RESEARCH

RELIABILITY OF BRONCHOSCOPIC PROCEDURES IN VERY ELDERLY PATIENTS AND THE ROLE OF CHARLSON COMORBIDITY SEVERITY INDEX ON PREDICTING BRONCHOSCOPIC COMPLICATIONS

Turkish Journal of Geriatrics
DOI: 10.31086/tjgeri.2020.168
2020; 23(3): 317-325

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Received: Jul 02, 2020
Accepted: Aug 06, 2020

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Abstract

Introduction: In this study, we aimed to evaluate the complications of bronchoscopy in patients aged 75 years and above and to investigate the role of comorbidities on the complications.

Materials and Method: All bronchoscopic procedures performed between September 2017 and September 2019 in our bronchology unit on patients aged over 75 years were evaluated retrospectively. Characteristics of patients and bronchoscopic procedures were recorded. Charlson Comorbidity Severity Index was calculated for each patient.

Results: Bronchoscopic procedures were performed on 272 patients. The average age was 78.6±3.8 years (min:75-max:92). 194 (71.3%) flexible fiberoptic bronchoscopy procedures, 68 (25%) endobronchial ultrasonographic procedures, and 10 (3.7%) rigid bronchoscopy procedures were performed. One or more comorbidities were present in 238 (87.5%) patients. The most common comorbidity was cardiovascular disease. There were 236 (86.7%) patients using one or more medications. One or more complications rates were %5,8 (16/272). The complication rates were 5.7% in the low (≤6) comorbidity severity index group versus 6.4% in the high (>6) comorbidity severity index group, and there was no statistical significance between the two groups (p=0.829). There is no mortality. Only one patient developed hypoxia and respiratory acidosis required noninvasive mechanic ventilation.

Conclusion: In summary, bronchoscopic procedures are very safe in patients with advanced age who had ≥1 comorbidities and high CCSI. Although CCSI helps in predicting complications and mortality in many diseases, it was not seen to contribute to predicting bronchoscopic complications. Although bronchoscopy rarely causes complications in the elderly, more prospective cohort studies on more detailed and specific indices are needed to predict these complications.

Keywords: Bronchoscopy; Comorbidity; Aged; Polypharmacy

INTRODUCTION

In the last century, life expectancy has increased significantly, especially in developed countries, thanks to socioeconomic progress, improved control of fatal infectious diseases (e.g., using vaccines and antibiotics), and environmental health initiatives (e.g., sanitation and water potability) (1,2). Increasing aging population in developing countries has an important effect on the epidemiology of lung cancer (3). Both the increase in the elderly population and the increased incidence of pulmonary diseases in this age group also increase the need for bronchoscopic approaches (2,4,5). Although the efficacy and safety of bronchoscopy in the general population are well defined, different results have been reported in studies involving the elderly population with higher comorbidities (4,6-9). Several selected studies have reported on comorbidities in elderly patients undergoing bronchoscopy. However, no study has specifically evaluated the role of comorbidities in bronchoscopic results (10). One of the important aspects in planning the examination and treatment of any disease is the evaluation of comorbidities and their severity. There are various indexes for evaluating comorbidities. Recently, the age-combined Charlson Comorbidity Severity Index (CCSI) prescribed by Charlson et al. in 1987 in order to predict perioperative complications and mortality possibilities is used (11). The aim of this study is to evaluate the complications of bronchoscopy in patients aged 75 years and above and to investigate the role of comorbidities in complications in our bronchology unit.

MATERIALS AND METHODS

All bronchoscopic procedures performed on patients aged 75 years and above in the bronchology unit were evaluated retrospectively between September 2017 and September 2019. The age, gender, comorbidities, used medicines, bronchoscopy indications, bronchoscopic procedures, sedation type and agent applied, material taken during the procedure, procedure duration, cytopathology and culture results, and complications of the procedure were recorded. CCSI was calculated for each patient according to the original publication by Charlson et al (12). Since all of our patients were above 75 years of age (which means three points for each patient), CCSI cut-off value was determined with 75% percentile value. It was divided into two groups: high (>6) CCSI and low (≤6) CCSI. Conventional bronchoscopic procedures were performed with flexible fiberoptic bronchoscopy (FOB) (BF-1TQ180 Olympus, Tokyo, Japan), and endobronchial ultrasonographic (EBUS) procedures were done with fiberoptic ultrasound bronchoscope (Convex Probe EBUS; EB-530 US; Fujifilm Medical Devices, Japan). Both procedures were performed under conscious sedation with midazolam. Topical airway anesthesia was administered using 1.0% or 2.0% lidocaine instilled through the bronchoscope. Rigid bronchoscopic procedures (Karl Storz, Germany) were performed under general anesthesia. General anesthesia induction was achieved with midazolam 0.05-0.1 mg/kg, propofol (maximum dose 1000 mg), remifentanil (maximum dose 2 mg), or rocuronium (maximum dose 50 mg), according to the patient's condition.

Approval for the research was obtained from the ethics committee of Istanbul Training and Research Hospital.

Statistical Analysis

Data were analyzed with the Statistical Package for Social Sciences (SPSS) version 22.0 for Windows software (IBM SPSS Statistics Data Editor). Descriptive data were given as number of participants and frequency. Categorical variables were expressed as the number of patients and CCSI value. Chi-square test was used to compare categorical variables. Continuous variables were documented as mean and standard deviation, and the Shapiro-Wilk test was used to determine whether these variables were normally distributed. The Student's t-test and Mann-Whitney U test were

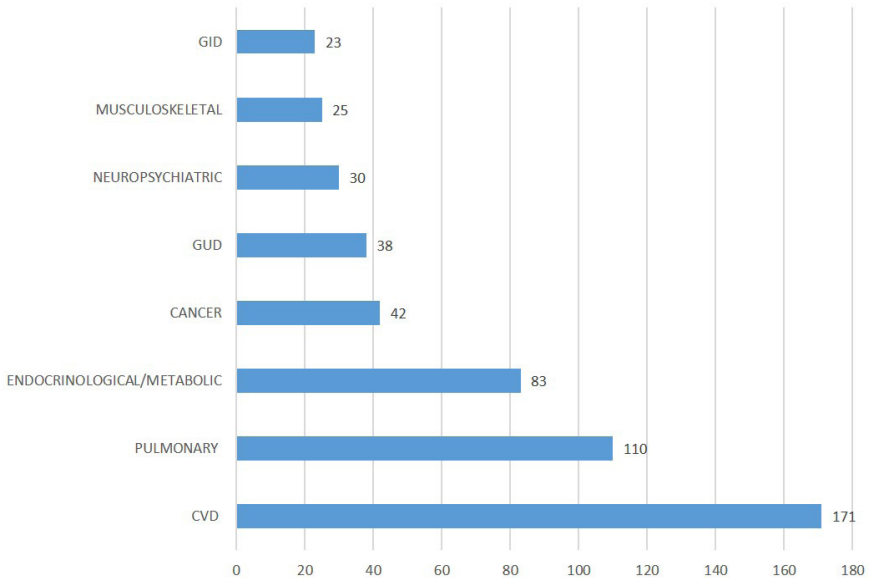
used for continuous variables depending on the normality of their distribution. A p-value of <0.05 was considered statistically significant.

RESULTS

Bronchoscopic procedures were performed on 272 patients. The average age was 78.6±3.8 years (min: 75-max: 92). 98 (36%) patients were females and 174 (64%) were males. The average ages of men and women were similar (78.2±3.5 and 79.1±4.2, respectively; p=0.076). 194 (71.3%) FOB, 68 (25%) EBUS, and 10 (3.7%) rigid bronchoscopy procedures were performed. Only 10 (3.7%) rigid bronchoscopy procedures were performed under general anesthesia, while the other procedures, 262 (96.3%), were performed with conscious sedation. Nodule and/or mass detected by radiologic imaging (n=80, 29.4%) was the most common indication for bronchoscopy. In 256 (94.1%) patients, procedures were performed without complications. The rate of complications was 5,8% (16/272). The most common complication was hemorrhage (n=8, 2.9%). Hypoxia (n=6, 2.2%), bradycardia (n=2, 0.7%), tachycardia (n=1, 0.4%), and respiratory acidosis (n=1, 0.4%) followed, respectively. The characteristics of patients and bronchoscopic procedures are summarized (Table 1). No patients required hospitalization due to hemorrhage. All instances of hemorrhage were minor or moderate and could be controlled by cold lavage and/or diluted adrenaline administration during the procedure. Also, there was no hipoxia requiring hospitalization. In only one patient, hypoxia and respiratory acidosis developed but did not require intubation and required 48 hours of hospitalization and noninvasive mechanic ventilation.

One or more comorbidities were present in 238 (87.5%) patients. The most common comorbidity was in CVD (Figure 1). The frequency of cancer was 15.44%, with lung cancer being the most common (Table 2).

Figure 1. Distribution of comorbidities



* Each patient had one or more comorbidities
CVD: Cardiovascular diseases, GUD: Genitourinary diseases, GID: Gastrointestinal diseases

Table 1. Characterictis of patients and bronchoscopic procedures.

Age, mean ± SD	**78.6 ± 3.8**
Gender, n(%)	
Male	174 (%64)
Female	98 (%36)
CCSI, median	5 (0-13)
≤5 (n,%)	171 (63)
6	54 (20)
7	18 (6,6)
>7	33 (12)
Indications, n(%)	
Nodule and / or Mass	80 (29,4)
Mediastina LAM	57 (21)
Infiltration and / or consolidation	26 (9,6)
Diffuse parenchymal lung disease	19 (7)
BLVR	18 (6,6)
Stent control (stenotic / Y stent)	16(5,9)
Hemoptysis	10 (3,7)
Tracheobronchomalacia	10 (3,7)
Other	36 (13,2)
Bronchoscopic Procedures (n, %)	
Flexible Bronchoscopy (FOB)	194 (71.3)
Endobronchial Ultrasonography (EBUS)	68 (25)
Rigid Bronchoscopy	10 (3,7)
Materials, n (%)	
Bronchial lavage	122 (39,7)
Bronchial biopsy	45 (14,6)
EBUS-TBNA	58 (18,9)
Wang- TBNA	11 (3,6)
Bronchoalveolar Lavage (BAL)	18 (5,9)
Cryo-TBLB	2 (0,7)
No material	51 (16,6)
Total	307 (100)
Complications (n, %)	
Hemorrhage	8 (2,9)
Hypertensive attack	4 (1,5)
Hypoxia	6 (2,2)
Bradycardia	2 (0,7)
Tachycardia	1 (0,4)
Respiratory Acidosis	1 (0,4)
≥ 1 complication	16 (5,8
Comorbidities	
≥ 1 comorbidity	238 (87,5)
No comorbidity	20 (7,35)
Comorbidity unknown	14 (5,15)

TBNA: Transbronchial Needle Aspiration; TBLB: Transbronchial Lung Biopsy; BLVR: Bronchoscopıc Lung Volume Reduction

There were 236 (86.7%) patients using one or more medications. Moreover, 109 (40%) patients were using five or more medications. The most commonly used medications in polypharmacy were cardiovascular medicines (n=166, 61%), statins (n=110, 40%), bronchodilatators (105, 38.5%), antiagregans/anticoagulans (n=75, 27.5%), oral antidiabetics/insulın (n=54, 20%), antiacids (n=38, 14%) and neurological / psychiatric medicines (n=27, 9.9%), respectively.

When the cut-off value was 6 according to CCSI, the respective complication rates were 5.7% versus 6.4% in the low and high groups, and there was no statistical significance between the two groups (p=0.829). Complication rates were 6.8% versus 3.8% in patients under 80 years and above 80 years, respectively, and there was no statistically significant difference between the two groups (p=0.335). The rate of complications in patients with one or more comorbidities was 5.9%, whereas it was 10% in patients without comorbidity (p=0.463). Processing time and sedation dose were not statistically significant different between those with and without complications (34.2±15.39; 31.6±13.5; p=0.67 and 2.15±0.68; 2.13±1.02; p=0.94, respectively)

When 16 patients having complications were evaluated, considering the characteristics of the individual bronchoscopic procedure, the procedure performed and the material specimen obtained, the characteristics of the comorbidities, the age, and CCSI, there was a heterogeneous distribution (Table 3).

Table 2. Malignancy Types of Cancer Patients

Malignancy types	N
Lung Cancer	15
Prostate Cancer*	6
Colon Cancer	5
Larynx Cancer	3
Malignant Melanoma	2
Breast Cancer	1
Bladder Tumors*	3
Lymphoma	2
Renal Cell Cancer	2
Tonsil Cancer*	1
Whartin Tumour	1
Sarcoma	1
Gallbladder Cancer	1
Endometrium Cancer	1

*One patient had three cancer type (Tonsil, Bladder and Prostate)

DISCUSSION

The increasing prevalence of respiratory disorders and increasing life expectancy in elderly patients

indicate that the performance and safety profile of bronchoscopic procedures should be better characterized for this age group (10). There are a selected number of studies evaluating reliability in the elderly population where bronchoscopic procedures are performed, and the results are contradictory. Also, the presence of comorbidities has been reported in very few studies. In our study, it was observed that bronchoscopy can be performed safely on patients over 75 years of age, with rare side effects and without mortality, and on elderly patients with comorbidities and high comorbidity severity index.

In the retrospective study of Haga et al., there was no difference in the rate of complications (12%) between the elderly and young population (4). In another prospective multicenter study of Haga et al., with 66 patients >80 years of age, it was stated that the complication rates (27.3%) were higher in the elderly population. They suggested that bronchoscopic processes of this age group should be examined in more detail, although fatal and major complications were not observed (7). In our study, the complication rate was 5.8% and it was less than both studies.

Hehn et al. evaluated the side effects according to age groups in patients over 18 years of age in their largest cohort study. Pulmonary side effects such as oxygen desaturation, bronchospasm, and laryngospasm were rare and their incidence was not related to age. Pneumothorax (3.4% versus 0.7%) and hemoptysis (3.8% versus 2.2%) were more frequent in the group of patients above 70 years old compared to the group under 40 years old. Transient hypotension was present in the group of patients above 70 years of age (1.9% vs. 0.5%), whereas the relationship between arrhythmia and age could not be shown. The frequency of all arrhythmias was 1%. In our study, the frequency of arrhythmia was similar with 1.1% in a similar age group population. In this study, there is an increase in the frequency of some comorbid diseases with age (COPD, CAD, and ILD), but their role in bronchoscopy was not mentioned (13). The frequency of bronchoscopy-related complications was similar in the younger population and those who are above 75 years old in studies involving older patients who underwent bronchoscopy due to foreign body aspiration. Mortality and major complications were not reported in either group. Oxygen desaturation was the most frequent complication and its frequency was 25% in the group of patients above 75 years old, but all of them were treated effectively and easily. The frequency of hypoxia in our study was much lower than this. The reason for the development of hypoxia may be the prolonged procedure time required for foreign body removal, but comparison could not be made since there is no data on the study time. In this study, the presence of one or more of the comorbidities (CHF, COPD, and neurological) as a risk factor was addressed in 13 of the 20 patients evaluated who are above the age of 75 years, but the severity of these comorbidities and their effects in terms of bronchoscopic complications were not evaluated (14).

Davoudi et al. showed that therapeutic bronchoscopy can be successfully performed in patients above 80 years of age with airway obstruction and multiple comorbidities (especially hypertension, arrhythmia, and coronary artery disease). Mild and moderate adverse events were recorded during and after the procedure but there was no need for reintubation and mechanical ventilation. Only one patient had <80% oxygen desaturation lasting over one minute. The reasons for this situation in this patient were as follows: the anesthesiologist and bronchoscopist sharing the same airway, the extent of malignant obstruction in the airway, and the severity of the underlying comorbidities. However, there was no mention of the characteristics and severity index of the existing comorbidities (15). In another study, complication and mortality rates were found higher in patients above the age of 80 years compared to the control group who are below the age of 80

years (11.5% vs. 5.5%, respectively). There was no difference between groups in terms of prevalence of ischemic heart disease, diabetes mellitus, hypertension, malignancy, and chronic lung disease. Although there was no difference in terms of the presence of comorbidity, it was reported that the difference in comorbidity severities might have played a role, and it was difficult to relate complications with comorbidities in the light of the available data. Mortality was rarely reported during the bronchoscopic procedure, but patients on mechanical ventilation were also included in this study. In terms of complications, no difference was observed in ventilated and nonventilated patients, but mortality was higher in the ventilated group (8). Ulaşlı et al. reported that the procedure was performed on 88.8% of the elderly patients without complications, with the mortality being 0.3%. Patients' comorbidities were not mentioned in their studies (16). In our study, procedure-related mortality was not seen in patients with high comorbidity severity index.

The strength of our study compared to other studies was that the CCSI of each patient was also calculated objectively in addition to the presence of comorbidities in all procedures. In studies investigating the safety of EBUS TBNA in the elderly population, CCSI was reported to be higher in elderly patients. However, there was no data regarding whether there is a difference in terms of complication rates in patients with and without high CCSI (17,18). CCSI has been studied

Table 3. Characteristics of patients who had complication

Complication	Age	CCSI	Comorbidities	Procedures
Bradycardia	75	7	RCC, CHF, CRF, CAD	EBUS-TBNA
HA+ Hemorrhage	77	4	CAD, HT	EBUS-TBNA
Hemorrhage	75	3	None	Wang NA
Tachycardia + Hypoxia	78	3	HT	Lavage&biopsy
Hypoxia	78	5	HT, COPD, BPH, demantia	Foreign Body
Hemorrhage	76	4	COPD	Wang NA
Hypoxia	75	6	CHF, COPD, HT, HL, DM	FOB, no material
Hypoxia	92	4	HT	Rijid, Criyo-TBLB
HA+ Hemorrhage	75	3	HT	Lavage
Hemorrhage	77	3	Asthma	Lavage
Hypoxia + Respiratory Acidosis	78	5	DM, HT, COPD	Rijid, stent control (PITS)
Hemorrhage	75	3	None	EBUS-TBNA
Hypoxia	74	6	COPD, DM, BPH, CAD	EBV removal
Bradycardia	81	11	Metastatic Prostat ca, CAD	EBUS-TBNA
HA+ Hemorrhage	75	5	HT, CAD, COPD	EBUS-TBNA
HA+ Hemorrhage	88	6	Osteoporosis, HT, CVD, PU	Wang İA

*One patient had three cancer type (Tonsil, Bladder and Prostate)

and evaluated as being useful in predicting postoperative complications of various invasive procedures (19,20). Park et al. recommend the routine use of CCSI to predict complications after laparoscopic distal gastrectomy in elderly patients with comorbidities (21). In another study, a positive correlation was noted between increased CCSI and prolonged postoperative complications in patients with colon and rectal cancer (22). However, neither age nor high CCSI was associated with complications in elderly patients.

When 16 patients with complications were evaluated, considering the characteristics of the individual bronchoscopic procedure, the performed procedure and the obtained material, the characteristics of the comorbidities, the age, and CCSI, there was a heterogeneous distribution.

If the number of patients in this study was higher, even if the ratio of patients with complications was the same, it could create a specific index that could predict complications with more patients with complications. A small number of patients was a limitation of our study on this issue.

An other limitation of our study was that it was retrospective. Except for the CCSI, many other specific parameters such as respiratory function test parameters, diffusion capacities, types of drugs used due to comorbidities, body mass index, and nutritional status could not be evaluated. The possibility that these parameters could be responsible for complications could not be ignored. Randomized controlled studies including all parameters in this age group may provide a new scale for predicting possible complications. Using a specific method, including pulmonary functions, type of bronchoscopic procedure, characteristics, stage and distribution of lung lesions, may be helpful for predicting complications of bronchoscopy. We think that our study can help further research on this subject. In summary, bronchoscopic procedures are very safe in patients with advanced age who had ≥1 comorbidities and high CCSI. Although CCSI helps in predicting complications and mortality in many diseases, it was not seen to contribute to predicting bronchoscopic complications. Although bronchoscopy rarely causes complications in the elderly, more prospective cohort studies on more detailed and specific indices are needed to predict these complications.

Disclosure statement: The authors declare no conflict of interest

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