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Effect of preoperative physical and respiratory therapy on postoperative pulmonary functions and complications after laparoscopic upper abdominal surgery in obese patients

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ABSTRACT

Aim of the study: To investigate the effects of preoperative physical and respiratory therapy on pulmonary functions and complications after elective laparoscopic upper abdominal surgery in obese patients.

Methodology: Patients were randomly assigned to receive respiratory and general exercise for 2 weeks before operation (group I; n = 26) two physical and specialized respiratory therapy sessions per week (each one 40 min) in comparison to non-engaged group in any exercise (group II; n = 24) Pulmonary functions outcome variables including slow vital capacity(SVC), inspiratory capacity(IC), maximum inspiratory and expiratory pressures (MIP and MEP and 6-min walk test were recorded as a baseline, after two weeks of exercise day two, five and one month post-operative. Any postoperative pulmonary complications were recorded.

Results: There were statistically significant difference between groups, patients in the intervention group (group I) had higher pulmonary function in all parameters than (group II) $P < .05$ in all the post-operative periods. Postoperative pulmonary complications occurred in 15 patients (62%) in the control group (group II) and in 7 patients (27%) in the intervention group (group I) ($P < .05$).

Conclusion: Preoperative physical and respiratory therapy improved pulmonary functions and decreased the incidence of post-operative pulmonary complications in obese patients undergoing to laparoscopic upper abdominal surgery.

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Introduction

Postoperative pulmonary complications after laparoscopic upper abdominal surgery may result from respiratory muscle dysfunction and lack of physical activity especially in obese patients [1,2].

Their incidence ranges between 12% and 58% [3]. The induced pneumoperitoneum in laparoscopic surgery, anesthetic drugs, drains and postoperative pain were the causes for the impairment in respiratory mechanics and mobility of the patients [4,5]. Preoperative respiratory and physical programs which called as preha-

bilitation lead to early recovery after abdominal surgery [6,7], however, its preventive role on postoperative pulmonary complications after surgery remains unclear [8].

Patients and methods

This study was a prospective, randomized, controlled trial from May 2014 to May 2016. Patients were recruited from the surgical outpatient clinic in Menoufia University Hospitals, Egypt. Inclusion criteria were elective upper abdominal surgery (laparoscopic biliary surgery, hiatus hernia repair, gastrectomy, splenectomy), no past surgical intervention in upper abdomen, Body Mass Index (BMI) was more than 30, and a good general condition. Exclusion criteria were unsuitable comorbidities as cerebrovascular disease, decompensated cardiac problems or any chest diseases or drugs affecting muscle strength. Informed consent was taken from all

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patients and they had right to refuse at any times. This study was approved by Menoufia University Ethical Committee. Patients were divided into 2 groups, group I (the treatment group) who received preoperative physical and respiratory therapy for 2 weeks before surgery, whereas the other group (group II) received no preoperative physical or respiratory therapy. All patients were admitted to the hospital at least 1 day before surgery, and the preoperative data were assessed before surgery. In the postoperative period, a physical and respiratory therapy protocol was applied in both groups until the third or fifth day postoperatively.

The preoperative therapy (respiratory and general) program based on two physical therapy sessions per week (each one 40 min), in the form of stretching exercises, trunk rotation (dissociation of the pelvis and shoulder girdle), active upper and lower extremity exercises, walking, and relaxation. For respiratory muscle training, patients were instructed to inflate air into a balloon for 15 min and diaphragmatic breathing training twice daily. The walking portion of the protocol consisted of a 10-min walk on a flat ground in a manner faster than their normal walking and constant as much possible, and was limited by perceived dyspnea. Respiratory muscle training and walking were carried out twice daily, at home, four times a week.

The other group patients did not receive any physical therapy intervention in the preoperative period.

The postoperative program was applied to both groups and was formed of daily physical therapy (two sessions 15-min per each one) on day 2 post operatively (if stable) and continued for 5th day postoperatively or until discharge, then the patient is asked to complete the same protocol of respiratory therapy at home for at least one week postoperatively (guided by physiotherapy specialist). This respiratory therapy consisted of deep breathing exercises followed by coughing. This was followed by active upper and lower extremity exercises (like those used in the preoperative protocol), performed in the seated position.

This study included 26 patients were in group I who received pre-and postoperative physical and respiratory therapy, and 24 patients included in group II who received no preoperative general or respiratory exercise. Physical respiratory therapy was done by physiotherapy specialist. Pulmonary functions including spirometry using a spirometer (SpiroanalyzerST-90 supplied by Fukuda Sangyo, Tokyo, Japan) measuring the following parameters: slow vital capacity (SVC) inspiratory capacity, IC) MIP and MEP (maximum inspiratory and expiratory pressures) and 6-min' walk test, they were measured in pre-and post-operative period as baseline recording of these parameters before starting exercise, after 2w of exercise, 2nd, 5th day and 4th week post operatively. Postoperative pulmonary complications, were recorded until the fifth postoperative day, based on clinical, laboratory including pulse oximetry, ABG, and imaging findings (chest x ray and CT chest if needed).

Results 50 age and gender matched patients were included in this study. They are randomly divided into two groups, treatment group (group I) (26 patients) and group II (24 patients) (See Tables 1 and 2).

Table 3 showed that there was no statistical significant difference between the studied groups in the baseline pulmonary functions parameters (SVC, IC, MIP, MEP and Six-minute walk test). This means that both groups were comparable to each other. In the preoperative period after exposure of group I to physical and respiratory therapy and in the post-operative period day 2, day 5, and 1 month there was high significant difference between group I and II.

Postoperative pulmonary complications

By the fifth postoperative day, 15/24 (62.5%) patients in the group II and seven patients (27%) in the treatment group (group I) had postoperative pulmonary complications ($P = .034$).

Table 1

A brief for our methodology; investigations and protocol of respiratory and general exercises.

Day	Investigations	Exercise
Base line at 1st visit	Baseline SVC, IC, MIP MEP and 6-min walk test + preoperative investigations including chest X-ray	Starting physiotherapy and chest specialist consultation
1 day before surgery (after 2 weeks of physical and respiratory exercises).	Completion of preoperative investigation + admission preoperative PFTs* and chest radiology	Physiotherapy and chest specialist consultation
Day 2 post-operative	CBC + specific investigations for the operation (if required) + postoperative PFTs+ chest radiology	Physiotherapy and assessment of complications
Day 5 post-operative	PFTs + X-ray chest + CBC	Physiotherapy and chest specialist consultation
1-month postoperative	PFTs	

* PFTs = pulmonary function tests.

Table 2

Demographic, Clinical and Surgical data in both groups.

	Group I (26 patients)	Group II (24 patients)
Age yrs. (Median)	55.5 (49–67)	52 (47–65)
Male/Female	12/14	10/14
<i>BMI</i>		
30–40	20 (77%)	21 (87%)
>40	6 (23%)	3 (13%)
Smokers	6 (23%)	4 (16%)
<i>Type of lap. Surgery</i>		
H.H	2 (7.5%)	2 (8%)
Gastric Sleeve	4 (15%)	3 (13%)
Splenectomy	2 (7.5%)	3 (13%)
Cholecystectomy	18 (70%)	16 (66%)
Operative time in minutes (Median)	134 (36–210)	133 (30–225)
<i>ASA classification</i>		
I	17 (65%)	16 (66%)
II	6 (23%)	5 (21%)
III	3 (12%)	3 (13%)
Hospital Stay duration	6 days (2–10)	9 days (4–14)

BMI = body mass index, FVC = forced vital capacity, FEV = forced expiratory volume at 1st sec, lap. = laparoscopic, H.H = hiatus hernia, ASA = American society of anaesthesia.

In group II, our records observed atelectasis in 7 patients, atelectasis with pneumonia in five patients, pneumonia with respiratory failure in three patients. The postoperative pulmonary complications in treatment group were atelectasis in three patients, pneumonia in two patients and pleural effusion in two patients. No respiratory failure detected in the post operative period in the treatment group.

Statistical analysis Results were statistically analyzed by SPSS version 22 (SPSS Inc., Chicago, IL, USA). Student's t test was used for parametric data. P value was considered significant if $\leq .05$.

Discussion

The relative increase in upper abdominal surgery post-operation respiratory complications so improvement of health status in the preoperative period is a challenge to reduce these complications [9].

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