Published in final edited form as:

Clin Lung Cancer. 2012 March ; 13(2): 149–156. doi:10.1016/j.clcc.2011.09.006.

The relationship between COPD and lung cancer in African American patients

Nader Mina¹, Ayman O. Soubani^{1,4}, Michele L. Cote^{2,4}, Tariq Suwan³, Angie S. Wenzlaff^{2,4}, Sunil Jhahria¹, Husam Samarah¹, and Ann G. Schwartz^{2,4}

¹Division of Pulmonary, Critical Care and Sleep Medicine, Wayne State University School of Medicine, Detroit, MI

²Department of Oncology, Wayne State University School of Medicine, Detroit, MI

³Department of Radiology, Wayne State University School of Medicine, Detroit, MI

⁴Karmanos Cancer Institute, Wayne State University School of Medicine, Detroit, MI

Abstract

Rationale—Airflow obstruction and/or emphysema have been associated with lung cancer risk, however this relationship and the joint occurrence of these conditions are not well studied in the African American population.

Objective—Describe the prevalence of airflow obstruction and/or emphysema in African Americans with lung cancer and evaluate their impact on the management and outcome of lung cancer.

Methods—Medical records were reviewed for 114 African Americans who had participated in population-based case-control studies of lung cancer and who sought medical care at the Karmanos Cancer Center in Detroit, Michigan. The medical records of these patients were reviewed for demographics, type and stage of lung cancer, spirometry, treatment and outcome. The chest CT scans around the time of the diagnosis of lung cancer were reviewed by a radiologist for evidence of emphysema. COPD was diagnosed when there were changes consistent with emphysema on CT scan and/or airflow obstruction by spirometry.

Results—There were no differences by sex for age at lung cancer diagnosis ($p=0.78$) and tumor histology ($p=0.43$). Men were more likely to present at a later stage of lung cancer diagnosis compared to women ($p=0.04$) and women were more likely to have surgery than men ($p=0.03$). Overall, 94% of men and 78% of women in this population had spirometry and/or CT evidence of COPD. Men were somewhat more likely to have COPD diagnosed by either CT or spirometry than women ($p=0.06$), but the GOLD Classification scores did not differ by gender among those with spirometry-diagnosed COPD ($p=0.34$). Seventy eight percent of individuals who did not report a previous diagnosis of COPD had clinical evidence of COPD, whereas 94% of individuals who reported a previous diagnosis of COPD also had clinical evidence of COPD ($p=0.03$). Among individuals who had both spirometry and CT data available, 29% had CT evidence of emphysema but normal spirometry. No differences in COPD diagnosis ($p=0.82$) or emphysema diagnosis ($p=0.51$) were noted by tumor histology. Stage at diagnosis also did not differ by COPD or emphysema diagnosis ($p=0.30$ and $p=0.06$, respectively), nor did treatment modality ($p=0.54$ and $p=0.10$, respectively). Lung cancer patients with COPD diagnosed either via spirometry or CT did

not show an increased risk of death compared to lung cancer patients without COPD after adjusting for age at diagnosis, gender and stage (HR=1.31 95% CI: 0.68-2.53).

Conclusion—There is a high incidence of COPD, emphysema in particular, in a selected group of African American patients with lung cancer. A significant number of these patients were not aware that they had COPD. There was no significant difference in the outcome of lung cancer in relation to the presence or absence of COPD.

Introduction

Lung cancer is a leading cause of cancer related death in the United States with 157,300 deaths annually ¹. COPD is the fourth-ranked cause of death in the United States with an age-adjusted death rate of 39.3 per 100,000 population ². Several studies have established the link between chronic airflow obstruction and/or emphysema and lung cancer. COPD is an independent risk factor for lung cancer, with chronic bronchitis and/or emphysema increasing lung cancer risk by two- to five-fold as compared with smokers with normal spirometry ³. Cigarette smoking is an obvious link between both diseases and the resulting chronic inflammation likely plays an important role in the pathogenesis of COPD and lung cancer ⁴.

African Americans are at higher risk for developing COPD and lung cancer. The annual incidence of lung cancer per 100,000 population is higher among African Americans (76.1) than the general population (69.3) or any other ethnic or racial group ⁵. COPD is also increasingly recognized as a major health problem in the African American population. Data from 1980 to 2000 show that death rates due to COPD rose faster in African Americans than in whites ⁶. In addition, some studies have suggested that African Americans are more susceptible to the damaging effects of tobacco smoking ^{7,8}. It is of special interest to further characterize the relation between COPD and lung cancer in the African American population. In this report, we describe the prevalence and clinical features of COPD in a cohort of African American patients with lung cancer and the impact of COPD on the diagnosis, treatment and outcome of lung cancer.

Methods

Medical records were reviewed for 114 African Americans who had participated in population-based case-control studies of lung cancer and who sought medical care at the Karmanos Cancer Center in Detroit, Michigan. The case-control studies have been described in detail elsewhere ⁹. Briefly, cases were diagnosed to have lung cancer between 9/1/99 and 6/3/2010 and identified through the Metropolitan Detroit Cancer Surveillance System (MDCSS), which is part of the national Surveillance, Epidemiology and End Results (SEER) program. Cases must have had a primary diagnosis of lung cancer and consented to release their medical records for review. Cases also participated in an interview that took place either by telephone or in person after their lung cancer diagnosis. Informed consent was obtained from each individual prior to the start of the epidemiological study.

The MDCSS provided information regarding age at diagnosis, histology (ICD-O coding), stage at diagnosis (local, regional or distant), vital status and months of survival. Data taken from the epidemiologic interview included ever/never smoking status, pack years of cigarette smoking, and whether the case had a previous physician diagnosis of COPD, chronic bronchitis or emphysema.

Variables obtained from medical record abstraction included pack years of smoking (continuous) and whether the patient reported COPD to the clinician (yes/no/unknown). Also data were abstracted on the presence of cardiovascular disease (yes/no/unknown), and

whether the individual was taking statins, inhaled corticosteroids or other pulmonary medications (all yes/no/unknown). Initial course of treatment information was also obtained from medical record abstraction, and included whether the individual had surgery (yes/no), radiation (yes/no), chemotherapy (yes/no), a combination of chemotherapy and radiation (yes/no), no treatment, or unknown treatment.

Spirometry closest to the time of the diagnosis of lung cancer was used to diagnose airflow obstruction (yes/no). Airflow obstruction was defined as post-bronchodilator forced expiratory volume in 1 second (FEV1)/ forced vital capacity (FVC) $\leq 70\%$ and other conditions with similar findings are ruled out. The Global Obstructive Lung Disease (GOLD) Classification score was used to classify the severity of airflow obstruction associated with spirometry.

CT scans closest to the time of the diagnosis of lung cancer and prior to treatment were reviewed by one radiologist for the presence and severity of emphysema. The chest CTs were done with different multidetector scanners and lung algorithm was routinely performed on all these studies. The section thickness ranged from 3-5 mm. The presence of emphysema was evaluated by a semi quantitative method similar to what has been described by the national emphysema treatment trial and subsequent studies¹⁰. Measurements of Hounsfield units were utilized as an objective confirmatory test. The level of -930 Hounsfield units or less was considered as evidence of emphysema as previously reported^{11, 12, 13}. The presence and degree of emphysema were categorized as: No emphysema, minimal, mild, moderate and severe. These grades correspond to the following subjective quantification: 0%, up to 10% of lung volume involvement, 10% to 25%, 25% to 50% and more than 50%, respectively. The presence of mild emphysema or higher ($>10\%$) was counted as emphysema present.

COPD was diagnosed based on whether airflow obstruction was present in those patients who had spirometry (N=58 patients, 51%) and/or the presence of emphysema on review of chest CT scans (all patients had chest CT scans and were reviewed by the radiologist).

Patient characteristics were examined by gender, whether COPD was reported to the clinician and by clinical evidence of COPD. Categorical variables were compared by chi-squared tests, and continuous variables were compared by t-tests. Kaplan-Meier models were used to assess univariate predictors of survival and to estimate one and two year survival. Cox Proportional Hazard modeling was employed to examine whether a diagnosis of COPD was associated with increased risk of death after adjusting for other predictive factors. A p-value of ≤ 0.05 was considered statistically significant, and all tests were two-sided. SAS Version 9.2 (Cary, NC) was used for all analyses.

Results

Patient characteristics are provided in Table 1, stratified by gender. Pack years among individuals who reported smoking to their physicians were similar for men (mean=37.0) and women (mean=37.5, $p=0.91$); however the amount smoked calculated from the subject interviews from the epidemiologic study differed by gender ($p=0.008$). Among men, the reported pack years was higher when calculated from the interview data (mean=47.5, $p=0.05$) than reported to the physician. Conversely, women reported somewhat lower pack years of smoking in the epidemiologic study (mean=30.7, $p=0.07$) compared to what was reported to the clinician. There were no differences by sex for age at lung cancer diagnosis ($p=0.78$) and tumor histology ($p=0.43$). Men were more likely to present at a later stage of lung cancer diagnosis compared to women ($p=0.04$) and women were more likely to have surgery than men ($p=0.03$).

Overall, 94% of men and 78% of women in this population had spirometry and/or CT evidence of COPD (either airflow obstruction on spirometry or emphysema on CT scan). Men were somewhat more likely to have COPD than women ($p=0.06$), but the GOLD Classification scores did not differ by gender among those with spirometry-diagnosed COPD ($p=0.34$). Emphysema was present in 75% of patients (81% of males and 73% of females). The severity of emphysema was also similar for men and women accessed via CT ($p=0.44$). History of cardiovascular disease and statin use did not differ between men and women with lung cancer ($p=0.93$ and $p=0.13$, respectively), nor did the use of inhaled corticosteroids ($p=0.21$) and other pulmonary medications ($p=0.09$). According to the medical records, one patient had history of sarcoidosis and none had the diagnosis of pulmonary fibrosis. Apart from emphysema, other radiological findings included pulmonary masses or nodules (79%), mediastinal lymphadenopathy (23%), pleural effusion (14%), pulmonary infiltrate (8%), and pulmonary fibrosis (2%).

Table 2 presents the association between COPD abstracted from medical records (“reported to the doctor”) and whether there was clinical evidence of COPD or emphysema (by CT and/or spirometry). Seventy eight percent of individuals who did not report a diagnosis of COPD had evidence of COPD, whereas 94% of individuals who reported a diagnosis of COPD also had clinical evidence of the disease ($p=0.03$). Reporting of pneumonia or asthma did not differ by clinical findings of COPD ($p=0.27$ and $p=0.19$, respectively).

Among individuals who reported no past history of COPD during the epidemiologic study, 80% did have clinical findings suggestive of COPD. Among individuals who reported having a previous diagnosis of COPD in the epidemiologic study, 13% did not have clinical evidence of COPD. Among individuals who had both spirometry and CT data available (49% of patients), 29% had CT evidence of emphysema but normal spirometry and in those with airflow obstruction by spirometry, 15% had no evidence of emphysema (data not shown).

Lung cancer pathology and treatment are presented in Table 3 by presence of COPD and emphysema. Among 114 patients, 27 patients had squamous cell carcinoma, 51 had adenocarcinoma, 1 had large cell carcinoma, 28 had NSCLC (NOS), and 7 had small cell carcinoma). No differences were noted by tumor histology for COPD diagnosis ($p=0.82$) or emphysema diagnosis ($p=0.51$). Stage at diagnosis also did not differ by COPD or emphysema diagnosis ($p=0.30$ and $p=0.06$, respectively), nor did treatment modality ($p=0.54$ and $p=0.10$, respectively). A total of 42 patients underwent surgery for treatment of lung cancer, (45% in the non-COPD group and 35% in the COPD group) with no statistically significant difference between the two groups ($p=0.54$). All patients except one were diagnosed with lung cancer at least two years prior to the time of analysis. 42 (36.8%) subjects were still alive at last follow up; the median follow up time was 42.5 months (range 17-100 months). For all subjects, the one year survival rate was 87%, and the two year survival rate was 61% (Table 4). Lung cancer patients with COPD diagnosed either via spirometry or CT did not show an increased risk of death compared to lung cancer patients without COPD after adjusting for age at diagnosis, gender and stage (hazard ratio (HR)=1.31 95% CI: 0.68-2.53). Similar results were noticed when comparing survival between those with or without emphysema based on chest CT scans HR 1.36 (95% CI 0.75-2.47, $p=0.31$). When subjects were stratified based on stage at diagnosis, there were no associations between COPD status and risk of death (data not shown).

Discussion

Several studies have established the association between COPD (manifested by airflow obstruction or emphysema) and lung cancer risk. To our knowledge, this is the first study to

characterize both diseases in a large African American population. In this series of lung cancer patients, there was a high prevalence of COPD (94% in males and 78% in females). Furthermore, 75% of our patients had emphysema based on CT scan with or without airflow obstruction which is also higher than previously reported in whites or the general population. In a recent report on COPD by the American Lung Association, the prevalence of physician diagnosed chronic bronchitis in the US population was 46.3/1000 for whites and 37.8/1000 for blacks. Also the incidence rate of emphysema in whites has been reported to be 18.9/1000 and 8/1000 for blacks ². In a recent study from Spain, emphysema was present in about one third of patients with lung cancer ¹⁴. Another study of 100 patients who underwent lobectomy for non-small cell lung cancer, emphysema was found in 52% of patients ¹⁵.

Beyond the high prevalence of COPD -in general- and emphysema -in particular- in our study, what is also striking about our findings in African Americans is the severe under-reporting or under-diagnosing of COPD. We do not have the data to determine whether study participants were diagnosed with COPD but chose not to share this with their physicians or during an interview, or whether they were never diagnosed. This will become increasingly important as guidelines for lung cancer screening are developed. Individuals with COPD, as discussed below, are at high risk for lung cancer therefore likely to benefit from screening, yet this requires that individuals have a COPD diagnosis. This observation also underscores the importance of screening patients with smoking history by a simple tool such as spirometry to detect the presence of airflow obstruction.

It has been reported in the literature that the presence of COPD, specifically emphysema on radiological assessment, even in the absence of cigarette smoking, increases the risk of developing lung cancer ^{16, 17}. In an analysis of the General Practice Research Database, among those with a prior diagnosis of COPD, annual incidence rates of lung cancer were more than four-fold and five-fold higher than in the general population in men and women, respectively. The incidence of lung cancer increased from 45 to 64 per 10,000 in men and from 29 to 48 per 10,000 in women. The mortality rates were significantly higher in those with prior COPD (rate ratios of 1.84; 95% CI: 1.65-2.05 in women and 1.90; 95% CI: 1.75-2.06 in men) ¹⁸. In another study, the prevalence of COPD in patients diagnosed with lung cancer was 50% compared with 8% in a randomly recruited community control group, matched for age, sex and pack-year smoking exposure (n = 602, odds ratio 11.6; p<0.0001) ¹⁹. In one of the case-control studies (women only) contributing cases to this study, COPD was associated with a significantly increased risk of lung cancer in the total study population (OR=1.67, 95% CI 1.15-2.41) and in white women (OR=1.85; 95% CI 1.21-2.81), however no increase in risk was seen in African American women ²⁰. A history of emphysema was associated with a 3-fold increased risk of lung cancer (OR=3.21; 95% CI 1.60-6.45) after adjusting for age, race, pack-years, family history of lung cancer, education, current BMI, and regular strength aspirin use. Risk was high in white women, but was not statistically significantly elevated in African American women. These negative findings in African American women are likely due to the under-reporting of COPD and emphysema in an interview setting.

In addition to shared exposures, several potential explanations have been suggested to explain the increased risk of lung cancer in patients with COPD. These include impaired ciliary clearance in areas of small airway inflammation with pooling of particles and prolonged exposure to inhaled carcinogens. Also chronic airway inflammation induced by cigarette smoke is thought to play a major role in the pathogenesis of both diseases. Several pathways, such as the nuclear factor- κ B pathway, have been found to be activated by cigarette smoke and are implicated in both local inflammation and tumor genesis. Reactive oxygen species are direct products of lung inflammation and promote DNA alterations that

may ultimately lead to lung cancer^{21,22}. In addition, a number of candidate single gene polymorphisms have been associated with susceptibility to lung cancer and COPD^{23,24}. Common polymorphisms associated with both COPD and lung cancer are found in genes coding for epoxide hydrolase 1, the matrix metalloproteinases, and interleukin (IL) 1. In a recent analysis by Van Dyke et al., single nucleotide polymorphisms (SNPs) in inflammatory pathway genes *IL6*, *IL7R*, *IL15*, *TNFA* and *IL10* were associated with risk of non-small cell lung cancer among African Americans; *IL7R* and *IL10* SNPs were associated with risk of lung cancer among Caucasians²⁵. Inflammatory SNPs also differentially predicted risk of non-small cell lung cancer according to history of COPD among Caucasians. Gene expression studies in COPD and lung cancer also point to up- and down-regulation of genes functioning in inflammation and oxidative stress in both these diseases²⁶⁻²⁹. These studies support the role of inflammation in both lung cancer and COPD.

The role of COPD on the prognosis of patients with lung cancer is not clear. In our study, the presence of COPD, and specifically emphysema, did not impact the stage of lung cancer at the time of diagnosis and had no influence on treatment modality or prognosis. In the study by Ueda et al, the presence of emphysema on pathological specimens of patients who underwent lung resection for non-small cell lung cancer was an independent poor prognostic factor for overall survival and disease-free survival¹⁵. Another study by Gullon, found that the presence of emphysema was a significant predictor of outcome on multivariate analysis (HR= 1.49; 95%CI 1.11-2.01)¹⁴. On the other hand, other studies have not demonstrated this association. In an analysis of the data on 2991 consecutive cases of lung cancer who underwent lung resection for stage I lung cancer, the presence of COPD did not affect the prognosis of lung cancer (HR 1.13, 95% CI 0.80 to 1.59)³⁰. In another study of 57 elderly patients with advanced lung cancer treated by chemotherapy, co-morbidities, including COPD, did not predict worse outcome³¹.

Studies have suggested that there are differences between African Americans and whites when it comes to the stage at time of presentation and management of lung cancer. These differences may be influenced by disparities in socio-economic status, health insurance and access to health care. In a study of lung cancer in African Americans 41% of patients had advanced disease (stage IV) compared to 24.3% in whites³². In an analysis of the SEER data, African American patients with early stage non-small cell lung cancer were less likely to undergo staging (odds ratio [OR] = 0.75; 95% CI, 0.67 to 0.83), and once staged, were still less likely to have surgery than whites (OR = 0.55; 95% CI, 0.47 to 0.64). Staged African American patients were less likely to receive a recommendation for surgery when it was not clearly contraindicated (67.0% v 71.4%; $P < .05$), and were more likely to decline surgery (3.4% v 2.0%; $P < .05$). Survival for African Americans and whites was equivalent after resection (hazard ratio = 1.02; $P = .06$)³³. In another study analyzing the same data, hospitals seeing a higher percentage of African American patients were less likely to have cancer directed surgery for lung cancer. Regression analysis revealed that hospital racial composition of 30% or greater African American patients had a significant negative effect on the likelihood of undergoing surgery for all patients (odds ratio [OR] = 0.71; 95% CI, 0.57 to 0.87), and for African American (OR = 0.69; 95% CI, 0.56 to 0.85)³⁴. In this study, 51% patients had distant disease (stage IV) at diagnosis. However, following diagnosis, the patients received aggressive therapy that was appropriate for the stage of lung cancer. Seventy eight percent of patients with local and regional stage disease underwent surgical resection and there was no difference between those with or without COPD. More females had surgical treatment compared to males (41% vs 26%, $p=0.03$). These observations suggest that African American patients, including women, in this cohort were not at a disadvantage when it came to the management of lung cancer after the diagnosis was made.

This study is unique in reviewing a large sample of African American population and including data on self-report of COPD as well as objective clinical data on the diagnosis of COPD and management of lung cancer. There are however several limitations to this study. These include the retrospective nature of the analysis and recruitment of patients from a single cancer center. Also, not all the patients had spirometry and measurements of gas exchange (DLCO) were not available. Although the diagnosis of emphysema was not dependent on radiological reports and validated criteria were used to score emphysema, the CT scans were reviewed by a single radiologist. The results would have been much stronger if the CT scans were reviewed by 2 or 3 independent radiologists. Further prospective, multicenter studies are necessary to validate the findings in this study. Also future studies should include comparisons to African American patients with COPD but no lung cancer and to non-African American population with lung cancer. In conclusion, there is a high prevalence of COPD, emphysema in particular, in a selected group of African American patients with lung cancer. A significant number of these patients were not aware that they had COPD. There was no significant difference in the outcome of lung cancer in relation to the presence or absence of COPD.

Acknowledgments

This research was funded in part by NIH grants R01-CA87895 and R01-CA060691 and contract N01PC-2010-00028 (Dr. Schwartz) and K07 CA125203 (Dr. Cote).

REFERENCES

1. Jemal A, Siegel R, Xu J, Ward E. Cancer statistics, 2010. *CA Cancer J Clin.* 2010; 60:277–300. [PubMed: 20610543]
2. [Accessed January 27, 2011] Trends in COPD (Chronic Bronchitis and Emphysema): Morbidity and Mortality. <http://www.lungusa.org/finding-cures/our-research/trend-reports/copd-trend-report.pdf>
3. Sherman CB. Health effects of cigarette smoking. *Clin Chest Med.* 1991; 12:643–658. [PubMed: 1747984]
4. Potton E, Mc Caughan F, Janes S. Chronic obstructive pulmonary disease and lung cancer. *Respir Med.* 2009; 5:34–37.
5. Centers for Disease Control and Prevention (CDC). Racial/Ethnic disparities and geographic differences in lung cancer incidence --- 38 States and the District of Columbia, 1998-2006. *MMWR Morb Mortal Wkly Rep.* Nov 12; 2010 59(44):1434–8. [PubMed: 21063273]
6. Mannino DM, Homa DM, Akinbami LJ, et al. Chronic obstructive pulmonary disease surveillance- United States, 1971–2000. *MMWR Surveill Summ.* 2002; 51:1–16.
7. Chatila WM, Wynkoop WA, Vance G, et al. Smoking patterns in African Americans and whites with advanced COPD. *Chest.* 2004; 125:15–21. [PubMed: 14718415]
8. Dransfield MT, Davis JJ, Gerald LB, et al. Racial and gender differences in susceptibility to tobacco smoke among patients with chronic obstructive pulmonary disease. *Respir Med.* 2006; 100:1110–1116. [PubMed: 16236491]
9. Schwartz AG, Cote ML, Wenzlaff AS, Land S, Amos CI. Racial differences in the association between SNPs on 15q25.1, smoking behavior, and risk of non-small cell lung cancer. *J Thorac Oncol.* 2009; 4:1195–201. [PubMed: 19641473]
10. [Accessed January 28, 2011] National Emphysema Treatment Trial. www.nhlbi.nih.gov/health/prof/lung/nett/lvrsweb.htm
11. Matsuoka, Shin; Yamashiro, Tsuneo; Washko, George R., et al. Quantitative CT Assessment of Chronic Obstructive Pulmonary Disease. *Radiographics.* Jan.2010 30:55–66. MD, PhD. MD. MD. doi:10.1148/rg.301095110. [PubMed: 20083585]
12. Wilson DO, Weissfeld JL, Balkan A, et al. Association of Radiographic Emphysema and Airflow Obstruction with Lung Cancer. *Am J Respir Crit Care Med.* 2008; 178:738–44. [PubMed: 18565949]

13. Gierada DS, Yusen RD, Pilgram TK, et al. Repeatability of quantitative CT indexes of emphysema in patients evaluated for lung volume reduction surgery. *Radiology*. 2001; 220:448–454. [PubMed: 11477250]
14. Gullón JA, Suárez I, Medina A, Rubinos G, Fernández R, González I. Role of emphysema and airway obstruction in prognosis of lung cancer. *Lung Cancer*. 2011; 71:182–5. [PubMed: 20554345]
15. Ueda K, Jinbo M, Li TS, Yagi T, Suga K, Hamano K. Computed tomography-diagnosed emphysema, not airway obstruction, is associated with the prognostic outcome of early-stage lung cancer. *Clin Cancer Res*. 2006; 12:6730–6. [PubMed: 17121893]
16. Menezes AM, Hallal PC. Role of passive smoking on copd risk in non-smokers. *Lancet*. 2007; 370:716–717. [PubMed: 17765504]
17. Littman AJ, Thornquist MD, White E, Jackson LA, Goodman GE, Vaughan TL. Prior lung disease and risk of lung cancer in a large prospective study. *Cancer Causes Control*. 2004; 15:819–827. [PubMed: 15456995]
18. Kiri VA, Soriano J, Visick G, Fabbri L. Recent trends in lung cancer and its association with COPD: an analysis using UK GP Research Database. *Prim Care Respir J*. 2010; 19:57–61. [PubMed: 19756330]
19. Young RP, Hopkins RJ, Christmas T, Black PN, Metcalf P, Gamble GD. COPD prevalence is increased in lung cancer, independent of age, sex and smoking history. *Eur Respir J*. 2009; 34:380–6. [PubMed: 19196816]
20. Schwartz AG, Cote ML, Wenzlaff AS, Van Dyke A, Chen W, Ruckdeschel JC, Gadgil S, Soubani AO. Chronic obstructive lung diseases and risk of non-small cell lung cancer in women. *J Thorac Oncol*. 2009; 4:291–9. [PubMed: 19190518]
21. Azad N, Rojanasakul Y, Vallyathan V. Inflammation and lung cancer: roles of reactive oxygen/nitrogen species. *J Toxicol Environ Health B Crit Rev*. 2008; 11:1–15. 2008. [PubMed: 18176884]
22. Stathopoulos GT, Sherrill TP, Cheng DS, et al. Epithelial NF-kappaB activation promotes urethane-induced lung carcinogenesis. *Proc Natl Acad Sci U S A*. 2007; 104:18514–18519. [PubMed: 18000061]
23. Schwartz AG, Prysak GM, Bock CH, Cote ML. The molecular epidemiology of lung cancer. *Carcinogenesis*. 2006
24. Engels EA, Wu X, Gu J, Dong Q, Liu J, Spitz MR. Systematic evaluation of genetic variants in the inflammation pathway and risk of lung cancer. *Cancer Res*. 2007; 67:6520–6527. [PubMed: 17596594]
25. Van Dyke AL, Cote ML, Wenzlaff AS, Chen W, Abrams J, Giroux C, Land S, Schwartz AG. Cytokine and Cytokine Receptor Single Nucleotide Polymorphisms Predict Risk for Non-small Cell Lung Cancer Among Women. *Cancer Epidemiol Biomarkers Prev*. 2009; 18:1829–40. [PubMed: 19505916]
26. Spira A, Beane J, Pinto-Plata V, Kadar A, Liu G, Shah V, Celli B, Brody JS. Gene expression profiling of human lung tissue from smokers with severe emphysema. *American journal of respiratory cell and molecular biology*. 2004; 31:601–610. [PubMed: 15374838]
27. Pierrou S, Broberg P, O'Donnell RA, Pawlowski K, Virtala R, Lindqvist E, Richter A, Wilson SJ, Angco G, Moller S, et al. Expression of genes involved in oxidative stress responses in airway epithelial cells of smokers with chronic obstructive pulmonary disease. *American journal of respiratory and critical care medicine*. 2007; 175:577–586. [PubMed: 17158281]
28. Van Dyke AL, Cote ML, Wenzlaff AS, Chen W, Abrams J, Land S, Giroux CN, Schwartz AG. Cytokine and cytokine receptor single-nucleotide polymorphisms predict risk for non-small cell lung cancer among women. *Cancer Epidemiol Biomarkers Prev*. 2009; 18:1829–40. [PubMed: 19505916]
29. Brøgger J, Steen VM, Eiken HG, Gulsvik A, Bakke P. Genetic association between COPD and polymorphisms in TNF, ADRB2 and EPHX1. *Eur Respir J*. 2006; 27:682–8. [PubMed: 16585076]
30. López-Encuentra A, de la Cámara A Gómez, Rami-Porta R, Duque-Medina JL, de Nicolás JL, Sayas J, Bronchogenic Carcinoma Cooperative Group of the Spanish Society of Pneumology and Thoracic Surgery (GCCB-S). Previous tumour as a prognostic factor in stage I non-small cell lung cancer. *Thorax*. May; 2007 62(5):386–90. [PubMed: 16449263]

31. Juan O, Albert A, Campos JM, Caranyana V, Muñoz J, Alberola V. Acta Oncol. 2007; 46(3):367–73. [PubMed: 17450473]
32. Etzel CJ, Kachroo S, Liu M, D'Amelio A, Dong Q, Cote ML, Wenzlaff AS, Hong WK, Greisinger AJ, Schwartz AG, Spitz MR. Development and validation of a lung cancer risk prediction model for African-Americans. Cancer Prev Res (Phila). Sep; 2008 1(4):255–65. [PubMed: 19138969]
33. Lathan CS, Neville BA, Earle CC. The effect of race on invasive staging and surgery in non-small-cell lung cancer. J Clin Oncol. Jan 20; 2006 24(3):413–8. [PubMed: 16365180]
34. Lathan CS, Neville BA, Earle CC. Racial composition of hospitals: effects on surgery for early-stage non-small-cell lung cancer. J Clin Oncol. Sep 10; 2008 26(26):4347–52. [PubMed: 18779622]

CLINICAL PRACTICE POINTS

- African Americans are at a relatively high risk of COPD and lung cancer.
- There are limited data on the relationship between COPD and lung cancer in African Americans
- This study shows that 94% of African American men and 78% of women with lung cancer had COPD by spirometry and/or chest CT scan 78% of individuals with COPD did not report diagnosis of COPD during personal interview
- There was no significant difference in the outcome of lung cancer in relation to the presence or absence of COPD in this selected group of African Americans
- Further multicenter studies are needed to study larger numbers of African Americans and compare the findings with those with lung cancer or COPD alone and to other patient populations.

Table 1

African American lung cancer case characteristics by sex

	Men N=31 N (%)	Women N=83 N (%)	p-value
Age at diagnosis (mean, SD)	58.7 (9.7)	58.0 (10.9)	0.78
Smoking			
Never	0 (0)	4 (5)	0.20
Ever	31 (100)	73 (88)	
Unknown	0	6 (7)	
Abstracted pack years among smokers (mean, SD)	37.0 (16.3)	37.5 (28.6)	0.91
Interview reported pack years among smokers (mean, SD)	47.5 (30.6)	30.7 (21.9)	0.008
Histology			
Small cell carcinoma	1 (3)	6 (7)	0.43
Non small cell lung carcinoma	30 (97)	77 (93)	
Stage at diagnosis			
Local	2 (6)	19 (23)	0.04
Regional	7 (23)	26 (31)	
Distant	21 (68)	37 (45)	
Unknown	1 (3)	1 (1)	
Treatment			
Surgical	8 (26)	34 (41)	0.03
Chemotherapy	7 (23)	13 (16)	
Radiation	0	10 (12)	
Combined chemotherapy and radiation	14 (45)	17 (20)	
No treatment	1 (3)	3 (4)	
Unknown	1 (3)	6 (7)	
Airflow obstruction (spirometry)			
No	5 (16)	16 (19)	0.37
Yes	13 (42)	24 (29)	
No spirometry conducted	13 (42)	43 (52)	
Emphysema (CT)			
No	6 (19)	22 (27)	0.43
Yes	25 (81)	61 (73)	
COPD diagnosed by either CT or spirometry			
No	2 (6)	18 (22)	0.06
Yes	29 (94)	65 (78)	
GOLD Classification of those diagnosed by spirometry			
1	4 (30)	7 (29)	0.34
2	7 (54)	7 (29)	
3	1 (8)	7 (29)	
4	1 (8)	3 (13)	

	Men N=31 N (%)	Women N=83 N (%)	p-value
Severity of emphysema diagnosed by CT			
Mild	15 (60)	41 (67)	0.44
Moderate	5 (20)	14 (23)	
Severe	5 (20)	6 (10)	
Cardiovascular disease (hypertension, CHF, or CAD)			
No	12 (39)	31 (37)	0.93
Yes	19 (58)	51 (61)	
Unknown	0	1 (1)	
Statin use			
No	19 (61)	59 (71)	0.13
Yes	12 (39)	19 (23)	
Unknown	0	5 (6)	
Inhaled Steroid use			
No	24 (77)	68 (82)	0.21
Yes	7 (23)	10 (12)	
Unknown	0	5 (6)	

Table 2

The relationship between clinical diagnosis of COPD (CT or spirometry diagnosis) and clinical history identified by medical record abstraction

	No Clinical Diagnosis of COPD (N=20) N (%)	Clinical Diagnosis of COPD (N=94) N (%)	p-value *
Medical record history of COPD			
No	17 (22)	60 (78)	0.03
Yes	2 (6)	34 (94)	
Do not know	1 (100)		
Pneumonia history reported to doctor			
No	17 (16)	90 (84)	0.27
Yes	2 (33)	4 (67)	
Do not know	1 (100)		
Asthma history reported to doctor			
No	19 (18)	86 (82)	0.19
Yes	0	8 (100)	
Do not know	1 (100)	0	

* Excludes missing values

Table 3
Lung cancer presentation and treatment, stratified by COPD and emphysema diagnosis

	Total N (%)	Not diagnosed with COPD through either CT or spirometry N=20	Diagnosed with COPD through either CT or spirometry N=94	p-value	Not diagnosed with emphysema by CT N=28	Diagnosed with emphysema by CT N=86	p-value [*]
Histology							
Small cell carcinoma	7	1	6	0.82	1	6	0.51
Non small cell lung carcinoma	107	19	88		27	80	
Stage at diagnosis							
Local	21	6	15	0.30	9	12	0.06
Regional	33	4	29		5	28	
Distant	58	10	48		13	45	
Unknown	2		2		1	1	
Treatment							
Surgical	42	9	33	0.54	15	27	0.10
Chemotherapy	20	4	16		5	15	
Radiation	10	1	9		1	9	
Combined chemotherapy and radiation	31	3	28		4	27	
No treatment	4	0	4		0	4	
Unknown	7	3	4		3	4	

* Excludes missing subjects from p-value calculation

Table 4

Univariate and multivariate survival analysis, by gender and COPD diagnosis

	One year survival rate (Kaplan-Meier unadjusted)	Two year survival rate (Kaplan-Meier unadjusted)	HR (95% CI)*	p-value* for factor in Cox regression model
All 114 subjects	87%	61%		
Sex				
Male	84%	52%	1.00 (0.58-1.71)	0.99
Female	88%	65%		
Clinical history of COPD				
No	87%	60%	0.82 (0.48-1.42)	0.48
Yes	86%	64%		
Diagnosed with COPD (spirometry and/or CT)				
No	95%	64%	1.31 (0.68-2.53)	0.42
Yes	85%	60%		
Diagnosed with Emphysema by CT				
No	89%	67%	1.36 (0.75-2.47)	0.31
Yes	86%	59%		

* Adjusted for age, sex and stage where possible