

PULSE OXIMETRY UTILIZATION AND OXYGEN WEANING DECISION TO CHILDREN PATIENT WITH ACUTE ASTHMA ATTACK AT EMERGENCY UNIT

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ABSTRACT

Introduction: Emergency nurses's somehow actually have lack of knowledge performing pulse oximetry utilization and decision made when an oxygen weaning is done especially for those patient's who are suffered from acute asthma attack. **Method:** The used method was by collecting and analyzing related textbook and articles with pulse oximetry and decision of oxygen weaning at children with acute asthma attack. The literatures were obtained from textbook and electronic articles such as ScienceDirect, World Health Organization, Google Scholar, PubMed and ClinicalKey with textbook and article criteria that were published from 2000 to 2015. **Results:** Pulse oximetry utilization based on asthma attack level to children. The attack level is divided into 3, mild, moderate, and severe. The asthma attack level can be classified based on the symptoms that can be seen by GINA guidance (2015) or by using PRAM (Pediatric Respiratory Assessment Measure) score. Mild asthma patients without oxygen administered will be examine by pulse oximetry every four hours, however, for those with oxygen administered will be set up pulse oximetry every two to four hours. For moderate attack, the pulse oxymetry examination had done in each two to four hours within stable condition, if it didn't stable the pulse oximetry should be installed continuously. While the severe asthma attack level, the pulse oximetry should be installed continuously for monitoring SpO₂ and breathing status. The oxygen weaning decision is done at SpO₂ > 91%. At SpO₂ 91% level then O₂ is still installed and SpO₂ reexamination in 60 minutes. If SpO₂ < 91%, then the O₂ giving can be increased up to SpO₂ >91% and rechecked in next 15-60 minutes. **Discussion:** Pulse oximetry provide information to SpO₂, further it can be used as evidence based in giving appropriate oxygen during stable condition as a guidance in the oxygen weaning.

Keywords: pulse oximetry, asthma, emergency

INTRODUCTION

Acute asthma attack is a characteristic of disease with recurrent attack episode, breathlessness and wheezing with varied frequency and level for each children. Asthma attack's are usually occurred because of long term asthma management failure or the presence of trigger factor exposure. The acute asthma attack is one of medical emergency or life threatening condition that are able to cause failure up to the death of the children that can be found in the emergency unit (WHO, 2015; Camrigo & Rowe, 2014)

Asthma is including five most deadly diseases in the world. About 235 million people attacked by asthma in the world and 10% of those are children (WHO, 2015). In the US, 12.8 millions attacked by asthma each year with prevalence mostly children of 5-17 years old and about 640.000 children taken to the

emergency unit (Nowak & Tokarski 2014). While in Indonesia, according to Health Department of Indonesia (2010) showed that asthma is part of 10 deathly and painfully diseases. For about 10% from 25 million of Indonesian's population suffer from asthma and the occurrence of these diseases in children is about 10-85% higher than those adult.

Signs and symptoms that often occurred in acute asthma are dyspnea, tight chest feeling, wheezing, breathlessness, unable to talk, the existence of accessory and expiration muscle. If these condition's develop rapidly without an appropriate treatment, within several minutes that can be caused life threatening. The children even looks so pale, cyanosis, sweating, confusion and sleepy that finally fall into hypoxia, hypercapnia and respiratory acidosis. Within this condition, the patient should be brought into emergency unit to get promptly

and properly treatment (Silverstri 2011; Pollart et al, 2011).

In emergency unit, assessment is needed in order to obtain comprehensively status especially for breathing status and patient oxygenation. It is important to note that low level oxygenation in blood may also influence both organ which are heart and brain (Fahy et al, 2011). Oxygen saturation correlates to adequacy status of patient breathing that can be measured by pulse oximetry (Camrigo & Rowe, 2014; Nitzan & Nitzan, 2013). Pulse oximetry is devices that generally used to patient treatment standard in the emergency unit, critical care and surgical operation room to measure oxygenation level such as hypoxia (Keahey et al, 2002). Pulse oximetry is one of non-invasive devices that are easy, simple, and reliable to perform it. As well as to knowing the real change of oxygenation status, intervention efficiency and diseases progressing process (Exadaktylos et al 2014; Lee et al, 2000; Martin et al, 2015; Keahey et al, 2002)

Pulse oximetry is very helpful to diagnosed and to patients treatment in the emergency unit. Especially, for patient's evaluation with acute asthma attack as well as it's complication. It is also can be used as a reason to giving an appropriate oxygen, when it should be given or weaned and to assessing oxygen therapy successfully (Keahey et al 2002; Fahy et al 2001). According to Hassan et al (2008) showed that pulse oximetry as a foundation to determine oxygen saturation monitoring that suitable with the asthma attack or wheezing. Others said that pulse oximetry is recommended for patient performing hemodynamic monitor, pre-operative patient and patient in emergency unit (Levin et al (2001). Holburn & Allen (1989) in Simon & Clark (2003) reported that pulse oximetry significantly has changed medical therapy for acute patient in the emergency unit and reduced arterial blood gas analysis up to 37%. Even the newest study stated that in emergency unit, therapy for acute asthma attack has changed because of pulse oximetry (Keahey et al, 2002).

Conventionally the pulse oximetry to measure arterial blood oxygen saturation that is calculated in percent between oxyhemoglobine concentration in blood that used as reliable indicator for disease level that relate with ventilation and perfusion (DeMeulener 2010; Elliot et al, 2006; Martin et al 2015). The higher oxygen concentration carried in blood to tissues

showed the more adequate ventilation and the higher SpO₂ percentage with the more accurate examination (Jo Grap, 2002).

Pulse oximetry is accurate and reliable to read SpO₂ between 70%-100%, with oxygen saturation difference of examination results by using arterial blood gas is 2% above or 2% below. But the device less accurate it is used for patient by using nail polish, artificial nail, has low hemoglobin content, hypothermia, poor tissue perfusion, clammyness, irregular bradycardia and arrhythmia as well as in patient with low saturated oxygen or under 80% or with very black skin (De Meulenaere, 2010, Simon & Clark, 2003, Fahy et al 2011)

In fact, in the emergency unit nurses or health care practitioner have lack of knowledge to using pulse oximetry especially for children with acute asthma attack. Based on study done by Papovich et al (2004) in Elliot et al (2006) stated that only 26% of pediatric nurses and 60% medical resident that understand about the use of pulse oximetry. It is affirmed by Davies et al (2003) in Elliott et al (2006) and Jo Grap (2002) should that only 29% nurses in emergency unit understand using pulse oximetry and only 36% of nurses had gotten training of pulse oximetry. On the other hand, Jo Grap et al (2002) revealed that pulse oximetry has been used by 87% nurses to asses' patient status regularly.

Because of that, it is important especially pulse oximetry in children with acute asthma attack, however many nurses had lack of appropriate knowledge to using it. Further, this literature review will discuss in detail about the use of pulse oximetry and the oxygen weaning decision for children with acute asthma attack in the emergency unit.

METHODS

Method used in the literature review was collecting and analyzing related textbook and articles with the use of pulse oximetry and the decision of oxygen weaning at the children with acute asthma attack. The literature was obtained from textbook and electronic article such as ScienceDirect, World Health Organization, Google Scholar, PubMed, and ClinicalKey with criteria of textbook and article which are published from 2000 to 2015.

RESULTS

Performing pulse oximetry towards children are based on asthma attack level.

According to Global Initiative for Asthma (GINA) (2015), asthma attack level divided into three which are mild, moderate and severe. According to GINA (2015) asthma attack level diagnosed asthma attack derive from sign and symptom. Children can be diagnosed as experience mild asthma attack if they are conscious, active, without any retraction and respiration rate wide range from normal to slightly increase. While those children with moderate asthma attack, will look alike conscious, able to open eyes, heart rate less than 200x/minutes (age 0-3 years old) or less than 180x/minutes (age 4-5 years old), mild to moderate retraction, nasal flaring, breathlessness during activities, wheezing, stridor within resting. Lastly for those both sign and symptoms severe asthma attack including agitation, lethargy, difficult to open eye, confusion, heart rate more than 200x/minutes (age 0-3 years old) or more than 180x/minutes (age 4-5 years old), a heavy chest retraction, nasal flaring, respiration rate increase from moderate to severe, breathlessness during activity, central cyanosis, wheezing and stridor.

Based on Ducharme et al (2008) the classification of asthma attack level also can be seen from PRAM (Pediatric Respiratory Assessment Measure) score with criteria of valuation which is the oxygen saturation, presence or not suprasternal retraction, presence or not scalene muscle contraction, air entry and wheezing. The assessment score of each criterion are combined with the maximum score of twelve and the minimum score of zero. Based on PRAM Scale Assessment it can be concluded with three categories. Firstly, score obtained 0-3 are categorized as mild attack, 4-7 are categorized as moderate and 8-12 as severe attack.

Performing pulse oximetry in children with mild attack, it's required for four hours without oxygen administered. While, children with oxygen administered, pulse oximetry is done in each two to four hours. Children with moderate asthma attack, pulse oximetry is carried out every two to four hours continuously especially if the patient signs and symptoms are unstable. Lastly, for severe attack, pulse oxymetry is installed continuously to monitor SpO₂ and status of breathing. If it is needed, patient with severe asthma attack required should be transferred into critical care (Children's Hospital of Colorado; Global Initiative for Asthma for Asthma, 2014;

Johnston 2009, Lieberthal 2016, Sighn 2009, Woods 2013; Zentz 2011, in Martin et al 2015)

Pulse oximetry used for SpO₂ examination has been done to children in the stable condition or to reach up SpO₂ 91% or more (Zentz 2011, Global Initiative for Asthma, 2014; Lieberthal et al, 2006; SIGN 2009 in Martin et al 2015). For children who administered oxygen and have SpO₂ at 91% level, it can be decided to oxygen weaning within monitoring every one times per shift. If SpO₂ more than 91% then oxygen weaning can be performed. For those patients who are wearing nasal cannul oxygen weaning can be reduce half, while for patients with face mask can be cutter down from one to five liter. Finally, SpO₂ examination is performed every 15-60 minutes and followed by every 30 minutes in one hours ahead. If SpO₂ is repeated and resulted at 91% then oxygen remains administered and need to re-evaluated every 60 minutes. On the other hand, if SpO₂ more than 91% it is better to follow steps of oxygen weaning and if SpO₂ less than 91% it's required oxygen administered until to reach SpO₂ 91% or more. Then followed every 15-60 minutes to reexamine SpO₂. Oxygen administered can be increased and monitored regularly if SpO₂ less than 91%. And oxygen weaning decision has been made if SpO₂ more than 91%. After oxygen weaning it's require to monitoring patients conditions in every two hours (Martin et al, 2015).

DISCUSSION

Pulse oxymetry is important device at the emergency unit. The device is able to detect hypoxia or oxygenation disturbance as an indicator of oxygenation status toward certain patients. Pulse oxymetry can be used as basis of investigation to oxygenation status so then we know when much oxygen needed and when the oxygen should be given. For example, patient that doing activities will require more oxygen then doing resting (Fahy et al, 2011). On the other hand, pulse oximetry at emergency unit is very helpful for diagnose patient as well as an objective evaluation to acute asthma attack and it's complication. Also, this device also can be used to measuring intervention and to showing disease progress (Hassan et al, 2008; Lee et al, 2000).

Performing pulse oximetry promptly can increase monitoring evaluation to patients. Any changes of signs and symptoms can be

evaluated as a basis to decision and prevented complication as well. The proper use of pulse oximetry to asthma patients may advantage both consistency and accuracy of oxygen delivering (Marten et al, 2015)

Several studies revealed that group of treatment using pulse oximetry has less of oxygen consumption compared to other groups. And for those who carry out pulse oxymetry might to detect early. In addition, randomized controls trial had showed that performing pulse oximetry had significantly impacts to decrease complication among post operative patients. Therefore, pulse oximetry as a guidance has been used in operating room and emergency unit (Pedersen, 2005). While, Voepel-Lewis et al (2013) stated that pulse oximetry was able to quickly identify deterioration breathing status and so it can enhance response time to treat the patients as well.

Pulse oxymetry also can be used to prevent delay of oxygen weaning. For instances, nurses are still remained administering oxygen even it's SpO₂ has reached 99%, even though it can be initialed oxygen weaning. Therefore, it will be speeding up healing as well as reducing health expenditures. Based on study done by Martin et al (2015) revealed that using pulse oximetry and oxygen weaning decision appropriately could reduce 50% of oxygen consumption and cutted down pulse oximetry utilization by 50-60% as well as reducing length of stay patient at critical care unit. However, pulse oximetry utilization is somehow applied to measure oxygen percentage brought by hemoglobin and it does't provide specifics information about blood gas analysis, hemoglobin level, ventilation and amount of blood brings to the tissue as well (Marten et al, 2015; Jo Grap, 2002).

CONCLUSION

It Is convinced that pulse oximetry utilization will provide accurate information related to patients status; reduce overcrowding patients at emergency unit; increase patient outcomes and reduce health care cost which those can positively increase service quality in emergency unit.

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