

Effects of Respiratory and Motor Rehabilitative Exercises for Patients of Open Heart Surgeries

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Abstract:

The current research aims to design some respiratory and rehabilitative exercises for hospitalized post-operative recovery of open-heart surgery male patients in addition to identifying its effects on cardio-vascular functioning (pulse – blood pressure – vital capacity – 1-min breathing rate – blood oxygen levels). The researcher applied the experimental approach (two-group design) with pre- and post-measurements. Research community included all open-heart surgery male patients (40-50 years) from Magdi Yacoub' Institute for heart diseases and research. Sample (n=16) was purposefully chosen after approval of the responsible physician and written consents of patients. Participants were divided into two groups (experimental = control = 8). The respiratory exercises were applied (3) time a day. Total number of sessions was (12) with session duration of (15-35) minutes. The researcher concluded that:

1. The recommended program had positive effects on the cardio-vascular function.
2. Suitable rehab exercises during recovery help the patient recover quickly and effectively
3. Suitable rehab exercises decrease the period of hospitalization and confirm good condition of the patient before leaving

Key Words: Respiratory Rehabilitative Exercises - Motor Rehabilitative Exercises - Open Heart Surgeries

Introduction & Research Problem:

World Health Organization (W.H.O.) indicated that in 2004, nearly 17.1 million patients died with cardiovascular diseases all over the world and nearly 7.2 million patients died due to coronary diseases while another 5.7 million patients

died with strokes. According to W.H.O.'s reports, the number of fatalities due to cardiovascular diseases may reach 23.6 million patients by 2030 as these diseases may be more common than infectious diseases. These diseases may

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be the major cause of disability in the world by 2020 (12)

Effects of movement and exercises on cardiovascular diseases are clear and numerous. It improves the contraction of the cardiac muscle, enhances blood flow in coronary arteries, decreases LDL levels and increases HDL levels (13).

The American Heart Association (2011) indicated that regular exercises during post-surgery recovery are vital for quick recovery. Physical activities, especially aerobic activities, are longer in duration and lower in intensity. It helps the heart to pump blood with minimal effort and decreases blood pressure in addition to decreasing cholesterol and body weight, controlling sugar levels in blood and providing comfort (6: 55)

Al-Kashef (2004) indicated that exercises affect all internal body organs and rehabilitate post-operative heart patients to return to normal life. Therefore, these exercises help those patients to adapt to their daily life requirements. Physical rehabilitative exercises are the most suitable form for cardiac

work as the human heart needs continuous work through exercises. This work should significantly increase the amount of blood pumped from the heart to the aorta at each contraction (14: 99, 107)

Through review of literature, the researcher found out that studies dealing the post-operative rehabilitative exercises for open-heart surgery patients are lacking as this type of patients – especially during post-operative recovery – suffer from significant decreases in flexibility at the trunk and limbs in addition to neck, shoulder and upper back pain, exhaustion and difficulties in breathing. Through this research, the researcher hoped to design some respiratory and rehabilitative exercises for hospitalized post-operative recovery of open-heart surgery patients.

Aim:

The current research aims to design some respiratory and rehabilitative exercises for hospitalized post-operative recovery of open-heart surgery male patients in addition to identifying its effects on cardio-vascular functioning (pulse – blood

pressure – vital capacity – 1-min breathing rate – blood oxygen levels).

Hypotheses:

1. There are statistically significant differences between the pre- and post-measurements of the control group on cardio-vascular functioning in favor of the post-measurements.

2. There are statistically significant differences between the pre- and post-measurements of the experimental group on cardio-vascular functioning in favor of the post-measurements.

3. There are statistically significant differences between the post-measurements of the control and experimental

groups on cardio-vascular functioning in favor of the experimental group.

Materials and Methods:

Approach:

The researcher applied the experimental approach (two-group design) with pre- and post-measurements.

Participants:

Research community included all open-heart surgery male patients (40-50 years) from Magdi Yacoub' Institute for heart diseases and research. Sample (n=16) was purposefully chosen after approval of the responsible physician and written consents of patients. Participants were divided into two groups (experimental = control = 8).

Table (1)
Stratification of Data for All participants on Age, Weight and Height (n=16)

Variable	Measurement	Control		Experimental		Means difference	(t)
		Mean	SD	Mean	SD		
Age	Year	47.19	6.27	46.12	5.98	1.07	0.58
Weight	Kg	79.12	5.91	78.77	5.81	0.35	0.55
Height	Cm	174.00	6.54	173.55	6.62	0.45	0.46

(t) Table value on $P \leq 0.05 = 2.10$

Table (1) indicated that there were no statistically significant differences between the experimental and control groups on all measured variables. This indicates the stratification of data.

Tools and Equipment:

- A monitor
- Asirometer for measuring breathing and vital capacity
- The recommended exercises program

- Patients' data logs (designed by the researcher)

Pre-measurements:

Pre-measurement on all research variables were taken for both groups from 15-11-2015 to 24-12-2015 for each patient.

The Recommended Exercises:

Rehabilitation exercises were applied to the experimental group from 15-11-2015 to 3-1-2016 by a rehab specialist and the researcher. Exercises started the second day after surgery at the ICU and lasted for (3) days for each patient. Exercises of this stage included simple breathing exercises. The program continued after the patient was moved to intermediary care unit as breathing and motor exercises were performed for (7) days. The recommended exercises (n=21) were applied according to individual differences among patients. Exercises were distributed over three stages as follows:

- **First stage (intensive care):** This stage started at the second day after surgery at the ICU where breathing exercises were applied and positively helped patients to get rid of secretions and to stimulate the nervous system and chest muscles. This stage lasted for (3) days (9 sessions) with three sessions per day as each session lasted for 10-15 minutes.

- **Second stage (intermediary care):**

Breathing and motor exercises were applied as the patient performed the exercises for the maximum range with the help of physical rehab specialist. This stage aimed to improve vital capacity and general motion of the patient. The stage lasted for (4) days and included (8) sessions (2 sessions per day). Each session lasted for 15-25 minutes.

- **Third stage (intermediary care):**

The patient performs exercises under supervision but without help. Exercises were graded from easy to difficult and should be stopped in case of pain even if the patient did not reach exhaustion. This stage aimed to restore patient's ability to perform daily life activities. It included (6) sessions and each session took 25-30 minutes (2 sessions per day).

Post-measurements:

Post-measurement on all research variables were taken for both groups from 25-11-2015 to 3-1-2016 for each patient following the same protocol of pre-measurements.

Statistical treatment:

The researcher used SPSS software to calculate: mean – SD – median – skewness – percentage - Z value - variance rate.

Results:

Table (2)
Mean, SD and Z value between the pre- and post-measurement of
all research variables for the control group (n=8)

Variable	Pre-		Post-		Variance (%)	Z	
	Mean	SD	Mean	SD			
Breathing rate (min)	28.06	2.65	24.00	1.52	14.74%	3.05	
Blood oxygen (%)	86.12	3.22	91.28	4.45	6.56%	2.14	
Pulse (PBM)	85.33	3.74	79.16	3.95	8.03%	2.08	
Blood pressure	Systolic	140.47	4.75	131.21	5.81	6.59%	1.62*
	Diastolic	91.18	4.08	88.36	4.55	3.09%	2.24
Vital capacity	500.00	5.23	600.00	3.24	20.00%	7.05	

Z table value on $P \leq 0.05 = 1.90$

Table (2) indicated statistically significant differences between pre- and post-measurements of the control group in favor of post-measurements on all research variable except for systolic blood pressure.

Table (3)
Mean, SD and Z value between the pre- and post-measurement of
all research variables for the experimental group (n=8)

Variable	Pre-		Post-		Variance (%)	Z	
	Mean	SD	Mean	SD			
Breathing rate (min)	28.15	2.71	19.35	1.08	31.26%	4.54	
Blood oxygen (%)	85.66	3.33	97.64	4.16	13.99%	3.81	
Pulse (PBM)	86.07	3.98	71.07	3.98	17.43%	3.89	
Blood pressure	Systolic	140.86	5.02	123.40	4.71	12.40%	3.75
	Diastolic	91.24	4.78	81.14	4.01	11.07%	3.66
Vital capacity	500.00	5.23	900.20	3.64	80.04%	4.36	

Z table value on $P \leq 0.05 = 1.90$

Table (3) indicated statistically significant differences between pre- and post-measurements of the experimental group in favor of post-measurements on all research variables.

Table (4)
Mean, SD and Z value between the post-measurement of all
research variables for the control and experimental groups (n=16)

Variable	Control		Experimental		Variance (%)	Z	
	Mean	SD	Mean	SD			
Breathing rate (min)	24.00	1.52	19.35	1.08	19.38%	4.31	
Blood oxygen (%)	91.28	4.45	97.64	4.16	6.97%	2.89	
Pulse (PBM)	79.16	3.95	71.07	3.98	10.22%	2.45	
Blood pressure	Systolic	131.21	5.81	123.40	4,71	5.95%	2.13
	Diastolic	88.36	4.55	81.14	4.01	8.17%	2.64
Vital capacity	600.00	3.24	900.20	3.64	50.03%	5.13	

Z table value on $P \leq 0.05 = 1.90$

Table (4) indicated statistically significant differences between post-measurements of the control and experimental group in favor of the experimental group on all research variables.

Discussion:

Table (2) indicated statistically significant differences between pre- and post-measurements of the control group in favor of post-measurements on breathing rate as variance rate reached 14.74%. This is in agreement with Said Al-Sayed (2007) and Andrea (2009) who agreed that this improvement is due to the success of the surgical operation and the medication program (4) (8).

Table (2) also indicated statistically significant differences between pre- and post-measurements of the control group in favor of post-

measurements on blood oxygen rate as variance rate reached 8.03%. This is in agreement with Iman Yaseen (2001) and Amal Hussain (2003) who indicated that this slight variance is due to the success of surgery, medical treatment and nutrition program (19) (5).

In addition, table (2) indicated no statistically significant differences between pre- and post-measurements of the control group in favor of post-measurements on systolic blood pressure as variance rate reached 6.59%. The same table indicated statistically significant differences between pre- and post-measurements of the control group in favor of post-measurements on diastolic blood pressure as variance rate reached 3.09%. This is in agreement with Braith R. W.

(2008). and Mahmoud Ramadan (2011) (7) (8) (1)

Furthermore, table (2) indicated statistically significant differences between pre- and post-measurements of the control group in favor of post-measurements on vital capacity as variance rate reached 20%. This is in agreement with Amal Hussain (2003) who indicated that this slight variance is due to the success of surgery (5).

These results indicated improvements on all research variables for the control group due to the success of surgery, medication and nutrition program.

Table (3) indicated statistically significant differences between pre- and post-measurements of the experimental group in favor of post-measurements on breathing rate as variance rate reached 31.26%. This is in agreement with Deljanin-Ilie.M (2007) and Hesham Hendawy (2008) who indicated that this improvement is due to the rehabilitative breathing exercises (10) (11).

In addition, table (3) indicated statistically significant differences between pre- and post-measurements of

the experimental group in favor of post-measurements on pulse rate as variance rate reached 17.43%. In addition, there are similar improvements on blood oxygen rate with variance of 13.99%. This is in agreement with Piotrowicz R, et al (2007) and Delay G, et al, (2007) who indicated that these improvements are due to rehabilitation exercises program.

Furthermore, table (3) indicated statistically significant differences between pre- and post-measurements of the experimental group in favor of post-measurements on systolic and diastolic blood pressure as variance rates reached 17.4312.40% and 11.07%. This is in agreement with Amal Hussain (2003) and Alexandros P.Patrianakos (2009) who indicated that these improvements are due to rehabilitation exercises program (5) (17).

Concerning vital capacity, table (3) indicated statistically significant differences between pre- and post-measurements of the experimental group in favor of post-measurements as variance rates reached 80.04%. This is in agreement with Deljanin-

Ilie.M (2007) and Delay G, et al, (2007) who indicated that these improvements are due to rehabilitation exercises program (10) (9).

These results indicated statistically significant differences between pre- and post-measurements of the experimental group in favor of post-measurements on all research variables. The researcher thinks that these improvements are due to applying the recommended program during intensive and intermediary stages according to principles of application and with special consideration of individual differences. This of course proves the positive effects of the recommended program.

Table (4) indicated statistically significant differences between post-measurements of the control and experimental group in favor of the experimental group on breathing rate as variance rate reached 19.38%. This is in agreement with Kemps HM,et al (2008) and Ahmed Helmy (2010) (15) (18).

Also, table (4) indicated statistically significant differences between post-

measurements of the control and experimental group in favor of the experimental group on pulse rate as variance rate reached 10.22%. In addition, there are similar improvements on blood oxygen rate with variance of 6.97%. This is in agreement with Iman Yaseen (2001), Al-Hoaikan (2002), Delay G, et al (2007), Braith R. W. (2008), Amal Hussain (2003) and Alexandros P.Patrianakos (2009) (19) (3) (9) (7) (5) (2).

In addition, table (4) indicated statistically significant differences between post-measurements of the control and experimental group in favor of the experimental group on systolic and diastolic blood pressure as variance rates reached 17.4312.40% and 11.07%. This is in agreement with Said Al-Sayed (2007), Shereen Hassan (2007), Deljanin-Ilie M ,et al (2007), Piotrowicz (2007), Amal Hussain (2003) and Alexandros P.Patrianakos (4) (16) (10) (17) (5) (2).

Furthermore, table (4) indicated statistically significant differences between post-measurements of the control and experimental group in favor of the experimental

group on vital capacity as variance rates reached 50.03%. This is in agreement with Deljanin-Ilie.M (2007) and Ahmed Helmy (2010) (10) (18).

These results indicated statistically significant differences between post-measurements of the control and experimental group in favor of the experimental group on all research variables. The researcher thinks that these improvements are due to applying the recommended program as it helped patients to face the challenges of surviving open heart operations. In addition, it is clear that the program has positive effects on speeding up post-surgery recovery in those patients. In addition, traditional rehabilitation programs may be effective but not to the same degree of the recommended program.

Conclusions:

4. The recommended program had positive effects on the cardio-vascular function.
5. Suitable rehab exercises during recovery help the patient recover quickly and effectively

6. Suitable rehab exercises decrease the period of hospitalization and confirm good condition of the patient before leaving

Recommendations:

1. Generalizing the use of rehab exercises in all heart institutes and clinics
2. Training nurses and specialists on performing these exercises with open-heart surgery patients
3. Performing more research works on the role of sport and physical activity in treating heart diseases.

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