

Autogenic Drainage versus Counter Rotation Effect on Blood Gases in Post Thoraco Abdominal Surgery

MAI G. MOUSTAFA, M.Sc.*; NESREEN G. EL-NAHAS, Ph.D.*; MONA M. TAHA, Ph.D.* and MOHAMED M. ABD EL-HAQ, M.D.**

The Department of Physical Therapy for Cardiovascular, Respiratory Disorders & Geriatrics, Faculty of Physical Therapy and the Department of Anesthesia, Faculty of Medicine**, Cairo University*

Abstract

Background: This study was conducted to find out the effect of autogenic drainage and counter rotation on blood gases in thoraco abdominal surgery.

Aim of the Study: To compare the effect of autogenic drainage and counter rotation on blood gases in thoraco abdominal surgery.

Patients and Methods: This study comprised 40 adult patients aged from 40-50 of both sexes who chose from Kasr Aini Hospital.

Methods: They were divided into two groups equal in number.

- Group A:** 20 patients that received first traditional physiotherapy (breathing exercise, percussion, vibration with postural drainage) then autogenic drainage.
- Group B:** 20 patients that received first traditional physiotherapy (breathing exercise, percussion, vibration with postural drainage) then counter rotation. The treatment done 3 times per day for 2 weeks.

Results: The results showed that there was no significant difference between both groups in PH, PAO₂, PACO₂, HCO₃. But there was significant difference in oxygen saturation between both groups at the end of 14 days. There was a significant increase in SaO₂ of group A compared with that of group B at 14th day ($p=0.001$).

Conclusion: Autogenic drainage had a positive effect on oxygen saturation than counter rotation technique, the results of this study support the importance of adding autogenic drainage to traditional physiotherapy to improve oxygen saturation.

Key Words: AD – Counter rotation – Thoraco abdominal surgery – ABG.

Introduction

THORACO-abdominal surgery is an operative that includes an incision into the thorax and abdomen, and a surgeon excises or repairs damaged, redundant or malignant tissue. It was observed that there was a fall in both pH and Po₂ with CO₂ retention during the post-operative period, decline in lung function was more significant in patients with gastrostomy compared to cholecystectomy [1].

Autogenic drainage is a self-drainage respiratory technique that utilizes controlled expiratory air flow (tidal volume) to mobilize secretions [2].

Autogenic drainage consisted of breathing at three different lung volumes and holding air for 3 seconds at peak of each inspiration. Such breathing allows to move the sputum by inhaled air from small to medium bronchus, and from medium to large bronchus and finally outside [3].

Counter rotation technique is the most effective technique for more patients with neurological conditions. The therapist starts by following the patient's breathing cycle with his hands on the patient's shoulder and pelvis. The therapist then assists the patient in inhalation and exhalation to promote ventilation [4].

Counter rotation is the most effective mobilizing technique for a tight chest which itself can facilitate deeper breath, tidal volumes can also increase for many patients by mobilizing the chest wall [4].

Arterial blood gases are measured to know the amount of oxygen dissolved in the blood (PAO₂), the percentage of hemoglobin saturated with oxygen (SAO₂), the amount of carbon dioxide that dissolved in blood (PACO₂) and the amount of acid

Correspondence to: Dr. Mai G. Moustafa, The Department of Physical Therapy for Cardiovascular, Respiratory Disorders & Geriatrics, Faculty of Physical Therapy, Cairo University

in blood pH. The oxygen measure used to determine whether a patient needs oxygen therapy. The carbon dioxide measures give an idea of lung function and is especially important to know when starting oxygen therapy [5].

Patients and Methods

This study carried during the period between October 2017 and April 2018, this randomized study was carried on forty adult patients from both sexes that participated in this study their age from 40 to 50 years. They chosed from Kasr Aini Hospital. They are medically stable.

Inclusion criteria:

- 1- Non smoker patients.
- 2- Medically stable patients.
- 3- Patients post thoraco abdominal operative.

Exclusion criteria:

- 1- Patients developing cancer.
- 2- Patients with rib fractures.
- 3- Inability to comprehend and follow instructions as in dementia.
- 4- Patients have low back pain or spondylolisthesis.

Procedures:

This study comprised 40 adult patients of both sexes who chosed from Kasr Aini Hospital. They assigned into two equal groups in number:

- Group A: Autogenic drainage technique.
- Group B: Counter rotation technique.

1- *Group A*: 20 patients that received first traditional physiotherapy (breathing exercise, percussion, vibration with postural drainage) then autogenic drainage.

2- *Group B*: 20 patients that received first traditional physiotherapy (breathing exercise, percussion, vibration with postural drainage) then counter rotation.

Evaluation proceders:

- Arterial blood gases (PAO₂, PACO₂, PH, HCO₃) for both groups.
- Hospitalization period assessed.

These tests assessed at the beginning of the study and after 2 week of training.

Treatment proceders:

Group A: 20 patients that received first traditional physiotherapy (breathing exercise, percus-

sion. Vibration with postural drainage) then autogenic drainage. The treatment started after 24 hours post-operative.

First stared *t* with postural drainage, postion was maintained at least 5-10 minutes then Percussion done for 15 minutes then vibration therapy was done for one minute after percussion therapy then patients sit in semi sitting postions and do breathing exercise in form of diaphragmatic breathing for 3 times and at the end of session do autogenic drainage.

Autogenic drainage used air that patients breathe out to move mucus from the smaller airways to central airways. Once the mucus be in the central airways, it can be cleared out. There are three levels, to the technique. Each level should last about 2-3 minutes. The full cycle taked 6-9 minutes, while a full session take 20-45 minutes. When mucus is felt in the central airways in level III, patient did two to three effective huff coughs. Coughing should be avoided if possible in level I and II [6].

Group B: 20 patients that received first traditional physiotherapy (breathing exercise, percussion. Vibration with postural drainage) then counter rotation technique. The treatment started after 24 hours post-operative.

Counter rotation technique consist of 2 phases:

The active phase of the technique using a PNF technique called rhythmic initiation the patient wasgentally log rolled in a small ROM in the side lying position the rolling is gradually increased to acheive more ROM from side lying toward prone this progression of movement usually make the second phase of technique more effective.

The second phase required the therapist to slowly change position to diagonal posture then standed or half kneeled behind the patient near his hips turning to a diagonal position until facing the patient head. Here the hand placement begin to be more specific. Assume again that patient is side lying on the left at the beginning of the expiratory cycle. The therapist left hand slowly glides over the patient's shoulder on right pectoral region, the right hand slowly glides back to the patient's right gluteal fossa. The therapist manually compress the rib cage on all three planes of ventilation at the end of exhalation by pulling the shoulder back and down while pushing the hip up and forward. This movement promoted more complete exhalation. When the patient begins the next inspiration the therapist switched hand placement to improved

TV. The therapist's left hand slides back to the patient's right scapula and the right hand slides forward just anterior to the patient's right iliac crest, as the patient inhales the therapist slowly stretches the chest to maximize inspiration TV. The therapist's left hand push the scapula up and away from the spine, and the right hand pulls the pelvic back and down to maximize all three planes of ventilation resulting in greater inspiration. The technique can be applied every two to three breaths to avoid fatigue [4].

The technique done for 10 minutes.

Statistical analysis:

- Descriptive statistics and *t*-test was conducted for comparison of the mean age of both groups.
- Chi squared test was conducted for comparison of sex distribution between both groups.
- *t*-test was conducted for comparison of PaO₂, PaCO₂, HCO₃, SaO₂ and pH-between both groups.
- ANOVA with repeated measures was conducted for comparison between 1st, 7th and 14th days mean values of PaO₂, PaCO₂, HCO₃, SaO₂ and pH in each group.
- The level of significance for all statistical tests was set at *p*<0.05.
- All statistical measures were performed through the Statistical Package for Social Studies (SPSS) Version 19 for windows.

Results

40 adult patients aged from 40-50 of both sexes who chosed from from Kasr Aini Hospital, they were divided into 2 equal groups, group A 20 patients that received first traditional physiotherapy then autogenic drainage, group B 20 patients that received first traditional physiotherapy then counter rotation. The results showed that there was no significance difference between both groups in ph, PaO₂, PaCO₂, HCO₃. But there was significant difference in oxygen saturation between both group at the end of 14 days. There was a significant increase in SaO₂ of group A compared with that of group B at 14th day (*p*=0.001) as showed in (Table 6).

Table (1): Descriptive statistics and *t*-test for comparing the mean age of group A and B.

	Group A X ± SD (SE)	Group B X ± SD (SE)	MD	<i>t</i> - value	<i>p</i> - value	Sign.
Age (years)	45.15±3.37 (0.75)	44.75±3.75 (0.83)	0.4	0.35	0.72	NS

Table (2): The frequency distribution and chi squared test for comparison of sex distribution of both groups (A and B).

	Group A	Group B	χ ²	<i>p</i> -value	Sig
Females	12 (55%)	10 (50%)	0.4	0.52	NS
Males	8 (45%)	10 (50%)			

χ² : Chi squared value.
p-value : Probability value.
 NS : Non Significant.

Table (3): Comparison between variables in group A and in group B in first day.

	Group A	Group B	<i>p</i> -value
Pao ₂	144.3±20.82 (4.65)	150.27±19.4 (4.34)	0.35
Paco ₂	37.64±5.44 (1.21)	38.89±5.77 (1.29)	0.48
pH	7.35±0.06 (0.01)	7.33±0.05 (0.01)	0.3
Hco ₃	19.25±3.52 (0.78)	20.28±2.38 (0.53)	0.28
O ₂ saturation	96.9±4.27 (0.95)	97.8±2.01 (0.45)	0.4

- The result showed that there were no significant different between both groups in first day.

Table (4): Comparison between variables in group A during 1st, 7th, 14th days of treatment.

	1st	7th	14th	<i>p</i> -value
• PaO ₂	144.3±20.82 (4.65)	128.38±30.72	126.18±29.04	0.009
• PaCO ₂	37.64±5.44 (1.21)	38.42±5.16 (1.15)	38.87±4.82 (1.07)	0.37
• HCO ₃	19.25±3.52 (0.78)	21.55±4.62 (1.03)	21.04±3.44 (0.76)	0.001
• O ₂ saturation	96.9±4.27 (0.95)	97.3±4.37 (0.97)	98.8±0.61 (0.13)	0.09
• pH	7.35±0.06 (0.01)	7.38±0.04 (0.01)	7.38±0.03 (0.007)	0.06

- The result showed that there were significant different in PaO₂, HCO₃, Ph between 1st, 7th, 14th day in group A, but there were no significant different in PaO₂ and O₂ saturation.

Table (5): Comparison between variables in group B during 1st, 7th, 14th days of treatment.

	1st	7th	14th	<i>p</i> -value
• PaO ₂	150.27±19.4 (4.34)	131.96±25.39 (5.67)	124.33±27.56 (6.16)	0.006
• PaCO ₂	38.89±5.77 (1.29)	36.32±5.79 (1.29)	36.54±5.52 (1.23)	0.08
• HCO ₃	20.28±2.38 (0.53)	21.49±2.67 (0.59)	21.61±1.98 (0.44)	0.02
• O ₂ saturation	97.8±2.01 (0.45)	96.95±1.5 (0.33)	97.15±1.84 (0.41)	0.009
• pH	7.33±0.05 (0.01)	7.37±0.05 (0.01)	7.36±0.06 (0.01)	0.02

- The result showed that there were significant different in PaO₂, HCO₃, O₂ saturation, Ph but there were no significant different in PaCO₂.

Table (6): Comparison between autogenic drainage and counter rotation $\bar{X} \pm SD$ (SE) at the end of 14th day post-treatment.

	Autogenic drainage	Counter rotation	p-value
Ph	7.38±0.03 (0.007)	7.36±0.06 (0.01)	0.3
PaO ₂	126.18±29.04 (6.49)	124.33±27.56 (6.16)	0.83
PaCO ₂	38.87±4.82 (1.07)	36.54±5.52 (1.23)	0.16
HCO ₃	21.04±3.44 (0.76)	21.61±1.98 (0.44)	0.52
O ₂ saturation	98.8±0.61 (0.13)	97.15±1.84 (0.41)	0.001

Discussion

Post-operative arterial desaturation and mechanical impairment of respiratory function are probably the most frequent for thoracic and upper abdominal surgery versus lower abdominal surgery and peripheral surgery [1,9,10]. However, there is still controversy concerning the relationship between the operative sites and occurrence of early post-operative hypoxemia.

Oxygen saturation did not fall during AD and increased to 94.5±0.7% by 1h following treatment (baseline, 93.3±0.8%; $p < 0.01$). We conclude that AD is less likely to produce oxygen desaturation and may be better tolerated by patients with CF, while producing similar benefits in sputum clearance [7].

Counter rotation technique has been developed specifically to promote a lower respiratory rate and improvement of chest wall mobility. This technique help to reduce high neuromuscular tone and increase thoracic mobility, thus often resulting in an increase tidal volume and simultaneous reduction in respiratory rate [4].

The present study was designed to study the effect of Autogenic Drainage (AD) and traditional physiotherapy (percussion, vibration and postural drainage) on arterial blood gases in post thoraco abdominal surgery with 2 weeks sessions. The patients were divided in two groups, each group consisted of twenty patients; the first group (group A) received autogenic drainage exercise and traditional chest physiotherapy (percussion, vibration and postural drainage), the second group (group B) received counter rotation technique and traditional chest physiotherapy for two weeks. The results of the study showed no significant difference between both groups in Po₂, HCO₃, PCO₂, Ph. But there was significant difference in oxygen saturation between both group at the end of 14 days. The mean \pm SD SaO₂ of group A at 14th day was 98.8±0.61% and that of group B was 97.15 ± 1.84%. The mean difference between both groups was 1.65%. There was a significant increase in

SaO₂ of group A compared with that of group B at 14th day ($p=0.001$).

This study demonstrated that three of trials were 2-day randomized crossover design, one was 5 day, one was 10 week, one was 6-months and was a 4 weeks parallel randomised controlled trial.

This study applied AD alone and AD followed by positive expiratory pressure and cough, the result found that in AD group there is statistically significant improvement in partial pressure of arterial CO₂, 6-minute walk test, and increase O₂ saturation level during and after AD [2].

The result of current study came in support with the result stated that autogenic drainage improve oxygen saturation as in group (A), and partial pressure of PCO₂ as showed at (Table 6).

This study demonstrated that thirty clinically stable male COPD patients were randomly assigned to AD or the ACBT treatment for a 20-day treatment, the result showed that autogenic drainage improved arterial oxygenation [8]. The result of current study came in support with the result stated that autogenic drainage improve oxygen saturation as in group (A).

This study demonstrated that 30 patients, 15 in each group, were taken in study Group A: Chest rotation and breathing exercise Group B: Breathing exercise only, it can be concluded from the present study that chest wall rotation has significant effect on Oxygen saturation [9].

The result of current study came in support with the result stated that counter rotation improve oxygen saturation as in group (B) as showed at (Table 4) so, the improvement of oxygen saturation in autogenic drainage is due to when performing autogenic drainage technique, the patient inspires deeper than the normal breath, described as the functional tidal volume (1.5-2 times from the size of the normal tidal volume), and exhales in a gentle but active way. The aim of breathing in this way is to achieve the highest possible expiratory air flow simultaneously in different generations of the bronchi, keeping bronchial resistance low, and avoiding bronchospasm and dynamic airway collapse. Under these circumstances, the speed of the airflow may mobilise the secretions by shearing them from the bronchial walls and transporting them from the peripheral airways to the mouth, the specific style of breathing described is performed at different lung volumes, usually starting within the expiratory reserve volume and progressing into inspiratory reserve volume [6].

Conclusion:

Autogenic drainage had a positive effect on oxygen saturation than counter rotation technique. The results of this study support the importance of adding autogenic drainage to traditional physiotherapy to improve oxygen saturation.

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مقارنة بين التصريف الذاتي والتناوب العداد وتأثيرهما على غازات الدم بعد جراحات الصدر والبطن

الغرض: تهدف هذه الرسالة لدراسة المقارنة بين التصريف الذاتي والتناوب العداد وتأثيرهما على غازات الدم بعد جراحات الصدر والبطن.

الأشخاص والأساليب المستخدمة: أربعون مريض من الذكور والإناث يتراوح أعمارهم بين ٤٠ إلى ٥٠ سنة تم إشراكهم في الدراسة وقد تم إختيارهم من وحدة الرعاية المركزة بمستشفيات جامعة القاهرة وقد تم تقسيمهم إلى مجموعتين مجموعة الدراسة (أ) تحتوي على ٢٠ مريض وتلقوا علاج طبيعي للصدر يحتوي على (نقر وإهتزاز على الصدر وتمارين تنفس وتفعيل الوضع) ثم تلقوا العلاج بالتصريف الذاتي والمجموعة (ب) إحتوت على ٢٠ مريض وتلقوا علاج طبيعي للصدر ثم تلقوا التناوب العداد وفي كل مجموعة تلقى كل مريض العلاج ثلاث مرات ف اليوم لمدة إسبوعين.

النتائج: أظهرت النتائج تحسن في تشبع الدم بالأكسجين ف مجموعة الدراسة (أ) عن مجموعة الدراسة (ب) وأظهرت أيضا عدم وجود فروق كبيرة ف معامل الهيدروجين. ضغط الأكسجين الجزئي. ضغط ثاني أكسيد الكربون الجزئي والبيكربونات.

الإستنتاج: نتائج هذه الدراسة تدعم أهمية إضافة العلاج بالتصريف الذاتي إلى العلاج الطبيعي للصدر لتحسين كمية الدم المشبعة بالأكسجين.