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KNOWLEDGE OF THE INTENSIVE CARE UNIT NURSING PROFESSIONAL ABOUT ARTERIAL GASOMETRY

CONHECIMENTO DO ENFERMEIRO DE UNIDADE DE TERAPIA INTENSIVA SOBRE GASOMETRIA ARTERIAL

CONOCIMIENTO DEL ENFERMERO DE UNIDAD DE TERAPIA INTENSIVA SOBRE GASOMETRIA ARTERIAL

Luciana Ramalho Rolim¹, Elizabeth Mesquita Melo², Natasha Marques Frota³, Natália Gondim de Almeida⁴, Islene Victor Barbosa⁵, Joselany Áfio Caetano⁶

ABSTRACT

Objective: to analyze the knowledge of nurse working in intensive care unit (ICU) on arterial gasometry (AG). **Method:** a descriptive study with, quantitative, performed in a public hospital in Fortaleza-CE, from February to March 2011, with 45 nurses. We used Statistic Package for Social Sciences to analyze the data. The research was approved by ethics committee of the hospital with no. 091211/10. **Results:** participants were predominantly aged 20-29 years and were female; time of academic graduation and in the ICU ranged from one to four years. The interpretation of the results of AG was performed by 53.3%. Nurses demonstrated knowledge about the technical procedure of AG and nursing actions after arterial puncture, however had little role in discussions of clinical procedures with the multidisciplinary team. **Conclusions:** it emphasizes the need for nurses working in ICU empower continually seeking to update themselves, mainly dealing with critically ill patients. **Descriptors:** Blood Gases; Acidosis; Alkalosis; Nursing Care.

RESUMO

Objetivo: analisar o conhecimento do enfermeiro que atua em unidade de terapia intensiva (UTI) sobre gasometria arterial (GA). **Método:** estudo descritivo, com abordagem quantitativa, realizado em um hospital público em Fortaleza-CE/Brasil. A coleta de dados foi realizada com 45 enfermeiros. Utilizou-se o programa SPSS (Statistic Package for Social Science) versão 19.0 para analisar os dados. O projeto foi encaminhado ao Comitê de Ética em Pesquisa da instituição, aprovado com protocolo no. 091211/10. **Resultados:** a interpretação dos resultados da GA era realizada por 53,3% dos enfermeiros, porém poucos participavam das discussões após a interpretação do exame. Os enfermeiros demonstraram conhecimento sobre o procedimento técnico da GA e as ações de enfermagem após a punção arterial, entretanto apresentaram pouca atuação nas discussões das condutas clínicas com a equipe multiprofissional. **Conclusão:** ressalta-se a necessidade dos enfermeiros que atuam em UTI capacitarem-se continuamente, buscando atualizar-se, principalmente por lidarem com pacientes críticos e com quadro hemodinamicamente instável. **Descritores:** Gasometria; Acidose; Alcalose; Cuidados de Enfermagem.

RESUMEN

Objetivo: analizar el conocimiento de los enfermeros que actúan en unidad de terapia intensiva (UTI) sobre gasometría arterial (GA). **Método:** estudio descriptivo, cuantitativo, realizado en un hospital público, en Fortaleza-CE, de febrero a marzo de 2011, con 45 enfermeros. Se utilizó el programa Statistic Package for Social Sciences (SPSS) para analizar los datos. El proyecto fue aprobado por el Comité de Ética de la institución con el protocolo 091211/10. **Resultados:** los participantes estaban predominantemente en la franja de edad de 20 a 29 años y eran de sexo femenino; el tiempo de formación académica y de actuación en UTI varió de uno a cuatro años. La interpretación de la GA era realizada por 53.3% de los enfermeros. Los enfermeros demostraron conocimiento sobre el procedimiento técnico de la GA y sobre las acciones de enfermería después de la puncción arterial, sin embargo presentaron poca actuación en las discusiones clínicas con el equipo multiprofesional. **Conclusiones:** se hace evidente la necesidad de que los enfermeros que actúan en UTI se capaciten continuamente, por tratar con pacientes críticos. **Descriptor:** Gasometría; Acidosis; Alcalosis; Cuidados De Enfermería.

¹Nurse Specialist in Nephrological Nursing, Universidade Estadual do Ceará/UECE. Fortaleza (CE), Brazil. E-mail: lucianarolim@gmail.com; ²Nurse PHD in Nursing, Professor at the Undergraduate Nursing Course from Universidade de Fortaleza/UNIFOR. Fortaleza (CE), Brazil. E-mail: elizjornet@yahoo.com.br; ³Nurse, Master's Degree Student, Universidade Federal do Ceará/UFC. Fortaleza (CE), Brazil. E-mail: natashafrota@hotmail.com; ⁴Nurse Master's Degree Student in Clinical Care from the Universidade Federal do Ceará /UECE. Fortaleza (CE), Brazil. E-mail: natygondim@gmail.com; ⁵Master, Doctorate's Student in Nursing, Universidade Federal do Ceará/UFC. Fortaleza (CE), Brazil. E-mail: islene@terra.com.br; ⁶Ph.D in Nursing, Universidade Federal do Ceará /UFC. Fortaleza (CE), Brazil. E-mail: joselanycaetano@ufc.br

INTRODUCTION

The Nursing Care Systematization (NCS) is a valuable tool that serves to enhance and guide the nursing practice, by providing a dynamic of systematized and interrelated actions, and its main focus is the health care of the human being. Moreover, it also enables the planning and development of qualified and specific care to the individual, family and community, as well as the registration of the professional nursing practice.¹

In the environment of the Intensive Care Unit (ICU), there are various technological devices that assist in sustaining life, as mechanical ventilation equipment, pulse oximeter, cardiac monitors and precision apparatus in the laboratory test results, which, in their turn, assist in the diagnostic elaboration, as well as in the therapy to be employed.² This technological impact in the hospital environment and the constant changes of such equipment of vital support to the ICU patients require that the nursing staff to adapt itself to the rhythm of further technologies for the service of the patient health.³

The ICU patients require a more complex care due to their medical condition of a more critical nature. The Nursing should be engaged in this process, by providing a care with specific characteristics, because the knowledge acquired at the ICU stands out, mainly, by progressive and fast advancement of new knowledge regarding this area.⁴

Often, the patient is admitted to the ICU with changes in the breathing pattern; thus, it is crucial to obtain data on the gasometry to determine and/or adjust the type of ventilatory support to be established. So, it is important that the nurse knows how to interpret the gasometry result in search of some defining characteristics, such as decreased PO₂, increased PCO₂ and decreased SO₂, since this information enables the identification of nursing diagnoses related to the respiratory function.¹

The Arterial Gasometry (AG) or arterial blood gas test (ABG) is an exam routinely performed in patients subjected to anesthesia or admitted to the ICU, being that its main indications are: assessment of the disorder in the acid-base balance and pulmonary oxygenation of the arterial blood and of the alveolar ventilation. The AG aims to reveal blood pH values, partial pressure of carbon dioxide (PaCO₂) and oxygen (PaO₂), bicarbonate ion (HCO₃) and oxy-hemoglobin saturation, among others. The result of the

blood gas test is used to assess respiratory diseases and other conditions that affect the lungs, as well as provides information with regard to the metabolic diseases through the interpretation of the operation of organic buffer systems.⁵

The collection and analysis of the gasometry are interventions of nurses and doctors to critically ill patients, by contributing to a positive evolution in the clinical picture of such patients.⁶ The nursing team who works at the ICU should be able to respond for its actions with regard to the scope of functions and duties at work, besides being constantly motivated to improve its professional qualification through an ongoing education program.³

Given the above, one realizes the need for the nursing professional to be always seeking new knowledge to the improvement of its practice with regard to the interpretation of exams and planning of actions addressed to the stabilization and maintenance of homeostasis of the critically ill patient.

This study becomes relevant due to the high demand for ICU patients with changes in acid-base balance. As the nurse is the professional who stays 24 hours providing care, its performance based on knowledge and appropriate use of information originating from the analysis and interpretation of exams favors the early identification of these changes, as well as a joint intervention with the multidisciplinary team in caring for such patients. Furthermore, it will contribute to the improvement of the practice of the nursing professional who works at the ICU, in case of caring of these patients, since it can offer subsidies for the knowledge and qualification of professionals.

OBJECTIVE

- To analyze the knowledge of nurses who work at the ICU on the accomplishment of the Arterial Gasometry.

METHOD

This is a descriptive study, with a quantitative approach, carried out from February to March 2011, in the intensive care units of a tertiary public hospital, which is located in the municipality of Fortaleza-CE/Brazil.

The study population totaled 54 nurses, and the sample consisted of 45 nurses. As the inclusion criterion, we have established: to be part of the cast of ICU nurses. As exclusion criteria, we have included the following: to

be scaled only for occasional duties or be away from activities, whether for vacation or medical leave. Hence, nine participants were excluded, because one professional was on vacation, two were on maternity leave and six refused to participate in the research.

Data collection took place from a structured tool containing sociodemographic information (age, gender, length of training, titling, working time at the ICU, professional bond) and information regarding the arterial gasometry, as the accomplishment of the AG, collection technique, interpretation of results and nursing interventions to the patient with acid-base change.

The data were organized in the Statistic Package for Social Science program (SPSS), version 19.0, and they are presented in tables and analyzed with basis on the descriptive statistics, by focusing on the absolute and relative frequency.

The ethical aspects were taken into account, based on the Resolution 196/96, which sets standards for researches involving human beings.⁷ The project was submitted to the Ethics Research Committee of the institution, receiving favorable opinion, under protocol nº 091211/10. The nurses who were participants in the study have signed the Free and Informed Consent Form, in which there were the study objectives, the guarantee of anonymity and of data use only for scientific purposes.

RESULTS

The nurses were characterized in relation to the variables: age, gender, length of graduation, titling, working time at the ICU and professional bond, as illustrated in Table 1.

Table 1. Distribution of nurses according to the sociodemographic characteristics. Fortaleza, 2011.

Variables	n=45	%
Age		
20-29	25	55,6
30-39	11	24,4
40-49	7	15,6
> or equal to 50	2	4,4
Gender		
Male	5	11,1
Female	40	88,9
Length of graduation		
Less than one year	13	28,9
From one to four years	16	35,5
From five to ten years	4	8,9
Over ten years	12	26,7
Titling		
Graduation	24	53,4
Specialist	20	44,4
Master	1	2,2
Working time at the ICU (years)		
Less than one year	16	35,6
From one to four years	20	44,4
From five to ten years	4	8,9
Over ten years	5	11,1
Institutional bond		
Public Servant	15	33,3
Cooperative worker	30	66,7

Of the 45 nurses, more than half (25), corresponding to 55.6%, were aged 20 to 29 years, followed by those aged 30 to 39 years, with 11 (24.4%). Regarding gender, the vast majority of participants were female, represented by 40 (88.9%).

With regard to the length of graduation, 16 (35.5%) nurses had between one and four years of academic training, 13 (28.9%) had less than one year and 12 (26.7%) had more than ten years. As for the titling, 24 (53.4%) had only graduation, 20 (44.4%) were specialists and only one professional (2.2%) had a master's degree title.

The working time at the ICU was an important aspect assessed in the study, given the experience of the nurse to perform the AG procedure throughout its working years within the ICU. It was observed that 20 (44.4%) of the participants worked at the ICU between one and four years and 16 (35.6%) had less than one year of work. Regarding the professional bond, 30 (66.7%) developed activities in the institution as cooperative workers, while 15 (33.3%) were public servants.

Table 2. Distribution of nurses according to the accomplishment of the arterial gasometry and related actions. Fortaleza, 2011.

Variables	n=45	%
Performs arterial gasometry		
Yes	24	53,3
No	21	46,7
Performs Allen Test before AG		
Yes	11	24,4
No	34	75,6
Interprets the AG results		
Yes	24	53,3
No	21	46,7
Participates in clinical discussions after AG interpretation		
Yes	33	73,3
No	12	26,7

It was found that 24 nurses (53.3%) conduct the AG in the ICU environment. During the procedure performance, only 11 (24.4%) do the Allen test before the blood collection. Regarding the interpretation of the results, 24 (53.3%) reported analyzing the results after

the gasometry collection and 33 (73.3%) participated in the clinical discussions after the interpretation of the above mentioned exam, together with the multidisciplinary team.

Table 3. Distribution of nurses' answers on the knowledge of the arterial gasometry technique. Fortaleza, 2011.

Variables	n=45	%
Choice of artery		
Yes	38	84,4
No	7	15,6
Maximum waiting time of the sample at room temperature		
Yes	43	95,6
No	2	4,4
Minimum pressure time of the artery after needle removal		
Yes	31	68,9
No	14	31,1

Regarding the nurses' knowledge about the AG collection technique, it was found that 38 (84.4%) had knowledge related to the selection of the artery to be punctured; 43 (95.6%) indicated the correct time for the

waiting of the collected sample at room temperature and 31 (68.9%) knew the suitable time to press the puncture location after the needle removal.

Table 4. Distribution of nurses on the knowledge on the indicative values of change in the acid-base balance. Fortaleza, 2011.

Variables	n=45	%
AG values found in the respiratory acidosis		
Yes	35	77,6
No	10	22,4
AG values found in the respiratory alkalosis		
Yes	29	64,4
No	16	35,6
AG values found in the metabolic acidosis		
Yes	21	46,7
No	24	53,3
AG values found in the metabolic alkalosis		
Yes	25	55,6
No	20	44,4

When evaluated on the interpretation of the AG results, it was found that 35 nurses (77.6%) knew the values of the arterial gases found in the presence of a respiratory acidosis, while 29 (64.4%) knew the values found in a situation of respiratory alkalosis. As

regards the metabolic disorders, 21 (46.7%) had knowledge about the relative values for the occurrence of metabolic acidosis and 25 (44.4%) on the values present in the metabolic alkalosis.

Table 5. Distribution of nurses according to the knowledge on the relevant aspects after the arterial gasometry collection. Fortaleza, 2011.

Variáveis	n=45	%
Minimum time for modifying the mechanical ventilator parameters		
Yes	17	37,8
No	28	62,2
Characteristic breathing of the metabolic acidosis		
Yes	28	62,2
No	17	37,8
Main defining characteristic of venous blood sample		
Yes	28	62,2
No	17	37,8
Acid-base change found at the kidney failure		
Yes	37	82,2
No	8	17,8

It was observed that only 17 (37.8%) had knowledge on the minimum time of the gasometry collection after changing the mechanical ventilator parameters. Regarding the characteristic breathing during the metabolic acidosis, 28 nurses (62.2%) knew how to recognize it. In relation to the differentiation between arterial and venous blood, 28 (62.2%) knew how to identify the main characteristics of the venous sample. As for the acid-base disorder found at the kidney failure, it was found that the majority of the nurses (37) had knowledge on the characteristic change in this situation, which represented a percentage of 82.2%

DISCUSSION

The nurses who were participant in this study were in the age group of young adults. Regarding the gender, there was a predominance of females, since the Nursing is historically characterized as a professional activity to be carried out almost exclusively by women.⁸

It was found that the nurses had little time of academic training, which can be associated with the fact that the target institution for this study is constituted in a teaching hospital, continuously receiving trainees and, thus, offering job opportunities for further graduates.

Nevertheless, it should be noted that the length of professional training is a preponderant factor for the development of activities at the ICU, since patients require specialized care due to the critical status in which they are framed. Moreover, the activities performed by nurses are complex and differentiated, requiring technical expertise and professional experience.⁹

Most nurses had no post-graduate degree or were just specialist; this result can be explained by the fact that they are newly formed. It is worth emphasizing the importance of hospitals stimulate the professional qualification as early as possible, especially those which work in the ICU,

because they deal with critical ill patients, thus requiring a more specialized care.

Still in this context, it should be highlighted that the work within an ICU requires activities with a high degree of responsibility and qualification, which can end up causing intense emotional distress.¹⁰ From this perspective, a study has showed that more experienced nurses - over the years - start to act in the fields of education and administration due to the high degree of stress in the care area.⁸

The findings related to the length of professional performance of the ICU workers, evidenced as the predominant period “one to four years”, followed by “less than a year of work” in intensive care, may be associated with the stressful burden caused by working in general care and, in particular, within an ICU. Accordingly, professionals with shorter completion time of undergraduate course win the opportunity to work together with critical ill patients, without much experience requirement regarding this clientele.

The meanings of “caring” and “care” for the Nursing field are directly related to the accomplishment of health care procedures that involve direct contact with the client and physical contact in most situations.¹¹

It should be verified that many nurses do not perform AG, being that this procedure is usually performed by laboratory technicians. Nonetheless, it is worth noting that the nurse should stop being a mere executor of tasks and assume the self-determination of its duties, through the adjustment of principles and administrative measures aimed at solving specific problems of its own competence.¹¹

Thus, it is of the utmost importance that the nursing professional assumes its participation in the gasometric blood examination, by considering the peculiarity of the patient, who is, in most cases, hemodynamically unstable, and it becomes hard to conduct the arterial percutaneous puncture, requiring specific skills and care.

A caution related to the AG collection is related to the accomplishment of the modified Allen test, before inserting the needle into the artery, which assesses the blood circulation in the selected hand, before the radial artery puncture, by assessing if the ulnar artery is able to provide a good perfusion, in case of hematoma in the radial artery.⁶ Most nurses reported not performing the Allen test, which may be associated with the low participation in the collection and/or exam or, even, due to the lack of knowledge about its importance. However, we should emphasize the importance of performing this test before collection, because it provides parameters for the vascular complications prevention.

The ability to analyze the AG, relating it to the patient's clinical signs, is a relevant function of the nurse, since it provides an overview of the patient situation in relation to its oxygenation, ventilation and acid-base status.⁶ Nonetheless, there was no significant difference between nurses who reported interpreting the gasometric examination and those ones who reported not having such action as routine.

The ICU is a set of functionally grouped elements that requires, in addition to equipment, uninterrupted and specialized medical and nursing care. In this context, the care based on clinical judgment and knowledge implemented by the nurse aims at establishing interventions that could cover the biopsychosocial needs of patients.⁴ The nursing process is a methodological tool that has ensured the applicability in the professional practice of theoretical frameworks of the Nursing itself, which guide specific decisions about what should be questioned and diagnosed, how to intervene and what should be assessed.¹¹

In the work process in health, it is recommended that professionals carry out their activities with interdependence and complementarity, by allowing the adjustment of activities that will improve the clinical status of the patient under their care.¹² Thus, it is essential that the nursing professional participates in the interpretation of the AG test results and in the interventions together with the patient, associated with the multidisciplinary team behaviors. However, the practical living shows that the interpretation of the AG test, commonly, does not belong to the routine care of the nurse, because it is restricted to doctors or physiotherapists. Often, the nurse is the first to receive the AG result, and may, according to the found changing, perform an

intervention, since, in an environment of intensive care, the patient condition can quickly change and in a dramatic way.

It is important having the participation of nurses in clinical discussions on the changes in the mechanical ventilator parameters after the AG interpretation, and such participation should be encouraged by hospital institutions, by giving more freedom to the nurse intervention. But, not only should be encouraged, as it should starts from the nurse, that is to say, the need to participate further in such discussions, and it is crucial to have an in-depth knowledge on the possible changes in the examination.

By considering that the disturbances of acid-base balance are common in critical ill patients, and it is generally associated with increased morbidity and mortality, one of the greatest contributions of the nursing professional to decrease costs, length of stay and mortality in patients with respiratory problems, consists in implementing interventions that prevent or minimize the intercurrents.⁵

Regarding the choice of the main artery for puncture, most professionals cited the radial artery as first choice, for being superficial, having lower blood flow, in addition to being accessible and easily identifiable. One of the common mistakes made by professionals that perform the AG collection is the prolonged exposure of the sample to the room temperature.⁶ In this study, most participants had scientific reasons with regard to the maximum waiting time of the collected AG sample at room temperature.

After the completion of the gasometry collection, you must press the location after the needle removal for at least 5 minutes or 10-15 minutes, if the patient is on anticoagulant therapy.⁶ This pressure should be done with the fingertips at the puncture location, which was reported by most professionals, who also drew attention to the required time. After the blood collection, you must observe its color, because if this is dark, may indicate venipuncture. Other important aspects to be observed are the pH and PaO₂ values, since if the pH value is lower than the clinically expected one and PaCO₂ value is higher, such rates may indicate venous blood.⁶ It is imperative having knowledge about such aspects, as well as the correct assessment of the sample by the nurse, which was observed among most researched workers.

Among the important activities carried out by the nurse, are the assessment of the

patient health and the implementation of needed interventions to care for it, in an individualized way, in order to meet the clear needs for each patient, by using the NCS as strategy.^{2,12} It is important that the nurse, previously and accurately, identifies the clinical signs that will guide the choice of the nursing interventions, which should be widely studied and refined by this worker at stake, in order to seek, not only the empowerment of knowledge, but above all the improvement of the individual health.^{2,12}

The technological evolution of mechanical ventilators used within ICU facilitates the possibilities of intervention and follow-up of the patient.¹³ The monitoring of arterial blood gases will determine the need for O₂ and allow assessing the effectiveness of the oxygenotherapy provided to the patient, which enables the nurse to identify the parameters of the acid-base status that the patient presents.²

By knowing how to interpret the AG, the professional can, quickly and accurately, identify an acid-base disorder, so it can appropriately intervene, especially if the patient is on mechanical ventilation, since the AG can guide the adjustment in the ventilator parameters, according to the patient needs.¹⁴ In the case of the blood gas parameters that define the acid-base changes, it was found that the nurses had knowledge about the parameters of the respiratory acidosis, respiratory alkalosis and metabolic alkalosis. Nevertheless, most of them showed poor knowledge regarding the determination of the metabolic acidosis.

Gas exchange is the main function of the respiratory system and hypoxemia is the most serious event in patients who are in mechanical ventilation care, since it directly jeopardizes the oxygen supply to the tissues. In monitoring alveolar ventilation, you must directly use the blood pressure of carbon dioxide (PaCO₂), which is obtained through the arterial gasometry, associated with the tidal volume and respiratory frequency, i.e., the minute-volume (MV).¹³

The gasometry should be routine part patient on mechanical ventilation, since it reveals the hypoxemia and hypercapnia rates, being that its control is indicated for every 24 hours. The PaO₂ is the partial pressure of O₂ in arterial blood, and the PaCO₂ is the partial pressure of carbon dioxide in arterial blood. The aforementioned examination assesses the alveolar ventilation, besides reflecting the pH changes, as the PaCO₂ values directly act on the acid-base balance. A PaO₂ below 40

mmHg, PaCO₂ persistently over 60 mmHg and pH below 7.25 indicate severity and need for ICU admission.¹³

The disorders in the acid-base balance can be unexpectedly found in certain ICU patients. A study conducted with elderly patients admitted to intensive care showed that a significant percentage has developed metabolic alkalosis related to the feeding by nasogastric probe, being essential the daily monitoring of the pH level by means of the blood gas analysis.¹⁵

Before an acid-base disorder, it is always important to seek the etiological diagnosis, so that the therapeutic approach is driven to the underlying cause, being crucial to characterize the disorder type presented by the patient.⁵ It should be highlighted that, in the presence of a respiratory acidosis, an immediate action becomes necessary, by developing an intervention together with the patient, thus reducing the time between the test result and the provided care.¹⁵

Subsequently to the modification of the mechanical ventilator parameters, the AG sample should be taken at least after 15 minutes, since this is the minimum time for that the patient may have a respiratory stability.¹⁶ It was found that most nurses were not aware of this information, which is important in the AG collection in patients on ventilatory support. In spite of the little knowledge regarding the changes present in the AG that indicate metabolic acidosis, most nurses had knowledge about the characteristic breathing at this disorder, perhaps due to the frequency of patients with such disorder in the ICU environment, associated to varied clinical pictures.

The signs and symptoms of the metabolic acidosis vary according to its severity, and may include confusion, drowsiness, nausea and vomiting, as well as Kussmaul breathing, which is defined as the respiratory rhythm characterized by increased respiratory depth and frequency, alternating apnea periods between inspiration and expiration.¹⁷ The blood acid-base assessment should be performed in all patients admitted to the ICU, whatever the underlying pathology, because besides the deviation of the acid-base balance, in itself, can provide data on the patient's respiratory function and on the tissue perfusion conditions.¹⁸

It should be emphasized that in ICU patients, especially those on hemodialysis, the AG should be daily taken for doing an ongoing monitoring of the kidney function, since these patients often have metabolic

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acidosis associated with kidney failure.¹⁹ According to the results of this study, most nurses had knowledge about the importance of the AG test in patients with kidney disorders, besides citing the main disturbance associated to these alterations.

During the nursing care, it is important to consider the integrality of the care, by observing the individual as a holistic being and with multiple needs. Direct actions focused on the observed needs in the individual, and that act as modifiers of human answers, need to be increasingly implemented and varied by the nursing professional.²⁰ Thus, its knowledge should be constantly enhanced in quest of improving the quality of care provided to the patient. In the case of the arterial gasometry, the nursing staff must be knowledgeable about the seriousness of such procedure, due to it being an invasive test performed in an artery or in an arterial catheter, with potential complications, as well as on its importance to identify disorders in the acid-basic balance.

CONCLUSION

Given the above, it should be concluded that most nurses did not conduct AG test, besides not considering the importance of the modified Allen test before the blood collection, either by lack of knowledge of its existence or by the little participation in such examination. The interpretation of the AG results was accomplished by slightly more than half of the assessed nurses, but a small amount participated in the discussions on the changes of the mechanical ventilator parameters after the AG interpretation.

The nurses have demonstrated knowledge about the technical procedure of the AG and the care after the arterial puncture. However, there is need for greater acting of such professionals regarding the nursing interventions. Although the nurse has many duties, the AG is a procedure that contributes to the clinical assessment of the ICU patient, and it should be valued as a criterion for the monitoring of its evolution.

The nurses who work together with critical ill patients should be increasingly qualified, by seeking to deepen their technical and scientific skills, since they are dealing with serious and hemodynamically unstable patients.

We have noticed a lack of research in this area; hence, it is essential to conduct further researches, creating greater knowledge, especially regarding the nursing care

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procedures, by increasing the information support to professionals who work in the ICU.

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Corresponding Address

Elizabeth Mesquita Melo

Rua Ageu Romero, 100, Ap. 02 – São Gerardo

CEP: 60325-110 – Fortaleza (CE), Brazil