Effect of the abbreviation of preoperative fasting to 2h with a drink containing carbohydrate in postoperative pulmonary function after Thoracoscopic Sympathectomy: a pilot randomized study

Efeito da abreviação do tempo de jejum pré-operatório para 2h com bebida contendo carboidratos na função pulmonar após a Simpatectomia Toracoscopica: um estudo piloto randomizado

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ABSTRACT
Objective: The organic response to trauma is attenuated by intake of a carbohydrate (CHO)-enriched drink 2 hours before surgery, as opposed to strict preoperative fasting. We investigated whether this approach would improve postoperative respiratory function in patients undergoing bilateral thoracoscopic sympathectomy. Method: Qualifying

patients (mean age, 24 years; range, 16-37 year) scheduled for thoracoscopic sympathectomy were randomized to conventional 6- to 8-hour fasting (control group, n=7) or 6-hour fasting for solids, followed by intake of a CHO-rich drink (12% maltodextrin in 200 mL of water) 2 hours before anesthesia (CHO group, n=7). Forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and forced expiratory flow between 25% and 75% of FVC (FEF 25-75%) were measured, and cirtometry was performed pre- and postoperatively (Day 1). The visual analog scale (VAS) was used to assess pain and well-being postoperatively. Results: Pain and well-being did not differ between groups by VAS scores. Thoracic expansibility declined postoperatively in both groups at axillary level but significantly decreased at xiphoid level only in the control group (*p*=0.04). Both groups showed significant declines in FVC and FEV1 on postoperative Day 1. Only the control group displayed significant postoperative FEF 25-75% decline, compared with preoperative baseline (*p*=0.01). Conclusion: In this pilot study, intake of a CHO-enriched drink 2 hours preoperatively benefitted patients postoperatively, enhancing basilar lung expansion and marginally improving lung function.

Keywords: preoperative fasting, Sympathectomy, pulmonary function, carbohydrate.

RESUMO

Objetivo: A resposta orgânica ao trauma é atenuada pela ingesta de bebida enriquecida com carboidratos (CHO) duas horas antes da cirurgia quando comparada a jejum pré-operatório tradicional. Nós investigamos se esse protocolo poderia melhorar a função respiratória em pacientes submetidos a simpatectomia videolaparoscopica bilateral. Métodos: Pacientes elegíveis (idade média 24, variação16-37 anos candidatos a simpatectomia videolaparoscópicas foram randomizados para receber jejum pré-operatório tradicional de 6-8h (grupo controle, n=7) ou 6h de jejum para sólidos seguido da ingestão de bebida rica em CHO (200 mL de agua contendo 12% de maltodextrina) 2h antes da anestesia (grupo CHO, n=7). Mensurou-se a capacidade vital forçada (FVC), volume expiratório forçado de 1 segundo (FEV1) e o fluxo expiratório forçado 25-75% (FEF 25-75%) além da cirtometria antes e após a operação (1o PO). A escala visual analógica (VAS) foi usada para mensurar a dor e o bem estar no pós-operatório Resultados: Os escores da VAS para dor e bem estar não foram diferentes entre os grupos. A expansibilidade torácica reduziu-se no pós-operatório nos dois grupos no nível axilar mas redução significativa no nível xifoide só ocorreu no grupo controle (p=0,04). Ambos os grupos mostraram redução significativa da FVC e FEV1 no 1o dia de PO . Em relação aos achados no pré-operatório, houve redução significativa da FEF 25-75% apenas no grupo controle (p=0.01) Conclusão: Neste estudo piloto, a ingestão de bebida contendo CHO 2h antes da cirurgia beneficiou pacientes no pós-operatório por melhorar a expansão pulmonar e marginalmente melhorar a função pulmonar

Palavras-chave: jejum pré-operatório, Simpatectomia, função pulmonar, carboidratos.

1 INTRODUCTION

Proper pulmonary function is an essential part of the postoperative recovery process. To improve rates of postoperative complications, especially lung-related events such as atelectasis and pneumonia, a physiotherapist's input in evaluating lung function is also critical[i,ii]. A number of potential interventions, such as early postoperative mobilization, lung expansion maneuvers, and airway clearance techniques, may improve respiratory muscle function during the postoperative period[iii]. Recently, the Enhanced Recovery After Surgery (ERAS) protocol has proposed changes to traditional perioperative care aimed at reducing lengths of stays and complications in abdominal operations[iv]. One of the cardinal shifts in ERAS practices is a curtailment of preoperative fasting[v]. By administering carbohydrate (CHO)-enriched drinks up to 2 hours in advance of anesthesia (thus limiting perioperative fast durations), the post-traumatic metabolic response time is shortened for improved muscle function after surgery[vi]. Some studies have already documented that postoperative muscle strength is enhanced by preoperative carbohydrate loading, and this benefit is presumed to include muscles of respiration[vii]. After a thorough literature review, we failed to encounter any studies addressing this topic in the realm of thoracic surgery, specifically video-assisted thoracoscopic surgery (VATS).

Prolonged preoperative fasting is standard in most community hospitals and often exceeds the traditional 6-8 hours generally required by a multicenter study. Long periods of fasting may diminish muscle function and accelerate protein breakdown for enhanced gluconeogenesis and provision of fuel during fasting conditions[7viii]. Muscle function is therefore impaired, increasing the likelihood of thoracic complications (ie, atelectasis, pneumonia) after surgical procedures[1ixi]. We subsequently wondered whether prolonged fasting might inflict some change in basal respiratory function before surgery is begun. Also, we anticipated a worsening of respiratory function after thoracic surgery (due to prolonged preoperative fasting), which perhaps might be mitigated by preoperative intake of CHO-enriched drink as above. The aim of this study was to assess postoperative respiratory function in patients undergoing VATS procedures for hyperhidrosis, with or without the use of CHO-enriched drinks to curb preoperative fasting.

2 METHODS

For this randomized controlled trial, we selected patients treated for hyperhidrosis between March 2013 and June 2014. Each underwent thoracoscopic sympathectomy, performed by a single surgeon (GMS) at Sao Matheus Hospital in Cuiaba, Brazil. The Research in Ethics Committee for the Federal University of Mato Grosso granted study approval (protocol number 230.981/2013), and all patients provided signed informed consent. Qualifications for study included non-malnourished (no recent weight loss and body mass index [BMI] >20 kg/m^2) subjects of either gender, each 16-60 years old and capable of general anesthesia, with American Society of Anesthesiologists (ASA) physical scores <3. Exclusion criteria were as follows: 1) non-adherence to stipulations of fasting protocol; 2) voids in pre- or postoperative evaluations (described below); 3) any hemodynamic instability displayed during perioperative care or serious postoperative complications; 4) comorbid conditions, specifically diabetes (fasting glycemia >100 mg/dl), renal failure (serum creatinine >2 mg/dl), liver insufficiency (bilirubin >2 mg/dl), or gastroesophageal reflux; 5) corticosteroid use within prior 6 months; 6) acknowledged smoking; and 7) preoperative forced vital capacity (FVC) <60%.

2.1 RANDOMIZATION

Patients were randomly assigned to one of two groups during final pre-admission outpatient visits. A series of random numbers were generated for two blocks of 10 patients using an onsite application (available at www.graphpad.com). The CONSORT statement[x] served as the basis for all patient randomization.

2.2 PREOPERATIVE FASTING PROTOCOL

Patients of the control group were fasted preoperatively for 6-8 hours; whereas those of the CHO group were instructed to abstain from solid food for 6 hours prior to procedures. Clear fluids were permitted up to 2 hours before scheduled operations, at which point they consumed a 12% solution of maltodextrin (25 g, Nidex Food Supplement; Nestlé, Vevey, Switzerland) in water (200 mL).

2.3 SURGICAL AND ANESTHETIC PROCEDURE

Each patient underwent bilateral thoracoscopic sympathectomy under general anesthesia. Briefly, two 5-mm incisions were made to explore the thoracic cavity, then identify and divide the thoracic sympathetic trunk. In instances of limited regional disease (facial, palmar, or axillary), corresponding sympathetic ganglia were identified and posteriorly divided. On an individual basis, diet was allowed ad libitum 3 hours after procedural completion, in accord with ACERTO guidelines[xi]; and intravenous analgesics (tramadol hydrochloride, 100 mg; dypirone, 500 mg every 4 h; or ketotifen fumarate, 100 mg every 8 h) were routinely prescribed. Hospital discharged was set for postoperative Day 1.

2.4 OUTCOME VARIABLES

All patients underwent cirtometry and spirometry testing at two points in time: the first just after outpatient randomization and the second on postoperative Day 1.

Cirtometry was undertaken by the same researcher (DBD-P), who assessed thoracic expansibility at axillary, xiphoid, and abdominal levels. A tape measure scaled in centimeters was used to measure circumferences after maximal inspiration and after maximal expiration in standing subjects. Measurements were obtained in triplicate at each level, the absolute differences between maximum values at inspiration and minimum values at expiration reflecting respective thoracic mobilities[xii].

Forced vital capacity (FVC), forced expiratory volume in one second (FEV1), forced expiratory flow between 25% and 75% of FVC (FEF 25-75%) were determined in each subject through spirometry (OneFlow FVC; Clement Clarke Int'l, Harlow, UK). As advised by the American Thoracic Society,[xiii] the best test or curve generated in the course of three attempts was considered representative.

2.5 STATISTICAL ANALYSIS

Categorical data were compared by Chi-square test or Fisher's exact test, using repeated measures ANOVA or paired *t*-test for group-wise comparisons of cirtometry and spirometry data. Standard software (SPSS for Windows 11.0; IBM, Armonk, NY, USA) sufficed for all computations, setting statistical significance at $p<0.05$.

3 RESULTS

Initially, 23 patients were enrolled for this study. Two procedures were cancelled, leaving 21 patients for randomization. Later, three control group and four CHO group members failed to meet the requisite FVC threshold of 60%. Ultimately, seven patients per group were analyzed. A flow chart of patient randomization is presented (Figure 1). There were no deaths and no postoperative complications. As planned, all patients were discharged one day after undergoing their surgical procedures. Both groups were clinically and demographically homogeneous (Table 1).

3.1 THORACIC MOBILITY

Thoracic expansibility at axillary level declined significantly in both groups (CHO, $p=0.02$; controls, $p<0.001$). Thoracic expansibility was significantly less in controls (p=0.04) at xiphoid level and also bordered on a significant decline at abdominal level (p=0.07). These findings appear in Figure 2.

3.2 FORCED VITAL CAPACITY (FVC)

Relative to preoperative determinations, significant and comparable declines in postoperative FVC values were documented in both groups (Table 2).

3.3 FORCED EXPIRATORY VOLUME IN ONE SECOND (FEV1)

As with FVC, postoperative FEV1 values were significantly lower than preoperative determinations in both groups and were comparable in group-wise comparison (Table 2).

Forced expiratory flow between 25% and 75% of FVC (FEF 25-75%)

Only in the control group were postoperative FEF 25-75% determinations significantly lower than those obtained preoperatively (Table 2 and Figure 2).

4 DISCUSSION

Herein, we assessed the pulmonary function of patients after thoracoscopic sympathectomy (in treating hyperhidrosis) to determine the impact of limited preoperative fasting. For this purpose, a CHO-enriched drink was administered 2 hours prior to surgery. Our findings confirm the safety of this practice, which now is cited in various international guidelines of anesthesia[xiv,xv]. Specifically, there were no subsequent instances of bronchial aspiration. Our chief premise was that the boost in energy achieved by departing from otherwise lengthy preoperative fasting would confer improved respiratory function. A recent study of ours in patients undergoing cholecystectomy has shown this to be true. Furthermore, Zani et al have demonstrated superior lung function (ie, peak expiratory flow, FEV1) and handgrip strength in patients whose preoperative fasting was curtailed, compared with conventionally fasted patients[xvi].

However, the present findings were more modest. Only one spirometry parameter (FEF 25-75%) differed significantly by group, showing a significant decline in postoperative testing of controls. In all other testing, both groups showed comparable postoperative declines, compared with baseline preoperative values. By cirtometry, preoperative CHO intake was associated with better thoracic expansibility at xiphoid level. While less dramatic, these outcomes are certainly aligned with those of Zani et al; and another trial involving lung resections in preoperative recipients of CHO has also registered fewer postoperative pulmonary complications and improved respiratory function, all as a consequence of reduced preoperative fasting and early postoperative energy availability[xvii] [deveria ser 16]. Thus, the cumulative body of evidence indicates that preoperative fasting should be optimized in the context of thoracic surgery (especially major interventions) to reduce related pulmonary complications.

Respiratory function generally deteriorates after abdominal or thoracic surgeries, accounting for their typically high rates of postoperative lung complications[xviii]. Furthermore, even a minor laparoscopic breach of the thoracic cavity (as in present study) may impair respiratory function, and the measurable effects of thoracoscopic sympathectomy may persist for up to one year[xix]. We have observed declines of 2-4 cm in thoracic expansibility, 42-56% in FVC, and 34-46% in FEV1. However, FEF 25-75% values are the most affected, falling ~112-116% in both test and control groups.

FEF 25-75% then remains the best test for evaluating bronchomotor tone in small airways and subsequently offers a practical and sensitive means of assessing distal airway status[19,xx]. Atelectasis is a common pulmonary complication due to collapse of small bronchi. According to our data, FEF 25-75% declined as much as 200% from preoperative baseline following surgery, and a study conducted elsewhere has shown similar postoperative and sustained FEF 25-75% declines after thoracoscopic sympathectomy[20,xxi]. This is likely due to sympathetic nerve division. Still, it is curious that FEF 25-75% was the sole test parameter to differ significantly by group in our study. This implies that airflow to small bronchi may be enhanced by curtailing preoperative fast in conjunction with CHO intake. It also corroborates the actions of others who have given CHO-enriched drinks before anesthesia to improve muscular strength[16,xxii].

This study is the first to explore the potential respiratory effects of a CHO-enriched drink consumed 2 hours before thoracoscopic sympathectomy. Although the patients tested were few, it serves as an important pilot study, fueling the need for further investigation. The findings overall lead us to conclude that reduced preoperative fasting is safe in the setting of thoracoscopic sympathectomy and may improve flow in small airways, ensuring better postoperative thoracic expansibility.

Table 1: Summary of clinical and demographic patient data by group

Variable	Group CHO	Group Control	*P*-value
Gender (n, %)			
Male	4 (57.1)	3 (42.8)	1.00
Female	3 (42.8)	7 (57.1)	
Age, yrs (mean±SD)	24±6	26±7	0.64
Diabetes	0	0	1.00
Hypertension	0	0	1.00
Weight, kg (mean±SD)	65±23	60±9	0.60
Height, cm (mean±SD)	162±14	161±9	0.82
BMI, kg/m² (mean±SD)	24.3±4.7	23.0±3.2	0.65

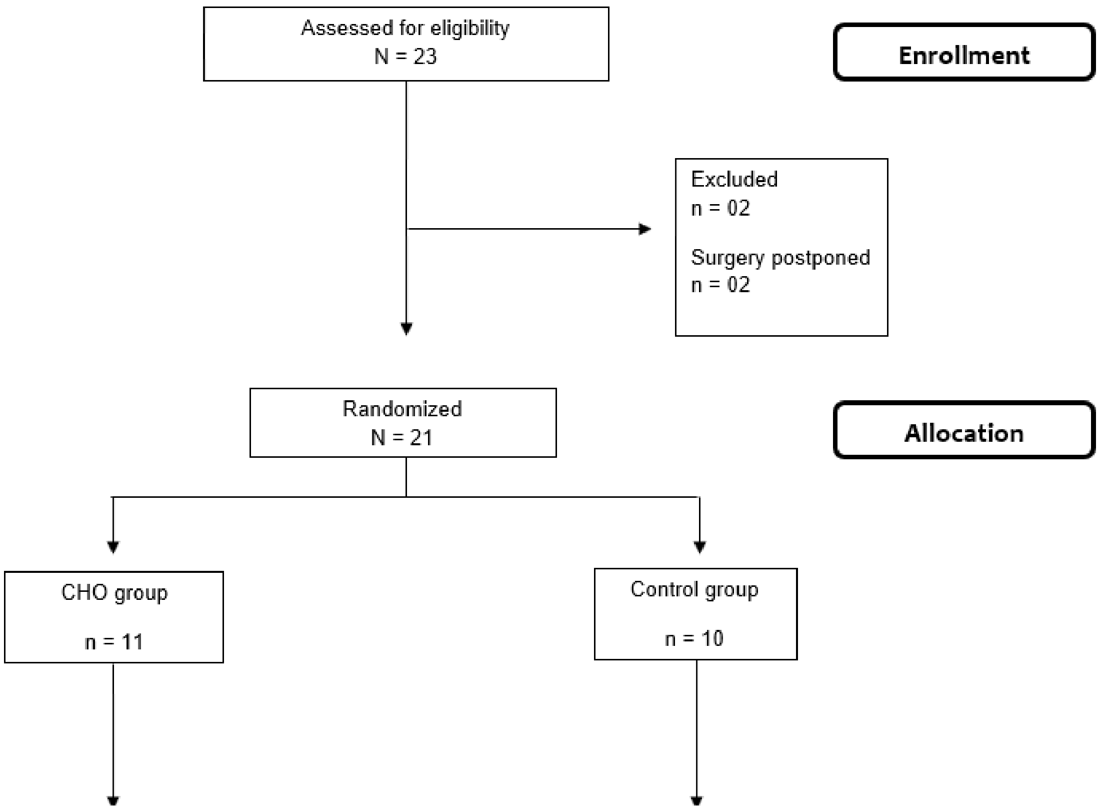
BMI: body mass index

Table 2. Pre- and postoperative spirometry results by group

FVC (%)	CHO group	Control group	*P*-value
Preoperative	97.7±31.9	124.0±41.1	0.20
Postoperative	56.7±22.1*	66.8±66.4*	0.71
FEV1 (%)			
Preoperative	75.8±27.9	92.8±16.1	0.39
Postoperative	41.3±17.2*	46.1±23.2*	0.61
FEF 25-75%			
Preoperative	178.5±134.4	180.7±90.8	0.97
Postoperative	66.7±48.2	64.5±30.8*	0.92

**p*=0.01 compared with preoperative baseline in same group
FVC, forced vital capacity; FEV1, forced expiratory volume in one second; FEF 25-75%, forced expiratory flow between 25% and 75% of FVC

Figure 1: Flowchart of patient randomization



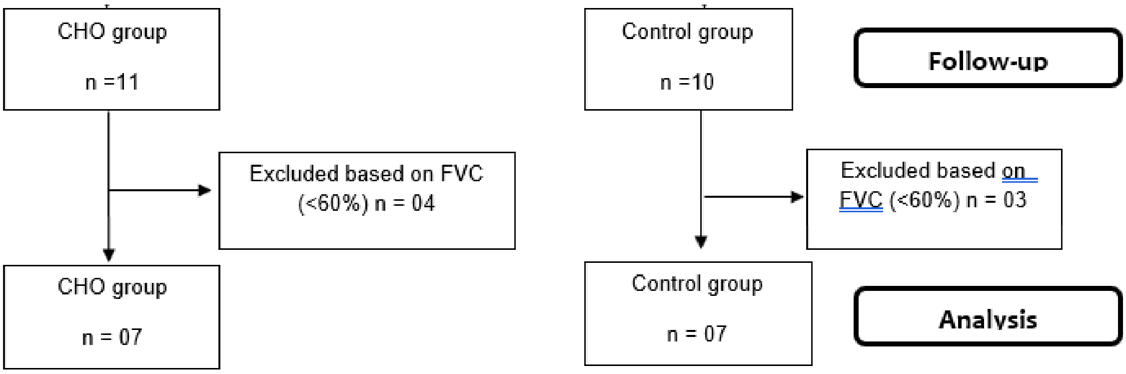
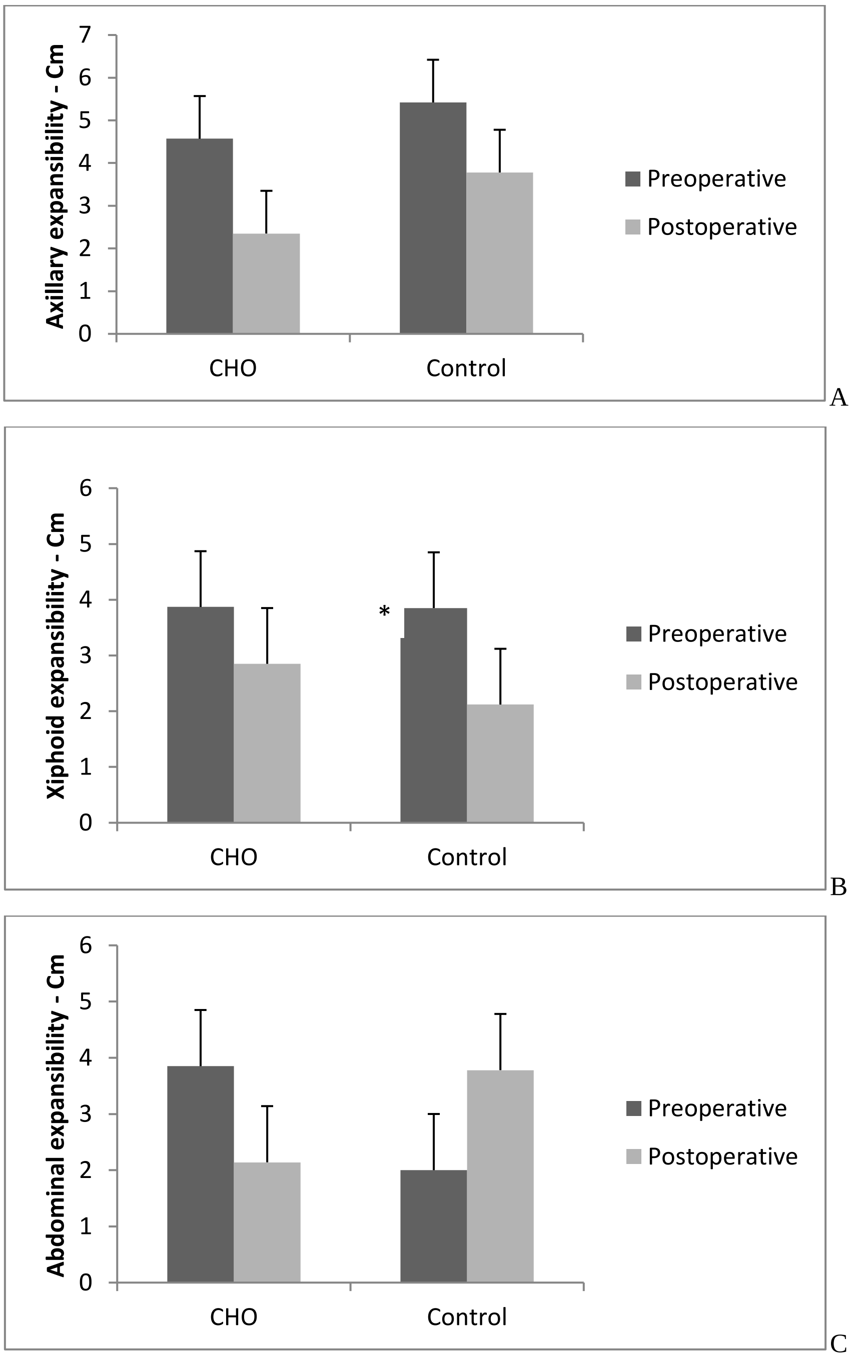


Figure 2: Changes in thoracic expansibility by group at (A) axilla, (B) xiphoid, and (C) abdomen



Data expressed as mean±SD

*$p<0.05$ compared with preoperative baseline in same group (paired Student's *t*-test)

Bullet points

- Limited preoperative fasting with CHO intake may enhance postsurgical recovery
- Preoperative CHO intake serves to improve respiratory muscle function
- Basilar thoracic expansibility is maintained postoperatively by CHO intake prior to thoracoscopic sympathectomy
- Small airway fluctuations may be mitigated by CHO intake 2 hours before surgery

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