ORIGINAL ARTICLE

Electrocautery vs Cryotherapy in Management of Central Airway Obstruction

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Abstract

Background: ***Central airway obstruction (CAO) is a life-threatening condition with a poor prognosis, particularly with proximal obstruction.***

Aim of the work: ***To compare the efficacy and safety of electrocautery and cryotherapy in managing CAO.***

Patients and Methods: ***Thirty patients with symptomatic CAO were randomized into two groups based on the treatment modality: Group A (15 patients) underwent bronchoscopic cryotherapy, while Group B (15 patients) received bronchoscopic electrocautery. To evaluate treatment outcomes, we assessed and compared airway patency, symptom improvement, performance status, spirometry, arterial blood gases, and thoracic imaging both before and after the intervention, as well as between the two groups. This prospective cohort study was conducted at the Interventional Pulmonology Unit, Department of Chest Diseases, Al-Hussien University Hospital, from February 2023 to February 2025.***

Results: ***Significant improvements were observed in all assessed parameters post-procedure. No major differences were found between groups.***

Conclusion: ***Electrocautery and cryotherapy are effective treatment options for CAO, offering similar outcomes in symptom relief and airway recanalization.***

Keywords: central airway obstruction; electrocautery; cryotherapy; bronchoscopy

1. Introduction

Central airway obstruction is defined as a ≥ 50% occlusion of the trachea, mainstem bronchi, bronchus intermedius, or lobar bronchi.[1] It presents a significant challenge in thoracic medicine, which is often underdiagnosed.[2] If left untreated, it leads to severe morbidity and death. While surgery is regarded as the gold-standard treatment for most clinical scenarios, it may not be feasible due to patient health or disease severity.[3] The assessment and management of patients with CAO necessitate a comprehensive understanding of the etiology, physiology, diagnostic methods, and treatment options. A multidisciplinary approach is essential, involving chest radiologists, anesthesiologists, medical oncologists, thoracic surgeons, and interventional pulmonologists.[4] Bronchoscopic interventions, particularly electrocautery and cryotherapy, have emerged as effective alternatives for restoring airway patency.

The current study intends to compare the efficacy and safety of electrocautery and cryotherapy in the management of CAO. By evaluating their comparative effectiveness, this study seeks to provide insights into their clinical outcomes, helping to guide optimal therapeutic choices for patients with CAO.

Accepted 15 June 2025.
Available online 31 July 2025

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https://doi.org/10.21608/aimj.2025.446640

2. Patients and methods

This prospective cohort study was conducted at the Interventional Pulmonology Unit, Department of Chest Diseases, Al-Hussien University Hospital, from February 2023 to February 2025. The study included 30 patients with symptomatic CAO. Inclusion criteria: patients with ≥50% intra-luminal obstruction in the trachea, main stem bronchus, bronchus intermedius, or lobar bronchus. Exclusion criteria: patients unfit for general anesthesia or rigid bronchoscopy, uncorrectable hypoxemia, coagulation defects, or non-viable lung distal to obstruction. The patients were randomly assigned to: Group A (n=15) patients managed using bronchoscopic cryotherapy, and Group B (n=15) patients managed using bronchoscopic electrocautery.

Prior to the intervention, a comprehensive pre-procedure assessment was conducted, including a detailed medical history, physical examination, symptom evaluation (dyspnea, cough, and hemoptysis), and performance status using the ECOG Scale.

Dyspnea was graded using the MRC Dyspnea Scale. Cough evaluation used Walsh's scoring system, with a score of 0 indicating no cough, score of 1 indicating cough that doesn't disturb sleep and a score of 2 indicating a cough that disturbs sleep.[5] Hemoptysis was also scored by Walsh's criteria, 0: no hemoptysis, 1: Streaks of blood in sputum, 2: Clots of blood in 4 days or less during the preceding 2 weeks, 3: Clots in 5 or more days during the preceding 2 weeks, 4: Hemoptysis requires blood transfusion.[5] Airway assessment included Mallampati scoring, mouth opening, thyromental distance, neck mobility, dental status, and temporomandibular joint evaluation.

Laboratory tests included a complete blood count, erythrocyte sedimentation rate, liver and kidney function tests, and coagulation profile. Spirometry (FEV1, FVC, and the FEV1/FVC ratio). Thoracic imaging (X-ray, CT scan) was reviewed. Arterial blood gases analysis and ECG were also performed. Flexible bronchoscopy was conducted for all patients to assess lesion site, size, and vascularity. The percentage of airway obstruction was estimated by visual comparison.

Bronchoscopic procedures were performed under general anesthesia using rigid bronchoscopy, with flexible bronchoscopy utilized as needed. Cryotherapy was performed using the Erbe Erbokryo Ca system with the cryorecanalization technique. The cryoprobe was placed inside the tumor, cooled for 5 to 20 seconds, and then the frozen tumor tissue was extracted by pulling strongly on the probe.

The electrocautery technique used a monopolar system with soft coagulation, where the electrocautery probe was pressed against the tumor base, applying 20-60W of energy until sufficient coagulation was achieved.

Post-bronchoscopic care involved assessing airway patency at procedure completion and documenting complications. Outcomes were classified as complete success (full lesion ablation), partial success (>50% reopening), or no success (<50% patency). Bleeding was categorized as mild (controlled by suction and/or adrenaline instillation), moderate (required intervention), or severe (procedure halted due to hypoxemia).[6]

Patients were extubated upon regaining consciousness and respiratory control, discharged within 24–48 hours, and reassessed after one week.

The follow-up evaluation included symptom reassessment (dyspnea, cough, performance status), spirometry, blood gas analysis, and imaging. The outcomes were then compared between the two groups, as well as pre- and post-intervention, to determine the efficacy and safety of each technique.

Statistical Analysis: Data entry and validation were performed using an Excel spreadsheet. Statistical analyses were conducted using SPSS version 30.0 for Windows. Frequency tables with percentages were used for categorical variables, and descriptive statistics (mean and standard deviation) were used for numerical variables. Quantitative variables were compared using the Student t-test or the ANOVA test. Pearson's Chi-square test was used for categorical variables. The significance level was set at a p-value < 0.05. Results were considered statistically significant at $p \leq 0.05$, highly significant at $p \leq 0.01$, and very highly significant at $p < 0.001$.

3. Results

The study cohort (n = 30) had a mean age of 58.83 ± 9.58 years and consisted of 76.67% males and 23.33% females. Smokers comprised 70% (mean smoking index: 22.67 ± 15.05 pack-years), while 30% were non-smokers. Common comorbidities included COPD, hypertension, diabetes, and malignancy. No significant differences were observed between groups in age, sex, smoking status, or comorbidities (Table 1).

Table 1. Demographic data of studied patients

VARIABLE	EC (N = 15)	CRYO (N = 15)	TOTAL (N = 30)	TEST OF SIGNIFICANCE	P-VALUE
AGE (YEARS)				T-test	
RANGE	32 - 69	36 - 74	32 - 74		
MEAN ± SD	59.6 ± 10.4	60.2 ± 8.9	58.83 ± 9.58	0.18	0.86
SEX				x^2	
MALE, N (%)	12 (80%)	11 (73.34%)	23 (76.67%)	0.186	0.66
FEMALE, N (%)	3 (20%)	4 (26.67%)	7 (23.33%)		
SMOKING STATUS				x^2	
SMOKER, N (%)	10 (66.67%)	11 (73.34%)	21 (70%)	0.16	0.69
NON-SMOKER, N (%)	5 (33.34%)	4 (26.67%)	9 (30%)		
COMORBIDITIES				x^2	
COPD, N (%)	3 (20%)	5 (33.33%)	8 (26.67%)	0.68	0.4
HTN, N (%)	4 (26.67%)	3 (20%)	7 (23.33%)	0.18	0.66
DM, N (%)	2 (13.33%)	3 (20%)	5 (16.67%)	0.24	0.62
HX OF CANCER OVARY, N (%)	0 (0%)	1 (6.67%)	1 (3.33%)	1.034	0.3
HX OF BRAIN TUMOR, N (%)	0 (0%)	1 (6.67%)	1 (3.33%)	1.034	0.3

EC; electrocautery, Cryo; cryotherapy, Hx; history

Histological diagnoses, obstruction location, lesion size, and vascularity are summarized in Table 2, revealing no significant pre-procedure differences between groups (p > 0.05).

Table 2. Histological diagnoses, site of lesion, CT size, and vascularity of lesion

VARIABLE	EC (N = 15)	CRYO (N = 15)	TOTAL (N = 30)	X^2	P-VALUE
HISTOPATHOLOGICAL DIAGNOSES					
ADENOCARCINOMA	3 (20%)	3 (20%)	6 (20%)	0	1
SQUAMOUS CELL CARCINOMA	6 (40%)	4 (26.70%)	10 (33.33%)	0.6	0.44
CARCINOID	1 (6.70%)	2 (13.30%)	3 (10%)	0.37	0.54
MUCOEPIDERMOID CARCINOMA	1 (6.70%)	1 (6.70%)	2 (6.67%)	0	1
SMALL CELL CARCINOMA	3 (20%)	3 (20%)	6 (20%)	0	1
FIBROUS POLYP	1 (6.70%)	0 (0%)	1 (3.33%)	1.03	0.31
METASTATIC	0 (0%)	1 (6.70%)	1 (3.33%)	1.03	0.31
MUCORMYCOSIS	0 (0%)	1 (6.70%)	1 (3.33%)	1.03	0.31
SITE OF THE LESION					
RIGHT MAIN STEM BRONCHUS	7 (46.67%)	6 (40%)	13 (43.33%)	0.13	0.71
LEFT MAIN STEM BRONCHUS	4 (26.67%)	5 (33.33%)	9 (30.00%)	0.16	0.69
RIGHT UPPER LOBE BRONCHUS	1 (6.67%)	2 (13.33%)	3 (10%)	0.37	0.54
BRONCHUS INTERMEDIUS	1 (6.67%)	1 (6.67%)	2 (6.67%)	0	1
DISTAL TRACHEA	1 (6.67%)	1 (6.67%)	2 (6.67%)	0	1
RIGHT LOWER LOBE BRONCHUS	1 (6.67%)	0 (0%)	1 (3.33%)	1.03	0.31
CT SIZE AND VASCULARITY OF MASS					
< 2 CM	3 (20%)	1 (6.70%)	4 (13.33%)	1.15	0.28
> 2 CM	12 (80%)	14 (93.30%)	26 (86.67%)	1.15	0.28
HIGHLY VASCULAR	7 (46.67%)	5 (33.33%)	12 (40%)	0.55	0.45
LOW VASCULAR	8 (53.33%)	10 (66.67%)	18 (60%)	0.55	0.45

As shown in Table 3, both groups experienced a highly significant improvement (p < 0.01) in dyspnea grade, cough severity, hemoptysis, and quality of life post-procedure. However, no significant differences were observed between the EC and Cryo groups before or after the procedure (p > 0.05).

Table 3. Effect of procedure on dyspnea grade, cough severity, hemoptysis and quality of life

GROUPS	EC (N=15) (%)	CRYO (N=15) (%)	X^2	P VALUE
DYSPNEA GRADE BEFORE THE				
GRADE I	0 (0%)	1 (6.67%)	1.03	0.31
GRADE II	6 (40%)	2 (13.33%)	2.72	0.09
GRADE III	8 (53.33%)	9 (60%)	0.13	0.71
GRADE IV	1 (6.67%)	3 (20%)	1.15	0.28
DYSPNEA GRADE AFTER THE				
GRADE I	11 (73.33)	7 (46.67%)	2.22	0.13
GRADE II	4 (26.67%)	8 (53.33%)	2.22	0.13
X^2	15	18		
P VALUE	0.000 (< 0.01)	0.000 (< 0.01)		
COUGH SCORE BEFORE THE				
SCORE 0	2 (13.30%)	1 (6.67%)	0.37	0.54
SCORE 1	6 (40%)	4 (26.67%)	0.6	0.44
SCORE 2	7 (46.7%)	10 (66.67%)	1.22	0.26
COUGH SCORE AFTER THE PROCEDURE				
SCORE 0	10 (66.67%)	8 (53.33%)	0.55	0.45
SCORE 1	5 (33.33%)	7 (46.57%)	0.55	0.45
X^2	12.43	15.84		
P VALUE	0.002 (< 0.01)	0.0004 (< 0.01)		
HEMOPTYSIS SCORE BEFORE THE				
SCORE 0	4 (26.67%)	5 (33.33%)	0.15	0.69
SCORE 1	1 (6.67%)	1 (6.67%)	0	1
SCORE 2	6 (40%)	5 (33.33%)	0.14	0.7
SCORE 3	4 (26.67%)	4 (26.67%)	0	1
HEMOPTYSIS SCORE AFTER THE				
SCORE 0	12 (80%)	13 (86.67%)	0.24	0.62
SCORE 1	3 (20%)	2 (13.33%)	0.24	0.62
X^2	15	12.9		
P VALUE	0.0017 (< 0.01)	0.0048 (< 0.01)		
QUALITY OF LIFE SCALE BEFORE THE				
SCORE 0	0 (0%)	0 (0%)	0	1
SCORE 1	3 (20%)	3 (20%)	0	1
SCORE 2	8 (53.33%)	9 (60%)	0.13	0.71
SCORE 3	4 (26.67%)	3 (20%)	0.18	0.66
QUALITY OF LIFE SCALE AFTER THE				
SCORE 0	7 (46.67%)	9 (60%)	0.53	0.46
SCORE 1	7 (46.67%)	5 (33.33%)	0.55	0.45
SCORE 2	1 (6.67%)	1 (6.67%)	0	1
X^2	15	15		
P VALUE	0.0001	0.0001		

Table 4 showed a highly significant improvement in obstruction severity in both EC and Cryo groups (p < 0.01). Following electrocautery, 46.67% of patients achieved total radiological improvement, while 53.33% showed partial improvement. After cryotherapy, total and partial improvements were 60% and 40%,

respectively. No significant differences were observed between groups in radiological findings (X-ray and CT) before or after the procedure ($p > 0.05$).

Table 4. Effect of procedure on airway obstruction and radiological abnormalities

GROUPS	EC (N = 15) (%)	CRYO (N = 15) (%)	X^2	P-VALUE
AIRWAY OBSTRUCTION BEFORE PROCEDURE				
GRADE 0	0 (0%)	0 (0%)	0	1
GRADE 1	0 (0%)	0 (0%)	0	1
GRADE 2	15 (100%)	15 (100%)	0	1
AIRWAY OBSTRUCTION AFTER PROCEDURE				
GRADE 0	5 (33.33%)	4 (26.67%)	0.14	0.7
GRADE 1	10 (66.67%)	11 (73.33%)	0.14	0.7
GRADE 2	0 (0%)	0 (0%)	0	1
X^2	15	15		
P-VALUE	0.0001	0.0001		
RADIOLOGICAL FINDINGS BEFORE PROCEDURE				
ENDOLUMINAL MASS/NODULE	1 (6.67%)	2 (13.33%)	0.37	0.54
LUNG MASS	3 (20%)	2 (13.33%)	0.24	0.62
LOBAR ATELECTASIS	5 (33.33%)	4 (26.67%)	0.15	0.69
COMPLETE ATELECTASIS	6 (40%)	7 (46.67%)	0.53	0.46
RADIOLOGICAL FINDINGS AFTER PROCEDURE				
TOTALLY IMPROVED	7 (46.67%)	9 (60%)	0.53	0.46
PARTIALLY IMPROVED	8 (53.33%)	6 (40%)	0.53	0.46
X^2	15	15		
P-VALUE	0.01	0.01		

Table 5 showed significant improvements in FEV_1% and FVC% (predicted) in both the EC and Cryo groups ($p < 0.01$), with no significant intergroup differences before or after the procedure ($p > 0.05$). PaO_2 and SaO_2 improved significantly in both groups ($p < 0.01$), while pH and $PaCO_2$ showed no significant changes ($p > 0.05$). No significant differences in blood gases were observed between groups.

Table 5. Effect of procedure on blood gases and spirometry

PARAMETER	TIME	EC (N = 15)	CRYO (N = 15)	T-TEST	P-VALUE
FEV_1 % OF PREDICTED	Before	Range: 28 - 76 Mean ± SD: 50 ± 14	Range: 29 - 75 Mean ± SD: 45 ± 11.6	1.065	0.29
	After	Range: 40 - 87 Mean ± SD: 65 ± 12.67	Range: 42 - 87 Mean ± SD: 59 ± 11.24	1.37	0.17
FVC % OF PREDICTED	Before	Range: 29 - 85 Mean ± SD: 59 ± 13.75	Range: 44 - 85 Mean ± SD: 59 ± 10.5	0	1
	After	Range: 45 - 95 Mean ± SD: 70 ± 12.57	Range: 55 - 95 Mean ± SD: 71 ± 10.55	-0.23	0.81
PH	Before	Range: 7.35 - 7.47 Mean ± SD: 7.40 ± 0.037	Range: 7.35 - 7.45 Mean ± SD: 7.39 ± 0.031	0.8	0.43
	After	Range: 7.39 - 7.45	Range: 7.37 - 7.45	1.23	0.22
		Mean ± SD: 7.41 ± 0.021	Mean ± SD: 7.40 ± 0.023		
PAO_2 (MMHG)	Before	Range: 58 - 82 Mean ± SD: 70.86 ± 7.12	Range: 58 - 80 Mean ± SD: 67.93 ± 7.32	1.11	0.27
	After	Range: 64 - 98 Mean ± SD: 83.66 ± 8.21	Range: 70 - 92 Mean ± SD: 81.13 ± 8.02	0.85	0.40
$PACO_2$ (MMHG)	Before	Range: 36 - 60 Mean ± SD: 45.26 ± 5.81	Range: 37 - 60 Mean ± SD: 44.13 ± 7.82	0.45	0.65
	After	Range: 37 - 49 Mean ± SD: 42.06 ± 3.15	Range: 37 - 49 Mean ± SD: 42 ± 3.96	0.046	0.96
SAO_2 (%)	Before	Range: 88 - 97 Mean ± SD: 93 ± 2.7	Range: 88 - 97 Mean ± SD: 92 ± 2.9	0.97	0.33
	After	Range: 90 - 99 Mean ± SD: 96 ± 2	Range: 93 - 98 Mean ± SD: 95 ± 1.7	1.47	0.15

All patients in the EC and Cryo groups successfully regained airway patency (100%). Complete success was achieved in 33.33% of the EC group and 26.67% of the Cryo group, while partial success occurred in 66.67% and 73.33%, respectively. There was no significant difference between groups ($p > 0.05$) (Table 6).

Table 6. Bronchoscopic success in restoring airway patency

OUTCOME	EC (N = 15)		CRYO (N = 15)		X^2	P-VALUE
	n	%	*n*	%		
COMPLETE SUCCESS	5	33.33%	4	26.67%	0.15	0.69
PARTIAL SUCCESS	10	66.67%	11	73.33%	0.15	0.69
NO SUCCESS	0	0%	0	0%	-	-

Procedural complications occurred in 1 case (6.67%) with electrocautery and 4 cases (26.67%) with cryotherapy, all manageable as mild intrabronchial bleeding. No significant difference was observed between the groups ($p < 0.05$) (Table 7).

Table 7. Complications

COMPLICATIONS	EC (N = 15)		CRYO (N = 15)		X2	P-VALUE
	n	%	*n*	%		
PRESENT	1	6.67%	4	26.67%	2.16	0.14
ABSENT	14	93.33%	11	73.33%	2.16	0.14

4. Discussion

Central airway obstruction (CAO), seen in a variety of malignant and nonmalignant airway disorders, is associated with a poor prognosis. The management of CAO is dependent on provider training and local resources, which may make the clinical approach and outcomes highly variable. Therapeutic bronchoscopy can improve the symptoms, quality of life, and survival of

patients with malignant and nonmalignant CAO.[1]

The mean age of our cohort (58.83 ± 9.58 years) aligns with prior studies on central airway obstruction. Abd El Hafez et al. reported a similar mean age (56.9 ± 6.3 years) in a study comparing argon plasma coagulation (APC) and cryotherapy.[7] Jeong et al. found a slightly older cohort (63 years) in a retrospective review of bronchoscopic cryotherapy.[8]

Our cohort had 76.67% male and 23.33% female patients, consistent with Jeong et al. (2023) (76% male) and Abdel-Aaty et al. (77.5% male, 22.5% female), confirming the male predominance in central airway obstruction. [8,9]

Squamous cell carcinoma was the most common, found in 40% of EC and 26.7% of Cryo patients. Adenocarcinoma and small cell lung cancer each occurred in 20% of the group. Carcinoid tumors were more frequent in Cryo (13.3%) than EC (6.7%), while mucoepidermoid carcinoma appeared in 6.7% of both groups. Metastatic lesions, a fibrous polyp, and mucormycosis were each found in one patient. Our findings align with Al Halfawy et al., who reported squamous cell carcinoma (23.3%), small cell lung cancer (20%), and adenocarcinoma (10%) in CAO patients. However, they also observed nonmalignant conditions like foreign bodies and tracheal webs, underscoring the diverse CAO etiologies.[10]

In our study, airway obstructions were most common in the right mainstem bronchus (43.33%), followed by the left mainstem bronchus (30%). Right upper lobe bronchus obstructions occurred in 10%, while bronchus intermedius and distal tracheal lesions were each found in 6.67% of patients. Right lower lobe bronchus obstruction appeared in one EC patient. These findings align with Abd El Hafez et al., who reported frequent lobar (60–70%) and mainstem bronchus (30–40%) obstructions.[7] Similarly, Abdel-Aaty et al. identified the right main bronchus as a common obstruction site (25% Cryo, 30% EC), with intermediate and left main bronchus obstructions also notable, reinforcing our results.[9]

In our study, dyspnea was universal (100%), cough was prevalent (90%), and hemoptysis was common (70%). These findings align with Farhat et al. who reported dyspnea and cough in 100% of patients, though hemoptysis was higher (90%), and fever (70%) was more frequent, suggesting differing etiologies.[11]

Similarly, Al Halfawy et al. found dyspnea (100%) and cough (96.7%) comparable to our results but noted lower hemoptysis (40%) and higher hoarseness (40%), underscoring the variability in CAO presentations and the need for comprehensive symptom assessment.[10]

Dyspnea, cough, and hemoptysis significantly improved post-procedure in both EC and Cryo groups ($p < 0.01$), with no significant intergroup differences ($p > 0.05$). Quality of life also improved ($p < 0.01$), with performance scores notably better in both groups.

Abd El Hafez et al. similarly reported significant symptom relief post-APC and cryotherapy, with no difference between techniques.[7] Moorjani et al. and El Badrawy et al. also observed marked dyspnea improvement with EC and Cryo, supporting our findings.[12,13]

Both electrocautery (EC) and cryotherapy (Cryo) significantly improved airway obstruction post-bronchoscopic intervention ($P < 0.01$), with no difference between groups ($P > 0.05$), indicating comparable efficacy. Our findings align with those of Al Halfawy et al., who reported significant improvement in postprocedural obstruction with cryotherapy.[10] Similarly, Mohamed and Alm El-Din demonstrated a progressive increase in complete endobronchial lesion removal rates (76.31% at 2 weeks, 85% at 6 weeks, $P < 0.05$).[14] Khan et al. further confirmed immediate airway obstruction relief and clinical improvement, reinforcing the role of bronchoscopic interventions in restoring airway patency.[6]

Both electrocautery and cryotherapy significantly improved FEV1%, FVC%, PaO2, and SaO2 ($P < 0.01$) without intergroup differences ($P > 0.05$). pH and PaCO2 remained unchanged. Our findings align with Abd El Hafez et al., who reported significant FEV1 and FVC improvements in both groups ($P < 0.05$).[7] Similarly, Farhat et al. observed significant spirometric and PaO2 improvements post-intervention, reinforcing the efficacy of both techniques in enhancing pulmonary function.[11]

Radiological assessment showed lobar or complete atelectasis, lung masses, or endoluminal masses in both groups. Post-intervention, total improvement occurred in 46.67% (EC) and 60% (Cryo) of patients, with partial improvement in 53.33% and 40%, respectively. Our findings align with Abdel-Aaty et al., who reported significant radiological improvements post-bronchoscopy ($P < 0.05$), reinforcing the efficacy of both techniques in resolving airway obstruction.[9]

Both EC and Cryo achieved 100% airway patency restoration, with complete recanalization in 33.33% (EC) and 26.67% (Cryo) and partial success in 66.67% and 73.33%, respectively. Our results align with Al Halfawy et al., who reported 53.3% complete and 46.7% partial success with cryotherapy.[10] Mohammad et al. and Lyu et al. also documented high recanalization rates.[15,16] Variability in outcomes may stem from differences in patient populations, procedural techniques, success definitions, treatment sessions, and

clinical settings. Patient-specific factors, including comorbidities and obstruction characteristics, also influence success rates.

Procedural complications occurred in 6.67% (EC) and 26.67% (Cryo) of cases, primarily as mild intrabronchial bleeding, with no significant intergroup difference (P > 0.05). Khan et al. reported moderate bleeding (13.3%) and other complications, including infections, arrhythmias, and pneumothorax.[6] Al Halfawy et al. noted a 10% complication rate, including mild bleeding, pneumothorax, and transient hypoxia.[10] Our findings indicate a low incidence of manageable complications, consistent with previous studies.

Study limitations include a small sample, short duration, no long-term follow-up, and no correlation between tumor type and procedure, potentially affecting outcomes. Strict exclusion criteria minimized major complications but may not reflect real-life scenarios.

4. Conclusion

Electrocautery and cryotherapy are effective endobronchial debulking techniques for CAO. Electrocautery offers rapid symptom relief and improved quality of life but requires careful training due to potential complications. Cryorecanalization is a safe and efficient alternative for restoring airway patency. Interventional bronchoscopy remains crucial in managing malignant and nonmalignant CAO, providing both treatment and palliation.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

Funding

No Funds : Yes

Conflicts of interest

There are no conflicts of interest.

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