Perioperative care for major elective surgery: a survey of Brazilian physiotherapists

Cuidados perioperados de cirurgias eletivas de grande porte: um levantamento dos fisioterapeutas brasileiros

Christiane Luck Macieira [1]
Luciana Dias Chiavegato [1,2]
Isabel Fialho Fontanele Garcia [1]
Adriana Claudia Lunardi [1,3*]

[1] Universidade Cidade de São Paulo (UNICID), São Paulo, SP, Brazil
[2] Universidade Federal de São Paulo (UNIFESP), São Paulo, SP, Brazil
[3] Universidade de São Paulo (USP), São Paulo, SP, Brazil

Date of first submission: May 21, 2021
Last received: October 20, 2021
Accepted: December 14, 2021
Associate editor: Clynton Lourenço Correa

*** Correspondence:** adrianalunardi@hotmail.com

Abstract

Introduction: Major surgeries are highly complex procedures and have a higher incidence of respiratory morbidity and mortality compared to other types of surgery. Postoperative pulmonary complications (PPC) are common after such surgeries and are associated with increased hospital stay, health care costs and surgical patient mortality. **Objective:** To investigate the most commonly used physical therapy techniques for the prevention and treatment of PPC among thoracic and abdominal surgery patients in all regions of Brazil. **Methods:** A total of 489 randomly selected physiotherapists who provided perioperative care for patients undergoing elective abdominal, thoracic or cardiac surgeries participated in this study. A questionnaire with nine questions about routine care and therapeutic choices for the surgical population was developed and assessed by 10 specialists before being administered to the physiotherapists. **Results:** Among the physiotherapists (63% with at least 5 years of experience with surgical patients), 50.9% considered the patient's surgical risk in their treatment either always or often. A total of 53.8% patients were treated by the physiotherapist following a physician's prescription. The most mentioned physical therapy techniques used to prevent PPC were postoperative mobilization/exercises (59.3%), postoperative lung expansion (52.8%), and preoperative advice (50.7%). In addition, 80.6% of the physiotherapists believe that incentive spirometry prevents PPC, while 72.8% expected this effect from positive airway pressure devices. **Conclusion:** Most physiotherapists in Brazil who work with surgical patients offer preoperative professional advice, use postoperative early mobilization and lung expansion techniques to prevent PPC, and consider the patient's surgical risk during treatment. In addition, some physical therapy sessions are routinely performed preoperatively.

Keywords: Elective surgery. Perioperative care. Physical therapy. Questionnaires.

Resumo

Introdução: *As cirurgias de grande porte são procedimentos de alta complexidade, apresentando maior incidência de morbi-mortalidade respiratória em comparação com outros tipos de cirurgia. Complicações pulmonares pós-operatórias (CPP) são comuns após tais cirurgias e estão associadas ao aumento da permanência hospitalar, dos custos com saúde e da mortalidade do paciente.* ***Objetivo:*** *Investigar as técnicas de fisioterapia mais utilizadas em todas as regiões do Brasil para o tratamento das CPP após cirurgias torácicas e abdominais.* ***Métodos:*** *Participaram deste estudo 489 fisioterapeutas selecionados aleatoriamente, que atuam na assistência perioperatória de cirurgias eletivas abdominais, torácicas ou cardíacas. Um questionário com nove questões sobre cuidados de rotina e escolhas terapêuticas na população cirúrgica foi elaborado e avaliado por 10 especialistas antes de ser aplicado aos fisioterapeutas.* ***Resultados:*** *Entre os fisioterapeutas (63% com pelo menos 5 anos de experiência com pacientes cirúrgicos), 50,9% considera o risco cirúrgico do paciente em seu tratamento sempre ou frequentemente; 53,8% dos pacientes foram tratados pelo fisioterapeuta após prescrição médica. As técnicas fisioterapêuticas mais citadas para a prevenção de CPP foram: mobilização/exercícios pós-operatórios (59,3%), técnicas de expansão pulmonar pós-operatória (52,8%) e orientações pré-operatórias (50,7%). Além disso, 80,6% dos fisioterapeutas acreditam que a espirometria de incentivo previne CPP, assim como 72,8% esperam esse efeito da pressão positiva nas vias aéreas.* ***Conclusão:*** *A maioria dos fisioterapeutas que trabalham com pacientes cirúrgicos no Brasil utiliza orientações profissionais pré-operatórias e técnicas de mobilização precoce e expansão pulmonar pós-operatória com o objetivo de prevenir CPP. A maioria dos fisioterapeutas costuma considerar o risco cirúrgico do paciente durante o tratamento. Além disso, algumas sessões de fisioterapia são realizadas rotineiramente no pré-operatório.*

Palavras-chave: *Cirurgia eletiva. Cuidado perioperatório. Fisioterapia. Questionários.*

Introduction

Major surgeries, such as upper abdominal, thoracic and cardiac surgeries, are highly complex procedures.[1] They have a higher incidence of respiratory morbidity and mortality compared to other types of surgery.[2,3] In addition, postoperative pulmonary complications (PPC) are common after major surgeries and they are associated with increased hospital stay, health care costs and surgical patient mortality.[3] Therefore, the implementation of preventive strategies to improve the surgical patient's clinical status is important to decrease incidence of PPC and consequent implications.[2] One of these strategies is the use of physical therapy techniques, which have been recommended to recovery postoperative respiratory function.[4] Some examples of techniques are deep breathing, incentive spirometry, and breathing with positive airway pressure. These techniques stimulate the increase of the transpulmonary pressure and, consequently, the expansion of collapsed alveolar units, preventing or treating PPC.[5,6]

Studies using lung expansion techniques still show conflicting results as an effective strategy for preventing PPC after upper abdominal, thoracic or cardiac surgeries.[7-10] Despite the weakness of evidence, the use of respiratory physical therapy techniques to prevent PPC remains widespread in clinical practice.[11-13] Likewise, current studies on early postoperative mobilization cannot show that these strategies are capable, by themselves, of reducing the occurrence of PPC after thoracic, cardiac and abdominal surgeries.[14-16]

Although theoretical support is still conflicting for the preventive intervention of a sole respiratory physical therapy for any type of patient, we believe that the techniques and resources continue to be widely applied by physiotherapists and prescribed by physicians, increasing hospital costs and occupying physiotherapist`s time with non-beneficial and not even scientifically proven clinical care. Therefore, given the above facts, the aim of this study was to map the physical therapy assistance of patients undergoing major elective surgeries in all regions of Brazil to identify the clinical approaches adopted in the country.

Methods

The study protocol was approved by the University Ethics Committee: Universidade Cidade de São Paulo (UNICID), no. 37948114.3.0000.0064.

Due to the absence of a validated instrument to question physiotherapists about their clinical practice with surgical patients, we developed a questionnaire that was evaluated by experts. The questionnaire was reformulated following experts' suggestions. Its final

version contained nine multiple choice questions about the perioperative care routine and the therapeutic choices in the surgical population. In addition, the questionnaire included questions about: highest degree level of education in physical therapy at the moment; professional time performance; characteristics of the patient, hospital and surgical procedures; how is done the referral of the patient to the physiotherapist; surgical risk of the patient according to the American Society of Anesthesiologists (ASA) classification;[17] number of interventions and length of physical therapy care before and after surgery; physical therapy techniques routinely chosen for the care of surgical patients; using of resources such as incentive spirometry and equipment that generate positive airway pressure (e.g., continuous positive airways pressure, intermittent positive pressure breathing, bilevel positive airways pressure, expiratory positive airways pressure, positive expiratory pressure) during patient care (Figure 1).

The questionnaire was applied in all regions of Brazil through the website SurveyMonkey, from March to September 2017.

SURVEY

Sex: ( ) Male ( ) Female Age: _____ years old

Public hospital ( ) Private hospital ( )

Fill in (in order of frequency) the most performed surgery site in your hospital (1 to 3):
( ) Abdominal ( ) Thoracic ( ) Cardiac

Fill in (in order of frequency) the type of surgery most frequently performed in your hospital (1 to 2):
( ) Conventional access (open or laparotomy or thoracotomy) ( ) Video-assisted (laparoscopy or thoracoscopy)

Professional training time: ( ) Less than 5 yrs ( ) 6 to 10 yrs ( ) 11 to 20 yrs ( ) 21 to 29 yrs ( ) More than 30 yrs
Title: ( ) Bachelor ( ) Specialist ( ) Master ( ) Doctor ( ) Postdoctoral

1. How the patient is referred for physiotherapy in the perioperative period of elective high abdominal, thoracic or cardiac surgeries?
( ) It's part of the hospital's routine ( ) Via medical prescription ( ) Referral from colleagues
( ) Others _____

2. Do you prioritize the perioperative care of major elective surgeries according to the patient's surgical risk?
( ) Always (Which scale do you use? _____) ( ) Often ( ) It depends
( ) Never ( ) I don't know any surgical risk scale

3. Most patients you see as a physical therapist are classified at what risk level according to the American Society of Anesthesiology (ASA) score?
( ) I don't know ( ) Low risk (ASA 1 & 2) ( ) Moderate risk (ASA 3) ( ) High risk (ASA 4 & 5) ( ) Non-living organ donor (ASA 6)

4. In your opinion, what type(s) of perioperative physical therapy intervention(s) prevent pulmonary complications in the postoperative period of elective upper abdominal, thoracic or cardiac surgery?
( ) Pulmonary secretion removal techniques ( ) Lung expansion techniques ( ) Professional advices
( ) Mobilization/exercises ( ) Use of positive pressure ( ) Incentive spirometry

5. How many physiotherapy sessions do you usually do in the preoperative period of upper abdominal, thoracic or cardiac surgery per patient?
( ) None ( ) 1 to 3 ( ) 3 to 5 ( ) 5 to 10 ( ) Over than 10

6. How long do you perform physical therapy sessions on the patient before major surgeries?
( ) 1 to 3 days ( ) 1 week ( ) 1 month ( ) 6 months

7. How many physical therapy sessions do you usually do in the postoperative period of upper abdominal, thoracic or cardiac surgery per patient?
( ) None ( ) 1 to 5 ( ) 5 to 10 ( ) 10 to 15 ( ) Over than 15

8. Do you use the incentive spirometry as a resource in your clinical practice to prevent pulmonary complications in the postoperative period of major abdominal, thoracic and cardiac surgery?
( ) Yes ( ) No

9. Do you use equipment that generates positive airway pressure (CPAP, IPPB, BIPAP, EPAP, PEP) for patients undergoing major surgery?
( ) Yes ( ) No

ASA 1 Normal healthy patient
ASA 2 Patient with mild systemic disease
ASA 3 Patient with severe systemic disease that is not a constant threat to life
ASA 4 Patient with severe systemic disease that is a constant threat to life
ASA 5 Moribund patient not expected to survive with or without surgery
ASA 6 Organ donor patient

Figure 1 - Final version of the questionnaire applied to the physiotherapists.

Firstly, a pilot test was performed and the questionnaire was applied to 10 physiotherapists with more than 10 years of clinical experience working in highly complex hospitals. These physiotherapists were asked about the design, ambiguities, terminology and structure of the instrument. Subsequently, the necessary adjustments and corrections were made to develop the final version of the questionnaire. Thereafter, a search was carried out on the Brazilian Ministry of Health website in order to identify the registered hospitals. Hospitals that performed major elective surgeries within the national network and their physical therapy services were selected and contacted by e-mail or phone to be invited to participate in the study. The heads of rehabilitation or physical therapy services of the contacted hospitals who agreed to participate provided the names of the services' physiotherapists. These names were coded with numbers and 20% of them were randomly selected by Microsoft Excel® software. This procedure was performed to avoid bias of only physiotherapists interested in the survey answering the questionnaire.The randomly selected physiotherapists were invited to participate in the study, and only those who agreed to participate received a cover letter containing the objective of the questionnaire, identification of the researchers, and information about assurance of confidentiality. After that, a 30-day deadline was set for the physiotherapist to answer the questionnaire and a reminder was issued to the physical therapy services' coordinators at midterm. All physiotherapists answered the questionnaire voluntarily, and none of them receive any kind of reward.

According to Edwards et al.,[18] some precautions in administering an e-mail survey can be taken to ensure most of the predicted answers and provide a reliable result. The following precautions were taken in this study:

1) Short questionnaire;

2) Statement that other physiotherapists have already answered this questionnaire (as it happens) in the body of the invitation e-mail;

3) Offering to send the final result of the study to the physiotherapists who answered the questionnaire;

4) E-mail header written in a simple and personalized way;

5) 30-day deadline to answer the questionnaire, with reminder notice at midterm.

All obtained data were treated descriptively with frequency analysis, using the software SigmaPlot 12.1 was used (San Jose, USA).

Results

Of the 14,700 physiotherapists working in hospitals who performed major surgeries, we contacted 2,940 randomly selected from 285 hospitals across Brazil. We obtained answers from 16.3% (n = 489) of the physiotherapists, of which 76.3% (n = 371) were female and most of them had up to 10 years of graduation and specialist title (Table 1).

Table 1 - Characteristics of physical therapy education, type of hospitals and region of Brazil (n = 489)

Characteristics	n (%)
Time since graduation	
Less than 5 years	179 (36.6)
6 - 10 years	172 (35.2)
11 - 20 years	109 (22.3)
21 - 29 years	21 (4.3)
More than 30 years	7 (1.4)
Highest degree level at the moment	
Bachelor	31 (6.3)
Specialist/ongoing specialization course	322 (65.8)
Master/master's in progress	99 (20.2)
Doctor/doctorate in progress	33 (6.7)
Postdoctoral	3 (0.6)
Type of hospital	
Private	199 (40.7)
Public	163 (33.3)
University	127 (26.0)
Region	
Southeast	298 (60.0)
Northeast	97 (19.5)
South	45 (9.0)
North	37 (7.5)
Midwest	12 (2.4)

Most of the patients assisted by the physiotherapists who answered the questionnaire have a surgical risk classified between low and medium, and undergo conventional abdominal surgery. Most of physiotherapists stated that they always or often treat the patient considering the surgical risk, performing one to three sessions before surgery and five to ten on the postoperative period (Table 2).

Table 2 - Surgical characteristics (n = 489)

Characteristics	n (%)
Types of surgery	
Abdominal	257 (52.6)
Cardiac	144 (29.5)
Thoracic	88 (18.0)
Surgical access	
Conventional	355 (72.6)
Video-assisted	134 (27.4)
Surgical risk	
Low (ASA 1 and 2)	128 (26.2)
Medium (ASA 3)	240 (49.1)
High (ASA 4 and 5)	121 (24.7)
Service according to surgical risk	
Always	199 (40.7)
Often	89 (18.2)
It depends	111 (22.7)
Never	37 (7.6)
I do not know about surgical risk	34 (7.0)
Others	19 (3.9)
Number of interventions	
Preoperative	
None	105 (21.4)
1 to 3 sessions	344 (70.4)
3 to 5 sessions	40 (8.2)
Postoperative	
None	0 (0.0)
1 to 5 sessions	50 (10.2)
5 to 10 sessions	338 (69.1)
10 to 15 sessions	53 (10.8)
More than 15 sessions	48 (9.8)

Note: ASA = American Society of Anesthesiologists classification.

Just over half of the patients undergoing major surgery are referred to physical therapy by doctor's prescription. The most commonly adopted interventions to prevent PPC reported by the physiotherapists were: early postoperative mobilization (59.3%), postoperative lung expansion techniques (52.8%), and preoperative professional advices (50.7%). Moreover, most of the physiotherapists confirmed that they use the incentive spirometry and equipment that generates positive airway pressure as lung expansion techniques to prevent PPC (Table 3).

Table 3 -Characteristics of physiotherapy assistance to surgical patients (n = 489)

Characteristics	n (%)
Indication to physical therapy	
Medical prescription	263 (53.8)
Hospital's routine	226 (46.2)
Interventions that prevent PPC	
Postoperative mobilization/exercises	290 (59.3)
Postoperative lung expansion techniques	258 (52.8)
Preoperative professional's advice	248 (50.7)
Postoperative incentive spirometry	217 (44.4)
Postoperative noninvasive positive-pressure	197 (40.3)
Postoperative mobilization/exercises	188 (38.4)
Preoperative incentive spirometry	171 (35.0)
Preoperative prophylactic pulmonary secretion removal techniques	132 (27.0)
Incentive spirometry to prevent PPC	
Yes	394 (80.6)
No	95 (19.4)
Positive pressure to prevent PPC	
Yes	356 (72.8)
No	133 (27.2)
Positive pressure indication	
Depends on the physician	36 (7.4)
As needed	33 (6.7)
Resource not available	5 (1.0)
Did not answer	415 (84.9)

Note: PPC = postoperative pulmonary complications.

Discussion

Our results show that most of the physiotherapists in Brazil appears to adhere to postoperative mobilization/exercises, postoperative lung expansion techniques and preoperative advises aiming to prevent PPC in surgical patients with low to medium surgical risk. Another interesting aspect is that the physiotherapists performed their care considering patients' surgical risk, which probably means targeting and intensifying treatment to patients at higher risk of complications. However, more than half of the physiotherapists stated that the indication of physical therapy happens under medical prescription. In addition, the most part of the Brazilian physiotherapists seems to believe that the use of equipment that generates positive airway pressure and

incentive spirometry prevent PPC, even with the weak scientific evidence about their effectiveness.

Early mobilization/exercises were reported as the main option for major of the physiotherapists who cares surgical patients. Early mobilization has been gaining more and more space as a field of research and encouragement to be carried out in clinical practice as a strategy to accelerate the recovery of patients, including perioperative care protocols such as the enhanced recovery after surgery (ERAS).[19,20] However, the most recent studies carried out to investigate the efficiency of this intervention did not find difference in the incidence of complications between patients undergoing abdominal or cardiopulmonary surgery allocated to early mobilization groups and those allocated to control groups.[21-23]

Despite growing evidence that preoperative physical training seems to be quite efficient as a prevention strategy for PPC,[24] this is a distant reality in Brazil due to the need for hospitalization in centers focused on physical rehabilitation, which does not yet exist in the country. The physical training protocol takes at least six weeks to achieve cardiopulmonary fitness.[25] However, most physical therapists report having one to three sessions before surgery. If on the one hand this number of sessions is not enough to achieve physical conditioning, on the other hand it provides the physiotherapists with the possibility to screen patients who need more sessions in the postoperative period, as well as to give professional advice to patients about postoperative care. In this sense, professional advices have been investigated as a strategy to prevent PPC and it seems to have great potential because it is based on patients' education on how to be an actor in their own postoperative recovery.[26]

The third most popular intervention among Brazilian physiotherapists is lung expansion techniques. The most current discussion about the lack of evidence of the effects of these techniques is focused on the biases of the randomized controlled trial (RCT)[27-29] and difficulty in making the patient adhere to the active interventions as incentive spirometry[30] and deep breathing. Probably, the lack of effect of lung expansion techniques could also be explained by factors related to the behavior of patients. Despite the controversy in the literature, a large number of Brazilian physiotherapists continue to believe in the beneficial effect of respiratory stimulator and positive pressure. This belief is also reported by professionals in the USA.[31] A possible explanation for this fact is that the practical experience of physiotherapists showing that lung expansion techniques seem to prevent PCC does not reflect what they read in the RCT. Perhaps the main difference between the two scenarios (RCTs versus real life) is the level of control of the clinical situation and the blind evaluation carried out in the studies with lower risk of bias. In any case, strategies for implementing scientific evidence need to be established by hospitals for the RCT to justify being conducted and returning responses to the society. We would like to add to this discussion that complete therapies (which include lung expansion and mobilization/exercise techniques) are poorly tested and could result in more effective physical therapy treatment in this population.

Our results also show that 53.8% (n = 263) of the physiotherapeutic care performed on surgical patients are prescribed by the medical team and not only by physiotherapist screening. A literature review study[32] about physiotherapist autonomy and current evidence about medical prescription performed in Australia shows that physiotherapists seek prescription rights, but there is a need for changes in current policy and legislation, as well as in Brazil.[33] The Australian authors also suggest that comprehensive assessment criteria should be developed and widely implemented to ensure safe practice and prescription by physiotherapists.[32] We should also remember that in the current health management model in Brazil, the payment of costs regarding inpatient treatment depends on the medical prescription.[34]

One of the main limitations of this study is the low response rate (16.3%), which may not be representative of all professionals in Brazil. However, this is the survey with the largest number of responding physiotherapists in the field of perioperative care. Another limitation was the use of a multiple-choice questionnaire that did not allow essay answers, as we opted for a quick answer questionnaire to increase the adherence to the research. Finally, we did not ask the physiotherapists about the reasons for their therapeutic choices and not even about the limited use of evidence-based practice.

Concluion

Our results show that most physiotherapists in Brazil who work with surgical patients use preoperative professional advices, postoperative early mobilization, and lung expansion techniques aiming to prevent

postoperative pulmonary complications. Most physiotherapists often consider the patient's surgical risk during treatment, increasing the chance of providing adequate care to those who are more likely to develop complications. In addition, some physical therapy sessions are routinely performed preoperatively. One worrying aspect is that, due to the current legislation, physiotherapists in Brazil do not have full autonomy to indicate physical therapy care by themselves.

Authors' contributions

CLM, LDC and ACL were responsible for the development of the study protocol; CLM, IFFG and ACL, for the data collection and, along with LDC, for analysing the results. CLM and IFFG wrote the manuscript, and LDC and ACL reviewed the final version.

References

1. National Institute for Health and Care Excellence. Perioperative care in adults. NICE Guideline NG180; 2020 [cited 2021 May 5]. Available from: www.nice.org.uk/guidance/ng180_

2. Kaufmann K, Heinrich S. Minimizing postoperative pulmonary complications in thoracic surgery patients. Curr Opin Anaesthesiol. 2021;34(1):13-9. DOI

3. Fernandez-Bustamante A, Frendl G, Sprung J, Kor DJ, Subramaniam B, Martinez Ruiz R, et al. Postoperative pulmonary complications, early mortality, and hospital stay following noncardiothoracic surgery: a multicenter study by the perioperative research network investigators. JAMA Surg. 2017;152(2):157-66. DOI

4. Smetana GW, Lawrence VA, Cornell JE. Preoperative pulmonary risk stratification for noncardiothoracic surgery: systematic review for the American College of Physicians. Ann Intern Med. 2006;144(8):581-95. DOI

5. Lunardi AC, Paisani DM, Silva CCBM, Cano DP, Tanaka C, Carvalho CRF. Comparison of lung expansion techniques on thoracoabdominal mechanics and incidence of pulmonary complications after upper abdominal surgery: a randomized and controlled trial. Chest. 2015; 148(4):1003-10. DOI

6. Santos EC, Campos AEP, Carmo OF, Lunardi AC. Comparing high and low levels of continuous positive airway pressure on lung aeration in patients with pleural drainage: A feasibility study for a randomized controlled trial. Physiother Res Int. 2019;24(1):e1753. DOI

7. Nascimento Jr P, Módolo NSP, Andrade S, Guimarães MMF, Braz LG, El Dib R. Incentive spirometry for prevention of postoperative pulmonary complications in upper abdominal surgery. Cochrane Database Syst Rev. 2014;2014(2):CD006058. DOI

8. Eltorai AEM, Szabo AL, Antoci Jr V, Ventetuolo CE, Elias JA, Daniels AH, et al. Clinical effectiveness of incentive spirometry for the prevention of postoperative pulmonary complications. Respir Care. 2018;63(3):347-52. DOI

9. Pantel H, Hwang J, Brams D, Schnelldorfer T, Nepomnayshy D. Effect of incentive spirometry on postoperative hypoxemia and pulmonary complications after bariatric surgery: a randomized clinical trial. JAMA Surg. 2017;152(5):422-8. DOI

10. Kotta PA, Ali JM. Incentive spirometry for prevention of postoperative pulmonary complications after thoracic surgery. Respir Care. 2021;66(2):327-33. DOI

11. Patman S, Bartley A, Ferraz A, Bunting C. Physiotherapy in upper abdominal surgery - what is current practice in Australia? Arch Physiother. 2017;7:11. DOI

12. Reeve J, Anderson L, Raslan Y, Grieve C, Ford J, Wilson L. The physiotherapy management of patients undergoing abdominal surgery: A survey of current practice. NZ J Physiother. 2019;47(2):66-75. Full text link

13. Van Beijsterveld CA, Bongers BC, Den Dulk M, Van Kuijk SMJ, Dejong KCH, Van Meeteren NLU. The association between preoperative physical functioning and short-term postoperative outcomes: a cohort study of patients undergoing elective hepatic resection. HPB (Oxford). 2019;21(10):1362-70. DOI

14. Balvardi S, Pecorelli N, Castelino T, Niculiseanu P, Alhashemi M, Liberman AS, et al. Impact of facilitation of early mobilization on postoperative pulmonary outcomes after colorectal surgery: a randomized controlled trial. Ann Surg. 2021;273(5):868-75. DOI

15. Castelino T, Fiore Jr JF, Niculiseanu P, Landry T, Augustin B, Feldman LS. The effect of early mobilization protocols on postoperative outcomes following abdominal and thoracic surgery: A systematic review. Surgery. 2016;159(4):991-1003. DOI

16. Santos PMR, Ricci NA, Suster EAB, Paisani DM, Chiavegato LD. Effects of early mobilisation in patients after cardiac surgery: a systematic review. Physiotherapy. 2017;103(1):1-12. DOI

17. Canet J, Gallart L, Gomar C, Paluzie G, Vallès J, Castillo J, et al. Prediction of postoperative pulmonar complications in a population-based surgical cohort. Anesthesiology. 2010;113(6): 1338-50. DOI

18. Edwards PJ, Roberts I, Clarke MJ, Diguiseppi C, Wentz R, Kwan I, et al. Methods to increase response to postal and electronic questionnaires. Cochrane Database Syst Rev. 2009;8(3):MR000008. DOI

19. Liang Y, Liu H, Nurse LZ, Zhu Y, Zhao M, Hu Y, et al. Enhanced recovery after surgery for laparoscopic gastrectomy in gastric cancer: A prospective study. Medicine (Baltimore). 2021;100(7):e24267. DOI

20. Brown JK, Singh K, Dumitru R, Chan E, Kim MP. The benefits of enhanced recovery after surgery programs and their application in cardiothoracic surgery. Methodist Debakey Cardiovasc J. 2018;14(2):77-88. DOI

21. Liu T, Feng J, Ge L, Jin F, Zhou C, Liu X. Feasibility, safety and outcomes of ambulation within 2h postoperatively in patients with lung cancer undergoing thoracoscopic surgery. Int J Nurs Pract. 2021:e12994. DOI

22. Zhu Q, Yang J, Zhang Y, Ni X, Wang P. Early mobilization intervention for patient rehabilitation after renal transplantation. Am J Transl Res. 2021;13(6):7300-5. Full text link

23. Balvardi S, Pecorelli N, Castelino T, Niculiseanu P, Alhashemi M, Liberman AS, et al. Impact of facilitation of early mobilization on postoperative pulmonary outcomes after colorectal surgery: a randomized controlled trial. Ann Surg. 2021;273(5):868-75. DOI

24. Topal B, Smelt HJM, Van Helden EV, Celik A, Verseveld M, Smeenk F, et al. Utility of preoperative exercise therapy in reducing postoperative morbidity after surgery; a clinical overview of current evidence. Expert Rev Cardiovasc Ther. 2019;17(6):395-412. DOI

25. Debes C, Aissou M, Beaussier M. [Prehabilitation. Preparing patients for surgery to improve functional recovery and reduce postoperative morbidity]. Ann Fr Anesth Reanim. 2014;33(1):33-40. French. DOI

26. Boden I, Skinner EH, Browning L, Reeve J, Anderson L, Hill C, et al. Preoperative physiotherapy for the prevention of respiratory complications after upper abdominal surgery: pragmatic, double blinded, multicentre randomised controlled trial. BMJ. 2018;360:j5916. DOI

27. Sullivan KA, Churchill IF, Hylton DA, Hanna WC. Use of incentive spirometry in adults following cardiac, thoracic, and upper abdominal surgery to prevent post-operative pulmonary complications: a systematic review and meta-analysis. Respiration. 2021;100(11):1114-27. Full text link

28. Ireland CJ, Chapman TM, Mathew SF, Herbison GP, Zacharias M. Continuous positive airway pressure (CPAP) during the postoperative period for prevention of postoperative morbidity and mortality following major abdominal surgery. Cochrane Database Syst Rev. 2014;2014(8):CD008930. DOI

29. Odor PM, Bampoe S, Gilhooly D, Creagh-Brown B, Moonesinghe SR. Perioperative interventions for prevention of postoperative pulmonary complications: systematic review and meta-analysis. BMJ. 2020;368:m540. DOI

30. Eltorai AEM, Baird GL, Eltorai AS, Pangborn J, Antoci V Jr, Cullen HA, et al. Incentive spirometry adherence: a national survey of provider perspectives. Respir Care. 2018;63(5):532-7. DOI

31. Eltorai AEM, Baird GL, Pangborn J, Eltorai AS, Antoci Jr V, Paquette K, et al. Financial impact of incentive spirometry. Inquiry. 2018;55:46958018794993. DOI

32. Moris JH, Grimmer K. Non-medical prescribing by physiotherapists: issues report in the current evidence. Man Ther. 2014;19(1):82-6. DOI

33. Prati FAM. Autonomia profissional do fisioterapeuta e do terapeuta ocupacional. 2016 [cited 2017 Jul 30]. Available from: https://tinyurl.com/2p82nmnc

34. Brazil. Law No. 9,656, of June 3, 1998. Provides for private health care plans and insurance. Brasília: Diário Oficial da União; Available at: Jun 4 1998. Full text link