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Evaluation of Bronchoscopic Lung Insufflation in the Management of Patients with Lung Collapse

ABBAS S. EL-MARAGHY, M.D.; AHMED A. ABU NAGLAH, M.D.; MOUSTAFA A. ZEDAN, M.D. and SAMEH U. NOUR, M.Sc.

The Department of Chest Diseases, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

Abstract

Background: Pulmonary atelectasis is one of the most commonly encountered abnormalities in chest radiographs. Flexible Bronchoscopy (FB) has been of great help in the management of many pulmonary conditions. Bronchoscopic insufflation of atelectatic portions of the lung can be safe and effective in treating acute lung collapse which is refractory to conventional therapy.

Aim of Study: To evaluate the safety and effectiveness of bronchoscopic lung insufflation in the management of Egyptian patients with lung collapse.

Subjects and Methods: An experimental cross-sectional study was carried out on 40 patients admitted in Al-Hussein and Sayed Galal Al-Azhar University Hospitals in the period from March 2016 to March 2018. Patients with acute partial or complete lung collapse that failed to re-expand with conventional methods (physiotherapy or lung recruitment manoeuvers) or those with rapidly aggravated collapse were included. The patients, after failed conventional methods, were categorized into two groups: Group 1: Included thirty-six patients managed by bronchoscopic toilet and suction only. (Thirty patients with success bronchoscopic suction and six patients whom collapse failed to expand with bronchoscopic suction). Group 2: Include ten patients managed by bronchoscopic insufflation technique either immediately in cases of rapidly aggravated collapse (four patients) or after failed initial bronchoscopic toilet and suction (six patients).

Results: Thoracic and upper abdominal operations caused significant numbers of postoperative lung collapse with lower lobes mostly affected. The mean value of PaO_2 was significantly improved after the bronchoscopic insufflation procedure (74.3± 10.4 vs. 60.9±9.7mmHg, p<0.001). The success rate of bronchoscopic insufflation was 80% in the first 24 hours with no significant procedure-related complications. Recurrence of collapse within 2 weeks follow-up was noted in pre-existing pulmonary disease, but was significant in smokers (p=0.022). Late intervention after 72 hours was associated with failed lung expansion.

Conclusion: Bronchoscopic insufflation was highly successful in treating lung collapse and improving lung oxygenation without significant complications.

Key Words: *Lung collapse – Bronchoscopic insufflation.*

Correspondence to: Dr. Sameh U. Nour, The Department of Chest Diseases, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

Introduction

LUNG collapse or atelectasis is loss of volume of a lung, lobe, or segment mainly due to obstruction of a major bronchus by tumor, foreign body, or bronchial plug [1]. Management of lung collapse depends firstly on non-pharmacologic therapies for improving cough and clearance of secretions from the airways [2]. Alveolar recruitment manoeuvres aimed at opening unstable airless alveoli thus increasing end-expiratory lung volume and improving gas exchange [3]. Bronchoscopic insufflation of atelectatic portions of the lung has been also described. It can be safe and effective in treating acute lung collapse which is refractory to conventional therapy [4]. The idea of insufflation is based conceptually on the idea that while mucus plugs may lead to atelectasis, their removal may not be sufficient to correct the defect. The addition of high pressures may overcome the high critical opening pressure and reduced lung compliance of the atelectatic lung [5].

Subjects and Methods

Design and setting: An experimental cross-sectional study was carried out on 40 Egyptian patients (16 females and 24 males) admitted in Al-Hussein and Sayed Galal Al-Azhar University Hospitals in the period from March 2016 to March 2018. Patients with acute lung collapse that failed to re-expand with conventional methods (chest physiotherapy or lung recruitment manoeuvers) were included.

All studied cases were subjected to: Full history taking, clinical examination, chest X-ray before and after the procedure, thoracic ultrasound, arterial blood gas analysis, C.T. chest, and a trial to treat the collapse by non-invasive techniques. If these measures failed to fully or partially re-expand the collapsed area, fiberoptic bronchoscopic suction was done and if failed, fiberoptic bronchoscopic lung insufflation was done. Insufflation was also immediately considered in rapidly aggravated collapse. The patient was monitored during the procedure and followed-up 2 weeks after the procedure. The patients, after failed conventional methods, were categorized into two groups: Group 1: Included thirty-six patients managed by bronchoscopic toilet and suction only. (Thirty patients with success bronchoscopic suction and six patients whom collapse failed to expand with bronchoscopic suction). Group 2: Include ten patients managed by bronchoscopic insufflation technique either immediately in cases of rapidly aggravated collapse (four patients) or after failed initial bronchoscopic toilet and suction (six patients).

Exclusion criteria include: (1) Patients with obstructive lung collapse due to endobronchial obstruction by foreign body or tissue occluding the airway. (2) Patients with lung collapse due to extra-bronchial compression by tumor, lymph node, or pleural problems (e.g. effusion or pneumothorax). (3) Patients with reduced lung compliance who might not tolerate pressurized insufflation technique (like ARDS). (4) Patients with longstanding collapse.

The device: Rubber three-way connections; one way connected to pressure manometer, 2 nd way was connected to inflation bulb of a sphygmomanometer, while the 3rd way was connected to the working channel of the bronchoscope and the components were tightly sealed to avoid air leaks. Fig. (1).

Fig. (1): Insufflation device with three way rubber connections.

Procedure:

The monitored patient was laying supine after I.V. access was obtained. Topical analgesic was applied to the nose and pharynx with or without conscious sedation according to the patient status. Bronchoscope was advanced through the patient airways toward the collapsed area, and then was wedged into the collapsed segment or all the segments of the collapsed lobe and insufflation was done 5-10 times at regular intervals under pressure not exceeding 20mmHg to avoid barotrauma and the patient hemodynamics were monitored. An inflation bulb with attached manometer was used and a maximum of five insufflations in two minutes were done to relieve most collapses.

Ethical consideration:

Ethical clearance was obtained from the Research Ethical Committee at Al-Hussein University Hospital. Procedures were performed after obtaining a signed written informed consent from patients or their relatives. Privacy and confidentiality were maintained throughout the study process. Subjects or their relatives received written notification of the intervention results.

Statistical analysis:

Data were analyzed using the SPSS computer package Version 21.0 (SPSS Inc., Chicago, IL, USA). For descriptive statistics; the mean $\pm$ SD was used for quantitative variables while the number and percentage were used for qualitative variables. Chi-square test (χ^2) was used to assess the differences in frequency of qualitative variables while Fisher's Exact Test (FET) was applied if any expected cell values in a 2 X 2 table was <5. Paired samples *t*-test was applied in order to assess the differences in means of quantitative variables. The statistical methods were verified, assuming a significant level of $p<0.05$.

Results

The study included 40 patients (24 males and 16 females) with mean age 58.2 ± 6.7 years and 52.5% of them were smokers. About 35% of patients were having pre-existing pulmonary disease and 65% presented mainly by acute dyspnea (with or without hypoxemia) while 35% were presented mainly by acute chest pain. In 55% of patients, the cause of collapse was post-operative (mainly cardio-thoracic, 8 out of 22 patients) and 30% due to neurological disorders while the remaining collaps-

es were due to respiratory causes. About 67.5% had lobar collapse and 32.5% with total lung collapse. Lower lobes were the site of collapse among nearly 42.5% of patients while middle lobe/lingula contributed to nearly 22.5%. Table (1).

Table (1): Different characteristics of collapse among the studied sample.

	Frequency (n=40)	Percent (%)
Pre-existing pulmonary disease:		
Yes	14	35
No	26	65
Main presentation:		
Acute dyspnea without hypoxemia	16	40
Acute dyspnea with acute hypoxemia	10	25
Acute chest pain	14	35
Causes of collapse:		
Respiratory disorder	6	15
Neurological disorder	12	30
Post-operative*	22	55
Type of collapse:		
Lobar collapse	27	67.5
Total lung collapse	13	32.5
Site of collapse:		
Lower lobes	17	42.5
Upper lobes	1	2.5
Middle lobe/lingula	9	22.5
Total lung collapse	13	32.5

*: Eight cases with cardio-thoracic operations (36.4%), seven with upper abdominal operations (31.8%), and seven with other operations (31.8%).

In majority of patients (60%), failed conventional methods were the indication of bronchoscopic insufflation and 40% due to rapidly aggravated collapse. The both bronchoscopic procedures were complicated by more oxygen desaturation in 25% while 75% showed no complications and the insufflation succeeded to treat collapse and no recurrence occurred in 80% of patients within 2 weeks follow-up after complete lung inflation on discharge while 20% showed recurrence. PaO_2 on room air was significantly improved after insufflation (74.3±10.4 vs. 60.9±9.7mmHg, $p<0.001$). Failure of re-expansion within 24 hours noticed in 20%, while 80% showed successful re-expansion and intervention within the first 72 hours occurred in 90% compared to 10% after 72 hours (Table 2).

Table (2): Bronchoscopic procedures among the studied sample.

	Frequency (n=40)	Percent (%)
Indication of bronchoscopic insufflation:		
Failed conventional methods	6	60
Rapidly aggravated collapse	4	40
Complication of bronchoscopic procedures:		
More desaturation during the procedure	10	25
No	30	75
Recurrent collapse within 2 weeks follow-up among bronchoscopic insufflation group:		
Yes	2	20
No	8	80
PaO2 on room air (mmHg) among insufflation group [1]:		
Before procedure	60.9±9.7	
After procedure	74.3±10.4	
	($p<0.001$ *)	
Failure of re-expansion within 24 hours among insufflation group:		
Yes	2	20.0
No	8	80.0
Time of intervention among both groups:		
Within 72 hours	36	90
After 72 hours	4	10

[1] *t*: Paired samples *t*-test. *: Significant.

In all our patients, re-expansion of collapse within 24hs was significantly successful with bronchoscopic insufflation when the time of intervention was in the 1 st 72 hours, compared to failure of re-expansion in all patients when intervention was delayed after 72 hours. Fig. (2).

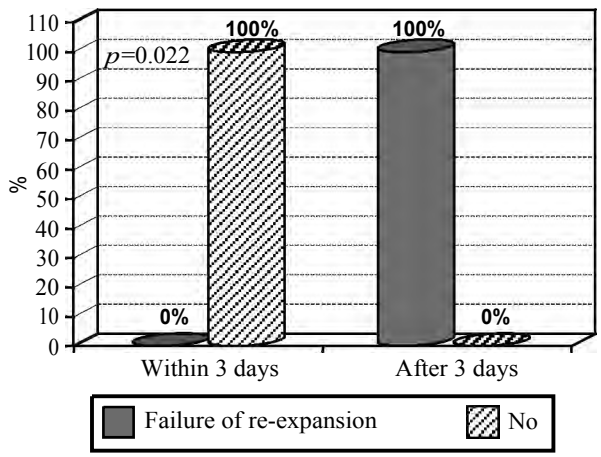

Fig. (2): Relation between failure of re-expansion within 24 hours and time of intervention.

When exploring complications of the procedures, more desaturation was significantly noticed in patients with pre-existing pulmonary diseases, while it showed no statistical difference according to the type of procedure or smoking habit. Table (3).

Table (3): Risk factors for recurrent collapse within 2 weeks follow-up among the studied sample.

	More desaturation during the procedure		χ^2/ FET	*p*-value
	Yes	No		
Smoking habit:				
Smoker	5 (23.8)	16 (76.2)	0.03	1.000
Non smokers	5 (26.3)	14 (73.7)		
Type of procedure:				
Bronchoscopic insufflation	4 (40.0)	6 (60.0)	0.9	0.435
Bronchoscopic suction	9 (25.0)	27 (75.0)		
Pre-existing pulmonary disease:				
Yes	8 (80.0)	6 (20.0)	14.3	<0.003*
No	2 (20.0)	24 (80.0)		

χ^2 : Chi-square test. FET: Fisher's Exact test. *: Significant.

Our results showed that among 8 patients who developed recurrent collapse within 2 weeks follow-up (2 among insufflation group and 6 among bronchoscopic suction group), 75% were smokers with statistical significance. Fig. (3).

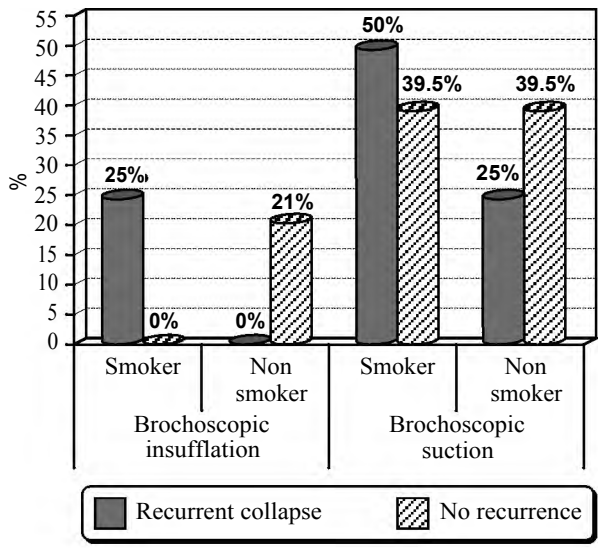

Fig. (3):

Discussion

Lung collapse (atelectasis) is one of the most commonly encountered abnormalities in chest radiographs [6]. Bronchoscopy has been identified as an important and safe tool to treat lung collapse in case of a lack of response to physical therapy or worsening atelectasis. However, the atelectatic segments may not expand, so the use of air insufflation in addition to standard bronchoscopy for the treatment of atelectasis was devised to overcome this problem [7].

Our results showed that more than half (55%) of our patients developed postoperative lung collapse and 35% of them were having pre-existing pulmonary disease. This was similar to the literature and other studies [8,9]. Similarly, Niyayeh-Saffari et al. found that 32.8% of Iranian patients had at least one type of atelectasis within the first three days after the surgery and that pre-operative pulmonary diseases like asthma, bronchitis, etc increase the risk of postoperative atelectasis [10].

Post-operative atelectasis develops due to decreased compliance of lung tissue, impaired regional ventilation, retained airway secretions and post-operative pain that interferes with spontaneous deep breathing and coughing [11].

Cardiothoracic and upper abdominal surgeries caused atelectasis in 36.4% and 31.8% of all our post-operative atelectasis. Serejo et al., prospectively studied the risk factors for pulmonary complications after emergency abdominal surgery and found that 75 out of 266 (28.2%) of patients developed post-operative pulmonary complications from which 16 patients (21.3%) developed lung atelectasis [12]. Some other studies found that the incidence of post-operative atelectasis was higher after thoracic surgery than that after abdominal or peripheral surgery [11,13]. The percentage was shooting as high as 90% in cardiac surgical patients [14].

Thirty percent of patients developed atelectasis as a result of neurological disorders. This finding coincides with Karanjia et al., who studied the clinical description of extubation failure in patients with primary brain injury and found that lung atelectasis was observed in 39% of their patients [15].

Lobar collapse was the most frequent type among our patients (67.5%) and lower lung zones were much affected by atelectasis (42.5%). Lung bases and posterior segments are vulnerable to dependent atelectasis [9]. Similar results were reported by Verheij et al., [16] in their review of pulmonary abnormalities after cardiac surgery with 46% of their patients showed left lower lobe collapse and by Pulletz et al., [17] who found that most areas of atelectasis were more noticed in the dependent lung zones specially the lower lobes.

Most of our patients (60%) were subjected to bronchoscopic insufflation due to failed conventional methods (chest physiotherapy and lung recruitment manoeuvers). Respiratory physiotherapy in hospitalized patients including postural drainage, chest wall percussion and vibration, and a forced expiration technique has been largely ignored leading to increased respiratory complications and the abuse of invasive treatment proce-

dures, such as bronchoscopy. On the other hand, selective recruitment of collapse utilizing bronchoscopic insufflation improves "targeted" lung volume and oxygenation with fewer hemodynamic effects. Additionally, bronchoscopic insufflation is useful in non-intubated patients who are unable to participate in chest physiotherapy due to altered mental status, chest wall pain and the morbidly obese [2].

The mean PaO_2 on room air has significantly improved (74.3±10.4 vs. 60.9±9.7mmHg, $p<0.001$) after the insufflation procedure among our patients. Similar significant improvement was reported by Wohlauer et al., with mean PaO_2:FiO_2 increased from 135 to 206 [18].

In about 80% of our patients subjected to insufflation, the procedure succeeded to treat collapse and no recurrence occurred within 2 weeks follow-up. While bronchoscopic suction was successful with no recurrence in the same period in 86% of patients subjected to bronchoscopic suction. Jelic et al., reported that atelectasis recurs frequently after bronchoscopy because the cause of compromised airway hygiene continues. Thus, failure to resolve the primary problem should not be an indication for repeated invasive intervention in the airways [19].

Our result showed that success rate of bronchoscopic insufflation was 80% in the first 24 hours. When using wedged flexible bronchoscopic insufflation technique, Wohlauer et al., showed 100% success rate on his work on 16 patients [18]. In another successful report of selective intrabronchial air insufflation, Abtahi et al., used recruitment bronchoscopy by trans-glottic approach to successfully treat lung collapse in an intubated mechanically ventilated patient [7]. Also, Abu-Hasan et al., reported successful use of bronchoscopic lung insufflation to treat left lung atelectasis by injecting 200ml room air followed by 200ml surfactant into the collapsed area through the wedged bronchoscope [4].

Apart from transient tachycardia and hypotension in some cases, most of the above researchers found that bronchoscopic insufflation technique is safe with no significant complications found like pneumothorax, alveolar hemorrhage or air dissected into vessels except some deaths related to the original insult and was not due to the procedure itself. However, we reported more oxygen desaturation during procedures in 25% of cases. This may be attributed to the sedation injected and/or underlying lung disease, as 80% of the insufflated group and 20% of the suction group were having pre-existing chronic pulmonary diseases and all of them were already hypoxemic.

Our results showed that smokers were subjected more to failure of re-expansion within 24 hours after the procedure and procedure complication than non-smokers but without significant difference between them. This finding was similar to that concluded by Graybill et al., in their review about the impact of smoking on perioperative pulmonary and upper respiratory complications after laparoscopic gynecologic surgery [20]. They owed the results to that laporoscopic surgery is simpler than open surgery with overall fewer complications and less anesthetic time. However, Hoshikawa and Tochii on their study on postoperative atelectasis and pneumonia after general thoracic surgery considered smoking cessation, in addition to other measures, are among strategies to reduce the risk of postoperative pulmonary complications including these two disorders [21]. The difference between our study and this study may be attributed to small sample size and many females in our study with the fact of many being non-smokers.

Our results considered smoking as a significant risk factor for recurrence of atelectasis after the two procedures. Many studies discussed the mechanism of smoking in atelectasis. Smoking affects the lung at various loci including the bronchi, bronchioles and the lung parenchyma. It alters both the structure and function of the bronchial mucus glands. Exposure to smoke increases both the number and size of these mucus-secreting glands, resulting in the production and deposition of excess mucus within the lumen of the airway. In response to enlarged, hyperactive mucus glands, as well as to the influx of inflammatory cells, the airway walls become thickened. Correspondingly, the diameter of the airway lumen is reduced and may more easily become congested or plugged with mucus and accordingly atelectasis ensues [22,23].

This study was subjected to some limitations; as a cross-sectional study it does not determine the cause-effect relationship, the small sample size, Also, as comparing bronchoscopic suction and insufflation groups, some patients were different according to age, sex, atelectasis site and extent, and underlying pulmonary disease which may give rise to data bias. Moreover, some patients had multiple organ dysfunctions that might affect the respiratory function and the outcome of the procedure that might affect the generalization of our results.

Conclusion:

The study tried to give insight into the safe usage of flexible fiberoptic bronchoscopic insufflation whenever indicated and the occurrence of complications were minor and self-limiting. Appropriate preparation, close supervision and adherence to the guidelines were essential for a successful and safe procedure.

References

1- KAMINSKY D.: Diseases and Pathology Congenital Lung Disease. In: Netter Collection of Medical Illustrations: Respiratory System. Kaminsky D., O'grady E., Thiel M. (eds.), 2nd edition, Volume 3, Section 4, Pp: 176-82. Elsevier, Saunders, 2011.

2- McCOOL F. and ROSEN M.: Nonpharmacologic airway clearance therapies: ACCP evidence-based clinical practice guidelines. Chest, 129 (1): 250-9, 2006.

3- PELOSI P., GAMA De ABREU M. and ROCCO P.: New and conventional strategies for lung recruitment in acute respiratory distress syndrome. Crit. Care, 14 (2): 210, 2010.

4- ABU-HASAN M., CHESROWN S. and JANTZ M.: Successful Use of Bronchoscopic Lung Insufflation to Treat Left Lung Atelectasis. Pediatr. Pulmonol., 48 (3): 306-9, 2013.

5- KREIDER M. and LIPSON D.: Bronchoscopy for atelectasis in the ICU: A case report and review of the literature. Chest, 124 (1): 344-50, 2003.

6- RESTREPO R. and BRAVERMAN J.: Current challenges in the recognition, prevention and treatment of perioperative pulmonary atelectasis. Expert. Rev. Respir. Med., 9 (1): 97-107, 2015.

7- ABTAHI H., GHARABAGHI M. and AZIMI M.: Recruitment bronchoscopy by trans-glottic approach successfully treated lung collapse in an intubated mechanically ventilated patient. B.M.J. Case Rep., doi: 10.1136/bcr-2013-200177, 2013.

8- CANET J. and MAZO V.: Post-operative pulmonary complications. Minerva Anestesiol., 76 (2): 138-43, 2010.

9- O'DONNELL A.: Bronchiectasis, atelectasis, cysts, and localized lung disorders. In: Cecil Medicine. Goldman L, Schafer AI, (Eds), 24th edition, Philadelphia, Pa: Saunders Elsevier, chapter 90, pp: 548-51, 2011.

10- NIYAYEH-SAFFARI N., NASIRI E., MOUSAVINASAB S., et al.: Frequency Rate of Atelectasis in Patients Following Coronary Artery Bypass Graft and Its Associated Factors at Mazandaran Heart Center in 2013-2014. Glob. J. Health Sci., 7 (7): 97-105, 2015.

11- SENGUPTA S.: Post-operative pulmonary complications after thoracotomy. Indian J. Anaesth., 59 (9): 618-26, 2015.

12- SEREJO L., Da SILVA-JÚNIOR F., BASTOS J., et al.: Risk factors for pulmonary complications after emergency abdominal surgery. Respir. Med., 101 (4): 808-13, 2007.

13- BRANSON R.: The scientific basis for post-operative respiratory care. Respir. Care, 58 (11): 1974-84, 2013.

14- JOSHI P., FRASER J. and MULLANY D.: The high risk cardiac surgical patient. Curr. Anaesth. Crit. Care, 16 (6): 369-83, 2005.

15- KARANJIA N., NORDQUIST D., STEVENS R., et al.: A Clinical Description of Extubation Failure in Patients with Primary Brain Injury. Neurocrit Care, 15 (1): 4-12, 2011.

16- VERHEIJ J., VAN LINGEN A., RAIJMAKERS P., et al.: Pulmonary abnormalities after cardiac surgery are better explained by atelectasis than by increased permeability oedema. Acta Anaesthesiol. Scand., 49 (9): 1302-10, 2005.

17- PULLETZ S., ADLER A., KOTT M., et al.: Regional lung opening and closing pressures in patients with acute lung injury. J. Crit. Care, 27 (3): 323.e11-8, 2012.

18- WOHLAUER M., MOORE E., HAENEL J., et al.: Selective intrabronchial air insufflation for acute lobar collapse in the Surgical Intensive Care Unit. J. Surg. Radiol., 2 (2): 178-80, 2011.

19- JELIC S., CUNNINGHAM J. and FACTOR P.: Clinical review: Airway hygiene in the Intensive Care Unit. Crit. Care, 12 (2): 209, 2008.

20- GRAYBILL W., FRUMOVITZ M., NICK A., et al.: Impact of smoking on perioperative pulmonary and upper respiratory complications after laparoscopic gynecologic surgery. Gynecol. Oncol., 125 (3): 556-60, 2012.

21- HOSHIKAWA Y. and TOCHII D.: Post-operative Atelectasis and Pneumonia after General Thoracic Surgery. Kyobu Geka., 70 (8): 649-55, 2017.

22- DEMLING R.: Smoke Inhalation Lung Injury: An Update. Eplasty; 8: e27, 2008.

23- CANET J., GALLART L., GOMAR C., et al.: Prediction of post-operative pulmonary complications in a population-based surgical cohort. Anesthesiology, 113 (6): 1338-50, 2010.

تقييم دفع الهواء بالمنظار الشعبى فى علاج مرضى إنخماض الرئة

يعد الإنخماض الرئوى من أكثر الآمراض شيوعا بأشعة الصدر السينية، ورغم إجراء العلاج الطبيعى أو المنظار الشعبى، فربما لا يحدث تمدد للفصوص المنخمضة، لذا تم إبتكار تقنية دفع الهواء للتغلب على تلك المشكلة. وقد تم إعداد تلك الدراسة لتقييم مدى أمان وكفاءة دفع الهواء بإستخدام المنظار الشعبى فى علاج هؤلاء المرضى. ولتحقيق هذا الهدف، إشتملت الدراسة على أربعين مريضا بالإنخماض الرئوى الناتج بعد العمليات أو لمرض تنفسى أو عصبى والذى تم تشخيصه سريريا وبالأشعة والموجات فوق الصوتية، وتم تقسيمهم لمجموعتين: المجموعة الأولى تم التعامل معها بالمص عن طريق المنظار وتضمنت ٣٦ مريضا، والمجموعة الثانية تم التعامل معهم بتقنية دفع الهواء بالمنظار الشعبى وعددهم عشرة مرضى (ستة منهم من حالات فشل مص الإفرازات عن طريق المنظار). وقد أظهرت نتائجنا أن عمليات الصدر وأعلى البطن تحدث الكثير من إنحماضات الرئة من إجمالى العمليات الجراحية، وأن الفصين السفليين للرئتين هما الأكثر تأثرا. كما أوضحت أن تقنية دفع الهواء بالمنظار آمنة وبمعدلات نجاح عالية مع قلة المضاعفات، وأن متوسط ضغط الأوكسجين الشريانى للمرضى يتحسن كثيرا بعد هذا الإجراء. كما أوضحت الدراسة أن من كانوا يعانون من نقص ضغط الأوكسجين الشريانى قبل الإجراء كانوا الأكثر تأثرا بمضاعفاته والتى تمثلت فى مزيد من نقص ضغط الأوكسجين الشريانى بعد الإجراء. وعند متابعة المرضى خلال فترة أسبوعين بعد الإجراء، تبين عودة الإنخماض أكثر بين المدخنين. كما أن تأخر الإجراء لما بعد ثلاثة أيام يصاحبه فشل تمدد الرئة. والخلاصة أن دفع الهواء بالمنظار الشعبى ناجح للغاية فى علاج إنخماض الرئة وتحسين نسبة الأوكسجين دون حدوث مضاعفات معتبرة، كما يظهر أن التدخين يسبب عودة الإنخماض خلال أسبوعين من المتابعة، كما أن التدخل المبكر ضرروى للحصول على نتائج أفضل. لذا نوصى بالوقاية المبكرة والبعد عن التدخين والتحكم الأفضل فى الآمراض التنفسية والتدخل المبكر بالمنظار الشعبى والمتابعة المنتظمة.