ROLE OF INCENTIVE SPIROMETRY ON MANAGEMENT OF POSTOPERATIVE PULMONARY COMPLICATIONS IN ELDERLY UROLOGY PATIENTS

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Abstract

Background: *Incentive spirometry (IS) is a device used to improve pulmonary function. It is a device that provides patients with visual feedback when they inhale at a predetermined flow rate/volume, sustain the inflation for a minimum of 3 seconds, and then expire. It is postulated that incentive spirometry (IS) might play a significant role in preventing and treating postoperative pulmonary complications. However, we need more research-based information on this issue.*

Objective: *The aim of the study was to assess the effectiveness of incentive spirometry in improving pulmonary function following urologic surgery in elderly patients.*

Methods: *This comparative study was conducted in the department of Urology, Dhaka medical college hospital (DMCH), Dhaka, Bangladesh, from January 2021 to December 2021. In total, 150 elderly people were included as the study subjects. The total subjects were divided into two groups. In group A, there were 75 patients who received incentive spirometry in addition to deep breathing, coughing and early ambulation. In Group B, there were also 75 patients, denoted as control group patients, who received standard care of treatment including deep breathing, coughing and early ambulation without incentive spirometry. All data were collected, processed, and analyzed by using MS Office and SPSS-18 programs as per need.*

Results: *In this study in incentive spirometry, postoperative VAS, FVC, FEV1, and FEV1/FVC scores were 5.29±1.73, 1.25±0.61, 1.21±0.45 and 88.61±18.44 respectively. On the other hand, in Group B (Non incentive spirometry), postoperative VAS, FVC, FEV1, and FEV1/FVC scores were 5.71±1.57, 1.14±0.56, 1.09±0.22 and 91.57±19.91 respectively. We found a significant correlation in comparing FEV1 (Forced Expiratory Volume) between both groups, with a P value of 0.040. In this study, in Group A (IS), only 8% of elderly patients of urological surgery were found with postoperative pulmonary complications. On the other hand, in patients without using Incentive spirometry, one-fifth (20%) were with postoperative pulmonary complications.*

Conclusion: *As per the findings of this study, both treatment methods are effective. But patients' compliance may be better in applying Incentive spirometry (IS) in urological surgery in elderly patients. Physicians can minimize the possibilities of postoperative pulmonary complications by using Incentive spirometry.*

Keywords: *Incentive spirometry, Postoperative pulmonary complications, PPC, Urology Elderly patients.*

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Introduction

Incentive spirometry (IS) is a device used to improve pulmonary function. It is a device that provides patients with visual feedback when they inhale at a predetermined flow rate/volume, sustain the inflation for a minimum of 3 seconds, and then expire. In the 1960s, intermittent positive pressure breathing (IPPB) was commonly used to prevent postoperative pulmonary complications.[1] However, IPPB came under scrutiny at the Sugarloaf Conference, where it was determined that there was

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insufficient evidence to support its use.[2,3] Coincidental with the criticism of IPPB, the incentive spirometer was introduced by Bartlett et al.[4] after observations that, for postoperative patients, yawning might generate pulmonary benefits. The group constructed a device to coach patients to emulate a yawning-like sustained maximal inspiration to prevent atelectasis, deciding that it was the sustained inspiration of yawning that yielded the benefit.[1] In 1973, the Bartlett-Edwards IS device was introduced to incentivize deep breathing by providing visual light feedback when patients achieved their inspiratory target volume.[4] In 1975, the Spirocare device further enhanced the "electronic IS visual feedback" by putting the "display lights" on a scale indicating increasingly larger inspiratory volumes, attempting to gamify patient engagement and adherence.[5] The major causes of PPCs (Postoperative pulmonary complications) may be shallow breathing and monotonous tidal volume in postoperative patients.[6] Other causes, such as opioid analgesia, anaesthesia and postoperative pain, also seem to contribute to this ventilation pattern without spontaneous deep breaths that occur every 5 or 10 minutes.[7] Techniques such as incentive spirometry, repeated deep inspiration and positive airway pressure exercises stimulate the generation of a significant and sustained rise in transpulmonary pressure, which helps expand collapsed alveolar units to prevent and treat the PPCs (Postoperative pulmonary complications).[8] Incentive spirometry (IS) has been widely used in clinical practices,[9] especially in managing patients in the pre-and postoperative period of major surgeries, because of its cost-effectiveness, ease of application and excellent adherence of patients to the method.[10]

Objective

To assess incentive spirometry's effectiveness in improving pulmonary function following urologic surgery in elderly patients.

Methodology

This comparative study was conducted in the department of Urology, Dhaka medical college hospital (DMCH), Dhaka, Bangladesh, from January 2021to December 2021. One hundred fifty elderly patients selected for urologic surgery under general anaesthesia in the Department of Urology in DMCH were included as the study population. The Ethical Committee of the mentioned hospital approved the study. As per the inclusion criteria of this study, only elderly patients of >60 years from both genders were included. On the other hand, as per the exclusion criteria of this study, patients with the necessity of regional or local anaesthesia or prolonged mechanical ventilation in ICU, a history of previous pulmonary disease or congestive cardiac failure and patients with intraoperative cardiac arrest were excluded. A total of 150 patients were divided into two groups. In group A, 75 patients received incentive spirometry in addition to deep breathing, coughing and early ambulation. On the other hand, in Group B, there were also 75 patients denoted as control group patients who received standard care of treatment, including deep breathing, coughing and early ambulation without incentive spirometry. All patients received a standard prophylactic antibiotic, postoperative pain control and instructions for deep breathing, coughing and early ambulation. Group A patients were instructed to use the incentive spirometry every hour, but no such instructions will be given to group B patients. The primary outcomes were measured by the changes in pulmonary function using forced vital capacity measurements between the patient's first and last measurements, along with first and last measurements with pulmonary complications like atelectasis, pneumonia etc. secondary outcomes were measured by the length of hospital stay and mortality. Postoperative pain was measured by VAS (Visual Analogue Scale)[11], and expiratory flow was measured by FVC (Forced Vital Capacity) and FEV (Forced Expiratory Volume)[12] measurement. All the data were compiled and sorted correctly, and the numerical data were analyzed statistically using SPSS version 28.0. The results were expressed as a percentage and mean ± SD and P Â0.05 were considered the significance level. The change in different scores and values was calculated by subtracting the end value from the initial value and was expressed as a percentage. Comparison between the groups was made by the student's t-test and chi-squared test.

Result

This study divided 150 elderly patients with urological surgery into two groups. In group A, 75 patients received incentive spirometry in addition to deep breathing, coughing and early ambulation as study group. In group B, there were also 75 patients denoted as control group patients, who received standard care of treatment including deep breathing, coughing and early ambulation without incentive spirometry. In the group, there were 76% male participants, and the rest 24% were female. On the other hand, in group B, 79% of participants were male participants, and the rest 21% were female (Table I). So, in both groups, male participants were dominating in number. In our study, in analyzing the pulmonary function test through both the methods, in pre-and postoperative stages against VAS, FVC, FEV1 and FEV1/FVC scores, we found exceptionally statistically significant correlations between the groups (Table III). In this study, in group A (IS), postoperative VAS, FVC, FEV1, and FEV1/FVC scores were 5.29±1.73, 1.25±0.61, 1.21±0.45 and 88.61±18.44 respectively (Table IV). On the other hand, in group B (Non-IS), postoperative VAS, FVC, FEV1, and FEV1/FVC scores were 5.71±1.57, 1.14±0.56, 1.09±0.22 and 91.57±19.91 respectively (Table IV). In addition, we found a significant correlation in comparing FEV1 (Forced Expiratory Volume) between both groups only, where the p-value was 0.040. In this study, in group A (IS), only 8% of elderly patients of urological surgery were found with postoperative pulmonary compli-cations. On the other hand, in patients without Incentive spirometry, one-fifth (20%) were with postoperative pulmonary complications (TableV).

Table-I

Age and gender distribution of participants (N=150)

Variables	Group A (n=75)		Group B (n=75)	
Age distribution (Mean ± SD)				
Age	54.13±3.16		54.13±3.16	
Gender distribution (%)				
Male	57	76%	59	79%
Female	18	24%	16	21%

Table-II

Effect of Incentive spirometry on pulmonary function test of group A (n=75)

Variables	Pre-operative	Post-operative	P value
VAS	Not measured	5.29±1.73	
FVC	2.69±1.12	1.25±0.61	<0.0001
FEV1	1.92±0.96	1.21±0.45	<0.0001
FEV1/FVC	76.84±22.47	88.61±18.44	0.0006

Table III

Effect of deep breathing on pulmonary function test of group B (n=75)

Variables	Pre-operative	Post-operative	P value
VAS	Not measured	5.71±1.57	
FVC	2.67±1.08	1.14±0.56	<0.0001
FEV1	1.88±1.02	1.09±0.22	<0.0001
FEV1/FVC	75.74±19.54	91.57±19.91	<0.0001

Table IV

Comparison of post-operative variables between two groups (N=150)

Study variables	Group A	Group B	P value
VAS	5.29±1.73	5.71±1.57	0.122
FVC	1.25±0.61	1.14±0.56	0.252
FEV1	1.21±0.45	1.09±0.22	0.040
FEV1/FVC	88.61±18.44	91.57±19.91	0.346

Table V

Comparison of post-operative complications between two groups (N=150)

Variables	Group A		Group B	
	n	%	n	%
Respiratory failure	3	4.0%	7	9.33%
Postoperative hypoxaemia	1	1.33%	4	5.33%
Tracheobronchial infection	2	2.67%	3	4.0%
Atelectasis	0	0.0%	1	1.33%

Discussion

This study aimed to assess the effectiveness of incentive spirometry in improving pulmonary function following urologic surgery in elderly patients. In this study, there were 76% of the male participants in the group, and the

remaining 24% were female. On the other hand, in group B there, 79% of participants were male participants, and the rest 21% were female. So, in both groups, male participants were dominating in number. In a study, it was reported that there were no significant differences between the groups in relation to FEV1 and FVC, corroborating data of Crowe and Bradley[13], who also observed that no significant differences in recovery of values of FVC and FEV1 in comparing the fulfilment of respiratory physiotherapy with respiratory physiotherapy associated to IS. In this study, in group A (IS), post-operative VAS, FVC, FEV1, and FEV1/FVC scores were 5.29±1.73, 1.25±0.61, 1.21±0.45 and 88.61±18.44 respectively. On the other hand, in group B (Non-IS), post-operative VAS, FVC, FEV1, and FEV1/FVC scores were 5.71±1.57, 1.14±0.56, 1.09±0.22 and 91.57±19.91 respectively. We found a significant correlation in comparing FEV1 (Forced Expiratory Volume) between both groups only, where the p-value was 0.040. Jenkins et al.[14] compared IS, DBE and control group, coughing/huffing and observed that there was no difference between groups in the recovery of pulmonary function or incidence of pulmonary complications. However, Westerdahl et al.[15] have found by chest computed tomography (CT) and arterial gasometry that DBE caused a significant reduction in areas of atelectasis and improvement in oxygenation. Corroborating the complexity of variables involved in this context, Celli et al.[16] On the other hand, Romanini et al.[17] found significant improvement by using IS, which was evident in the group's exercises with IPPB. In this study, in group A (IS), only 8% of elderly urological surgery patients had post-operative pulmonary complications.

On the other hand, in patients without Incentive spirometry, one-fifth (20%) were with postoperative pulmonary complications. Although the patients in a study[18] were guided to perform ten repetitions for every waking hour, the mean rate of the fulfilment of breathing exercises was less than that observed. Stiller et al.[19] assessed the quantity of care offered to patients during the day and whether the intensity of treatment may influence the results and also found the same incidence of pulmonary complications.

Limitation of the study

As it was a single-center study with a small sample size, the findings of this study may not reflect the exact scenario of the whole country.

Conclusion & recommendation

As per the findings of this study, we can conclude that both treatment methods are effective. But patients' compliance may be better in applying Incentive spirometry (IS) for such purposes because forced expiratory volume was found to be some higher in using Incentive spirometry. To get more specific findings, we recommend conducting similar studies with larger-sized samples in several places. The surgeon can minimize the possibilities of postoperative pulmonary complications by using Incentive spirometry.

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Conflict of interest: *None declared.*

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