Original article

Chronic Obstructive Pulmonary Disease in Patients with Catheter Diagnosed Coronary Artery Disease: Prevalence and Risk Factors

Faris Muthana,[1] Tarig E. Yagoub,[1] AlaEldin H. Ahmed[1,2,3]

Abstract

Background: Chronic obstructive pulmonary disease (COPD) and coronary artery disease (CAD) co-morbidity exists at different rates. This co-morbidity affects quality of life and increases mortality. In the developing world the prevalence of CAD is increasing but the prevalence of COPD is unknown. This study was designed to estimate the proportion of patients with CAD who have concomitant COPD and identify factors that may increase the likelihood of COPD in CAD patients.

Methods: A cross sectional study that included consecutive adults with catheter diagnosed CAD recruited from two cardiac centers. Patients completed a COPD diagnosis validated questionnaire and performed spirometry using an electronic spirometer. COPD was diagnosed if patient score placed him/her in the high likelihood zone of having COPD, or if the FEV1 was less than 80 % predicted. Results were compared using chi-square test.

Results: Fifty nine patients with CAD were studied. The mean age (SD) was 59 (9.7) years. Of these 59 patients; 27 (44%) had COPD diagnosed by either questionnaire or spirometry. COPD was significantly more among patients with single vessel disease compared with multiple vessel disease (p = 0.01). There was no difference in the number of smokers among patients with CAD and COPD, and CAD alone (p = 0.29). The prevalence of COPD increased with increasing age (p=0.003).

Conclusion: In this group of patients with CAD more than two in five have concomitant COPD. The prevalence of COPD increases with age and is more in patients with single vessel disease compared with patients who have multiple vessel disease.

Key words: Chronic obstructive pulmonary disease; coronary artery disease; single vessel disease; multiple vessel disease; smoking; age

Many studies have shown that chronic obstructive pulmonary disease (COPD) and coronary artery disease (CAD) co-morbidity exists at different rates specially that they share a common risk factor namely cigarette smoking.[1-4]

[1]Elshaab Teaching Hospital, Khartoum, Sudan.
[2]Department of Medicine, University of Khartoum, Khartoum, Sudan.
[3]Sudan Heart Centre, Khartoum, Sudan.
Correspondence to: Dr. AlaEldin H. Ahmed. E-mail: drahahmed@hotmail.com

COPD and CAD co-morbidity affects health related quality of life, medication choice, morbidity and increases mortality.[1-3] Also, COPD has been shown to be an independent cardiovascular risk factor in many reports,[5-7] and the incidence of CAD has been shown to be directly related to progressive FEV1 worsening.[6] There is growing evidence that COPD is associated with a systemic inflammatory component, the intensity of which relates to the severity of the underlying disease.[5] It is conceivable that this systemic inflammatory component may exacerbate the inflammatory process that is associated with atherosclerosis and atherothrombosis.[5]

The incidence and prevalence of CAD are increasing in the developing world; it is projected that worldwide CAD mortality rates will double from 1990 to 2020, with approximately 80% of the increase attributable to the developing world.[8] Existing data suggest that rapid socioeconomic growth in developing countries is increasing exposure to risk factors for CAD, such as diabetes, hypercholesterolemia, hypertension, and smoking.[8,9] In the developed world COPD affects more than one in twenty of the adult population and over the next few years COPD is projected to be the third leading cause of death.[10,11] Epidemiology data of COPD in the developing word are very sparse; in fact there is hardly any published work in relation to this. This study was carried out to estimate the proportion of patients with catheter diagnosed CAD who have concomitant COPD and identify risk factors for COPD and CAD co-morbidity in a developing world country – Sudan.

Methods

This is a cross sectional study that was conducted during the period August 2007 to January 2008 inclusive. It included all consecutive adults with catheter diagnosed CAD recruited from two cardiac centers in Khartoum, Sudan: Sudan Heart Centre and Elshaab Teaching Hospital. Ethical approval for the study was obtained from the administrative and ethical committee of Sudan Heart Centre and all patients gave informed consent to take part in the study. All patients were interviewed and completed a COPD diagnosis validated questionnaire,[12] and a score was calculated for each patient. A COPD diagnosis was assigned to all individuals whose total score (19.5 or more) placed them within the high likelihood zone of having obstruction in a receiver operator characteristic (ROC) curve; these are individuals with high predictive value of a

positive result.[12] Patients performed spirometry using an electronic spirometer: (*Spida 5, Micromedical, England).* The maneuver was explained to each subject and the best of three readings was recorded. Height was measured to the nearest centimeter and weight was recorded to the nearest kilogram. Predicted values were calculated as those for blacks. Study diagnoses were based on guidelines developed by the American Thoracic Society and European Respiratory Society task force: standards for the diagnosis and treatment of patients with COPD.[13] A study diagnosis of COPD was assigned to persons with FEV1 less than 80 % predicted.[13] Results were compared using chi-square test.
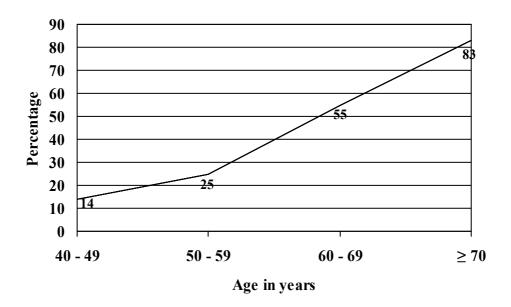
Results

A total of 59 patients with catheter proven CAD were studied. The table shows the demographic and clinical characteristics of the 59 patients. More than half were males. The overall prevalence of COPD diagnosed by either questionnaire or spirometry was 44%. All 59 patients completed the questionnaire; of these 20 had total scores that placed them within the high likelihood zone of having obstruction in a receiver operator characteristic (ROC) curve (scored 19.5 or more) and were labelled as COPD. Of the 59 patients studied 40 performed spirometry and of these 11 had FEV1 less than 80% predicted and were diagnosed as COPD. Of the 59 patients with CAD, 29 had single vessel disease of whom18 were diagnosed as COPD significantly higher than 9 patients with COPD among 30 patients with multiple vessel disease (p = 0.013). The total numbers of current or previous smokers among the 59 patients with CAD were 22 (37%). Of the 22 smokers 12 were among patients with CAD and COPD and 10 were among patients with CAD alone; the difference was not statistically significant (p = 0.296).

The table: Demographic and clinical characteristics of the 59 patients with catheter proven coronary artery disease.

Characteristic	Number (percentage)	p value
Sex		
Male	35 (59%)	
Female	24 (41%)	
COPD diagnosed by questionnaire or spirometry	27 (44%)	
Questionnaire diagnosed COPD	20 (34%)	
Spirometry diagnosed COPD	11 (28%)	
COPD in patients with single vessel disease	18 (62%)	
		p = 0.0134
COPD in patients with multiple vessel disease	9 (30%)	
Smokers (CAD + COPD)	12 (44%)	
		P = 0.296
Smokers (CAD alone)	10 (31%)	

The figure shows the prevalence of COPD, expressed as percentage, among different age groups in the 59 patients with CAD. The prevalence of COPD increased significantly with increasing age (p = 0.0032).

The figure: the prevalence of COPD (expressed as percentage) among different age groups in the 59 patients with CAD (p = 0.0032).

Discussion

The present study has shown that more than two in five patients with CAD have concomitant COPD. Prior work has demonstrated that CAD and COPD co-morbidity exists at different rates.[1-4] However, these studies were either retrospective or were conducted in primary care settings where the diagnoses of CAD was made on clinical grounds rather than by angiography.[3,4] The difference in prevalence between previous work and our study may be explained by the fact that the present study was hospital based and recruited patient with CAD diagnosed by cardiac catheterization. Moreover, the present study was conducted in a developing world country where the epidemiology of CAD and COPD are likely to be different compared with those of the developed world. Nevertheless, the prevalence rate recorded in this study is high enough to warrant COPD screening of all patients with catheter proven CAD. Epidemiological studies have shown that the developing world will bear the brunt of the worldwide increasing incidence of CAD and CAD mortality.[8] Given these projected increases in CAD the high prevalence of COPD co-morbidity in CAD patients shown in this study will have an enormous burden in terms of disability, mortality and health expenditure in developing world countries.[1,14,15] This will be an add on to health budgets that are already exhausted by the load of treating and preventing endemic diseases.

For the diagnosis of COPD we used both a COPD diagnosis validated questionnaire and spirometry. The definitive diagnostic maneuver for COPD is spiromtry.[16] However, prior work has demonstrated that questionnaires based on patient-reported information can be used to identify individuals likely to have COPD among specific risk groups.[12,17] The GOLD guidelines define an early stage of COPD – GOLD stage 0 – in which individuals have chronic respiratory symptoms without measurable airflow obstruction.[16] Furthermore, prospective long term population based studies focusing on early stage COPD in relation to respiratory disease years latter have shown significantly increased risk of developing COPD.[18,19] The questionnaire we used adopted a simple scoring system to enhance practicality.[12] We used a cut score that placed individuals in a zone with a high likelihood of having obstruction in an ROC curve - high positive predictive value (PPV).[12] At this cut point, the questionnaire we used had PPV very comparable to other surveys that adopted the same approach.[12] Since the questionnaire scoring system we used is based on positive and negative predictive values, which are sensitive to baseline prevalence, questionnaire performance is likely to be different in different populations with different rates of prevalence. The questionnaire we used achieved high PPV at a baseline prevalence of COPD of 18.7%.[12] Since the prevalence rates of COPD in CAD patients are higher than 18.7% as shown in previous studies,[1-4] we expect the questionnaire to have a higher PPV in our subjects at the cut point we used and hence increase the number of individuals with COPD albeit the increment being small.

Our study identified two risk factors for COPD and CAD co-morbidity: increasing age and single vessel disease. Community based studies showed that the prevalence of COPD increases with increasing age.[19,20] It was, therefore, not surprising to find significantly more COPD in older patients with CAD. In numerical terms the problem is likely to have a significant socioeconomic impact given the projected increase in CAD patients and an increasing aging population. It is known that patients with multiple vessels CAD have worse prognosis when compared with patients with single vessel CAD.[21] Our study, however, showed that significantly more patients with CAD and COPD had single vessel disease than patients with CAD alone. The likely explanation for this finding

is a selection bias in the population we studied. It is known that concomitant COPD in CAD patients increases symptoms.[1,2] The patients we studied are patients with CAD who were recruited from the catheter laboratory and it is very likely that they were symptomatic and were, therefore, investigated by cardiac catheterization. However, a larger scale study is needed to find if concomitant COPD affects prognosis in patients with single vessel CAD.

The current study has not shown smoking to be a risk factor for COPD in CAD patients. Smoking is a well established risk factor for both COPD and CAD.[22-24] The number and percentage of smokers in patients with CAD alone and CAD and COPD co-morbidity in the present study fall short of figures recorded in other epidemiological surveys.[22,23] We believe that the likely explanation for these differences is cultural denial of smoking in our community especially among females. This is supported by epidemiological studies of smoking conducted in communities similar to ours using questionnaires which showed wide variation in prevalence and concluded that social, cultural, and religious inhibitions may have prevented smokers from providing accurate information about their smoking habits.[25-27] We, therefore, consider that the actual numbers of smokers among the population we studied is higher. There are, however, two further alternative explanations for the low prevalence of smoking among the present study population that we ought to consider: firstly, we have not assessed the role of passive smoking which increases the risk of ischemic heart disease by about 30% and contributes significantly to the development of COPD.[28,29] Hence, we can not rule out the possible contribution of passive smoking to causing COPD and CAD in our subjects. Secondly, it is possible that non-smoking related COPD, which may be more prevalent in developing countries,[30] and risk factors other than smoking for CAD were important etiological factors in this study population.

Conclusion

In conclusion this study has shown that 44% of patients with catheter proven CAD have concomitant COPD in a developing country – Sudan. This will have enormous burden on health expenditure in a region where health budgets are already strained by costs of compacting endemic diseases. Given the projected increases in incidence of CAD in this part of the world the problem is likely to get worse. The prevalence rate we recorded warrants routine screening of all CAD patients for COPD specially those with single vessel disease and older individuals. Further large scale studies are needed to determine future trends and define the epidemiology of COPD better.

References

1. Sin D, Hand SFP. Chronic obstructive pulmonary disease as a risk factor for cardiovascular morbidity and mortality. *Pro Am Thoracic Soc* 2005;(2):8-11.
2. Wijnhoven HAH, Kriegsman DMW, Hesselink AE *et al*. The influence of co-morbidity on health-related quality of life in asthma and COPD patients. *Respir Med* 2003;97:468–75.
3. Holguin F, Folch E, Redd SC *et al*. Comorbidity and Mortality in COPD Related Hospitalizations in the United States, 1979 to 2001. *Chest* 2005;128:2005-11.
4. Soriano JB, Visick GT, Muellerova H, *et al*. Patterns of comorbidities in newly diagnosed COPD and asthma in primary Care. *Chest* 2005;128:2099-2107.
5. Sin DD, Paul Man SF. Why are patients with chronic obstructive pulmonary disease at increased risk of cardiovascular disease?. The potential role of systemic inflammation in chronic obstructive pulmonary disease. *Circulation* 2003;107:1514-19.
6. Schroeder EB, Welch VI, Couper D *et al*. Lung function and incident coronary heart disease. The atherosclerosis risk in communities study. *Am J Epidemiol* 2003;158:1171-81.
7. Sunyer J, Ulrik CS. Level of FEV1 as a predictor of all cause and cardiovascular mortality: an effect beyond smoking and physical fitness. *Eur Respir J* 2005;25:587-88.
8. Okrainec K, Banerjee DK, Eisenberg MJ. Coronary artery disease in the developing world. *Am Heart J.* 2004;**148(1)**:7-15.

9. Al-Nozha MM, Arafah MR, Al-Mazrou YY *et al*. Coronary artery disease in Saudi Arabia. <u>*Saudi Med J.*</u> 2004;**25(9)**:1165-71.

10. Mannino DM. Chronic obstructive pulmonary disease: definition and epidemiology. *Respir Care* 2003;48(12):1185-91.

11. Hurd S. The impact of COPD on lung health worldwide: epidemiology and incidence. *Chest* 2000;117:1S-4S.

12. Price DB, Tinkelman DG, Nordyke RJ, *et al*. for the COPD Questionnaire Study Group. Scoring System and Clinical Application of COPD Diagnostic Questionnaires. *Chest* 2006;129:1531-9.

13. Celli BR, MacNee W, and committee members. Standards for the diagnosis and treatment of patients with COPD: a summary of the ATS/ERS position paper. *Eur Respir J 2004*; 23:932–46.

14. Murray CJL, Lopez AD. Alternative projections of mortality and disability by cause 1990–2020: Global Burden of Disease Study. *Lancet*1997;349:1498–1504.

15. Sullivan SD, Ramsey SD, Lee TA. The Economic Burden of COPD. *Chest* 2000;117;5-9.

16. Global Initiative for Chronic Obstructive Lung Disease. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease, updated 2007. Available at: www.goldcopd.com. Accessed August 16, 2008.

17. Price DB, Tinkelman DG, Halbert RJ, *et al*. Symptom-based questionnaire for identifying COPD in smokers. *Respiration* 2006;73:285–295.

18. Albers M, Schermer T, Heijdra Y *et al*. Predictive value of lung function below the normal range and respiratory symptoms for progression of chronic obstructive pulmonary disease. *Thorax* 2008;63:2001-7.

19. Lindberg A, Eriksson B, Larsson LG *et al*. Seven-year cumulative incidence of COPD in an age-stratified general population sample. *Chest* 2006;129:879-85.

20. Menezes MB, Perez-Padilla R, Jardim JB, *et al*. for the PLATINO Team. Chronic obstructive pulmonary disease in five Latin American cities (the PLATINO study): a prevalence study. *Lancet* 2005;366:1875-81.

21. Felker GM, Shaw LK, O'Connor CM. A standardized definition of ischemic cardiomyopathy for use in clinical research. *J Am Coll Cardiol* 2002;39:210–8.

22. US Surgeon General. The Health Consequences of Smoking: Chronic Obstructive Lung Disease. Publ No. 84– 50205. Washington DC, USDHHS, 1984.

23. US Public Health Service: The Health Consequences of Smoking: Cardiovascular Disease: A Report of the Surgeon General. DHHS (PHS) 84-50204, 1983.

24. Barnes PJ. Chronic obstructive pulmonary disease. *N Eng J Med* 2000;343:269–80.

25. Jarallah JS, Al-Rubeaan KA, Al-Nuaim AA *et al*. Prevalence and determinants of smoking in three regions of Saudi Arabia. *Tobacco Control* 1999;8:53–56.

26. Hamadeh RR. Smoking habits of medical students in Bahrain. *J Smoking Related Dis* 1994;5:189–95.

27. Siddiqui S, Ogbeide DO, Al Khalifa I, Smoking in a Saudi community: prevalence, influencing factors, and risk perception. *Fam Med* 2001;33(5):367-70.

28. Barnoya J, Glantz SA. Cardiovascular effects of secondhand smoke nearly as large as Smoking *Circulation* 2005;111:2684-98.

29. Hole DJ, Gillis CR, Chopra C *et al*. Passive smoking and cardiorespiratory health in a general population in the west of Scotland. *Br Med J* 1989;299:423-7.

30. Marsh S, Aldington S, Shirtcliffe P *et al*. Smoking and COPD: what really are the risks?. *Eur Respir J*2006;28: 883–6.