International Journal of Community Medicine and Public Health
Chilkapurwar RR et al. Int J Community Med Public Health. 2024 Mar;11(3):1322-1326
http://www.ijcmph.com
pISSN 2394-6032 | eISSN 2394-6040

DOI: https://dx.doi.org/10.18203/2394-6040.ijcmph20240638

Short Communication

Effect of Buteyko breathing technique on peak expiratory flow rate in patients undergone upper abdominal surgery

Ruchita Rao Chilkapurwar*, Abhijit D. Diwate, Arijit K. Das

Department Cardiovascular and Respiratory Physiotherapy, DVVPFs College of Physiotherapy, Ahmednagar, Maharashtra, India

Received: 17 December 2023
Revised: 01 February 2024
Accepted: 02 February 2024

***Correspondence:**
Dr. Ruchita Rao Chilkapurwar,
E-mail: chilkapurwar24@gmail.com

ABSTRACT

Upper abdominal surgery (UAS) alters postoperative pulmonary function, as observed by impairment of lung volumes such as total lung capacity, vital capacity. Impaired clearance of sputum results in a vicious cycle of colonization and infection of bronchi with pathogenic organisms, dilation of bronchi and further sputum production. Ten patients undergone UAS were assigned randomly in two groupsequally; their ages ranged from 23 to 60 years. The group A received Buteyko breathing. The data were collected before and after the same treatment period for both groups. The evaluation procedure was carried out to measure peak expiratory flow meter. Post treatment evaluation showed a significant difference in peak expiratory flow meter in both groups but in the favor of group A. Post treatment result showed a significant differencewithin the group. The post treatment value of group A was 272 which was better than group B which was 172. Combination of Buteyko breathing with conventional physiotherapy were considered to bean effective exercise for postoperative pulmonary complications after upper abdominal surgeries.

Keywords: UAS, Buteyko breathing technique, Peak expiratory flow rate

INTRODUCTION

Surgery of the abdomen and UAS includes a large amount of general surgery. These surgeries deal with complications, risks, and consequences related to a range of procedures under the broad headings of general abdominal (laparotomy), esophageal surgery, gastric surgery, obesity surgery, small bowel surgery, biliary and duodenal surgery, liver surgery, and pancreatic surgery.[1] The global burden of functional gastrointestinal disorders according to worldwide prevalence and burden of functional gastrointestinal disorders, results of Rome foundation global study is >40%.[2] FGIDs were more prevalent among women than men. In India, infectious diseases accounted for 454 million of 490 million cases of GI and liver disorders in 2016.[3] The type of laparotomy, procedure, and patient characteristics broadly indicate the risks and complications.[4] Wound infection, small bowel obstruction, enterocutaneous fistula, and incision hernia are significant complications and consequences that should also be mentioned. However, the less common nature of these can be emphasized to the patient.[5] UAS includes a bunch of pathophysiological responses, which cause post-operative pulmonary complications (PPCs). Postoperative pulmonary complication includes atelectasis, pleural effusion, pneumonia, pulmonary edema, acute respiratory distress syndrome, and pneumothorax.[6] Surgical duration, anesthesia and nociception impairment, respiratory function impairment, mucociliary clearance depression and suppression the cough reflex leading to secretion retention and reduced lung volumes, thereby contributing to atelectasis and the development of infection.[7] The reported incidence of post operative pulmonary complications in UAS is between 10% and 50% of patients.[8] Patients who undergo abdominal surgery receive general anesthesia. The

adverse respiratory effect such as depression of the central respiratory drive caused by administering these anesthetic agents for surgery leads to unconsciousness, muscle relaxation, and analgesia, known as the triad effect.[9] The block in the neuro transmission process impairs the activity. It causes relaxation of the respiratory muscles, especially the diaphragm, which assumes a relaxed dome shape, thus impairing the respiratory muscle function.[10] The ventilatory responses to hypercapnia and hypoxia are significantly impaired even at low doses of anesthetic drugs. As a result, hypercapnia is the norm unless artificial ventilation is used, and severe hypoxemia.[11]

The reduction in the diaphragmatic activity and ventilatory responses decreases lung volume. Anesthesia and surgery are usually associated with a reduction in functional residual and vital capacity; FRC may fall to about 70% of its pre-operation level and remain depressed for several days.[12] Buteyko breathing exercises have evolved since the 1960s, when Dr. Konstantin Buteyko, MD, PhD, developed his first respiratory technique.[13] The mechanism behind BBT cab be understood by three steps 1. normal breathing 2. control pauses 3. relaxed reduced volume breathing.[14] Breath stacking is an exercise that helps improve and maintain the breath size you can take and can be used regularly to clear mucus from the respiratory tract (secretion clearance).[15]

METHODS

Recruitment samples

After obtaining ethical clearance from institutional ethical committee samples were recruited who have undergone UAS in the tertiary care hospital. Convenient sampling method is utilized. The duration of the study was 3 months. It was started in August 2023 and completed in October 2023.

Evaluation

All patients were explained about the study procedure and benefits of the current research work. Informed written and verbal consent was taken from all the patients earlier included in the study. Demographic data of patients including name, age, gender, occupation, any history of systemic diseases and medications were documented. All participants were explained about the precautions and instruction during the intervention sessions.

Intervention

Treatment was carried out for 5 days for each patient.

Group A received Buteyko breathing technique with conventional physiotherapy treatment group B received stacked breathing technique with conventional physiotherapy treatmentIntervention

Patients of both the gender with age group of 18 to 70 were selected on the basis of inclusion criteria. Detailed subjective assessments was done to rule out any abnormalities before proceeding for treatment. The purpose of this study and the treatment was post-operatively explained to the entire subject population and was educated regarding the same.

Similar post-operative medical care in terms of ventilation and pain medications and standardinstitutional rehabilitation protocol (e.g., bedside mobilizations and ambulation) was followed for all the patients as per the hospital policy. Chest physiotherapy intervention with respect to the study, was started on POD 1 for both groups. The average time for treatment ranged between 20 min to 40 min.

Group A step 1: Exercise session included Buteyko breathing with conventional physiotherapy. The patients were sitting upright and adapted a good posture with relaxed shoulders and rested lower back. She/he can't change breathing before taking CP. Patient was asked to take a small breath in and a small breath out hold nose on the "out" breath, with empty lungs but not too empty until feeling the first need to breathe in. Release nose and breathe in through it.

Step 2: Shallow breathing: To monitor the amount of air flowing through his/her nostrils by placing his/her finger under the nose in a horizontal position. Then, to breathe air slightly into the tip of his/her nostrils. For example, just take enough air to fill the nostrils and no more. Breathe in a flicker of air with each breath. The patient was asked to exhale that to pretend that his/her finger is a feather, and to breathe out gently onto his/her finger so that the feather does not move. Breathe out and to concentrate on calming his/her breath to reduce the amount of warm air he/she feel on the finger.

Step 3: Putting it together: Take CP. Reduced breathing for 3 min. Take CP. Reduced breathing for 3 min. Take CP. Reduced breathing for 3min. Take CP. Reduced breathing for 3 min. Take CP. Reduced breathing for 3 min.

Group B included stacked breathing exercises with conventional physiotherapy. Patient was in high sitting position on the bed with continuous monitoring of hemodynamic parameters, including oxygen saturation, pulse rate, non-invasive blood pressure, respiratory rate and pre-exercise peak expiratory flow rate were measured by peak flow meter.

Ask the patient to take a deep breath and take 3-4 breath one over another till the fullness experience in the chest.

Hold the breath for a maximum of 10 seconds.

Ask to expire air by pursed lip breathing or huffing or splinted coughing (if secretion ispresent)

Wait for 15-30 before repeating to allow relaxation, ten repetition and two times daily onPOD 1 to POD5

RESULTS

The total calculated sample size was 10. They were divided into two groups; BBT group A and SBT group B. Each group contained 05. Total 24 patients were screened in which according to the inclusion and exclusion criteria only 10 patients were selected. Finally, 10 patients (05 in BBT group A and 05 in the SBT group B) completed the study protocol and were included for data analysis. Post treatment evaluation showed a significant difference in peak expiratory flow meter in both groups but in the favor of group A. Post treatment result showed a significant difference within the group. The post treatment value of group A was 272 which was better than group B which was 172.

Table 1: Parameters and sample variable of group A and group B.

Parameters	Sample variable, (n=05) group A, BBT	Sample variable, (n=05) group B, SBT
Male, n (%)	80	80
Female, n (%)	20	20
Age (In years)	39.6±7.092	44.2±17.68
Weight (kg)	65.4±6.542	65.6±3.782
Height (cm)	169.6±7.26	162.4±6.06
BMI (kg/m^2)	22.68±0.76	24.88±0.77

Table 2: Mean and standard deviation of the outcome of group A and group B.

Outcome	Group A BBT		Group B SBT	
	Mean	Standard deviation	Mean	Standard deviation
PEFR predicted	470.2	72.17	459.2	31.44
PEFR performed	120	17.32	90	20
Follow up	272	63	174	51
PEFR % reduction	74.42	2.08	79.25	62.05

Table 3: Comparison between both the groups.

Baseline PEFR				Follow up PEFR			
Group A BBT	**Group B SBT**	**P value**	**T value**	**Group ABBT**	**Group BSBT**	**P value**	**T value**
120	90	0.0167	3.162	272	174	0.016	3.955

Table 4: Comparison between baseline and follow up of the both the groups.

Group A BBT PEFR				Group B SBT PEFR			
Baseline	**Follow up**	**P value**	**T value**	**Baseline**	**Followup**	**P value**	**T value**
120	272	0.0029	6.517	90	174	0.0067	5.150

DISCUSSION

Abdominal surgeries are mostly performed under general anesthesia which impairs respiratory muscle function. Respiratory muscle function impairment leads to reduced vital capacity and FRC.[16] Because of anesthesia respiratory system is depressed which affect cough reflex.[17] There is a reduction in functional residual capacity (FRC), of inspiratory (IRV) and expiratory reserve volumes (ERV) and vital capacity (VC), also causing a reduction in expiratory flow, probably due to the reduced diaphragmatic activity.[18] Physiotherapy has a mainstay in management of post-surgical complications.[19]

Peak expiratory flow rate

Peak expiratory flow rate is an important measure to evaluate the patient's expiratory capacity post abdominal surgery as the PEFR is severely affected post-abdominal surgery. In the present study patients were having more reduction in PEFR on POD 1 group A 120 and group B 90 if compared to POD 5 which improved to group A 272 and group B 174. Peak expiratory flow rates improved in both groups post treatment with group A and group B (Table 3). Group A showed significant improvement as compared to the group B. In within the group analysis both the groups showed significant improvement as a result of stacked breathing and Buteyko breathing given to the respective groups. As the present study showed reduced PEFR in baseline in both the groups with (p=0.0167) (Table 1) which can be the result of pain, reduced diaphragmatic movement and retained secretions. As both breathing exercises improves the basal expansion with the help of inspiratory and expiratory hold. the results on POD 5B showed significant improvement. Ford et al studied 15 patients undergoing upper abdominal

surgeries and his data indicated reduced diaphragm activity in the postoperative period, with a shift from predominantly abdominal to rib cage breathing. There was a reversal toward normal function by 24 hours[20]. This reduction in diaphragm function may be responsible for the atelectasis, reduced vital capacity, and hypoxemia in postoperative patients. This was confirmed in the study done by Julie et al in which PEFR was found to be significantly reduced at 60 minutes, 24 hour and 48 hours after UAS.[21] According to ciao et. al. peak of postoperative diaphragm dysfunction occurs in the period between two to eight hours after surgery, returning to preoperative values in seven to ten days, interfering in most spirometric values, including PEF.[22] In the present study the percent reduction values have improved within 5 days. The limitation of the study includes the smaller sample size and a wide age gap between the patients which could have been specified.

CONCLUSION

The present study shows that Buteyko Breathing has showed more statistically significant results as compared to Stacked Breathing Technique. The PEFR has improved in the group A as compared to the group B. So, Buteyko Breathing Technique can be utilized in patients with abdominal surgery in the rehabilitation of the patients.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Shah D, Makharia GK, Ghoshal UC, Varma S, Ahuja V, Hutfless S. Burden of gastrointestinal and liver diseases in India, 1990-2016. Indian J Gastroenterol. 2018;37(5):439-45.
2. Sperber AD, Bangdiwala SI, Drossman DA, Ghoshal UC, Simren M, Tack J. Worldwide Prevalence and Burden of Functional Gastrointestinal Disorders, Results of Rome Foundation Global Study. Gastroenterology. 2021;160(1):99-114.
3. Overend TJ, Anderson CM, Lucy SD, Bhatia C, Jonsson BI, Timmermans C. The Effect of Incentive Spirometry on Postoperative Pulmonary Complications. Chest. 2001;120(3):971-8.
4. Sanya AO, Akinremi AO. Effects of breathing exercise training on selected pulmonary indices in post-abdominal surgery patients. Nig J Clin Pract. 2001;4(2):91-5.
5. De Cleva R, De Assumpção MS, Sasaya F, Chaves NZ, Santo MA, Fló C et al. Correlation between intra-abdominal pressure and pulmonary volumes after superior and inferior abdominal surgery. Clinics (Sao Paulo). 2014;69(7):483-6.
6. Patman S, Bartley A, Ferraz A, Bunting C. Physiotherapy in upper abdominal surgery-what is current practice in Australia? Arch Physiother. 2017;7(1):11.
7. Emily F, Fatima A. Incentive Spirometer and Inspiratory Muscle Training - StatPearls - NCBI Bookshelf. 2022.
8. Fernandes DDL, Camponogara NR, Léo JRN, Jéssica MB, Caroline MP, Carolina ZMR et al. Effect of deep breathing exercise on oxygenation of patients under major abdominal surgery: randomized clinical trial. J Surg. 2021;8-16.
9. Maillard J, Elia N, Haller CS, Delhumeau C, Walder B. Preoperative and early postoperative quality of life after major surgery - a prospective observational study. Health Qual Life Outcomes. 2015;13:12.
10. 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;j5916.
11. Gilbert C, Chaitow L, Bradley D. Recognizing and Treating Breathing Disorders. Elsevier Health Sci. 2014;321.
12. Coventry BJ. Upper Abdominal Surgery. London: Springer London. 2014;5436-5.
13. 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.
14. Using an incentive spirometer: MedlinePlus Medical Encyclopedia. Available at: https://medlineplus.gov/ency/patientinstructions/000451.htm. Accessed on 17 December, 2023.
15. Da Luz Fernandes D, Camponogara Righi N, José Rubin Neto L, Michelon Bellé J, Montagner Pippi C, Zeni do Monte Ribas C et al. Effects of the breath stacking technique after upper abdominal surgery: a randomized clinical trial. J Bras Pneumol. 2022;e20210280.
16. Harris J. Disorders of the arterial system. In: Tjandra J, Clunie G, Kaye A, Smith J (eds) Textbook of surgery. Blackwell Publishing, Massachusetts. 2006.
17. Shirodkar S, Deo M, Joshi M. The Effect of Breathing Exercise and Incentive Spirometry versus Breathing Exercise and EzPAP® on Flow Rates and Chest Expansion in Post Abdominal Surgery Patients: A Randomized Controlled Trial. International Journal of Health Sciences and Research. 2022;10;12(5):57-63.
18. Tyson AF, Kendig CE, Mabedi C, Cairns BA, Charles AG. The effect of incentive spirometry on postoperative pulmonary function following laparotomy: a randomized clinical trial. JAMA Surg. 2015;150(3):229-36.
19. Geralemou S, Probst S, Gan TJ. The role of capnography to prevent postoperative respiratory adverse events. APSF Newsl. 2016;31:42-3.
20. Sasaki N, Meyer MJ, Eikermann M. Postoperative respiratory muscle dysfunction pathophysiology and preventive strategies. Anesthesiology.

2013;118(4):961-78.
21. Treschan T, Kaisers W, Schaefer M, Bastin B, Schmalz U, Wania V et al. Ventilation with low tidal volumes during upper abdominal surgery does not improve postoperative lung function. Br J Anaesth. 2012; 109(2):263-71.
22. Olayan LH. Implementation of a perioperative respiratory care bundle to improve respiratory outcomes following major abdominal surgery, PhD thesis. Birmingham (UK): University of Birmingham. 2021.

Cite this article as: Chilkapurwar RR, Diwate AD, Das AK. Effect of Buteyko breathing technique on peak expiratory flow rate in patients undergone upper abdominal surgery. Int J Community Med Public Health 2024;11:1322-6.