Clinical Impact of Preoperative Physiotherapy on Postoperative Pulmonary Complications of Oncological Patients

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Impacto Clínico da Fisioterapia Pré-Operatória nas Complicações Pulmonares Pós-Operatórias de Pacientes Oncológicos

Impacto Clínico de la Fisioterapia Preoperatoria sobre las Complicaciones Pulmonares Postoperatorias de Pacientes Oncológicos

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ABSTRACT

Introduction: Preoperative physiotherapy in cancer patients plays a fundamental role in reducing postoperative complications. It is known that the preoperative assessment identifies risk factors and is critical in reducing the development of such complications. **Objective:** Identify the effect of preoperative kinesiotherapy and inspiratory muscle training on postoperative pulmonary complications in cancer patients. **Method:** Thirty patients were randomly divided into a kinesiotherapy group, inspiratory muscle training group and control group, with 10 participants in each group. Respiratory muscle strength assessment, 6-minute walk test and peripheral muscle strength were performed. The Wilcoxon test was used for comparison before and after treatment. The Kruskal Wallis test was also performed to compare the post-treatment result and the Chi-square test for categorical variables. The Cohen test (d) was also performed to identify the effect size. **Results:** Nine (90%) individuals in the control group had complications, while in the kinesiotherapy and inspiratory muscle training groups, complications were observed in two (20%) and three (30%) patients, respectively. Maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) in inspiratory muscle training and MIP in the kinesiotherapy group demonstrated clinical impact when compared to the control group. **Conclusion:** Kinesiotherapy and inspiratory muscle training impacted the reduction of postoperative complications of oncology surgeries.

Key words: Neoplasms; Preoperative Care; Physical Therapy Modalities; Breathing Exercises/adverse effects; Surgical Oncology.

RESUMO

Introdução: A fisioterapia pré-operatória em pacientes oncológicos tem papel fundamental para redução das complicações pós-operatórias. Sabe-se que a avaliação pré-operatória identifica os fatores de risco e é decisiva na redução do desenvolvimento de tais complicações. **Objetivo:** Verificar o efeito da cinesioterapia pré-operatória e do treino muscular inspiratório nas complicações pulmonares pós-operatórias em pacientes oncológicos. **Método:** Trinta pacientes foram divididos aleatoriamente em grupo cinesioterapia, grupo treinamento muscular inspiratório e grupo controle, com dez participantes em cada grupo. Foram realizadas avaliação da força muscular respiratória, teste de caminhada de seis minutos e força muscular periférica. Foi utilizado o teste de Wilcoxon para comparação pré e pós-tratamento. Também foi realizado o teste Kruskal Wallis para comparação do resultado pós-tratamento e o teste qui-quadrado para variáveis categóricas. Utilizou--se o teste de Cohen (d) para identificação do tamanho do efeito. **Resultados:** Nove (90%) indivíduos do grupo controle apresentaram complicações, enquanto, nos grupos cinesioterapia e de treinamento muscular inspiratório, as complicações foram observadas em dois (20%) e três (30%) pacientes, respectivamente. As pressões inspiratória máxima (PImáx) e expiratória máxima (PEmáx) no treinamento muscular inspiratório e a PImáx no grupo cinesioterapia demonstraram impacto clínico quando comparados ao grupo controle. **Conclusão:** A cinesioterapia e o treinamento muscular inspiratório impactaram na redução das complicações pós-operatórias das cirurgias oncológicas.

Palavras-chave: Neoplasias; Cuidados Pré-Operatórios; Modalidades de Fisioterapia; Exercícios Respiratórios/efeitos adversos; Oncologia Cirúrgica.

RESUMEN

Introducción: La fisioterapia preoperatoria en pacientes oncológicos tiene un papel fundamental en la reducción de las complicaciones posoperatorias. Se sabe que la evaluación preoperatoria identifica factores de riesgo y es decisiva para reducir el desarrollo de tales complicaciones. **Objetivo:** Verificar el efecto de la kinesioterapia preoperatoria y el entrenamiento de los músculos inspiratorios sobre las complicaciones pulmonares postoperatorias en pacientes con cáncer. **Método**: Treinta pacientes fueron divididos aleatoriamente en un grupo de kinesioterapia, un grupo de entrenamiento de los músculos inspiratorios y un grupo de control, con diez participantes en cada grupo. Se realizó una evaluación de la fuerza de los músculos respiratorios, la prueba de marcha de seis minutos y la fuerza de los músculos periféricos. Se utilizó la prueba de Wilcoxon para comparar antes y después del tratamiento. También se realizó la prueba de Kruskal Wallis para comparar el resultado postratamiento y la prueba de chi-cuadrado para variables categóricas. También se realizó la prueba de Cohen (d) para identificar el tamaño del efecto. **Resultados**: Nueve (90%) individuos en el grupo de control tuvieron complicaciones, mientras, en los grupos de kinesioterapia y entrenamiento de los músculos inspiratorios, se observaron complicaciones en dos (20%) y tres (30%) pacientes, respectivamente. Las presiones inspiratorias (MIP) y espiratorias máximas (MEP) en el entrenamiento de los músculos inspiratorios y MIP en el grupo de kinesioterapia demostraron un impacto clínico en comparación con el grupo de control. **Conclusión:** La kinesioterapia y el entrenamiento de los músculos inspiratorios impactaron en la reducción de las complicaciones posoperatorias de las cirugías oncológicas.

Palabras clave: Neoplasias; Cuidados Preoperatorios; Modalidades de Fisioterapia; Ejercicios Respiratorios/efectos adversos; Oncología Quirúrgica**.**

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INTRODUCTION

In the last years, according to the National Cancer Institute José Alencar Gomes da Silva (INCA), malignant neoplasms correspond to the second main cause of morbidity and mortality in the world where 8.2 million persons in average die by cancer every year. In Brazil, for each year of the triennium 2020-2022, 625 thousand new cases of cancer will occur[1].

The time interval between the diagnosis and beginning of the treatment are important to guide the curative measures of the disease[2] and despite the advances in radiotherapy and chemotherapy, surgery continues to be one of the main resources for cancer care, fulfilling many roles in prevention, diagnosis, curative treatment, treatment supporting measures, palliative treatment and reconstructions becoming vital to reduce early mortality by cancer[3].

Despite high rates of cure from surgeries, its complications as infections, skin lesions, suture dehiscence, musculoskeletal and vascular alterations, further to cardiac and pulmonary complications occur in postoperation[4]. In this context, for maximized and well succeeded oncologic treatment it is paramount a free-complications surgery; in addition, identify risk factors predisposing to this outcome can help to elaborate prevention strategies[5].

The risk factors of motor functional decline of oncologic patients are common because of the intrinsic characteristics potentialized in the aftermath of surgical trauma. Anemia of the chronic disease, caquexia, malnourishment and muscle fatigue are some of the main factors associated with increase of morbidity, mortality, consultation costs and postoperative hospitalization time[6].

Respiratory muscle weakness and pre-surgery diaphragm dysfunctions may be related to pulmonary complications, leading to a reduction of the expectoration and oncologic postoperative respiratory functions[7]. Anesthetics, cough disorders (because of the pain) immobility and compromise of the nervous central system are potential triggers of postoperative pulmonary complications (POPC)[4].

Preoperative and oncologic rehabilitation physiotherapy helps to identify the current changes, programs and specific training for each patient and reduction of risk factors for postoperative respiratory, motor, or sensorial complications. Therefore, the principle of preoperative pulmonary evaluation is the analysis of these major risk factors of the POPC causes, anticipating and guiding with adequate techniques to its recovery[8,9].

Therefore, the aim of the present study is to compare the effect of preoperative physiotherapy in POPC in oncologic patients with control group (CG).

METHOD

Randomized clinical trial with CG. The sample consisted of 30 individuals in oncologic treatment randomly assigned to three groups: kinesiotherapy (KinesioG), inspiratory muscle training (IMTG) and CG with ten individuals in each group. One investigator randomized using the software Randomization (http://randomization.com/). Another than the first investigator responsible for the randomization and for the treatment proposed evaluated all the participants in pre-operation. Two other investigators conducted each treatment (third and fourth). A fifth investigator conducted post-operation follow up ensuring the blind stages of the study.

The sample power was based in the number of POPC which is the main study outcome to calculate the study sample size. The sample power test used was based in proportion for two groups. While verifying the sample power comparing CG with IMTG, the result was 98%. Between CG and KinesioG, was 91%. Online calculator DSS research was used for the calculation[10]. According to Loureiro and Gameiro[11], value above 80% is considered a good sample power.

The eligibility criteria were patients with cancer diagnosis and indication of oncologic elective surgery aged between 20 and 70 years old, with or without indication of admission in intensive care unit in good cognitive conditions who were not participating of another preoperative physiotherapy program. Hemodynamically unstable patients with history of skin cancer resection and those in poor physical conditions for tests were excluded.

170 oncologic patients listed in the scheduled surgeries of "*Hospital de Caridade São Vicente de Paulo*" in Guarapuava/PR were identified. Of these, 90 were excluded because of skin cancer and one due to poor physical conditions for tests. Ten individuals refused to participate and 34 accepted but were unable to reach the "*Clínica-Escola de Fisioterapia* (Physiotherapy Clinical School) of Unicentro where the study was conducted. 45 participants who underwent preoperative evaluation were included. 15 of which were excluded for failing to attend the consultations. Exercises were not performed due to the worsening of the clinical condition (n=5), chemotherapy important side effects (n=4), postponement of surgical procedure (n=3) and hospital admissions due to complications (n=3). Consequently, the final sample consisted of 30 patients.

The Institutional Review Board of the West Central State University approved the study, report number 2.124.493/17. All the participants signed the Informed Consent Form.

Initially, the participants were submitted to anamnesis to identify risk factors, evaluation of the respiratory (RMS) and peripheral (PMS) muscle strength, respiratory function, and functioning. The groups treated underwent revaluation after consultations ended.

RMS and PMS were measured with analogic manovacuometer, brand "*Comercial Médica*". For maximum inspiratory pressure (MIP), expiration until residual volume (RV) was requested and then, maximum inspiratory until total pulmonary capacity (TPC) with strength held for two seconds. To evaluate the maximum expiratory pressure (MEP) it was requested deep inspiration until TPC with maximum expiration at RV level held for two seconds. Both maneuvers were repeated three times and the best measurement was registered[12].

For the six-minutes walking test (6MWT), the participants were guided to walk the biggest distance as possible in a color tape marked stretch on the floor with cones in both extremities for six minutes. The norms of the American Thoracic Society for the test were followed[13].

The PMS was measured through palmar grip strength exerted over a manual dynamometer Saehan. The patient, seated on a chair with the feet laying on the floor, the upper limb tested placed with the arm at the side of the trunk, elbow in flection with forearm at 90º of pronation and wrist in neutral position, was guided to exert as much strength as possible for three to four seconds and relax. Three tests were performed in the dominant upper limb with one-minute interval and the best measure registered[14,15].

The three groups were accompanied in post-operation during the hospitalization daily until hospital discharge in order to identify the POPC, classified according to the criteria adopted by Hulzebos et al.[16] as shown in Chart 1. Patients' charts, multi-disciplinary team evolution, imaging and laboratory tests were reviewed.

The KinesioG program consisted of four physiotherapeutic consultations of approximately 40 minutes. Stretching exercises of the major and minor pectoral muscles and thigh posterior muscles, thorax rotation exercises (with stick) were performed, deep inspiration, fractionated ventilatory pattern in two and three times, active and resistance exercises (when the patient tolerates) of upper and lower limbs and walk in treadmill in speed matched to the participant tolerance for ten minutes. All the activities were executed in three series of ten repetitions each, with one-minute interval between them[17]. The Modified Borg scale was used to rate the resistance applied to the exercises and treadmill speed, which is a descriptive marker of subjective physical effort of dyspnea and fatigue in lower limbs. The scale ranges from zero to 10, where zero means no effort and 10, maximum effort[18]. The patients responded to the scale and those whose effort was below 7 were submitted to resistance adjustments.

Chart 1. Classification of the postoperative pulmonary complications

Type 1
• Dry cough
• Microatelectasis and temperature above 37.5°C, without documented cause
• Dyspnea without documented cause
Type 2
• Productive cough not attributed to the right cause
• Bronchospasm (presence of wheezing) and necessity of change of treatment
• Hypoxemia with signs of wheezing and dyspnea
• Atelectasis with radiologic confirmation associated to temperature above 37.4°C or abnormal pulmonary findings
• Hypercapnia with necessity of treatment
Type 3
• Pleural effusion with necessity of thoracocentesis
• Suspicion of pneumonia (radiologic evidence without bacterioscopy confirmation)
• Pneumonia with radiologic evidence and confirmation in bacterioscopy
• Pneumothorax
• Reintubation with period of mechanic ventilation within no more than 48 hours
Type 4
• Ventilatory failure: postoperative dependence of ventilator over 48 hours
• Intubation with subsequent dependence of mechanic ventilation for more than 48 hours

The IMT protocol was met with four consultations of approximately 40 minutes. The training was performed with Threshold IMT® of Phillips, initiating with 60% of MIP. The load was increased, based in the patient's perceived effort with the Modified Borg scale. Had the participant reached rate 7 of the Modified Borg scale, the load would increase 5%. Two series of 30 respiratory efforts were carried out with one-minute interval between them[19,20].

Post training, the patient was guided to perform exercises of diaphragmatic breathing, with deep inspirations by the nose and inflating the abdominal region. Three series of ten repetitions each were performed.

The data were presented in mean and standard-deviation or raw values with percentage. After the analysis of normality through the statistical test Komogov-Smirnov, the Wilcoxon test was selected for pre and post treatment comparison between the KinesioG, IMTG groups and the Kruskal Wallis test to compare post-treatment results of two groups with the result of CG, in

addition to the chi-square test for categorical variables. The level of significance was p≤0.05.

Regarding pulmonary complications, they were divided in "with complications" (responses 1, 2, 3 and 4) and "without complications" (response 0) and through three contingency 2x2 tables the comparisons among the groups treated with control and among them were performed.

The relative risk (RR) was calculated too, comparing preoperative physiotherapy with CG, considering RR>1 as low risk of complications (protective factor), RR=1 without impact and RR<1, increase of risk (risk factor). Together with RR, the necessary number to treat (NNT) – number of individuals who need to be treated to prevent the unwanted outcome – whose interpretation is: the lower the NNT, higher is the magnitude of the benefit, NNT=1 means that all the patients benefitted with the therapy and higher NNT represents low magnitude for the treatment[21].

In addition, with the objective of investigating the clinical impact of preoperative physiotherapy in patients submitted to oncologic surgery, the Cohen test (d) was performed to investigate the effect size. Values lower than 0.5 are considered as low clinical impact, values between 0.5 and 0.8 as moderate and values above 0.8 as great clinical impact[22].

RESULTS

The characteristics of the groups are presented in Table 1.

For the analysis of the influence of preoperative physiotherapy in POPC it was decided to divide the groups in "with" and "without complications". In Table 2, it is possible to see that the groups treated presented less POPC when compared with CG (KinesioG X CG, p=0.01 and IMTG X CG p=0.02) and that among the groups treated no significant difference was found (KinesioG X IMTG p=0.89).

Table 3 presents the results of RMS, of PMS and the distance walked of the three groups and the clinical impact. A significant improvement of MIP both in KinesioG and IMTG when compared with pre and post-operation and of both compared with CG was noticed. For MEP, it was observed a significant gain only in the IMTG.

Table 1. Characterization of the Sample

Variables	IMTG Mean±SD [CI]	KinesioG Mean±SD [CI]	CG Mean±SD [CI]	p-value
Age	52±16	58.8±14.2	54±10	0.53
(years)	[40.4; 63.5]	[48.6; 68.9]	[46.7; 61.2]	
Weight	69.3±16.7	80.7±14.5	74.9±24.7	0.42
(Kg)	[57.3 ;81.2]	[70.3; 91.1]	[57.2; 92.5]	
Height	1.63±0.09	1.67±0.08	1.59±0.07	0.28
(m)	[1.56; 1.70]	[1.59; 1.71]	[1.5; 1.6]	
BMI	25.9±5.2	29.34±4.5	28.8±8.55	0.43
(kg/m2)	[22; 29]	[26.1; 32.6]	[22.7; 34.9]	
Gender	n(%)	n(%)	n(%)	0.06
(M/F)	4(40) /6(60)	(60) /4(40)	1(10)/9(90)	
Tobacco use	4(40%)	2(20%)	-	0.08
DM	-	4(40%)	1(10%)	0.07
Surgical Procedure				
Head and Neck	-	4(40%)	1(10%)	0.06
Breast	2(20%)	3(30%)	4(40%	
Hysterectomy	-	2(20%)	1(10%)	
Abdominal	7(70%)	-	3(30%)	
Others	1(10%)	1(10%)	1(10%)	
POPC				
0	8(80%)	7(70%)	1(10%)	0.11
1	1(10%)	1(10%)	2(20%)	
2	-	2(20%)	7(70%)	
3	1(10%)	-	-	
4	-	-	-	

Captions: SD: standard deviation; CI: Confidence Interval; POPC: postoperative pulmonary complications; KinesioG: kinesiotherapy group; IMTG: inspiratory muscle training group; CG: control group; BMI: Body Mass Index; F: female; M: male; DM: *diabetes mellitus*.

Table 2. Presence of postoperative pulmonary complications

POPC	IMTG n(%)	KinesioG n(%)	CG n(%)
With complications	2 (20)	3 (30)	9 (90)
Without complications	8 (80)b,c	7 (70)a	1 (10)

Captions: POPC: postoperative pulmonary complications; KinesioG: kinesiotherapy group; IMTG: inspiratory muscle training group ; CG: control group; a: p=0.01 in the comparison of KinesioG with CG; b: p=0.02 in the comparison IMTG with CG and c: p=0.89 in the comparison between KinesioG and IMTG.

In relation to the clinical impact of preoperative physiotherapy, there was a great clinical impact in MIP and MEP for IMTG, and of MIP for KinesioG.

After the analysis comparing IMTG with CG, it was noticed that IMT reduces RR in 67% the RR while KinesioG reduces RR of POPC in 78% (Table 4).

DISCUSSION

The results of this study showed improvement of RMS with strong clinical impact in MIP and MEP in IMTG, and MIP in KinesioG after the physiotherapeutic intervention. In addition, it was observed the protective effect of preoperative physiotherapy in the POPC.

Postoperative period can be marked by pulmonary complications creating constant concerns. The prevalence of POPC in this study was 20% in KinesioG, 30% in IMTG and 90% in CG. According to Cabral et al.[23], thoracic and lower abdomen surgeries provoked the second major change of the pulmonary function, reducing in 30% the functional residual capacity.

In CG, POPC were noticed in 90% of the individuals. Of these, 20% (n=2) had complications type 1; 60% (n=6), type 2, and 10% (n=1), type 4. For the KinesioG, only 30% (n=2) had complications, being 10% (n=1) type 1, and 20% (n=2), type 2. Silva and Silva Filho[24] highlighted among the main postoperative complications, the development of atelectasis, hypoxemia, and pneumonia, affecting nearly 80% of the patients submitted to surgical procedure. Oliveira et al.[25] noticed that dry or productive cough, dyspnea, bronchospasm, pleural effusion, pneumonia, pneumothorax, ventilatory dysfunction and reintubation can be observed too. The authors[25] proved also that the high incidence of respiratory complications correlated with prolonged hospitalization, rates of morbimortality, use of medication and high hospital costs.

In this study, there was lower prevalence of POPC in the groups treated, being possible to affirm that preoperative physiotherapy, regardless of the type (kinesiotherapy – kinesio or inspiratory muscle training – IMT) were risk protective for POPC significantly. Templeton and Greenhalgh[26] affirmed that the main benefit after preoperative exercises program is what will reduce the risk of developing postoperative complications of a patient.

Steffens et al.[27], in a systematic review found evidences that the implementation of a preoperative exercises program was effective in reducing the number of postoperative complications and time of hospitalization in patients submitted to lung cancer surgery.

Post-treatment MIP encountered in KinesioG and in IMTG was significantly higher than in CG, which can justify lower number of POPC even the CG presenting lower functioning capacity observed in the 6MWT distance.

According to Abreu et al.[7], when RMS and preoperative pulmonary functions are compared, it was found that the RMS both for MIP and MEP reduced in post-operation. Santos et al.[4] found negative correlation between MIP and POPC.

In addition, this study shows that MIP was the variable with the greatest clinical impact in both groups, reinforcing once again their importance for POPC. According to Lai et al.[28], in a preoperative aerobic exercises program in patients with lung cancer it was observed higher number of POPC in CG in 30-days period post-surgery. Furthermore, the study found an increase of

Table 3. Comparison of the respiratory and functioning variables between groups and its clinical impact

Variables	IMTG				KinesioG				CG	
	Pre	Post	p-value	Cohen(d)	Pre	Post	p-value	Cohen(d)	Pre	p-value
MIP	44±22.7	72±19.3	0.008*	1.40	60.5±16.4	80±16.3	0.001*	1.26	41±29.7	0.001*
MEP	55±18.4	74±16.4	0.02*	1.15	64±19.6	72.5±23.2	0.38	0.43	64.5±26.0	0.59
PMS	26.7±6.3	27.9±6.1	0.67	0.20	24.5±71.3	23.7±6	0.8	+0.23	25.1±7.1	0.35
6MWT	432±47.3	452±34.3	0.29	0.51	408±77.7	405±51.4	0.9	+0.05	393.5±193.6	0.5

Captions: KinesioG: Kinesiotherapy Group; IMTG: inspiratory muscle training group; CG: control group; MIP: maximum inspiratory pressure; MEP: maximum expiratory pressure; PMS: peripheral muscle strength; 6MWT: distance walked in the six-minute walking test. *Difference between IMTG-post, KinesioG-post and CG-pre.

Table 4. Analysis of relative risk comparing intervention and control groups

Groups	IMTG	KinesioG
CG	RR=0.33 NNT=2	RR=0.22 NNT=2

Captions: KinesioG: Kinesiotherapy group; IMTG: Inspiratory Muscle Training Group; CG: control group; RR: relative risk; NNT: number needed to treat.

the peak of expiratory flow and distance in the 6MWT proving that, similar to this study, a preoperative exercise training can be a vital rehabilitation strategy with positive physical effect, reducing POPC.

Gomes Neto et al.[29] verified the influence of IMT physiotherapeutic technique in pre and post-operation of heart surgery over the time of hospitalization and pulmonary functioning after the surgical event. This study showed that there are evidences in the literature about the improvement of MIP and MEP, reduction of until two days of hospital stay, improvement of the forced expiratory volume in the first second (FEV1), forced vital capacity and peak of expiratory flow, in addition to risk reduction of POPC due to improvement of the strength and endurance of the respiratory muscles.

Cunha et al.[30] reported that the respiratory muscle training utilizing IMT with load equal to 60% of the MIP, three series of 12 repetitions, five times a week for at least two weeks (with load readjusted weekly) before the esophagectomy resulted in a significant increase of the strength and preoperative resistance of the respiratory muscle (inspiratory and expiratory) through measures of MIP and MEP. However, the increase of the muscle strength did not result in satisfactory outcomes of postoperative MIP and MEP and did not impact the patients' recovery. In this study, it was attempted to investigate not a specific surgery, but any type of oncologic surgical procedure and a great clinical impact was found in MS post-IMT, reducing 67% of RR of complications.

Sobrinho et al.[31] demonstrated the importance of preoperative physiotherapy in heart surgery regarding reduction of hospitalization time and change of pulmonary volumes and RMS. Patients were randomized in two groups, one of IMT (I), who performed RV and IMT with Threshold, with resistance of 40% of MIP through the entire preoperative period once a day; and another of CG (II), where only one routine guideline was applied. MIP and MEP increased in the fifth day pre-operation and RV increased significantly in the same period. In group II, RV grew expressively after pre-operation and time of hospitalization was higher. Although in this study the target public was oncologic patients, there was a significative improvement in MIP and MEP in group IMT when preoperative and post-operation were compared and both variables had great clinical impact when compared with CG. The results corroborate the study quoted previously since IMTG had less POPC and their strength was significantly higher than the CG.

Regardless of not being noticed significant increase in 6MWT, the post-IMT values were higher than CG. Silva et al.[32], utilizing IMT found statistically significant difference in the 6MWT distance of the experimental group in intra and inter groups comparison. The authors concluded that IMT promotes more ventilatory effectiveness and inspiratory muscles reduce their consumption of O_2, leading the individual to remain more time in submaximal tests. A possible explanation for the benefits of IMT over the functioning capacity would be the fact that the delay in appearance of metaboreflex of inspiratory muscles may have helped the improvement of the performance.

The small number of the participants with many losses and the non-specificity of the treatment for different surgical procedures is the limitation of the study, it is suggested similar studies with larger sample and for specific surgical procedures.

CONCLUSION

The results encountered indicate that Kinesio and IMT were effective with clinical impact in the reduction of POPC resulting from oncologic surgeries.

CONTRIBUTIONS

Heloise Angelico Pimpão, Isadora Pandolfo Bortolazzi and Andersom Ricardo Frez contributed for the study conception and/or design. Gabrielle Pazzetto de Mattos and Maria Julia Batista Moreira contributed for the manuscript wording. João Afonso Ruaro and Marina Pegoraro Baroni participated of the critical review. Christiane Riedi Daniel contributed for the study conception and/or design and critical review. All the authors approved the final version to be published.

DECLARATION OF CONFLICT OF INTERESTS

There is no conflict of interests to declare.

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