Outcomes of Interventional Therapeutic Bronchoscopy in a Dedicated Bronchoscopy Unit

Thesis

Submitted for Partial Fulfillment of Doctorate Degree in Chest Diseases

By

Amr Mohamed Awad Tag Eldin
M.B., B. Ch, - M.Sc in Chest Diseases & Tuberculosis

Supervised by

Prof. Adel Mahmoud Khattab
Professor of Chest Diseases
Faculty of Medicine - Ain Shams University

Prof. Emad ElDin Abdel Wahab Korraa
Professor of Chest Diseases
Faculty of Medicine - Ain Shams University

Prof. Ashraf Mokhtar Madkour
Professor of Chest Diseases
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
2017

Abstract

Introduction: The technical developments have led to bronchoscopy being used in complex diagnostic as well as therapeutic procedures. Interventional bronchoscopy is defined as diagnostic and invasive therapeutic interventions that extend beyond routine flexible bronchoscopy. Interventional bronchoscopy has come a long way with exciting new techniques added to the pulmonologist's armamentarium encompassing both diagnostic as well as therapeutic procedures.

Aims: To study the outcomes of ITB in a dedicated bronchoscopy unit as regard bronchoscopic outcomes of the two main practices: Central (benign or malignant) airway obstruction (CAO) and foreign body (FB) extraction.

Methodology: This was a retrospective-prospective study design initiated in January 2014 in which patients undergoing ITB in Bronchoscopy unit, Chest department, Ain Shams University previously during period between January 2012 and December 2013 (retrospective part) or subsequently during period between January 2014 till June 2015 (prospective part) were included in the current study. The study included 180 patients, divided into 78 patients in the retrospective part and 102 patients in the prospective part.

Results: One hundred and eighty patients fluffed the study inclusion criteria and were recruited from Bronchoscopy unit, Chest department, Ain Shams University during the study period. The retrospective part of the study (between January 2012 and December 2013) included 78 patients and prospective part of the study (between January 2014 till June 2015) included 102 patients.

Conclusion: ITB is an effective and a promising treatment approach for palliative treatment of patients with malignant and benign CAO.

Recommendations: Future researches are needed on larger number of patients and long study duration. High degree of suspicion of FB inhalation is critical for patients with unresolved chest symptoms.

Keywords: Interventional Therapeutic Bronchoscopy, Dedicated Bronchoscopy, Central Airway Obstruction

First of all, thanks to Allah whose magnificent help was the main factor in completing this work.

No words can express my deep sincere feelings Towards **Prof. Adel Mahmoud Khattab,** Professor of Chest Diseases, Faculty of Medicine–Ain Shams University for his continuous encouragement, guidance and support he gave me throughout the whole work. It has been a great honor for me to work under his generous supervision.

I would like to express my deepest appreciation, respect and thanks to **Prof. Emad ElDin Abdel Wahab Korraa,** Professor of Chest Diseases, Faculty of Medicine–Ain Shams University, for his continuous guide in all aspects of life beside his great science, knowledge and information.

I would like to express my deepest appreciation, respect and thanks to **Prof. Ashraf Mokhtar Madkour,** Professor of Chest Diseases, Faculty of Medicine–Ain Shams University, for his continuous guide in all aspects of life beside his great science, knowledge and information.

Last but not least, sincere gratitude to ***My Family*** for their continuous encouragement and spiritual support.

سورة البقرة الآية: ٣٢

Contents

Subjects	Page
List of abbreviations	II
List of figures	V
List of tables	VIII
• **Introduction**	1
• **Aim of the work**	3
• **Review of Literature**	
♦ Introduction and History	4
♦ Interventional Bronchoscopy	6
♦ Rigid Bronchoscopy	10
♦ Flexible Bronchoscopy	18
♦ Patient Evaluation and Anesthesia	22
♦ Sedation and General anaesthesia	28
♦ Interventional Techniques and Instruments	32
♦ Tracheal Stenosis	49
♦ Foreign Bodies	55
♦ Chest Department Ain Shams University Hospital Experience in Interventional Bronchoscopy	69
• **Patients and Methods**	72
• **Results**	99
• **Discussion**	132
• **Conclusion**	147
• **Recommendations**	148
• **Summary**	149
• **References**	153
• **Arabic Summary**	

List of Abbreviations

ABG : Arterial blood gas

AFB : Autofluorescence bronchoscopy

APC : Argon plasma coagulation

BUN : Blood urea nitrogen

CAO : Central airway obstruction

CO_2 : Carbon dioxide

COPD : Chronic Obstructive Pulmonary Disease

CPAP : Continuous positive airway pressure

CT : Computed tomography

CXR : Chest X ray

D : Dilation

EBRT : External-beam radiation therapy

EBUS : Endobronchial ultrasound

EC : Electrocautery

ECG : Electrocardiogram

FB : Foreign body

FBI : Foreign body inhalation

FEV1 : Forced expiratory volume in 1 second

FIO_2 : Fraction of inspired oxygen

FOB : Fibroptic Bronchoscopy

HDR : High-dose-rate

IB : Interventional Bronchoscopy

IBV : Intrabronchial valves

ICU : Intensive care unit

INR : International normalized ratio

IP : Interventional Pulmonologist

ITB : Interventional therapeutic Bronchoscopy

LDR : Low-dose-rate

MD : Mechanical debridement

MMRC : Modified medical research council

N_2O : Nitrous oxide

NSCLC : Non-small cell lung cancer

PaO_2 : Partial pressure of O2 in arterial blood.

PDT : Photodynamic therapy

RB : Rigid bronchoscopy

ROS : Reactive oxygen species

SaO2 : Oxygen saturation

SEMS : Self-expandable metallic stents .

TBFB : Tracheobronchial foreign body

TBM : Tracheo- bronchomalacia

TBNA : Transbronchial needle aspiration

TBO : Tracheobronchopathia osteochondroplastica

TFBI : Tracheobronchial foreign body inhalation

List of Figures

No.	Figure	Page
1	Indications of Interventional Bronchoscopy.	6
2	Rigid Bronchoscopy.	14
3	Flexible Bronchoscopy.	18
4	Algorithm for the management of malignant central airway obstructions.	33
5	Figure of Electrocautery.	35
6	(a) Nd:YAG laser, (b)befor procedure, (C)after procedure.	37
7	The various flexible applicators for local treatment using the fiberoptic bronchoscope.	40
8	Brachytherapy.	42
9	Intrabronchial valves.	44
10	Dumon stents of different sizes and lengths.	46
11	UltraFlex Stents.	47
12	Y-shaped stent.	48
13	Common types of FB.	56
14	Visual analogue scale score.	75
15	Types of Malignant CAO.	82
16	Therapeutic Alogrithm of CAO.	84
17	Therapeutic Alogrithm of inoperable symptomatic malignant CAO.	85
18	Dumon silicone stent.	91
19	Forceps Rattooth.	97
20	(a) Laryngeal mask (b, c) laryngeal mask + FOB.	98
21	Rigid Bronchoscope.	98

No.	Figure	Page
22	Frequency of Interventional therapeutic bronchoscopy practiced.	100
23	Sex among central airway obstruction cases.	102
24	Radiological findings among CAO cases Types of Malignant CAO.	103
25	Malignant obstruction of the airways.	104
26	Interventions done among central airway obstruction cases.	105
27	Procedure route among malignant CAO cases.	106
28	Shows that hemorrhage and hypoxia was the most common complications among malignant CAO.	107
29	Clinical symptoms among malignant CAO cases before and after Interventional therapeutic bronchoscopy.	109
30	Dyspnea score among malignant CAO cases before and after Interventional therapeutic bronchoscopy.	109
31	Karnofsky Performance Status score among malignant CAO cases before and after Interventional therapeutic bronchoscopy.	110
32	Interventional bronchoscopy therapeutic effect among malignant CAO cases.	111
33	Sex among benign central airway obstruction cases.	113
34	Radiological findings among benign CAO cases.	114

No.	Figure	Page
35	Interventions done among benign CAO cases.	**117**
36	Procedure route among benign CAO cases.	**118**
37	Sex among foreign body cases.	**121**
38	Foreign body nature.	**122**
39	Clinical presentation of foreign body cases.	**123**
40	Radiological findings among foreign body aspiration cases.	**124**
41	Foreign body sites.	**125**
42	Complications among FB aspiration cases.	**127**

List of Tables

No.	Table	Page
1	SPECTRUM OF ITB.	9
2	Pre-procedure evaluation.	24
3	Post procedure evaluation.	31
4	Comparison of Currently Available Bronchoscopic Ablative Therapies.	43
5	Common causes of trachea-bronchial stenosis.	53
6	Advantages and disadvantages of flexible and rigid bronchoscopy for foreign body removal.	65
7	Potential complications due to foreign body inhalation and its bronchoscopic removal.	68
8	Modified medical research council dyspnea scale.	76
9	Karnofsky index of performance.	76
10	Speiser`s obstruction scoring criteria.	77
11	Criteria in Solid tumors (revised RECIST) guidelines.	78
12	Interventional therapeutic bronchoscopy patients studied.	99
13	Classification of Benign and Malignant CAO.	101
14	Demographic characteristics of malignant CAO cases.	102
15	Radiological findings among malignant CAO cases.	103

No.	Table	Page
16	Interventions done among central airway obstruction cases.	105
17	Procedure characteristics of malignant CAO cases (prospective only).	106
18	Complications among malignant CAO cases.	107
19	The comparison between clinical radiological and bronchosopic evaluation before and after ITB (prospective only).	108
20	Outcomes of ITB among malignant CAO cases (prospective only).	111
21	Demographic characteristics of benign CAO cases.	112
22	Radiological findings among benign CAO cases.	114
23	Causes of stenosis of Benign CAO.	115
24	Bronchoscopic Treatment of Benign CAO.	116
25	Interventions done among benign CAO cases.	117
26	Procedure characteristics of benign CAO cases.	118
27	Outcomes among benign CAO cases.	119
28	Demographic characteristics of foreign body cases.	120
29	Foreign body nature.	122
30	Clinical presentation of foreign body cases.	123
31	Radiological findings among foreign body cases.	
32	Foreign body sites.	125

No.	Table	Page
33	Procedure characteristics among foreign body cases (proceptive only).	**126**
34	Outcomes among FB aspiration cases.	**127**
35	Comparison between foreign bodies regarding demographic characteristics.	**128**
36	Comparison between foreign bodies regarding Clinical presentation.	**129**
37	Comparison between foreign bodies regarding radiological findings.	**130**
38	Comparison between foreign bodies regarding foreign body sites.	**131**

Introduction

The technical developments have led to bronchoscopy being used in complex diagnostic as well as therapeutic procedures.[1] Interventional bronchoscopy is defined as diagnostic and invasive therapeutic interventions that extend beyond routine flexible bronchoscopy. [2] Interventional bronchoscopy has come a long way with exciting new techniques added to the pulmonologist's armamentarium encompassing both diagnostic as well as therapeutic procedures.[1]

Interventional therapeutic bronchoscopy (ITB) is an evolving field within pulmonary medicine that focuses on application of advanced bronchoscopic techniques for the treatment of various malignant and nonmalignant airway disorders. Therapeutic procedures pertaining to these disorders include, but are not limited to, rigid bronchoscopy (RB), laser bronchoscopy, endobronchial electrosurgery, argon-plasma coagulation, cryotherapy, airway stent insertion, balloon bronchoplasty and dilatation techniques, endobronchial radiation (brachytherapy) and photodynamic therapy. [1,3] In addition to four most recent developments with great potential including bronchoscopic lung volume reduction, bronchial thermoplasty used in benign lung