Research Article

Effectiveness of Structured Teaching Programme on Knowledge Regarding Arterial Blood Gas Analysis and its Interpretation among Intensive Care Unit Staff Nurses

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Abstract

Aim: The aim of the study was to assess the knowledge of intensive care unit (ICU) staff nurses regarding arterial blood gas (ABG) analysis and interpretation. **Materials and Methods:** Pre-experimental design of one group pre- and post-test group design was selected for the study. The sample size was 50 ICU staff nurses and was drawn through purposive sampling. A structured knowledge questionnaire was used to collect data from the subjects. The collected data were analyzed using descriptive and inferential statistics and interpreted in terms of objectives and hypothesis of the study. **Results:** The present study findings revealed that most of them 35 (70.0%) had inadequate knowledge, 15 (30%) had moderate knowledge, none of them had adequate knowledge in pre-test and 40 (80%) had adequate knowledge, 10 (20%) had moderate knowledge and none of them had inadequate knowledge in post-test. The pre-test mean score was 26.72 and standard deviation was 5.3. The post-test mean score was 43.3 and standard deviation was 3.8. The calculated *t*-value was 17.5 which was significant at 0.05 level. **Conclusion:** The study findings concluded that structured teaching programme was effective in improving the knowledge of ABG analysis and its interpretation. It was clear that such information has the potential to be invaluable in the treatment of a wide range of patients.

Key words: Arterial blood gas analysis, intensive care unit, structured teaching programme, staff nurses

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Introduction

The arterial blood gas (ABG) report is the cornerstone in the diagnosis and management of clinical oxygenation and acid-base disturbances. An abnormal blood gas report may be the first clue to an acid-base or oxygenation problem: It may indicate the onset or culmination of cardiopulmonary crisis and may serve as a gauge with regard to the appropriateness or effectiveness of therapy. Thus, the ABG report plays a pivotal role in the overall care of cardiopulmonary disease.[1]

Acid-base homeostasis exerts a major influence on protein function, thereby critically affecting tissue and organ performance. Deviations of systemic acidity in either direction can have adverse consequences and, when severe, can be life-threatening. Yet it is the nature of the condition responsible for severe acidemia or alkalemia that largely determines the patient's status and prognosis.[2]

An ABG is a blood test that measures the acidity, or pH, and the levels of oxygen (O_2), and carbon dioxide (CO_2) from an artery. The test is used to check the function of the patient's lungs and how well they are able to move O_2 into the blood and remove CO_2.[3]

Interpreting an ABG is a crucial skill for physicians, nurses, respiratory therapists, and other health-care personnel. ABG interpretation is especially important in critically

ill patients. The utilization of an ABG analysis becomes necessary in view of the following advantages: (1) Aids in establishing diagnosis, (2) guides treatment plan, (3) aids in ventilator management, (4) improvement in acid/base management; allows for optimal function of medications, and (5) acid/base status may alter electrolyte levels critical to a patient's status.[4-6]

ABG analysis assesses a patient's partial pressure of O_2 (PaO_2), providing information on the oxygenation status; the partial pressure of CO_2 ($PaCO_2$), providing information on the ventilation status (chronic or acute respiratory failure, and is changed by hyperventilation (rapid or deep breathing) and hypoventilation (slow or shallow breathing); and acid-base status. An advanced understanding of acid-base physiology is as central to the practice of critical care medicine.[6,7]

Blood gas analysis is a commonly used diagnostic tool to evaluate the partial pressures of gas in blood as well as acid-base content. Understanding and use of blood gas analysis enables care provider to interpret respiratory, circulatory, and metabolic disorders. Interpretation leads to an understanding of the degree or severity of abnormalities, whether the abnormalities are acute or chronic, and if the primary disorder is metabolic or respiratory in origin. With increasing use of ABG analysis in various ward and other hospital settings to aid medical diagnosis and management, nurses who can interpret results are often able to initiate earlier interventions and understand the reasons for medical interventions.[4,8]

The use of ABGs in an emergency department was studied by reviewing, retrospectively, 5000 consecutive patients. Of these, 169 (3.38%) had ABGs done; 150 (85%) manifested at least one abnormality; and 58 (35%) were hospitalized. A total of 35 different diagnoses were made among those patients who had ABGs done. Pneumonia was the most common (34), followed by chest pain (14). Hypoxia, the most frequent abnormality, was found in 124 (75%) of all tested patients. In an emergency department, where rapid accumulation of data is necessary, ABGs play a key role in patient evaluation.[9]

Objectives of the study

The objectives of the study are as follows:
1. Assess the knowledge of intensive care unit (ICU) staff nurses regarding ABG analysis and its interpretation by conducting pre-test
2. Evaluate the effectiveness of structured teaching programme regarding ABG analysis and its interpretation among ICU staff nurses by comparing mean pre-test and post-test knowledge scores
3. Determine the association between pre-test knowledge scores of ICU staff nurses regarding ABG analysis and its interpretation and selected demographic variable

Assumptions

The study assumed that structured teaching programme enhances the knowledge on ABG analysis and its interpretation among ICU staff nurses.

Materials and Methods

Pre-experimental design of one group pre- and post-test group design was selected for the present study. Independent variable was structured teaching programme on ABG analysis and its interpretation among ICU nurses. Dependent variable was the knowledge regarding ABG analysis and its interpretation. The study was conducted in Manjunath Hospital in Bengaluru.

Description of the tool

The tool was developed by the investigator after reviewing the related literature and guidance from the experts in the field. The tool consists of two parts.

Part I

It deals with demographic variables such as age, sex, educational qualification, years of experience, religion, marital status, and workshops attended.

Part II

It consists of structured self-administered knowledge questionnaire, to assess the knowledge regarding ABG analysis and its interpretation among staff nurses working in ICU. It consists of 30 items. For each correct response, a score of one mark was given and for every incorrect answer, a score of 0 was given. The level of knowledge was categorized as:
- <50%–Inadequate knowledge
- 51-75%–Moderate knowledge
- >75%–Adequate knowledge

The validity of the tool was established in consultation with seven nursing experts in the field of Medical Surgical Nursing. The tool was modified according to the suggestion and recommendations of experts and tool was finalized. The reliability of the questionnaire was assessed by testing the stability and internal consistency. The value was found to be reliable (r = 0.9). The spearman's brown prophecy formula was used to assess the internal consistency using split half technique. The value was found to be reliable.

Method of data collection

The study was conducted for a period of 30 days. The investigator obtained permission from the consent authority and each participant, before the study. The purpose of the study was explained to the subjects. The investigator gave a brief introduction and pre-test was conducted for 30 min. The level of knowledge was assessed using questionnaire. Immediately after the pre-test, teaching was given. On 7th day, the post-test was assessed using the same questionnaire. The data gathered were analyzed and interpreted manually. The data collected were analyzed by means of descriptive statistics and inferential statistics. A probability of $P < 0.05$ level of significance was considered significant.

Results

Findings related to demographic variables

With regard to the age, majority of the samples 30 (60%) were in the age group of 20–25 years. The majority of the subjects 40 (80%) were Hindus. In relation to gender, the majority of them were females 40 (80%).

With regard to the educational qualification, the majority 27 (54%) of the respondents were B.Sc Nurses. Considering the years of experience, 27 (54%) of the respondents had an experience between 1 and 2 years. In relation to marital status, most of the respondents 41 (82%) were unmarried. Regarding the workshops attended, 45 (90%) nurses were not attended workshops related to ABG analysis and its interpretation.

Findings related to assessment of pre-test and post-test knowledge

In Table 1, the frequency and percentage distribution of pre-test and post-test knowledge score of ICU staff nurses was presented. Among 50 ICU staff nurses, most of them 35 (70.0%) had inadequate knowledge, 15 (30%) had moderate knowledge, none of them had adequate knowledge in pre-test and 40 (80%) had adequate knowledge, 10 (20%) had moderate knowledge, none of them had inadequate knowledge in post-test. It was inferred that most of the staff nurses had inadequate and moderate knowledge in pre-test and most of the staff nurses had adequate knowledge in post-test.

Findings related to effectiveness of structured teaching programme on knowledge regarding ABG analysis and its interpretation among staff nurses by comparing mean pre-test and post-test knowledge scores.

The pre-test mean score was 26.72 with the standard deviation 5.3 and post-test mean score was 43.3 with the standard deviation 3.8. The obtained $t = 17.5$ was highly significant at the level of $P < 0.05$. There is a significant difference between the mean pre- and post-test level of knowledge among staff nurses. Thus, structured teaching programme regarding ABG analysis and its interpretation was proven to be effective on the level of knowledge among staff nurses [Table 2].

Findings related to association between the pre-test knowledge scores with selected socio-demographic variables.

Chi-square test was used to find out the association between pre-test knowledge scores with selected demographic variable. The result had shown that there was a significant relationship between pre-test scores with selected demographic variables such as age, gender, educational qualification, experience, and previous workshops attended. It was also found that there was no significant relationship between religion and marital status with pre-test knowledge scores on ABG analysis and its interpretation.

Table 1: Frequency and percentage distribution of pre-test and post-test knowledge score of the ICU staff nurses regarding ABG analysis and its interpretation (*n*=50)

S. No.	Level of knowledge	Pre-test		Post-test	
		F	(%)	F	(%)
1	Inadequate knowledge	35	70.0	0	0
2	Moderate knowledge	15	30.0	10	20.0
3	Adequate knowledge	0	0	40	80
	Total	50	100	50	100

ABG: Arterial blood gas, ICU: Intensive care unit

Table 2: Pre- and post-test level of knowledge regarding ABG analysis and its interpretation (n=50)

S. No.	Level of Knowledge	Mean	SD	"*t*" Value
1	Pre-test	26.72	5.3	17.5*
2	Post-test	43.3	3.8	

ABG: Arterial blood gas,* Significant at *P* < 0.05 level

Discussion

Health is considered as one of the most important values in life. It is a key factor and is regarded as precious. Health as well as longevity should be protected and enhanced as much as possible. Early detection and treatment are one of the measures to prevent illness and also to reduce complications and death. Early diagnosis is key to better management.[10]

According to Hippocrates (460–377 BC), good health resides in a proper balance among the four humors: Blood, phlegm, black bile, and yellow bile. Among these, humors blood is very important as it plays a key role in maintaining normal body mechanism. The primary function of blood is to transport O_2 from the lungs to the body tissue and CO_2 from the tissues to the lungs. This function is essential to prevent the death of tissues due to hypoxia.[11]

The study findings revealed that the comparison between mean pre-test and post-test post test score regarding ABGs among nurses was 26.72–43.3 with mean difference 16.58. Calculated *t*-value was found to be 17.52 which was found to be highly significant.

The present study is supported by Akashpreet Kaur, Gopal Singh Charan, a study was undertaken to assess the effectiveness of structured teaching programme on knowledge and practice regarding ABG analysis among the 60 ICU nurses at selected hospitals, Jalandhar. The study results revealed that mean difference of pre-test and post-test knowledge score of nurses was 7.83 and $t = 20.631$ which was more than tabulated value at 5% level of significance. This revealed that structured teaching programme had significant effect on knowledge and practice of nurses regarding ABG analysis.[12]

These findings were consistent with the study conducted by Hemavathy *et al*. (2016). Results revealed that before

implementing structured teaching programme, of 30 samples 4 (13.3%) had inadequate knowledge, 20 (66.7%) had moderate adequate knowledge, and only 6 (20%) had adequate knowledge about ABG analysis. However, in post-test 4 (13.3%) had moderate adequate knowledge and 26 (86.7%) had adequate knowledge and none had inadequate knowledge about ABG analysis. The pre-test mean value is 19.5 and the standard deviation value is 3.03. The post-test mean value is 25.1 and standard deviation value is 2.14. The mean difference is 5.6 and the standard deviation difference is 9. The paired t = 8.4, the difference was found to be statistically significant which indicates the effectiveness of structured teaching programme in improving the level of knowledge.[13]

The results of the present study were consistent with results of another study by Padma *et al*. regarding ABG analysis and its interpretation among 30 staff nurses show that 4 (13.3%) had A grade, 7 (23.3%) had B + grade, 12 (40%) had B grade, 5 (16.7%) had C grade, and 2 (6.7%) had D grade knowledge and mean value was 19.0 and standard deviation was 3.5 in staff nurses. The study concluded that the majority of staff nurses had D grade knowledge.[14]

Conclusion

The conclusions can be drawn from the study findings had shown that the majority of the samples had moderate to inadequate knowledge. The study concluded that structured teaching programme was effective in enhancing the level of knowledge of staff nurses regarding ABG analysis and interpretation.

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