Intensive and Critical Care Nursing (2016) xxx, xxx–xxx

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/iccn

ORIGINAL ARTICLE

Clinical nurses' knowledge level on pulse oximetry: A descriptive multi-centre study

Dragana Milutinović [a,*], **Gordana Repić** [b], **Branimirka Arandelović** [c]

[a] *Department of Nursing, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia*
[b] *Medical School ''7 April'', Novi Sad, Serbia*
[c] *Department of Nursing, College of Technological Science Šabac, Serbia*

Accepted 30 May 2016

KEYWORDS
Anaesthesiology;
Descriptive;
Emergency;
Intensive care;
Knowledge;
Multi-centre;
Nurses;
Pulse oximetry

Summary
Objectives: The aim of this study was to assess the level of knowledge on pulse oximetry among nurses. Understanding this is important because insufficient knowledge can lead to misinterpretation of pulse oximetry readings and consequently compromise patient safety.
Research methodology: The study was cross-sectional and included a sample of 198 nurses. A modified questionnaire by Kiekkas et al. was used as the research tool.
Setting: Intensive care units, anaesthesiology and emergency departments in two tertiary health care institutions in Serbia.
Main outcome measures: Principles of pulse oximeter function and conditions that can affect accuracy and reliability of pulse oximetry readings.
Results: The lower percentage of correct responses about principles of pulse oximetry function was found in items related with the alarm reliability and understanding technical limitations. The factors that might affect pulse oximetry readings which were not identified by the nurses at a satisfactory level were the body position and specific kinds of ambient light. The mean scores of knowledge level were significantly different regarding departments ($p = 0.015$).
Conclusion: Since this study revealed a lower level of knowledge in some aspects of pulse oximetry, it can be concluded that the generally firm belief that ''experience is everything'' can be challenged. This fact is important for the quality of health care and the patient's safety.

* Corresponding author at: University of Novi Sad, Faculty of Medicine, Department of Nursing, Hajduk Veljkova 3, 21000 Novi Sad, Serbia. Tel.: +381 21 420 677; fax: +381 21 6624153.
E-mail addresses: dragana.milutinovic@mf.uns.ac.rs, milutind021@gmail.com (D. Milutinović), gordana.repic@gmail.com (G. Repić), branimirka.arandjelovic@gmail.com (B. Arandelović).

http://dx.doi.org/10.1016/j.iccn.2016.05.006
0964-3397/

Please cite this article in press as: Milutinović D, et al. Clinical nurses' knowledge level on pulse oximetry: A descriptive multi-centre study. Intensive Crit Care Nurs (2016), http://dx.doi.org/10.1016/j.iccn.2016.05.006

Implications for Clinical Practice

- Measuring the oxygen saturation of patients appears to be a simple procedure; however, accurate interpretation of its readings is much more complicated.
- Insufficient knowledge among nurses can lead to misinterpretation of its readings and consequently compromise the patient's safety.
- Continuous educational programmes about the oxyhaemoglobin dissociation curve, basic principles of pulse oximetry function and its technical characteristics, as well as the conditions that can affect its readings among nurses are strongly recommended.

Introduction

Pulse oximetry is the non-invasive continuous monitoring of peripheral capillary oxygen saturation (SpO_2), which is measured with every pulse wave (Hernandez, 2001; Howell, 2002). The level of SpO_2 is estimated by photo detection, where two differing wavelengths of light (wave-length of red light is 660 nm; wave-length of infrared light is 940 nm) radiate through a well-perfused body area, measuring the changing absorbance for each wavelength. Comparing the amount of absorbed infrared and red light, the oxyhaemoglobin/deoxyhaemoglobin ratio is calculated and thus the percentage of saturation of arterial haemoglobin displayed on the device screen.

Pulse oximetry devices, whose function was based on principles of different red and infrared absorption level, were first developed in Japan in the mid-1970s, but became commercial only a decade later, when the multiple use sensor was introduced (Kyes, 2007; Westhorpe and Ball, 2008). Therefore, pulse oximetry has been integrated in clinical practice for almost three decades because it enables cost-effective monitoring of respiratory status and early detection of hypoxaemia (Stannard, 2010).

Until the 1980s, physical assessment of the skin was the most common method for monitoring hypoxaemia in order to detect central cyanosis. However, central cyanosis is relatively unreliable and considered to be a late indicator of hypoxaemia (Casey, 2011; Giuliano and Liu, 2006), and the human eye is not precise enough to detect it properly (DeMeulenaere, 2007). Oxygen saturation has to be below 80% in order to detect any changes in the skin colour by inspection (Casey, 2011; Giuliano and Liu, 2006).

Pulse oximetry very soon became a part of regular clinical practice thanks to its simple application, rapid assessment of the patients' oxygenation status, no need to break the skin or analyse blood and thus no contact with body fluids (Schulz, 2007). It has been widely in use in different clinical settings, especially in intensive care units, where it has been incorporated into multi-parameter monitoring systems, in emergency departments and operating theatres where it has been a part of the standard equipment since 1986 (Giuliano and Liu, 2006; Kyes, 2007). It has also been integrated in clinical practice in emergency departments, during patient the transport to hospital, as well as for home care.

In addition to critically ill and injured patient; pulse oximetry is recommended for patients with respiratory illness, especially those on oxygen therapy, patients with chronic obstructive pulmonary disease or asthma and for patients who receive therapy which can produce respiratory depression (Booker, 2008; Howell, 2002). Therefore, pulse oximetry is indicated in every condition that needs continuous monitoring of oxygenation status of patient (Hernandez, 2001). Recently, the acuity of hospitalised patients has increased and therefore pulse oximetry monitoring has further increased. It can be concluded that there is a need for a knowledge of the use of pulse oximetry among health care professionals (Giuliano and Liu, 2006).

Although measuring the oxygen saturation of patients appears to be a simple procedure, the accurate interpretation of its readings is much more complicated. Therefore, in order to avoid misinterpretation of SpO_2 values and improve patient safety, it is necessary to understand the oxyhaemoglobin dissociation curve, the basic principles of pulse oximetry functioning and its technical characteristics, as well as conditions that can affect its readings (Elliott and Coventry, 2012; Giuliano and Liu, 2006).

Many studies have shown that the knowledge of health care professionals on pulse oximetry is insufficient, which is particularly important in the field of respiratory physiology and in understanding the basic principles and limitations of this method of monitoring hypoxaemia (Attin et al., 2002; Bilgin et al., 2000; Elliott et al., 2006; Fouzas et al., 2010; Harper, 2004; Huijgen et al., 2011; Johnson et al., 2012).

Methods

Objectives

In clinical practice both physicians and nurses employed in intensive care units, anaesthesiology departments and emergency departments are responsible for the interpretation of SpO_2 values. Because of that, evaluation of their knowledge on pulse oximetry is very important because insufficient knowledge can lead to misinterpretation of its readings and consequently compromise the patient's safety. Therefore, this study assessed the level of knowledge on pulse oximetry among nurses.

Setting

This cross-sectional and multicentre study was conducted in the adult Intensive Care Units (ICU), Anaesthesiology Departments (AD) and Emergency Departments (ED) in two tertiary health care institutions in Serbia, from October 27 to November 30, 2014.

Please cite this article in press as: Milutinović D, et al. Clinical nurses' knowledge level on pulse oximetry: A descriptive multi-centre study. Intensive Crit Care Nurs (2016), http://dx.doi.org/10.1016/j.iccn.2016.05.006