Effect of hyperoxygenation for one and two minutes on PH, Pao₂, Paco₂, O₂sat during endotracheal suctioning in patient under mechanical ventilation in ICU in Zanjan Vali-e-Asr hospital 2011

Moraveji M, MS.c¹, Soleiman Nezhad N, MS.c², Bazargan M, MD³

1- Dept of Nursing, zanjan Branch, Islamic Azad University. Zanjan, Iran.
2- Zanjan Uni. of medical sciences, Zanjan, Iran.
3- Tehran Uni. of medical sciences, Tehran, Iran.

*Corresponding Author Email: Mahtabmoraveji@yahoo.com

Abstract

Background and objective: Endotracheal suctioning (ETS) is an inevitable procedure in patient under mechanical ventilation. The most important complication of this procedure is hypoxemia. The aim of this study is effect of hyperoxygenation for one and two minutes on hypoxemia during ETS. This study is a clinical trial on 30 patients under mechanical ventilation in ICU of Vali-e-Asr hospital in Zanjan. The samples are selected based on study criteria. Finding show that in comparison two long of time hyperoxygenation for one and two minute during ETS has not meaningful effect on O₂sat and Pao₂ but it cause meaningful effect on PH and Paco₂. This recommended for best use of time and cost and to prevent hyperoxygenation complication.

Keywords: Endotracheal Suctioning, Hyperoxygenation.

Introduction

In patients which are under positive pressure mechanical ventilation (PPM), using artificial airways like end tracheal tube (ETT) and tracheotomy inevitable. Intubation and inability to cough in order to extracting secretion, suctioning is necessary. In spite of the fact that ETS makes patients uncomfortable but it is necessary for cleaning trachea bronchial tree (Nikravan - Monfared and Shiri, 2009). ETS has some complications on body systems like:

1. Respiratory system (decreasing of lung volume, hypoxia, alveolar collapses, infection and trauma).
2. Circulatory system (bradycardia, hypotension)
3. Nerves system (increase intracranial pressure and decreasing brain blood flow)

In spite of these complications number of studies on these side effects and the ways of preventing from them is low (American Association of Respiratory care 2009). There are several methods of ETS as: open suction system, semi open suction system and close suction system. In open suction system (which is already used in Vali-e-Asr hospital) ETT is disconnected from Y-piece and insert suction catheter for extract secretion. In this method disconnecting patient from ventilator can cause decreasing airway pressure to 1 atmosphere. In semi open system without disconnecting patient from ventilator suction catheter is inserted from side hole of connector. This method prevents from decreasing of lung volume. But in third method suction catheter is placed regularly between Y-piece and ETT without disconnecting patient dose the suctioning Almgren (2005).

One of the most important complications of ETS is Hypoxia caused by disconnecting from ventilator and negative pressure for extracting secretion. For decreasing hypoxia usually hyperventilation, hyperinflation and hyper oxygenation (HO).HO is used before and after ETS. In this method patients are under 100% oxygen before and after ETS (Nikravan –Monfared and Shiri, 2009).

100% oxygen is supplied by ventilator and manual (Carsten et al, 2009).

High percentage during ETS is a hazard for patient’s safety. It is known as a fact that using 100% oxygen can cause absorption atelectasis.
Therefore unnecessary use of 100% oxygen is a hazard for patients. Controlling O₂ saturation (O₂ sat) before and after ETS is necessary and if O₂ sat decreases they must be connected to 100% oxygen. The most number of ventilators are equipped with 100% oxygen (American Association of Respiratory care 2009). By reviewing different studies on effects of hyper oxygenation on O₂ sat and other parameters of arterial blood gas (ABG), there isn’t any particular period of time for it the aim of current study is surveying effects of hyper oxygenation in different periods of time.

Methods

Current research is clinical trial. The aim of study is surveying effects of HO for one and 2 minutes on PH, PaO₂, O₂ sat and PaCo2. During ETT suctioning in patients under mechanical ventilation in ICU in Zanjan vali-e-asrt hospital.

The inclusion criteria were: to have age up 18, to be under mechanical ventilation at least for 48 hours, having mild or moderate respiratory disorders, not having hyperthermia having more than 25% HCT, to not to be suctioned for 1 hour before suctioning by researcher, to have stable hemodynamic, having ETT tube 8 or 8.5 and to have consent of patient relatives.

Exclusion criterias were: not taking sedatives, discontinuing or changing bronchodilators, changing in ventilator setting during study.

Sampling was purposive convenience sampling with 30 subjects. The sample size estimated by previous studies and Cochran formula. So researcher asked for assistance from a doctor for selecting cases and commenting ABG. ABG Samples were taken before and 30 seconds after UTS with HO. ABG commented by physician. Data was analyzed in Statistical Package for social science (SPSS 16).

Ethical considerations

This study abided by the Helsinki Declaration at all stages of its running and has been authorized by the … Hospital and … University ethics committee.

Results

For describing studies variable average number of ABG parameters (PH, PaO₂, O₂ sat and PaCo2) has been estimated ABG was taken before ETS (ABG₀), 30 seconds after hyper oxygenation over one minute (ABG₁) and after 30 seconds HO over 2 minutes (ABG₂). (Table 1)

T-test used for comparing ABG parameters. Comparing was done between ABG₀ and ABG₁, ABG₀ and ABG₂, ABG₁ and ABG₂.

O₂ sat: There wasn’t any meaningful different between ABG₀ and ABG₁, and ABG₂. But there was a meaningful different between ABG₁ and ABG₂ (P=0.103).

PaO₂: There wasn’t any meaningful different between ABG₁ and ABG₂. Also there wasn’t a meaningful different between ABG₀ and ABG₁, ABG₁ and ABG₂.

About other parameters (PH and PaCo₂) there were meaning differences in comparing. (Table 2) According to this fact that there was no different between O₂ sat and PaO₂ in 2 methods of suctioning but about other parameters (PaCo₂ and PH) the second method of HO decreases PaCo₂ and increases PH.

Discussion

This study was done with aim of surveying effects of HO for one and two minutes of ETS on ABG parameters in patients under mechanical ventilation.

Findings were presented into tables by aims. About the first aim of study (measuring ABG parameters before UTS) mean of parameters show that there wasn’t any kind of acute respiratory problem or excessive change in ABG parameters. After HO for 1 minute UTS was done, 30 seconds after UTS ABG was taken (ABG₁) and results was compared with ABG₀ and ABG₂. For reaching to the last aim of study after HO for tow minuets UTS was done and ABG was surveyed 30 seconds after UTS and results was compared with ABG₀ and ABG₁.

By observing each ABG parameters distinguished that there was no meaning full different in O₂ sat among ABG₀, ABG₁ and ABG₂ but there wasn’t any different between ABG₁ and ABG₂. Results of this study represents that using HO during UTS not only prevents from Hypoxia but improves O₂ sat in patients. According to Zoo Yung Ping’s study UTS effects on O₂ sat (Zhu eta/ 2004) and according to
Wang et al. study they advised HO for preventing from Hypoxia (Wain and Gould, 2005). Ebady’s study which was about effects of HO, hyperinflation and hyperventilation on hypoxia during UTS, HO prevents from hypoxia and absolutely it is better than other 2 methods Ebad (2009). By reviewing studies researchers believe in importance of HO for preventing from hypoxia but they haven’t published a certain time for HO. For example Fernandez has done HO in 2 minutes (Fernandez et al., 2004) and Carsten choose one minute for HO (Carsten et al., 2009). Based on current study there isn’t any different in O2sat between 2 suction methods for one and 2 minutes so it is advised to HO for 1 minute. As there wasn’t any meaningful different in PaO2 between 2 methods of UTS so both of them are so similar to each other. But about PH and PaCo2, observed that there was a meaningful different compared by ABG1 and ABG2 with ABG0. There is a meaningful different in PH and PaCo2 between 2 methods of HO in one and 2 minutes. Brummel et al study emphasizing on HO in supporting mode (MMV, SIMV, PSV, …) and believes that without HO there won’t be PaO2 decreasing after UTS under Continuous Mandatory Ventilation (CMV) mode patients (Sanja Jelic, 2009; Brummel et al., 2003). If patient ventilated in supporting modes without applying pre oxygenation there will be decreasing in PaO2.

In spite of previous studies with the aim of emphasizing on HO before and after UTS up to now certain effect of HO on ABG parameters have not diagnosed. Anyway there isn’t any official resource for studying on effects of period of HO on ABG parameters especially on PH and PaCo2 and this article is in need of more studies.

Conclusion

For saving money and time and also for preventing from side effects caused by HO, we need to know the most effective period of time for UTS Results of current study shows that the duration of HO has’t any effect on PaO2 and O2sat but it can affect PH and PaCo2.

Acknowledgement

We would like to acknowledge the contribution of research assistant for this project of Islamic Azad University of Zanjan and we thank the patient’s family and Vali-e-Asr employees who participated in this study.

Table 1. mean of ABG parameters in primary ABG and after 2 different methods of suctioning.

<table>
<thead>
<tr>
<th>Suction methods</th>
<th>O2 sat</th>
<th>PaO2</th>
<th>PaCo2</th>
<th>PH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABG0*</td>
<td>92.736</td>
<td>90.283</td>
<td>38.886</td>
<td>7.372</td>
</tr>
<tr>
<td>ABG1*</td>
<td>95.560</td>
<td>89.943</td>
<td>45.918</td>
<td>7.278</td>
</tr>
<tr>
<td>ABG2*</td>
<td>95.160</td>
<td>91.740</td>
<td>41.490</td>
<td>7.290</td>
</tr>
</tbody>
</table>

ABG0* : ABG before ETS
ABG1* : ABG after HO over one minute
ABG2* : ABG after HO over two minutes

Table 2. Comparing the mean of ABG parameters in different methods of UTS.

<table>
<thead>
<tr>
<th>Variable</th>
<th>P-value O2 sat</th>
<th>P-value PaO2</th>
<th>P-value PaCo2</th>
<th>P-value PH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABG0 and ABG1</td>
<td>0.015</td>
<td>0.920</td>
<td>0.000</td>
<td>0.006</td>
</tr>
<tr>
<td>ABG0 and ABG2</td>
<td>0.015</td>
<td>0.727</td>
<td>0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>ABG1 and ABG2</td>
<td>0.103</td>
<td>0.104</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

ABG0 : ABG before ETS
ABG1* : ABG after HO over one minute
ABG2* : ABG after HO over two minute

References