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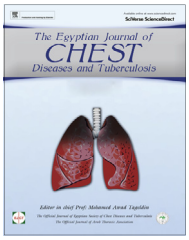

ORIGINAL ARTICLE

Outcome of endobronchial electrocautery versus external beam radiotherapy or both together in the palliative management of non-small cell lung cancer

Samah M. Shehata [a,1], **Ashraf E. El-Shora** [a,*], **Mohamed A. Mazroaa** [b,2], **Mostafa I. Ragab** [a,3]

[a] *Chest Department, Zagzazig University, Egypt*
[b] *Clinical Oncology Department, Zagzazig University, Egypt*

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KEYWORDS

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Abstract *Background:* Approximately 75% of patients with non-small cell lung cancer (NSCLC) present with locally advanced or metastatic disease which renders them inoperable and virtually incurable. Whene the aim of treatment is palliation, radiotherapy and bronchotherapeutic procedures are often recommended.

Aim of the work: To evaluate the outcome of endobronchial electrocautery and or external beam radiotherapy (XRT) in the palliative treatment of patients with inoperable non-small cell lung cancer.

Patient and methods: 40 patients with unresectable stage IIIA and IIIB NSCLC, 33 males and 7 females, their mean age of 60.82 ± 6.23 years were recruited in the study. Eligible patients were randomly classified into 3 groups: Group I: included 11 patients who received combined external irradiation (XRT) with end bronchial electro cautery, Group II: included 11 patients who received end bronchial electrocautery without external irradiation XRT, Group III: including 18 patients who received external palliative irradiation alone. Evaluation of chest symptoms, chest CT, PFTs, ABGs and quality of life outcomes were done before the interventional bronchoscopy and XRT therapies then one week and one month after the end of treatment.

* Corresponding author. Tel.: +20 1223595477.
E-mail addresses: sama7she7ata2000@yahoo.com (S.M. Shehata), drshora68@yahoo.com (A.E. El-Shora), mmazrouh@yahoo.com (M.A. Mazroaa), mstrgb@yahoo.com (M.I. Ragab).
[1] Tel.: +20 1142036075.
[2] Tel.: +20 1069999218.
[3] Tel.: +20 1005850829.

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Results: As regards improvement of endobronchial symptoms; one week after completion of treatment, Group III patients was significantly lesser than Groups I and II and one month after treatment, there was no significant difference between all patient groups except in cough which was in Group III of lesser improvement than Groups I and II. As regards patients who had atelectasis before starting treatment: Group I showed 100% disappearance of atelectasis either complete or partial one month after completion of treatment while Group II showed 77.77% disappearance of atelectasis either complete or partial and finally Group III showed 64.29% disappearance of atelectasis either complete or partial. As regards changes in both FEV1% and FVC%; all patient groups showed significant differences pretreatment and one month after completion of treatment and Group I patients was significantly different than patients of both Groups II & III.

Conclusions: The replacement of external radiation with bronchoscopic therapy may not be a recommended option, but its addition to XRT may be a relatively simple method of augmenting the symptom palliative effect, providing higher response rates for re-expansion of collapsed lung and reducing endobronchial obstruction endoscopically.

Introduction

Almost 30% of lung cancer patients at present have thoracic symptoms which may only be caused by the endobronchial component of their disease such as cough, haemoptysis, breathlessness and obstructive pneumonitis. Best palliative therapy is usually provided by external irradiation, with or without chemotherapy. In an emergency, however, or if relapse occurs after external irradiation or prior resection, endoscopic management may be more effective. When the main component of the airway obstruction is endoluminal, endoscopic disobliteration provides immediate and safe relief of symptoms. This may be achieved by various techniques including, lasers, argon plasma, electrocautery, cryo-therapy; photodynamic therapy and brachytherapy [1].

With increasing numbers of lung cancer patients, there was increased need for sophisticated interventions in these patients and expanding the role of Chest Department, Zagazig University in its surrounding environment. Intervention bronchoscopy unit with APC and Electrocautery was established on 2008 at chest Department Zagazig University Hospitals.

The aim of this work was to evaluate the outcome of endobronchial electrocautery and or external beam radiotherapy in the palliative treatment of patients with inoperable non-small cell lung cancer.

Patients and methods

This study was conducted at the Chest Department (Bronchoscopy Unit) and Clinical Oncology Department of Zagazig University Hospitals during the period from June 2008 to June 2011. 40 patients with unresectable stage IIIA and IIIB NSCLC, 33 males and 7 females, their mean age of 60.82 ± 6.23 years were included in the study. Patients gave their signed written consent after detailed explanation of the protocol of the study. All the included patients had a diagnosed unresectable NSCLC with endobronchial tumor in either main or lobar bronchi.

Eligible patients were randomly classified into 3 groups:

- Group I: included 11 patients who received combined external irradiation (XRT) with endobronchial electrocautery.
- Group II: included 11 patients who received endobronchial electrocautery without XRT.
- Group III: including 18 patients who received external palliative irradiation alone.

Inclusion criteria

To be eligible for the study, patients had to have:

(1) Unresectable endobronchial tumour when its main component is endoluminal, present in the proximal main or lobar bronchi, proved to be NSCLC by histopathological examination of stage IIIA or IIIB [2].
(2) World Health Organization performance status of 0–2.
(3) No prior chemotherapy or surgery or radiotherapy.

All patients were considered fit for palliative radiotherapy when they had stage III disease which was too extensive for radical irradiation on the basis of either [3]: A primary tumor larger than 6 cm or the presence of more than a single mediastinal node with a minimal diameter of 10 mm in the short axis.

Patients were considered fit for therapeutic bronchoscopy if they had the following criteria [4]:

(1) Symptoms were related primarily to airway obstruction (cough, dyspnea, hemoptysis and obstructive pneumonia).
(2) The tumor was located within the lumen of the airway.
(3) The margins between tumor and normal airway were identifiable.

Exclusion criteria

Operable tumors without any contraindications to surgery, presence of severe coagulation defect, orthopneic patient with severe respiratory distress, patients with extensive myocardial ischaemia in ECG or patients with cardiac arrhythmias were excluded from the study.

All patients were submitted to:

(1) Thorough medical history, smoking habit and history of associated illness.
(2) Full clinical examination: general and local chest examination.
(3) Postero-anterior and lateral chest radiography.
(4) CT scan of the chest.
(5) Diagnostic fiberoptic bronchoscopy.
(6) Lung function tests were performed by using computerized pulmonary function apparatus (ZAN 100, computerized pulmonary function apparatus).
(7) XRT delivered as the followings: the target volume was irradiated with 3 Gy per fraction (five times a week) up to a total dose of 30 Gy (100%) without correction for lung tissue density.
(8) Interventional bronchoscopic electrocautery was performed under general or local anesthesia. The flexible bronchoscopy was either passed directly or via an endotracheal tube. General anesthesia technique for interventional bronchoscopy is a total intravenous anesthesia, consisting of hypnotic action and analgesia. Endotracheal tube was inserted. FOB was inserted via endotracheal tube and ventilation was assisted, controlled (IPPV) or manual by hand bag. Intra-operative monitoring included continuous pulse oxymetry, electrocardiography, and intermittent noninvasive measurement of blood pressure were performed. With the electrocautery, the monoplar probe was pressed against the tumor base and applying 20–40 W of energy until sufficient blanching was apparent. Inspired oxygen concentrations were kept at 30% if possible. The pulsed mode and low inspired oxygen concentrations were chosen to minimize the risk of unintentional penetrating injury or airway fire. Coagulated or vaporized tissues were removed mechanically or with suction. In the cases of bulky tumor, electrocautery were used to coagulate the tumor base to shut off vascular structures and to reduce the risk of bleeding when tumor tissue was mechanically removed. Retreatment sessions continued until $>75\%$ reopening of the normal airway lumen had been achieved.
(9) Symptoms were recorded and scored before treatment then one week and one month after treatment completion using the Speiser symptom score [5].
(10) The primary endpoints were symptom response; symptom response for each of the four measured symptoms was documented.
(11) After completion of treatment all patients were re-examined by bronchoscopy one month after treatment completion for evaluation of endobronchial response. The extent of obstruction using endoscopic criteria before and after treatment was scored using the obstruction score described by Speiser and Spratling.
(12) Definitive re-expansion of atelectasis or post-obstructive pneumonia was assessed one and four weeks after the end of the entire course of treatment by means of PFTs, Chest radiographs and CT scan of the chest
(13) Acute and late pulmonary and esophageal toxicity were recorded according to the Radiation Therapy Oncology Group (RTOG) [6].
(14) Quality of life assessment using the EORTC QLQ-C30 Version 3 questionnaires before treatment and at one week and one month following treatment [7,8].

Statistical analysis

The demographic, clinical, radiological, physiological and pathological data gathered together with the patients' outcome were tabulated and statistically analyzed and coded, entered and checked to an Epi-info file using Epi-info version 10 computer packages. Data were summarized using; the arithmetic mean as an average describing the central tendency of observations, the standard deviation (S.D.) as a measure of dispersion of the results around the mean, the number of observations for each variable studied (NO).

The Chi-square test (χ^2), comparison of means: ANOVA and multiple comparison tests (LSD and paired *t*-test): For all the above-mentioned statistical tests, the threshold of significance is fixed at the 5% level (*p*-value), a *p*-value $\geqslant 0.05$ indicates non-significant results, a *p*-value <0.05 indicates significant results, a *p*-value <0.01 indicates high significant results, and a *p*-value <0.001 indicates very high significant results.

Results

One week after treatment, Group III was significantly lesser than Groups I and II as regards improvement of all endobronchial symptoms (cough, dyspnea, haemoptysis and obstructive pneumonia) (see Figs. 1–4).

One month after treatment, Group III was significantly lesser than Groups I and II as regards improvement of cough. While, there was no significant difference between all patient groups as regards improvement of other endobronchial symptoms.

Pre-treatment and one month after completion of treatment, Group I and III showed significant difference in mean obstruction scores of lobar bronchi only, while Group II

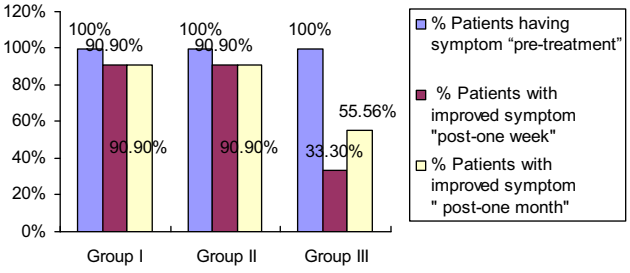

Figure 1 Cough score response rate.

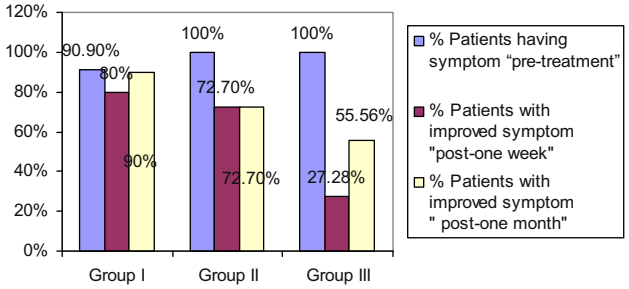

Figure 2 Dyspnea score response rate.

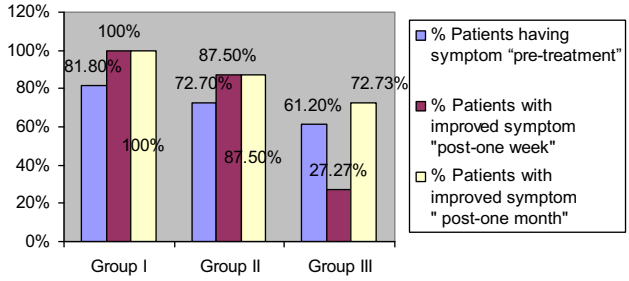

Figure 3 Hemoptysis score response rate.

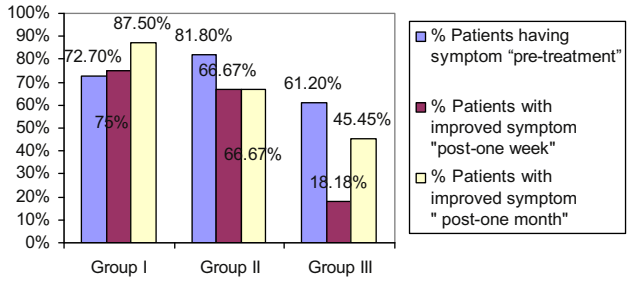

Figure 4 Fever score response rate.

showed significant difference in mean obstruction scores of main bronchi only.

As regards patients with atelectasis before treatment: Group I showed 100% disappearance of atelectasis either complete or partial after treatment. Group II showed 77.77% disappearance of atelectasis either complete or partial and 22.23% persistence of atelectasis after treatment. Group III showed 64.29% disappearance of atelectasis either complete or partial, 21.4% persistence of atelectasis and 14.29% progression of atelectasis after treatment. *As regards patients without atelectasis before treatment:* Group I showed 100% prevention of atelectasis after treatment. Group II showed 50% prevention of atelectasis after treatment. Group III showed 75% prevention of atelectasis after treatment (see Fig. 5).

Group I was significantly different than Groups II and III as regards changes in PaO_2. One week and one month after completion of treatment (see Figs. 6–8).

Group II was significantly different than Groups I and III as regards absence of post treatment complications. There was no significant difference between patient Groups I and III as regards post treatment complications (see Fig. 9).

One week after completion of treatment:

Group III was significantly different than Groups I and II as regards global health status and (physical, role) functional scales.

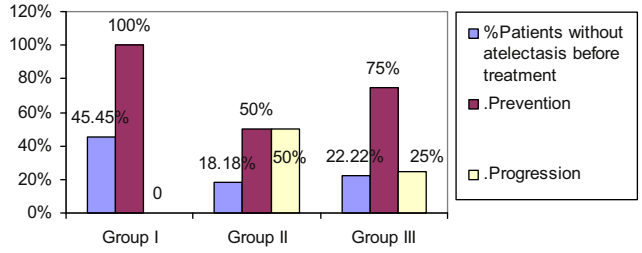

Figure 5 Radiological assesment ''one month post treatment''.

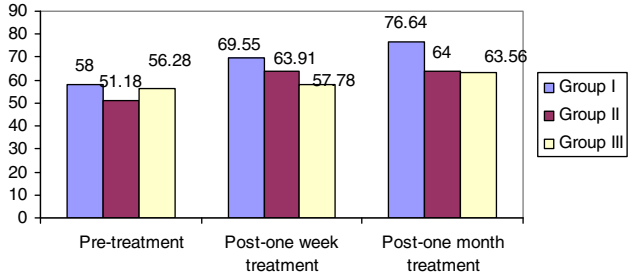

Figure 6 Mean FEV1%.

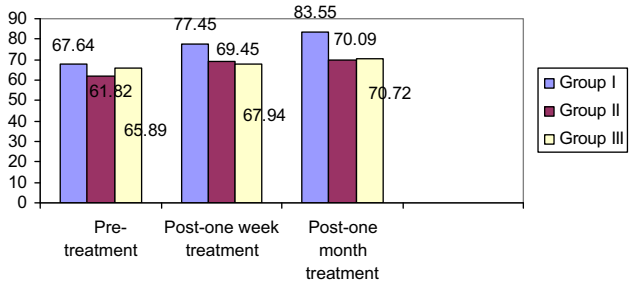

Figure 7 Mean FVC%.

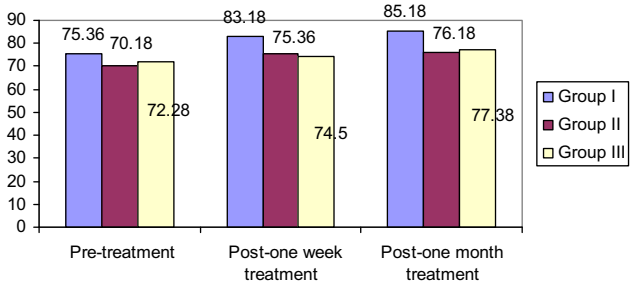

Figure 8 Mean PaO_2 (mmHg).

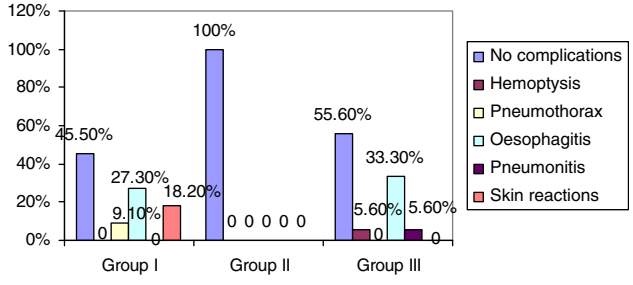

Figure 9 % Post-treatment complications.

There was no significant difference between all patient groups as regards other functional scales.

Group I showed significant difference as regards changes in global health status and (physical, role, emotional) functional scales, pre-treatment and one week after completion of treatment.

Group II showed significant difference as regards changes in global health status and (physical, role, emotional and cognitive) functional scales, pre-treatment and one week after completion of treatment.

Group III showed significant difference as regards changes in (emotional and cognitive) functional scales, pre-treatment and one week after completion of treatment.

One month after completion of treatment:

Group III was significantly different than Groups I and II as regards changes in physical functional scales only.
There was no significant difference between all patient groups as regards other Functional scales and global health status.
Group I showed significant difference as regards changes in global health status and (physical, role, emotional) functional scales, pre-treatment and one month after completion of treatment.
Group II showed significant difference as regards changes in global health status and (physical, role, emotional and cognitive) functional scales, pre-treatment and one month after completion of treatment.
Group III showed significant difference as regards changes in global health status and (physical, role, emotional and cognitive) functional scales, pre-treatment and one month after completion of treatment.

Discussion

The current study included 40 patients with unresectable stage III NSCLC referred to Chest and Clinical Oncology Departments, Zagazig University Hospitals, during the period from June 2008 to June 2011. Patients were divided into 3 groups: The first group (Group I) received both palliative radiotherapy and electrocautary the second group (Group II) received electrocautary alone and the third (Group III) received palliative radiotherapy alone.

In the present study, the mean ages of patients were 60.82, 62.55 and 60.72 years in Groups I, II and III respectively. As regard the histopathological subtypes, Squamous cell carcinoma was the commonest pathologic subtype among the studied patients groups, followed by adenocarcinoma then large cell carcinoma.

The number of bronchoscopic sessions in patient Groups (I & II) ranged from 1–4 sessions. As regards symptom response rates Table 1 demonstrated that one week after completion of treatment, there was an improvement in all the four symptoms assessed in the three groups of patients. But, Group III was significantly lesser than Groups I and II as regards the overall response rate of the four presenting symptoms. The therapeutic bronchoscopic techniques electrocautary provided significant immediate relief of all endobronchial symptoms in the majority of patients [9]. While XRT provided a delayed relief of symptoms, it needed at least four weeks to allow enough time for acute morbidity to subside and the majority of responses to be evident [10].

One month after completion of treatment, the overall response rate of cough in Group III was significantly lesser than in Groups I and II. While, there was no significant difference between the three patient groups as regards improvement in dyspnea, hemoptysis and obstructive pneumonia. In our patient groups, the addition of bronchoscopic electrocautary to palliative external radiation appeared to provide a great benefit in symptom response rates, especially for haemoptysis.

Our results agreed with the following studies: Kvale et al. [9] stated that immediate relief of dyspnea can be achieved with electrocautery in 55–75% of patients. Crosta et al. [1] observed an immediate and substantial subjective improvement consisting in the complete regression of bleeding, obstructive infectious complications and dyspnea. On the other hand, the following studies demonstrated less response rate of symptom improvement: Hosni et al. [11] demonstrated that

Table 1 Comparison between different patient groups according to symptom score response rates one week and one month after completion of treatment.

Presenting symptoms	Group I (No. of improved patients/no of patients having symptoms)	Group II (No. of improved patients /no of patients having symptoms)	Group III (No. of improved patients/no of patients having symptoms)	*P* value
Cough No. (%)				
Patients having symptom "pre-treatment"	11/11(100%)	11/11(100%)	18/18(100%)	> 0.05
Post-one week	10/11(90.9%)	10/11(90.9%)	6/18(33.3%)[a]	< 0.001
Post-one month	10/11(90.9%)	10/11(90.9%)	10/18(55.56%)***(c)	< 0.05
Dyspnea No. (%)				
Patients having symptom "pre-treatment"	10/11(90.9%)	11/11(100%)	18/18(100%)	> 0.05
Post-one week	8/10 (80%)	8/11 (72.7%)	5/18(27.28%)[a]	< 0.01
Post-one month	9/10 (90%)	8/11 (72.7%)	10/18(55.56%)	> 0.05
Haemoptysis No. (%)				
Patients having symptom "pre-treatment"	9/11(81.8%)	8/11 (72.7%)	11/18(61.2%)	> 0.05
Post-one week	9/9(100%)	7/8 (87.5%)	3/11(27.27%)[a]	< 0.001
Post-one month	9/9 (100%)	7/8 (87.5%)	8/11(72.73%)	> 0.05
Manifestations of obstructive pneumonia No. (%)				
Patients having symptom "pre-treatment"	8/11 (72.7%)	9/11(81.8%)	11/18(61.2%)	> 0.05
Post-one week	6/8 (75%)	6/9(66.67%)	2/11(18.18%)[a]	< 0.05
Post-one month	7/8 (87.5%)	6/9(66.67%)	5/11(45.45%)	> 0.05

[a] Means Group III was significantly different than Groups I and II.

Table 2 Comparison between different patient groups according to obstruction scores pre-treatment and one month after completion of treatment.

Site of obstruction	Group I		Group II		Group III		*P* value
	No of Pat.	Mean ± SD	No of Pat.	Mean ± SD	No of Pat.	Mean ± SD	
Main bronchi							
Pre-treatment	2	6 ± 0.0	4	5.25 ± 1.5	4	3 ± 0.0[a]	< 0.05
Post-treatment	2	3 ± 0.0	4	2.5 ± 1.0	4	4.5 ± 1.73	> 0.05
P value		Not computed		< 0.01		> 0.05	
Lobar bronchi							
Pre-treatment	9	2 ± 0.0	7	1.71 ± 0.49[b]	14	2 ± 0.0	< 0.05
Post-treatment	9	0.22 ± 0.44	7	0.86 ± 1.07	14	0.64 ± 0.63	> 0.05
P value		< 0.001		> 0.05		< 0.001	

[a] Means Group III was significantly different than Groups I and II.
[b] Means Group II was significantly different than Groups I and III.

Table 3 Radiological assessment as regards atelectasis between different patient groups one month after completion of treatment.

Atelectasis as regards radiology	Group I (%)	Group II (%)	Group III (%)	*P* value
(I) Patients with atelectasis before treatment: N (%)	6/11 (54.55)	9/11 (81.82)	14/18 (77.78)	> 0.05
1. Complete disappearance	3/6 (50)	3/9 (33.33)	3/14 (21.43)	
2. Partial disappearance	3/6 (50)	4/9 (44.44)	6/14 (42.86)	
3. No change	0	2/9 (22.22)	3/14 (21.43)	
4. Progression	0	0	2/14 (14.29)	
(II) Patients without atelectasis before treatment: N (%)	5/11 (45.45)	2/11 (18.18)	4/18 (22.22)	> 0.05
1. Prevention	5/5 (100)	1/2 (50)	3/4 (75)	
2. Progression	0	1/2 (50)	1/4 (25)	

improvement of symptoms after electrocautery was 42.9% ± 8.6 for dyspnea, 78.5% ± 10.6 for haemoptysis, and 61.5% ± 8.9 for cough. Langendijk et al. [12] found that among patients allocated to receive XRT alone, the response rate for dyspnea was 37% (16 out of 43). For cough, the response rate was 38%, for haemoptysis the response rates was 82%, for chest pain the response rate was 67% and the response rate for pain in the arm/shoulder was 69%.

This difference in the response rate may be due to either patient factors (older age group, poorer performance status), tumor factors (different tumor pathology or stage) and lastly due to different bronchoscopic techniques used (rigid bronchoscopy, other endobronchial modality used e.g. laser therapy).

As regards obstruction scores of main and lobar bronchi, Table 2 showed that there was no significant difference between all patient groups as regards mean obstruction scores of either main or lobar bronchi one month after completion of treatment. Group II showed significant difference in mean obstruction scores of main bronchi only, pre-treatment and one month after completion of treatment. Groups I and III showed significant difference in mean obstruction scores of lobar bronchi only, pre-treatment and one month after completion of treatment.

Concomitant bronchoscopic electrocautery during XRT provides higher response rates for re-opening of obstructed airway mainly when obstructing tumours present in the main bronchus.

Mallick et al. [5] demonstrated that there was considerable improvement in the obstruction score across all patient groups (combined XRT + bronchoscopic therapy and bronchoscopic therapy alone). This reduction was highly significant statistically ($p < 0.001$).

In our study, Table 3 illustrated that higher rates of radiological re-expansion assessed with chest radiograph and CT scan of the chest were observed with XRT and bronchoscopic therapy compared to bronchoscopic therapy or XRT alone. Bronchoscopic therapy debulked only endobronchial mass, while XRT reduced the volume of intrathoracic mass either (endobronchial or extrabronchial), so both modalities were complementary to each other and not alternatives.

Langendijk et al. [12] demonstrated that significantly higher rates of radiological re-expansion assessed with chest radiograph and CT scan of the chest were observed with XRT and electrocautary compared to XRT alone.

As regards changes in pulmonary function tests; Table 4 showed that patients in Group I were significantly better than Groups II and III as regards changes in FVC after one week of treatment. After one month of treatment there were significant improvements in patients of Group I than in both Groups II and III as regards changes in FVC% and FEV1%. Bronchoscopic treatment enabled rapid mechanical debulking of obstructing mass and hence immediate relief of atelectasis and re-expansion of previously collapsed lung so causing improvement of pulmonary functions.

XRT showed a delayed relief of pulmonary functions, as it needed at least four weeks to allow enough time for acute morbidity to subside and the re-expansion of collapsed lung to be evident.

Stout et al. [10] stated that XRT alone resulted in re-inflation of collapsed lung and improvement of pulmonary

Table 4 Comparison between different patient groups according to pulmonary function tests pre-treatment, one week and one month after completion of treatment.

Pulmonary function tests	Group I	Group II	Group III	P value
(I) FEV1% (mean ± SD)				
Pre-treatment	58 ± 14.29	51.18 ± 13.49	56.28 ± 12.32	>0.05
Post-one week treatment	69.55 ± 10.37[a]	63.91 ± 11.75	57.78 ± 13.93	<0.05
Post-one month treatment	76.64 ± 9.8[b]	64 ± 12.13	63.56 ± 16.8	<0.05
*P*1 value	<0.001	<0.05	>0.05	
*P*2 value	<0.001	<0.05	<0.05	
(I) FVC% (mean ± SD)				
Pre-treatment	67.64 ± 11.28	61.82 ± 10.40	65.89 ± 8.08	>0.05
Post-one week treatment	77.45 ± 6.15[a]	69.45 ± 8.63	67.94 ± 11.7	<0.05
Post-one month treatment	83.55 ± 6.41[b]	70.09 ± 9.14	70.72 ± 12.92	<0.01
*P*1 value	<0.001	<0.05	>0.05	
*P*2 value	<0.001	<0.05	<0.05	

*P*1: means probability of difference between pre-treatment and one week post-treatment.
*P*2: means probability of difference between pre-treatment and one month post-treatment.
One week after completion of treatment: Group I was significantly better than both Groups II & III as regards changes in FVC%.
One month after completion of treatment: Group I was significantly better than Groups II and III as regards changes in FEV_1 and FVC.
[a] Means Group I was significantly different than Group III only.
[b] Means Group I was significantly different than Groups II and III.

function tests 60%. Hossni et al. [11] demonstrated that improvement of pulmonary function tests (PFT) after bronchoscopic electrocautery treatment were FVC 15.8% ± 6.6 and FEV1 12.6% ± 4.9.

As regards changes in PaO_2 Table 5 showed that:

One week after completion of treatment: Group I was significantly different than Group II and III as regards changes in PaO_2. But, both Groups I and II showed significant difference as regards changes in PaO_2, pre-treatment and one week after completion of treatment. Group III showed no significant difference as regards changes in PaO_2, pre-treatment and one week after completion of treatment.

One month after completion of treatment: Group I was significantly different than Groups II and III as regards changes in PaO_2. All patient groups showed significant difference as regards changes in PaO_2, pre-treatment and one month after completion of treatment.

Venuta et al. [13] showed that PaO_2 significantly improved after laser bronchoscopic treatment (69 ± 8 mmHg pre laser, 82 ± 5 mmHg post laser, $P < 0.001$).

Quality of life assessment demonstrated that:

One week after treatment completion, both Groups I and II showed statistically significant improvement in the global health status, the symptom scales of dyspnea, cough, haemoptysis and insomnia. Most of the functional scales (physical, role, cognitive and emotional functioning) also showed significant improvement. On the other hand, Group III showed only significant improvement in nausea and vomiting, constipation symptom scales and (emotional and cognitive) functional scales. Bronchoscopic electrocautery showed immediate relief of endobronchial symptoms mainly, while XRT alone did not.

One month after treatment completion, all patient groups showed statistically significant improvement in the global health status, the symptom scales of dyspnea, cough, haemoptysis, anorexia and insomnia. Most of the functional scales (physical, role, cognitive and emotional functioning) also showed significant improvement. On the other hand, Groups I and III showed significant improvement in fatigue, pain in (chest, arms/shoulders) and medicine for pain. XRT had tendency to palliate chest pain and the more systemic symptoms of anorexia, tiredness and nausea. Also, XRT relieved the endobronchial symptoms but with delayed effect. In contrary, bronchoscopic electrocautery were ineffective in palliation of extrabronchial symptoms and other systemic symptoms as they have no effect on extraluminal masses or pathology of tumor. Thus, XRT and bronchoscopic therapy may well perform complimentary roles in palliation.

Table 5 Comparison between different patient groups according to PaO_2 pre-treatment, one week and one month after completion of treatment.

PaO_2 (mmHg)	Group I	Group II	Group III	*P* value
Pre-treatment	75.36 ± 8.55	70.18 ± 7.55	72.28 ± 5.51	>0.05
Post-one week treatment	83.18 ± 6.93[a]	75.36 ± 5.77	74.50 ± 8.23	<0.01
Post-one month treatment	85.18 ± 7.13[a]	76.18 ± 5.11	77.38 ± 6.3	<0.01
*P*1 value	<0.001	<0.05	>0.05	
*P*2 value	<0.001	<0.01	<0.05	

*P*1: means probability of difference between pre-treatment and Post-one week treatment.
*P*2: means probability of difference between pre-treatment and Post-one month treatment.
[a] Means Group I was significantly different than Groups II and III.

Venuta et al. [13] demonstrated that the functional scales (physical, emotional and social) and the symptoms scales (fatigue, dyspnea and pain) were significantly improved after endoscopic treatment, as well as the global quality of life scale (p-value <0.001). Mallick et al. [5] found that one month after treatment completion, there was improvement in most categories that were relevant to the patient population and the treatment received. The global health status was significantly

Table 6 Comparison between different patient groups according to post treatment complications.

Complications	Group I (%)	Group II	Group III (%)	P-value
1.No complications	5(45.5)	11(100%)[a]	10(55.6)	<0.05
2. Hemoptysis No. (%)	0	0	1(5.6)	–
3.Pneumothorax No. (%)	1(9.1)	0	0	–
4.Oesophagitis No. (%)	3(27.3)	0	6(33.3)	>0.05
5.Pneumonitis No. (%)	0	0	1(5.6)	–
6. Skin reactions No. (%)	2(18.2)	0	0	–

[a] Means Group II was significantly different than Groups I and III.

Table 7 Comparison between different patient groups according to quality of life outcomes (EORTC QLQ-C30) (Global health status and Functional scales) pre-treatment, one week and one month after completion of treatment.

EORTC QLQ-C30	Group I	Group II	Group III	P-value
(I) Global health status	50.65 ± 15.14	57.79 ± 19.81	60.32 ± 15.34	>0.05
Pre-treatment	81.82 ± 9.63	85.71 ± 18.35	60.32 ± 15.34[a]	<0.01
One week post-treatment	89.66 ± 9.63	84.42 ± 22.32	73.02 ± 26.22	>0.05
One month post-treatment				
P_1 value	<0.001	<0.01	>0.05	
P_2 value	<0.001	<0.01	<0.05	
(II) Functional scales				
1. Physical functioning				
Pre-treatment	74.09 ± 14.8	64.09 ± 25.87	74.09 ± 14.8	>0.05
One week post-treatment	42.27 ± 9.58	41.36 ± 15.51	70.44 ± 25.55[a]	<0.05
One month post-treatment	32.73 ± 6.84	39.09 ± 13.93	53.82 ± 27.87[a]	<0.05
P_1 value	<0.001	<0.01	>0.05	
P_2 value	<0.001	<0.001	<0.001	
2. Role functioning				
Pre-treatment	76.14 ± 16.25	82.95 ± 17.02	71.53 ± 16.5	>0.05
One week post-treatment	43.18 ± 10.25	54.55 ± 14	68.39 ± 20.96[a]	<0.001
One month post-treatment	34.09 ± 5.84	48.86 ± 18.07	48.61 ± 24.59	>0.05
P_1 value	<0.001	<0.001	>0.05	
P_2 value	<0.001	<0.001	<0.001	
3. Emotional functioning				
Pre-treatment	69.89 ± 13.35	78.41 ± 14.89	73.26 ± 12.46	>0.05
One week post-treatment	40.34 ± 11.98	47.16 ± 12.61	53.13 ± 15.93	>0.05
One month post-treatment	40.34 ± 11.98	47.16 ± 12.61	53.13 ± 15.93	>0.05
P_1 value	<0.001	<0.001	<0.001	
P_2 value	<0.001	<0.001	<0.001	
4. Cognitive functioning				
Pre-treatment	81.36 ± 25.28	86.36 ± 14.2	87.5 ± 7.43	>0.05
One week post-treatment	69.55 ± 8.43	74.32 ± 10.25	71.25 ± 17.81	>0.05
One month post-treatment	69.55 ± 8.43	74.32 ± 10.25	71.25 ± 17.81	>0.05
P_1 value	>0.05	<0.05	<0.001	
P_2 value	>0.05	<0.05	<0.001	
5. Social functioning				
Pre-treatment	76.82 ± 21.19	84.09 ± 15.9	81.94 ± 13.71	>0.05
One week post-treatment	69.55 ± 11.56	78.55 ± 15.08	77 ± 19.17	>0.05
One month post-treatment	69.55 ± 11.56	78.55 ± 15.08	77 ± 19.17	>0.05
P_1 value	>0.05	>0.05	>0.05	
P_2 value	>0.05	>0.05	>0.05	

$P1$: means probability of difference between pre-treatment and Post-one week treatment.
$P2$: means probability of difference between pre-treatment and Post-one month treatment.
[a] Means Group III was significantly different than Groups I and II.

improved. Overall scores show a statistically significant improvement in the symptom scales of dyspnea, cough, haemoptysis and fatigue. Most of the functional scales (physical functioning, role functioning and social functioning) also showed significant improvement. Other parameters that had initially near-normal scores were maintained.

Complications were recorded during treatment and during a follow-up period of one month after completion of treatment, Table 6 showed that no complications were occurred in Group II patients. In Group I, 55.5% of patients developed complications in the form of {pneumothorax, grade II oesophagitis and skin reactions}. Lastly, in Group III, 44.4% of patients developed complications in the form of {grade II oesophagitis, mild hemoptysis in one patient and grade II pneumonitis}. Bronchoscopic electrocautery is less complicated procedure than XRT.

A tracheal fire while using bronchoscopic electrocautery was reported by Hooper and Jackson [14] and may have contributed to the unpopularity of electrocautery. Stout et al. [10] stated that the excess acute morbidity (dysphagia) with XRT was expected and reached statistical significance in the clinicians' assessment. Crosta et al. [1] demonstrated that no lethal complications such as hemorrhage, pneumothorax, respiratory and heart failure, myocardial infarction and pulmonary embolism that have been observed in their treated patients. Hosni et al. [11] stated that complications encountered from electrocautery were negligible. Bleeding in 3 (4%) patients, Pneumomediastinum in 1 (1%) patients, Hypercarbia in 1 (1%) patients and no complication in 10 (13.3%) patients. Mallick et al. [5] stated that the radiotherapy-related morbidity was low. Acute grade I odynophagia was seen in 32 of the 95 patients (33.7%) patients. All acute complications were self-limiting. No grade II-grade IV acute complications were seen. This variations in the results of post-treatment complications may be due to advanced patient age; presence of associated comorbidities, poor performance status, less preoperative pulmonary reserve or may be due to different bronchoscopic procedures used using rigid bronchoscope or different sedations during general anesthesia or different XRT fractionation dose applied (Table 7).

Finally, bronchoscopic therapeutic procedures are safe and effective tools for immediate endobronchial symptom palliation in advanced NSCLC. It considerably improves the quality of life in advanced NSCLC.

The benefit with XRT was seen mainly in chest pain, anorexia, nausea and tiredness. These are mainly extrabronchial symptoms, and cannot be palliated with bronchoscopic electrocautery. Thus, XRT and bronchoscopic therapy may well perform complimentary roles in palliation.

Conclusion

The replacement of external radiation with bronchoscopic therapy may not be a recommended option, but its addition to XRT may be a relatively simple method of augmenting the symptom palliative effect, providing higher response rates for re-expansion of collapsed lung and reducing endobronchial obstruction endoscopically. We recommend a long-term, large number prospective study of various therapeutic bronchoscopic modalities, to assess survival and quality of life of patients with NSCLC for long duration, and also the possible recurrence rate of the lesions.

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