Physical therapy in the immediate postoperative period after abdominal surgery*

Atendimento fisioterapêutico no pós-operatório imediato de pacientes submetidos à cirurgia abdominal

Luiz Alberto Forgiarini Junior, Alexandra Torres de Carvalho, Tatiane de Souza Ferreira, Mariane Borba Monteiro, Adriane Dal Bosco, Marisa Pereira Gonçalves, Alexandre Simões Dias

Abstract

A series of pulmonary complications can occur after abdominal surgery. Therefore, it is necessary to introduce appropriate treatment early in order to minimize postoperative complications. The objective of the present study was to evaluate patients submitted to abdominal surgery in terms of the effect of physical therapy in the immediate postoperative period. This was a randomized clinical trial, in which one group of patients was submitted to physical therapy in the postoperative recovery room and, subsequently, in the infirmary, whereas another group was submitted to physical therapy in the infirmary exclusively. We conclude that physical therapy performed in the immediate postoperative period minimizes losses in lung function and respiratory muscle strength, as well as shortening recovery room stays.

Keywords: Physical therapy (specialty); Postoperative period; Surgery/abdomen.

Resumo

A cirurgia abdominal causa uma série de complicações pulmonares após o processo cirúrgico. Assim, faz-se necessário um tratamento precoce adequado objetivando minimizar as complicações no período pós-operatório. Objetivamos avaliar o efeito do atendimento fisioterapêutico no pós-operatório imediato de pacientes submetidos à cirurgia abdominal. Este foi um ensaio clínico randomizado, no qual um grupo recebeu atendimento fisioterapêutico na sala de recuperação e, posteriormente, nas enfermarias, e outro grupo o recebeu somente nas enfermarias. Concluímos que a fisioterapia realizada no pós-operatório imediato reduziu a perda da função pulmonar, a perda da força muscular ventilatória e o tempo de internação na sala de recuperação.

Descritores: Fisioterapia (especialidade); Período pós-operatório; Cirurgia/abdome.

The incidence of clinically relevant pulmonary complications in the postoperative period after abdominal surgery ranges from 5% to 30%. Such complications are the leading causes of morbidity and mortality, increasing hospital stays, medication use and hospital costs.[1] Respiratory therapy has been shown to be effective in the postoperative period, reducing the incidence of pulmonary complications in patients submitted to abdominal surgery.[2,3]

In order to minimize postoperative complications of abdominal surgery, early initiation of postoperative treatment is necessary. The objective of the present study was to evaluate patients submitted to abdominal surgery in terms of the effect of physical therapy in the immediate postoperative period in the recovery room.

This was a randomized clinical trial, in which patients who underwent open abdominal surgery and remained in the recovery room were

* Study carried out at the Methodist University Center of the Porto Alegre Institute, Porto Alegre, Brazil.
Correspondence to: Alexandre Simões Dias. Rua Hipólito da Costa, 543, casa 18, Morro Santa Tereza, CEP 90840-110, Porto Alegre, RS, Brasil.
Tel 55 51 9916.5657. E-mail: simoesdias@terra.com.br
Financial support: None.
Submitted: 21 August 2008. Accepted, after review: 4 November 2008.

included. Individuals who had sepsis, degenerative neuromuscular disease, spinal trauma or AIDS were excluded, as were patients on mechanical ventilation and patients who simultaneously underwent thoracic surgery.

For data collection, in the preoperative period and in the immediate postoperative period, we used an evaluation chart, on which the following information was recorded: vital signs; body mass index; pain scale score; presence of cough and secretion; smoking status; respiratory muscle strength; pulmonary function; history of pulmonary disease; and Perioperative Respiratory Therapy scale score.[4]

Written informed consent was obtained from each patient, and the study was approved by the Research Ethics Committee of the Santa Casa Hospital Complex in Porto Alegre, Brazil.

The patients were divided into two groups: patients submitted to physical therapy in the recovery room and, subsequently, in the infirmary (RR+Inf group); and patients submitted to physical therapy in the infirmary exclusively (Inf-only group).

After a patient had been found to meet the inclusion criteria, the evaluation previously described was performed and the patient was subsequently randomized into one of the groups. Randomization was performed using legal-size brown envelopes without any external markings. Each envelope contained a sheet of paper that read "Physical Therapy in the Recovery Room (RR+Inf group)" or "Physical Therapy in the Infirmary (Inf-only group)". The envelopes were divided into sets of ten, each set containing five envelopes from each group. Those envelopes were shuffled and numbered from 1 to 10. Therefore, the first patient included in the study would correspond to envelope 1, and so on. After one set was finished, it was excluded, and the next set was dealt with similarly.[5]

The following variables were measured in the pulmonary function tests: FVC; PEF; FEV_1; and Tiffeneau index (FEV_1/FVC). All of those variables were assessed using a Vitalograph spirometer, MDO2120 (Maids Moreton, Buckingham, UK). As a reference, we used the Pulmonary Function Test Guidelines established by the Brazilian Thoracic Association.[6]

Maximal respiratory pressures—MIP and MEP—were determined using a digital vacuum manometer, model MVD300 (GlobalMed, Porto Alegre, Brazil), also according to the recommendations of the Brazilian Thoracic Association Pulmonary Function Test Guidelines.[6]

Pulmonary function, as well as maximal respiratory pressures, was evaluated by a rater who was blinded to the group assignment of the patient.

The decision to discharge a patient from the recovery room was made by the nurse in charge of the unit, based on a postanesthetic recovery score.[7] It should be emphasized that the nurse was also blinded to the group assignment of the patient.

The statistical analysis was performed using the program Statistical Package for the Social Sciences, version 14.0 (SPSS Inc., Chicago, IL, USA). Categorical variables were presented as frequency, whereas continuous variables were expressed as mean and standard deviation. The variables were evaluated for normal distribution using the Kolmogorov-Smirnov test and compared using the Student's t-test. The level of significance was set at 5%.

Although the study included 40 patients who underwent abdominal surgery, 4 patients, who were discharged without undergoing the postoperative evaluation, were lost. Therefore, the final sample consisted of 36 patients. There were 19 individuals in the RR + Inf group and 17 in the Inf-only group. The mean age was 51 years in the RR+Inf group and 54 years in the Inf-only group, and there were a total of 29 female patients (80%). The most common surgical procedures were open cholecystectomy, exploratory laparotomy and partial hepatectomy, and the principal clinical diagnosis was acute cholecystitis, followed by choledocholithiasis.

The anthropometric and clinical characteristics of the population studied in each group can be seen in Table 1. There were no statistically significant differences between the groups.

In the preoperative period, 72.2% of the patients presented no alterations upon pulmonary auscultation, and 72.2% had no cough. The smoking habit was found in 31.6% of the RR+Inf group patients and in 29.4% of the Inf-only group patients. Most of the patients had no history of pulmonary disease.

The results of the pulmonary function tests and respiratory muscle strength tests are presented in Table 2. There were statistically significant differences between the groups

in terms of spirometry data ($p < 0.05$), with FVC and FEV_1 being significantly lower in the Inf-only group than in the RR+Inf group.

Regarding respiratory muscle strength, the intergroup comparison revealed a significant reduction in postoperative MEP, showing that physical therapy in the recovery room preserves the decrease in respiratory muscle strength.

Stays in the recovery room were found to be significantly shorter in the RR+Inf group (220.9 min) than in the Inf-only group (309 min; $p = 0.001$; Table 1).

The present study demonstrated that physical therapy in the recovery room can be beneficial to patients submitted to abdominal surgery, since the values of pulmonary function and respiratory muscle strength in the patients who received early physical therapy presented less variation in comparison with those obtained in the patients who received physical therapy only after being transferred to the infirmary.

The two groups were homogeneous in terms of all the demographic parameters analyzed (Table 1), and there was a predominance of

Table 1 - Demographic, anthropometric and clinical characteristics of the sample.

Characteristic	RR + Inf	Inf-only	p
Gender, n (%)			
Male	2 (10.5)	5 (29.4)	0.15
Female	17 (89.5)	12 (70.6)	0.28
Age, years	51.8 ± 13.5	54.1 ± 14	0.63
Weight, kg	66.2 ± 12.9	70.7 ± 11.6	0.28
Height, m	1.64 ± 0.1	1.66 ± 0.1	0.44
BMI, kg/m^2	24.6 ± 4.3	25.4 ± 5	0.61
HR, bpm	77.2 ± 9.0	70.4 ± 11.6	0.06
RR, breaths/min	18.4 ± 2.3	19.9 ± 3.1	0.11
SpO_2, %	97.3 ± 0.8	97.2 ± 1.2	0.81
Smoking, n (%)			
Never smoked	9 (47.4)	9 (52.9)	0.94
Former smoker	4 (21.1)	3 (17.6)	0.75
Smoker	6 (31.6)	5 (29.4)	0.46
PORT, n (%)			
Low risk	12 (63.5)	10 (68)	0.44
Moderate risk	7 (37.5)	7 (32)	0.64
High risk	0	0	
HPD, n (%)			
Yes	4 (21.1)	4 (23.5)	0.85
No	15 (78.9)	13 (76.5)	0.41
Cough, n (%)			
Efficient productive	2 (10.5)	3 (17.6)	0.63
Inefficient productive	0 (0)	1 (5.9)	0.41
Nonproductive	2 (10.5)	2 (11.8)	0.63
Absent	15 (78.9)	11 (64.7)	0.24
Auscultation, n (%)			
Preserved BS	15 (78.9)	11 (64.7)	0.28
Decreased BS	3 (15.8)	6 (35.3)	0.47
Rhonchi, n (%)	1 (5.3)	0 (0)	0.36
Body temperature, °C	36.3 ± 0.4	36.2 ± 0.6	0.69
Recovery room stays, min	220.9 ± 46.3	309 ± 66.85	0.001

RR + Inf: patients submitted to physical therapy in the recovery room and, subsequently, in the infirmary; Inf-only: patients submitted to physical therapy in the infirmary exclusively; BMI: body mass index; HR: heart rate; RR: respiratory rate; PORT: Perioperative Respiratory Therapy (scale score); HPD: history of pulmonary disease; and BS: breath sounds. Continuous variables are presented as mean ± SD.

Table 2 - Pulmonary function tests and tests of respiratory muscle strength.

Variable	RR+Inf			Inf-only			p
	Pre	Post	Δ (Pre – Post)	Pre	Post	Δ (Pre – Post)	Δ (RR+Inf – Inf-only)
FVC, L	2.79 ± 0.90	2.50 ± 1.01	–0.29	2.96 ± 0.72	2.16 ± 0.47	–0.79	0.03*
FEV_1, L	2.20 ± 0.60	1.86 ± 0.58	–0.34	2.42 ± 0.48	1.68 ± 0.59	–0.73	0.01*
FEV_1/FVC, %	1.15 ± 0.39	1.17 ± 0.63	0.01	1.13 ± 0.34	1.24 ± 0.53	0.11	0.46
PEF	2.02 ± 0.72	1.51 ± 0.42	–0.5	1.95 ± 0.60	1.50 ± 0.47	–0.45	0.58
MIP	62.5 ± 11.4	54 ± 8.7	–	66.8 ± 12.4	50.9 ± 9.2	–	0.73
MEP	61.1 ± 12.1	53.4 ± 10.9	–	55.2 ± 8.2	40.1 ± 7.6	–	0.04**

females. The mean age of 53 years is in agreement with data in the literature, which show that, among patients with cholecystitis, there is a higher prevalence of abdominal diseases in females, especially those in their 50s.[8]

Various factors contribute to the development of postoperative complications. The surgical procedure itself, performed in the abdominal region, is one such factor. Studies have demonstrated that this type of approach contributes to the development of postoperative complications, which are more common than are those resulting from thoracic or cardiac surgery.[9,10]

In the two groups studied, there is a clear decrease in pulmonary function in the postoperative period when compared with the preoperative period, although a statistically significant difference was found only in the Inf-only group (FVC and FEV_1). This finding is in agreement with those of one group authors, who demonstrated a 47% reduction in vital capacity, as well as a significant reduction in respiratory muscle strength, in patients submitted to gastroplasty.[11] Similarly, another group of authors demonstrated that there was a reduction in respiratory muscle strength in patients submitted to elective laparotomy of the upper abdomen and that this reduction was found to be lower than the values predicted for the preoperative period.[12] Those same authors found that there was a reduction in FEV_1, and that the patients submitted to laparotomy had a 6.5 times greater risk of postoperative pulmonary complications than did those who underwent open abdominal surgery.[12]

In our study, we found a significant postoperative reduction in respiratory muscle strength (MEP) in both groups evaluated. Postoperative MIP was significantly reduced in both groups. Although the reduction in muscle strength was greater in the Inf-only group than in the RR + Inf group, the difference was not significant. Another group of authors reported alterations in ventilatory muscle strength in patients submitted to abdominal surgery. This reduction, according to the authors, is due to postoperative pain, since the group that received analgesic therapy in the study period presented less alteration in ventilatory muscle strength.[13] According to some authors, pulmonary complications after abdominal surgery can be prevented by performing inspiratory muscle training in the preoperative period, there being a reduction in the incidence of atelectasis after the procedure.[1]

When we analyzed the history of pulmonary disease, we found that most patients had presented no pulmonary alterations and that, according to one study, a history of pulmonary disease increases mortality in patients submitted to abdominal surgery.[14]

No standard protocol for physical therapy procedures or techniques was used in the recovery room. The procedures and techniques most commonly used were diaphragmatic proprioception, inflating respiratory patterns, forced expiratory maneuvers, expiratory delay and assisted cough. In the infirmary, early ambulation was added to the procedures mentioned above. The lack of standardization of the physical therapy techniques used is a factor that might have affected the results obtained.

Physical therapy in the immediate postoperative period after abdominal surgery is an early treatment alternative, since it preserves pulmonary function and expiratory muscle strength.

References

1. Dronkers J, Veldman A, Hoberg E, van der Waal C, van Meeteren N. Prevention of pulmonary complications after upper abdominal surgery by preoperative intensive inspiratory muscle training: a randomized controlled pilot study. Clin Rehabil. 2008;22(2):134-42.
2. Hulzebos EH, van Meeteren NL, van den Buijs BJ, de Bie RA, Brutel de la Rivière A, Helders PJ. Feasibility of preoperative inspiratory muscle training in patients undergoing coronary artery bypass surgery with a high risk of postoperative pulmonary complications: a randomized controlled pilot study. Clin Rehabil. 2006;20(11):949-59.
3. Mackay MR, Ellis E, Johnston C. Randomised clinical trial of physiotherapy after open abdominal surgery in high risk patients. Aust J Physiother. 2005;51(3):151-9.
4. Torrington KG, Henderson CJ. Perioperative respiratory therapy (PORT). A program of preoperative risk assessment and individualized postoperative care. Chest. 1988;93(5):946-51.
5. Hulley SB, Cummings SR, Brower WS, Grady D, Hearst N, editors. Delineando a Pesquisa Clínica - Uma abordagem epidemiológica. Porto Alegre: Artmed; 2006.
6. Sociedade Brasileira de Pneumologia e Tisiologia. Diretrizes para Testes de Função Pulmonar. J Pneumol. 2002;28(Suppl 3):S2-S237.
7. Aldrete JA, Kroulik D. A postanesthetic recovery score. Anesth Analg. 1970;49(6):924-34.
8. Andreoli TE, Carpenter CJ, Griigs RC, Loscalzo J, editors. Cecil - Medicina Interna Básica. Rio de Janeiro: Elsevier; 2006.
9. Brooks-Brunn JA. Predictors of postoperative pulmonary complications following abdominal surgery. Chest. 1997;111(3):564-71.
10. Doyle RL. Assessing and modifying the risk of postoperative pulmonary complications. Chest. 1999;115(5 Suppl):77S-81S.
11. Paisani DM, Chiavegato LD, Faresin SM. Lung volumes, lung capacities and respiratory muscle strength following gastroplasty. J Bras Pneumol. 2005;31(2):125-32.
12. Bellinetti LM, Thomson JC. Respiratory muscle evaluation in elective thoracotomies and laparotomies of the upper abdomen. J Bras Pneumol. 2006;32(2):99-105.
13. Vassilakopoulos T, Mastora Z, Katsaounou P, Doukas G, Klimopoulos S, Roussos C, et al. Contribution of pain to inspiratory muscle dysfunction after upper abdominal surgery: A randomized controlled trial. Am J Respir Crit Care Med. 2000;161(4 Pt 1):1372-5.
14. Neto LJ, Thomson JC, Cardoso JR. Postoperative respiratory complications from elective and urgent/emergency surgery performed at a university hospital. J Bras Pneumol. 2005;31(1):41-7.

About the authors

Luiz Alberto Forgiarini Junior
Physical Therapist. Federal University of Rio Grande do Sul, Porto Alegre, Brazil.

Alexandra Torres de Carvalho
Physical Therapist. Methodist University Center of the Porto Alegre Institute, Porto Alegre, Brazil.

Tatiane de Souza Ferreira
Physical Therapist. Methodist University Center of the Porto Alegre Institute, Porto Alegre, Brazil.

Mariane Borba Monteiro
Professor. Methodist University Center of the Porto Alegre Institute, Porto Alegre, Brazil.

Adriane Dal Bosco
Professor. Methodist University Center of the Porto Alegre Institute, Porto Alegre, Brazil.

Marisa Pereira Gonçalves
Professor. Department of Physical Therapy and Rehabilitation, Federal University of Santa Maria, Santa Maria, Brazil.

Alexandre Simões Dias
Professor. Professional Masters Program in Rehabilitation and Inclusion, Methodist University Center of the Porto Alegre Institute, Porto Alegre, Brazil.