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Research Article

Wide Respiration practices along Acapella against Impetus manometry on Averting Respiratory problems ensuing CABG

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The early days ensuing CABG is a critical era as it demands a big threat of respiratory problems and prevalence. In an attempt to raise bronchial density ensuing incision, different wide breathing operation was executed as a chief part in the care of the treatment case. The reasoning for Wide Respiration Practices along Acapella and Impetus Manometry is which they avert treatment complications (TRM), which developing vascular operation. Different research to confirm the strength of Wide Respiration Practices along Acapella and Impetus Manometry on averting respiratory problems following CABG incision was completed. The requirement to research instant results of the pair methods is still be deliberated. AIM To compare the research on the instant effect of wide respiratory practices along Acapella versus Impetus manometry on averting respiratory problems ensuing CABG. 30 themes bearing CABG and who fulfilled the formation basis were preferred for the research. These patients were incidentally divided toward 2 types particularly, type A and type B which individually consist of 15 themes. Study shows that both the treatments are effective in reducing pulmonary complications. Increase in SPO_2 and PEFR is more significant in Acapella as compare to spirometry. Gradual day wise increase in both SPO_2 and PEFR is noted during the treatment. On 1st day of treatment Incentive spirometry is better than acapella. On 4th day of treatment Acapella is better than Incentive spirometry. In this study, we found that Incentive spirometry is more effective than Acapella on the 1st day of treatment in increase in SPO_2 while on the 4th day of treatment Acapella is more useful than Incentive spirometry in increase in SPO_2.

Keywords: CABG, ACAPELLA, Incentive spirometry, Breathing exercises.

1. Introduction

Coronary artery ailment (CAD) is the supreme cause of demise and disorder in evolved countries. Prior to the development of the PCI coronary artery bypass graft (CABG) system, it turned into the most effective not unusual system for vascular resorption. Fortunately, another CAD treatment, more effective PCI, is a safer and less costly vascular regeneration program than CABG. [1]

Initial reclamation of regular coronary oxygenation after myocardial encirclement barriers infarct length, keeps left ventricular feature, and curtail fatality. Globally, acute respiratory failure is still one of the 20 major diseases causing high mortality in the Intensive Care Unit (ICU). In the United States, the incidence of respiratory failure in adults is 306 cases in 100,000 population per year at the age of 75-84 years. In 2016, out of 50 countries in Asia, there were 10.4% of the total ICU hospitalized patients with acute respiratory failure [4, 5].

The prevalence of respiratory failure in Indonesia is not clearly recorded. The incidence of respiratory

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failure ranked second cause of death in the hospital that is equal to 20.98% in 2010 based on data ranked ten non-communicable diseases (PTM) in 2012.[6] The number of sufferers who installed mechanical ventilation due to respiratory failure in 2019 in Wilasa Citarum Panti Hospital as many as 198 people (19.8%), the data of death sufferers who were installed mechanical ventilation as many as 96 people.

Actions taken in reducing oxygen desaturation during the suction process are as comfortable as possible, setting the suction pressure variant, suction duration for 10-15 seconds each suction, suction no more than 3 times a day, pre oxygenation before, during and after the process suction but oxygen saturation <95% is still found [2, 7-10].

Head of Bed (HOB) is a reclining position with the head of the bed elevated to various heights of the position of the bed without using a pillow or other support, does not maneuver the neck area and lower extremities in a straight position without flexi, extension and rotation [11].

HOB 30 degrees affects venous drainage and Cerebral perfusion Pressure (CPP). Brain blood flow depends on CPP, where CPP is the difference between Mean Arterial Pressure (MAP) and Intracranial Pressure (ICP) which affects cerebral oxygen saturation in patients with neurological disorders [12, 13]. Age will cause a decrease in physiological function of the body where there is a decrease of 1 mmHg decrease in PaO2 every year age increases, respiratory muscle strength decreases, chest wall motility decreases, alveoli elasticity decreases so that affects systemic oxygenation including the brain [1, 14].

HOB 45 degrees reduces pressure on the diaphragm by the abdomen, increases alveolar expansion, maximizes the development of the lower front of the chest, resulting in an increase in pulmonary tidal volume especially in degenerative diseases. This happens because of compliance with the respiratory system thereby reducing the workings of the respiratory muscles, and reduces the anatomic and physiological loss space marked byincreased SpO2, PaO2 and PCO2 decreased in patients with mechanical ventilation [15, 16].

Not all the air that enters the airway reaches the alveoli, the place where the gas exchange takes place. The portion of tidal volume that is not involved in gas exchange will affect the volume of anatomic loss and the volume of physiological loss space. Anatomical loss space depends on body posture and disease status. The loss space will increase PcO2 in certain disease cases [1].

The results of several previous studies stated that the physiological effects of body position on the respiratory work system with Head of Bed (HOB 30 and 45 degreess) and oxygenation can increase oxygen saturation in critical patients with mechanical ventilation characterized by SpO2, PaO2 increasing and PCO2 decreasing [15, 17-19].

Findings on the effects of HOB 45 and 30 degress body position are still being applied to different clinical conditions including suction. The lack of clarity about the effects of HOB 45 and 30 degreess during the suction procedure on oxygen saturation is a problem that inhibits the provision of effective treatment for sufferers who do open suction.

2. Methodology

This research is a true experimental study, using a simple random sampling technique with a pretest-posttest randomized control group design. The total population of the study was 37 subjects then identified the research subjects based on inclusion and exclusion criteria, then excluded 5 study subjects and obtained as many as 32 patients. The division of the group was done by simple random sampling with a total of 16 study subjects. The first group with HOB 45 degrees with hyperoxygenation is called the intervention group and the second group with HOB 30 degrees with hyperoxygenation is called the control group. Each group was measured oxygen saturation 3 times. Proving the effectiveness of HOB 45 degrees with hyperoxygenation is more effective than HOB 30 degrees on oxygen saturation during the suction process in patients with mechanical ventilation.

3. Data Analysis

Univariate analysis in this study is a description of the characteristics of respondents in the form of categorical data, namely gender, age, type of disease

(non-pulmonary and pulmonary disease), hemodynamic status, HB levels, body temperature levels. Categorical data are presented in the form of proportions while numeric data in the frequency distribution table. Bivariate analysis was performed to determine differences in the effectiveness of HOB 45 and HOB 30 degrees with hyperoxygenation by parametric test with repeated measure anova test followed by pairwise comparisons test.

3.1. Confounding Analysis

Table 1. Frequency distribution based on the characteristics of the subjects in the group intervention and control group (n = 32)

Characteristics	Intervention	Control	*P.*
	F%	F%	
Age (Mean ± SD)	55.75 ± 9,277	54.94 ± 8,652	0.360
Gender			
Male	8 50	5 31.2	0.128
Girl	8 50	11 68.8	
Types of diseases	F%	F%	1,000
Pulmonary	8 50	8 50	
Non-pulmonary	8 50	8 50	
Frequency (HR)	90.38 ± 9,535	94.94 ± 5.767	0.084
Hemoglobin levels	11,713 ± 1.2027	11,394 ± 0.9066	0.142
Body temperature level	37,038 ± 0.5252	37,413 ± 0.4455	0.590

* Descriptive statistics test * Levene homogeneity Test: sig> 0.05

The table above shows the mean age of the respondent, sex, type of disease, hemodynamic: frequency Heart Rate, Hemoglobin levels and body temperature level were not significant differences in the intervention group and the control group (p> 0.05).

3.2. Oxygen Saturation

a. Data Normality Test

Saturation data normality test results on SpO2 Pre intervention up to SpO2 post 2 in both groups are listed in the table below.

Table 2. Test normality of oxygen saturation data before and after treatment in the intervention group and control group

Variable	Group	
	Intervention	Control
SpO2 Pre	0.146	0.145
SpO2 Post 1	0.610	0.168
SpO2 Post 2	0.060	0.100
Pre - post 1	0.157	0.061
Pre - post 2	0.073	0.100
Post 1 - post 2	0.061	0.166

* Shapiro-wilk, sig> 0.05

Table 2 Test the normality of data on oxygen saturation and the difference in the distribution of oxygen saturation data is performed using Shapiro-Wilk (sample <50) with the results of each measurement data normally distributed against SpO2 in the intervention group and control group with a significant value of P> 0.05. So that statistical analysis (parametric test) can be carried out, namely repeated measure ANOVA test because more than 2 times the measurement is followed by pairwise comparisons.

b. Analysis of Oxygen Saturation Differences between Intervention Groups and Control Groups (Between Groups)

Table 3. Analysis of Differences in Oxygen Saturation Between Groups intervention and control group (n = 32)

Group	Type III sum of Squares (Amount)	D*f*	Mean Square (average)	F	P
Between groups	18,375	1	18,375	6,060	0.020

* Anova Repeated Measure

Table 3 shows that the F value for the time factor of measurement between groups was significantly different from the F value of 6,060, p = 0.020 (p <0.05). Then it can be concluded that there is an overall difference in oxygen saturation after HOB 45 and 30 degrees given hyperoxygenation between the two groups.

c. Analysis of differences in oxygen saturation before and after the intervention group and control group

Table 4 shows the difference in oxygen saturation before and after treatment is statistically significantly different with the value of p = 0.000 (p <0.05), so it can be concluded that there is an overall significant difference in oxygen saturation after HOB 45 and 30 degrees with hyperoxygenation in the intervention

group and control groups on pre, post 1 and post 2 measurements.

The results of the oxygen saturation statistical test in the two groups in the pre- intervention showed a value of p> 0.05, there was no difference in saturation between the intervention and control group (homogeneous data). Analysis to find out the meaningful measurement, post-hoc paired wise comparison.

Table 4. Analysis of differences in oxygen saturation in the intervention and control group

Group	Pre Mean ± SD	Post 1 Mean ± SD	Post 2 Mean ± SD	F	P
HOB 45^0	95.44 ± 1.548	97.50 ± 1,366	98.63 ± 1,258	41,046	0,000
HOB 30^0	96.38 ± 1,088	97.81 ± 1,223	95.75 ± 1,390	38.95	0,000
Difference	0.063	-0.313	2,875		
P-value	0896	0.501	0,000		

* Anova Repeated Measure

Table 5. Analysis of Differences in Oxygen Saturation before and after Treatment

Group	Pre> <Post 1	Pre> <Post 2	Post 1> <Post 2
HOB 45^0	2,063	3,188	1,125
	(-2,964-1,161)	(-4,084-2,291)	(454-1,796)
p-value	0,000	0,000	0.003
HOB 30^0	2,438	0.375	2,063
	(-2,951-1,924)	(-1.198-448)	(-2,921-1,204)
p-value	0,000	0.347	0,000

* posc hoc pairwise comparisons

Table 5 shows that in the HOB 45 degrees results p value <0.05, this result means that differences were obtained in all measurements while in the HOB 30 degrees group p values

>0.05 in pre >< post 2 measurements, so it can be concluded that the HOB 45 degrees group is more effective in each measurement time compared to the HOB 30 degrees group with a P value = 0.000, a difference of 3,188 in the intervention group and 0.375 in the control group.

4. Discussion

Statistical test results showed that HOB 45 degrees with hyperoxygenation was more effective than HOB 30 degrees on oxygen saturation during open suction in patients with mechanical ventilation, with oxygen saturation 98.63%, P = 0.000, 95% confidence interval.

This study population with degenerative age (45-70 years) that both have a decreased respiratory system due to age factors are no exception to lung function ie decreased respiratory muscle strength, decreased chest wall motility, alveoli elasticity decreases, causing decreased tidal volume. Increasing age also causes blood oxygen levels to decrease by 1 mmHg from the value of arterial oxygen base pressure (PaO2) each year which is marked by decreased peripheral oxygen saturation [1].

The respiratory mechanism consists of inspiration and expiration through the role of lung compliance and airway resistance, most of the work of the breath is carried out by the respiratory muscles to develop the lungs [1]. Besides the factors that affect changes in oxygen saturation include: hemodynamic status, Hemoglobin levels, types of diseases (especially degenerative diseases) and body temperature levels [20].

Non-pulmonary diseases such as heart disease can affect the delivery of oxygen into the tissues so cooperation between the respiratory system and the cardiovascular system is needed. The amount of oxygen that is distributed to certain tissues is determined by the amount of oxygen entering the lungs (tidal volume), tidal volume depends on the respiratory muscles, airway resistance and adequate gas exchange, blood flow into the network, and the ability of blood to oxygen, whereas the amount of

oxygen in the blood is determined by the amount of dissolved oxygen and Hemoglobin. If there is a problem with the heart, the oxygen transfer to the network is not optimal, haemodynamic disturbance and Mean Arterial Pressure are characterized by decreased oxygen saturation [1].

Pulmonary disease can cause disturbances in lung complication which is characterized by decreased lung function because the lungs cannot stretch optimally, tidal volume decreases so that the diffusion process is disrupted and a decrease in systemic oxygenation occurs [1, 21].

Not all the air that enters the airway reaches the alveoli, the place where the gas exchange takes place. The portion of tidal volume that is not involved in gas exchange will affect the volume of anatomic loss and the volume of physiological loss space. Anatomical loss chamber volume depends on body posture and disease status [1]. Space loss increases the partial pressure of arterial carbon dioxide (PaCo2) because the blood that carries carbon dioxide back from the tissue because it cannot reach the alveoli.

At the time of inspiration, the respiratory center sends impulses along the phrenic nerve so that the diaphragm contracts. When the abdominal organs move downward and forwards, so that the length of the chest increases to enter air into the lungs. The diaphragm moves about 1 cm, and the ribs are pulled up from the midline of the body around 1.2-2.5 cm with inhalation of 500 cc of air [22].

HOB 45 degrees by using gravity will pull the diaphragm down so as to allow chest expansion or help develop the lower front of the chest, reduce abdominal pressure, and respiratory system compliance resulting in an increase in SpO2, this will also reduce anatomical and physiological loss chambers [15, 16] so it can be concluded that the higher the HOB, the more the development of the lower front of the chest and the increasing volume of lung residue in degenerative age sufferers with non-pulmonary and pulmonary diseases [1, 22].

Oxygen saturation immediately after the last 10 seconds of suction was 98.63%, this proves that after suction free airway is effective, the process of inspiration is adequate, this will imply that blood perfusion to important organs is still adequate such as brain, heart, lungs that are marked saturation Peripheral oxygen is within normal limits or hypoxia does not occur during the suction process so the implications of HOB 45 degrees with types of non-pulmonary disease and pulmonary disease by controlling the frequency of hemodynamics : regular heart rate between 60- 100 times / minute, Hemoglobin ≥10gr% level and body temperature level between ≥360C - <380C effective against oxygen saturation during open suction in patients with mechanical ventilation attached.

In a previous study conducted by Jacquiline et all (2017), adjusting the position equation with HOB 40 degrees for 20 seconds, 150 mmHg suction pressure as much as 5 times insertion in one episode of mucus evacuation, the results obtained by applying 100% FiO2 immediately post suction 98.0%, p = 0.001, 95% CI [19]. The difference in difference between the results of oxygen saturation in the current study and that of Jacquiline et all by 0.63%. This proves that HOB higher than 30 degrees with hyperoxygenation is more effective against oxygen saturation during the suction process.

The results of this study are reinforced by Deye et al (2013) that the physiological effects of body position on the respiratory work system in patients with weaning difficulties with the results of the semi-Fowler 45 degrees position are effective in maintaining normal saturation in reducing inspirational effort and are found to be at least as comfortable as other positions for difficult patients weaned with oxygen saturation after HOB 45 degrees of 97% [17]. The difference in difference between the results of oxygen saturation in the current study with the study by Deye et all was 1.63%. The results of this study were also supported by Shah DS et al (2012) Comparison of the Effects of Semi Fowler's VS Side Lying Position on Tidal Volume & Pulse Oximetry in ICU. Patients who stated that semi-fowler 45 degrees found better in increasing oxygenation in mechanical ventilation in ARDS patients, this position can increase tidal volume up to 440 ml and oxygen saturation by 97.75% in patients with mechanical ventilation [23]. This result is clinically significant but not statistically significant (p> 0.05).

Suction without preoxygenation 100% can cause a decrease in functional residual capacity quickly during

the suction process, causing hypoxia, but hyperoxygenation too long can cause high toxicity, namely acute lung injury and acute respiratory failure syndrome, dry mucous membranes, epistaxis or infection in the nostrils [1, 21].

Adequate preoxygenation, which is a patient who needs 100% oxygen for the process of respiration, aims to reduce respiratory work and myocardium, increase vital capacity and avoid hypoxemia [20]. The results of this study are in line with Hossein T et all (2015) which states that Pre oxygenation is 100% for 2 minutes, causing less interference with arterial oxygen saturation during the suction process with an average oxygen saturation value immediately after suction 95.61%, p <0.05 [24].

The results of the current study are different from those reported by Prato et al (2015) who examined the effect of various bed head heights on respiratory mechanics in 35 mechanically ventilated patients and found that after 5 minutes of semifowler 30 degrees there was an increase in oxygen saturation to normal limits in HOB 30 degrees and HOB 45 degrees with a significance value of p <0.05, but more effective at position 300 with an average oxygen saturation value of 96- 98% [18].

The same finding reported by Asmaa et all (2017) that Head of Bed (HOB 30 and 45 degreess) can increase oxygen saturation in critical patients for 30 minutes at 48 hours after head trauma with the results of both Head Of Bed equally increasing oxygen saturation values to normal levels but is more effective on HOB 30 degrees [13], but the application of both Head Of Bed has not yet been carried out on suction measures.

High suction pressure can cause respiratory failure due to oxygen desaturation, loss of lung volume during the suction process. During suction intervention, not only secretions are sucked but incoming oxygen is also sucked up as a result of high negative suction pressure, the Endotracheal Tube circuit is released from the ventilator marked by oxygen desaturation to below 95%.

On the other hand, high suction pressure can maximize the evacuation of mucus. the greater the suction pressure, the greater the amount of air inhaled from the lungs, this will have an impact on reducing the amount of oxygen that will diffuse from the alveoli to the pulmonary capillaries and bind to Hemoglobin which will then be seen in a decrease in oxygen saturation [2, 25, 26].

Suction pressure in this study was 140 mmHg for 10 seconds each suction as much as 3 times of suction in one episode of mucus evacuation that had been used previously by Muhaji (2017) with the result an increase in oxygen saturation after open suction 98.07%, P = 0.004 [27], while in this study an increase in oxygen saturation of 98.63%, p = 0.000. The magnitude of the difference in current research with research conducted by Muhaji by 0.56%.

HOB 45 degrees with hyperoxygenation can increase the ability of the lung to inflate or expand the lower front lung in response to increasing intraalveolar pressure, effective ventilation with maximum inhalation through hyperoxygenation 100% thereby reducing oxygen consumption during the inspiration process and can reduce oxygen desaturation during the suction process open with a pressure of 140 mmHg characterized by oxygen saturation reaching 98.63% immediately after the 10 seconds of the last suction.

5. Conclusion

HOB 45 degrees with hyperoxygenation is more effective than HOB 30 degrees in 30 minutes with 100% hyperoxigence for 2 minutes of oxygen saturation in patients who are mechanically ventilated in the ICU.

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