answered correctly, and 26.3% answered incorrectly. Respiratory acidosis: 44.7% answered correctly and 20.2% answered incorrectly. Metabolic alkalosis: 42.1% answered correctly and 22.8% answered incorrectly. Metabolic acidosis: 43.9% answered correctly and 21.0% answered incorrectly.
A5	pH values decreased considerably in the first 30 seconds; Pco₂ concentration increased in the first 30 seconds; HCO₃ concentrations decreased in the first 30 seconds; the lower the sample temperature, the slower the rate of decline in pO₂.
A6	1. Impaired Spontaneous Ventilation - Decreased partial pressure of oxygen, increased heart rate, increased partial pressure of carbon dioxide, and decreased arterial oxygen saturation. 2. Ineffective Breathing Pattern: Dyspnea, abnormal breathing pattern, tachypnea, and use of accessory muscles. 3. Impaired Gas Exchange: decreased carbon dioxide, abnormal arterial blood gases, and hypoxemia.
A7	Discomfort during blood collection: 83% of patients reported pain (ranging from mild discomfort to severe pain). Heart rate and respiratory rate: These were higher immediately after the painful stimulus compared to the other moments of the assessment. There was no difference in SpO₂ levels between the different assessment moments.
A8	Respiratory rate: was lower 5 min after blood gas collection in newborns on mechanical ventilation, compared to the moment immediately after. Heart rate: decreased 5 min after blood gas collection in newborns in the Oxy-Hood, showing a reduction in this parameter compared to the moment immediately after the procedure. SpO₂: increased slightly 5 min after blood gas collection in neonates in the Oxi-Hood, confirming the stabilization of this variable compared to the moment immediately after the procedure. Pulse: Decreased 5 minutes after ABG collection, when compared to the moment immediately after, and newborns on MV had an increased pulse immediately after the procedure compared to before, but 5 minutes later returned to baseline values.
A9	Many nurses do not perform ABG, as this procedure is performed by laboratory technicians. Allen test: Most nurses do not perform this test, possibly due to their limited involvement in sample collection or a lack of knowledge about its importance. Interpretation of a test: There was no significant difference between nurses who interpreted AG and those who did not, with this interpretation being more common among physicians and physical therapists.

Maximum sample waiting time: Most were aware of the time at room temperature.

Interpretation of a test: Although nurses are aware of the parameters of respiratory acidosis, respiratory alkalosis, and metabolic alkalosis, many have poor knowledge of metabolic acidosis. However, most recognize the importance of AG in patients with renal changes and can identify the main disorders associated with these changes.

Source: Authors, 2024.

To enable analysis, interpretation, and discussion of the information obtained, the results were divided into three categories: 1. Nurses' knowledge of blood gas analysis and interpretation of results; 2. Nursing care during arterial blood gas analysis; and 3. the impact of pain during arterial puncture and identified nursing diagnoses.

DISCUSSION

CATEGORY 1: Nurse knowledge of blood gas analysis and interpretation of results.

Arterial blood gas analysis (ABG) is a routine test in the intensive care unit that can be used to assess acid-base disturbances. It allows the identification of metabolic, respiratory, and renal changes in critically ill patients and helps in the diagnosis and clinical evolution. It is also indicated in the prognosis of diseases such as diabetic ketoacidosis, chronic obstructive pulmonary disease, acute and chronic respiratory failure, chronic kidney disease, invasive mechanical ventilation, and other clinical conditions. The procedure is contraindicated in coagulopathies and in the absence of contralateral flow⁹.

The nurse's knowledge and skills in performing and interpreting arterial blood gas analysis are essential for quality of care and patient safety. Correctly analyzing these parameters provides crucial information about acid-base balance, oxygen levels and lung function, which are essential for assessing the patient's respiratory and metabolic status⁶.

The studies analyzed provide important data on nurses' knowledge and practice of the GA procedure. One of the studies found that of the participants surveyed, only 22.2% reported having extensive knowledge on the subject, 11.1% had low knowledge, while the majority (66.7%) had moderate knowledge¹⁰. In another study, it was found that 46.7% of nurses do not perform AG in critical care, as this procedure is generally performed by laboratory technicians⁶.

The poor performance of most nurses on Allen tests can be attributed to their limited involvement in data collection or their lack of understanding of its relevance^{6,11,12}. It was found that although these professionals had knowledge of the technical procedure and the care required after arterial puncture, their involvement in performing the procedure was low⁶. They also showed weaknesses in interpreting the test, with this analysis being more common among doctors and physiotherapists^{6,10,12}.

In this context, it is essential that nurses participate in blood gas studies, taking into account the specific characteristics of critically ill patients, who are often haemodynamically unstable, making arterial puncture difficult and requiring special techniques and care appropriate to their unstable condition.

When confronted with an ABG test indicating respiratory acidosis, 74.1% of nurses were able to correctly identify the disorder, while 25.8% made errors in interpretation¹⁰. Considering the results of this study, it was found that nurses working in intensive care units still have deficits in the interpretation of ABG results, which can affect the diagnosis and professional behaviour towards the patient^{6,10,12}.

It is known that the parameters of arterial blood analysis are measured by the pH value, the partial pressure of carbon dioxide (PaCO₂), the partial pressure of oxygen (PaO₂), the bicarbonate concentration (HCO₃), the oxygen saturation (SpO₂) and the base excess. The reference values for the pH value are between 7.35 and 7.45 and indicate neutrality, values < 7.35 indicate acidity, and values > 7.45 indicate alkalosis. Normal PaO₂ refers to a result between 80 and 100 mmHg, and its ratio identifies pulmonary gas exchange in relation to an increase or decrease in oxygen pressure².

PaCO₂ evaluates the effectiveness of alveolar ventilation and its normal range is between 35 and 45 mmHg. A value below 35 mmHg indicates hyperventilation, a value above 45 mmHg indicates hypoventilation. HCO₃ assesses renal function and the reference values

are between 22 and 26 mEq/L. Values <22 mEq/L in conjunction with a pH <7.35 indicate metabolic acidosis, and HCO₃ >26 mEq/L in conjunction with a pH >7.35 indicate metabolic alkalosis. The base excess (BE) signals an excess or deficit of dissolved bases in the blood. Normal values are between -2 and +2. A result < -2 indicates metabolic acidosis, and values above +2 indicate metabolic alkalosis¹³.

The removal technique consists of several steps. It is therefore important that the arterial puncture is performed accurately and carefully by qualified professionals, always taking into account the possible risks and benefits for the patient. The professional responsible for taking arterial blood samples must be adequately trained and have the necessary skills to perform the procedure¹.

The data on nurses' practice in taking this test in intensive care units is remarkable. Although they opted for the recommended syringe and all applied pressure to the collection site after collection, there were significant deficits in other areas^{11,12}.

Regarding the preparation of the material and the puncture, it was found that only 93% used the correct amount of heparin in the syringe, 86% did not consider the ideal puncture site and the correct angle of the needle according to the chosen artery was only observed in 36% of the punctures. In addition, only 29% performed the puncture with a lateralised needle and half of the nurses did not draw the recommended amount of blood. Removal of air bubbles from the sample and homogenisation were only

performed in 14% of cases. In addition, although all samples were stored on ice, none were immediately sent for analysis¹¹.

A study investigated nursing students' knowledge of interpreting GA and provided valuable insights into students' competence in this area of clinical practice. It was found that a large majority (92.1%) correctly identified the artery of first choice for puncture. However, when it came to performing the Allen test, 78.1% of participants had already performed it. Regarding the correct angle for radial artery puncture, 59.6% knew that it was 45°. Regarding the duration of arterial compression after puncture, only 44.7% of the students recognized the need for 5 minutes of compression¹².

CATEGORY 2: Nursing care during arterial blood gas analysis.

Arterial puncture for blood sampling is a task that can only be performed by nurses within the care team; however, preparation and technical/scientific knowledge are required to perform this procedure. It is important that the nurse selects the most appropriate site for the arterial puncture to ensure the success of the procedure and the patient's well-being⁶.

The sample is taken by puncturing the radial artery, the brachial artery or the femoral artery, whereby a careful, individual assessment must be made in order to choose the best

puncture site. The radial artery is the most suitable site as it is easily accessible and the ulnar artery is available as an alternative collateral circulation in case of vascular complications. The femoral artery is the last choice due to the lack of collateral flow, greater susceptibility to infectious processes and difficult access to this region⁹.

Before puncturing the selected site, the physician must perform antisepsis of the skin to minimize microbial contamination of the site and reduce the risk of contamination of the sample. The amount of arterial blood collected varies between 2 mL and 3 mL, and the puncture site should be pressed for 5 to 10 minutes after collection¹.

The Allen test should be performed prior to arterial puncture to assess contralateral blood flow in the limb to be punctured^{6,11,12}. It should be performed in the forearm area by pressing the radial artery and the ulnar artery simultaneously for at least 30 seconds. After the prescribed time has elapsed, only the ulnar artery should be decompressed and it should be checked whether the blood flow to the hand is restored exclusively by the circulation of the ulnar artery. The test is considered positive if the blood flow from the ulnar artery perfuses the blood vessels of the hand within 10 seconds or less, and consequently negative if the perfusion time is more than 10 seconds, indicating that the blood flow from the ulnar artery is insufficient and thus arterial puncture in this limb is contraindicated⁹.

The blood gas sample is unstable, with rapid fluctuations in blood gas values due to

exposure time. Therefore, pay attention to air bubbles in the syringe, high or low exposure temperatures of the material, excess heparin in the syringe and the time between extraction and sample processing and analysis^{11,14}.

A significant drop in pH values was observed within 30 minutes of collection, indicating that a short period of time between collection and processing is sufficient to cause changes. The PaCO₂ concentration increased in the first 30 minutes after collection, while the HCO₃ concentration decreased. This shows that it is ideal if the samples are processed immediately after collection so that the results are not affected by external influences¹⁴.

As far as patient safety is concerned, iatrogenic incidents that occur among nursing staff have a direct impact on patients' quality of life. Nurses are responsible for direct care and can therefore recognize most adverse events and take action to minimize them. Patient safety practices during care can reduce illness, injury, treatment and length of stay⁵.

As it is an invasive procedure, arterial puncture for arterial blood gas analysis is associated with complications. The nurse responsible for the puncture and blood sampling is responsible for preventing complications and intervening if necessary. Complications of arterial puncture include persistent postoperative pain, arterial ischemia, local necrosis, thrombosis, embolism, hematoma, vasospasm, compression neuropathy, arteriovenous fistula formation and aneurysms⁹.

CATEGORY 3: The impact of pain during arterial puncture and identified nursing diagnoses.

A study of pain assessment during blood sampling in sedated children receiving mechanical ventilation provided important insights into the perception of pain in this clinical context. A significant percentage, 83%, of patients experienced painful reactions during blood sampling, ranging from mild discomfort to severe pain, as assessed by the Face, Legs, Activity, Cry, and Consolability (FLACC) behavioral scale¹⁵.

In addition, it was observed that both respiratory rate and heart rate were significantly increased immediately after the painful stimulus compared to the other time points studied. There were no significant differences in oxygen saturation between the different time points of the evaluation. Although diastolic blood pressure was higher 5 minutes after the procedure than before the procedure, this difference did not reach statistical significance. These data underline the importance of careful and sensitive pain management in children undergoing mechanical ventilation with the aim of minimizing discomfort during blood gas sampling¹⁵.

In another study conducted with newborns, the extent of pain during arterial puncture was investigated. The results indicated that 46.8% resulted in decreased saturation. Changes in heart rate, such as bradycardia or tachycardia, were observed in 58.1% of cases.

All responded to the procedure by crying, clearly indicating the presence of pain. The assessment of pain using the Premature Infant Pain Profile (PIPP) scale showed that 30.6% of babies felt no pain, while 45.2% experienced severe pain. Arterial puncture was perceived as more painful and there was no statistically significant difference in pain intensity between the first and second puncture attempts¹⁶.

The study conducted on changes in physiological parameters of neonates (NB) undergoing the following types of oxygen therapy: mechanical ventilation (MV), oxy-hood and nasal CPAP during blood gas sampling, showed that NB in oxy-hood had physiological changes in heart rate (HR), pulse and saturation (SpO₂) parameters, while patients on mechanical ventilation had changes in respiratory rate and pulse¹⁷. The study confirms that neonates on nasal CPAP showed no instability immediately before, after and five minutes after the procedure and were therefore more stable than the other neonates in terms of the parameters studied during arterial puncture. The study indicates that neonates receiving oxygen were more sensitive to pain, as all neonates receiving this type of oxygen therapy showed clinical severity¹⁷.

In arterial blood gas analysis, several nursing diagnoses can be made based on the clinical indicators observed¹⁸, such as:

1. Impaired spontaneous breathing:

Characterized by decreased partial pressure of oxygen, increased heart rate, increased partial pressure of carbon dioxide and decreased arterial

oxygen saturation, indicating difficulty in pulmonary ventilation.

2. Ineffective breathing pattern:

Characterized by dyspnea, an abnormal breathing pattern, tachypnea and the use of accessory muscles, as well as nosebleeds and bradypnea, indicating inadequate respiratory rhythm and depth.

3. Impaired gas exchange:

characterized by abnormal arterial blood gasses, hypoxemia, along with nosebleeds, cyanosis, dyspnea, irritability, hypercapnia, decreased carbon dioxide, abnormal breathing pattern, abnormal arterial pH, and tachycardia, indicating a disorder of gas exchange in the lungs.

Nursing diagnoses provide important information about the patient's respiratory and cardiovascular system and enable early intervention to ensure adequate ventilation and oxygenation, as well as monitoring and treatment of potential complications of the respiratory system.

CONCLUSION

Based on the analysis of the articles, it was found that many nurses still have weaknesses in taking arterial blood samples and interpreting the results, and that the lack of the Allen test may be related to a lack of understanding of its importance.

Considering the legislation in force, the technical standards and the code of ethics for nurses who rely on the results of the arterial blood gas test, it is essential that nurses receive

technical and scientific training, as it is an essential and complex procedure that is fundamental for monitoring the clinical condition of patients, especially in the ICU, given the instability and rapid changes in the clinical picture.

The study is limited by the lack of publications on this topic and further research is needed to assess the level of knowledge and performance of these professionals.

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"Nothing to declare."

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