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# BRONCHOPULMONARY COMPLICATIONS OF INDOOR POLLUTION IN IRANIAN RUSTIC POPULATION

Kazem Amoli*, MD

* *Professor, Tehran University of Medical Sciences, Faculty of Medicine, Imam Khomeini Hospital: Department of Medicine*

## SUMMARY

Chronic bronchopulmonary disorders occurred in a large number of rustic females who used to bake bread at their dwellings under unhgyienic conditions. Bronchoscopy revealed advanced pathological changes with characterised black areas infiltrating the bronchial walls. Findings in ten patients who referred with acute chronic respiratory symptoms and a positive history of indoor pollution are described with an emphasis on their bronchoscopic changes.

***KEY WORDS:*** *Anthracosis; Chronic Bronchitis; Indoor polluiton*

## INTRODUCTION

Indoor pollution, as a cause of respiratory disorders, is now the focus of interest in both developed (1) and developing (2) countries. The World Health Organization (WHO) has directed several studies, mainly regarding the acute respiratory infections in children (3). However, the long-term effects of indoor pollution needs more consideration as they involve a wide

spectrum of bronchopulmonary changes in a large population at risk.

## CASE REPORTS

During 1985-1990, ten patients who referred with chronic respiratory symptoms, complicated by repeated exacerbations, were found to have bronchopulmonary lesions characterised by black, anthracotic areas in their airways (Table 1). Nine cases were elderly rustic women who used to bake bread at their dwellings during their youth. The male patient was a cook as well as a domestic baker. They were all Iranian and had never smoked tobacoo.

All the patients referred with a long history of cough, sputum, and dyspnea, complicated by recurrent episodes of deterioration. Clinically, they were ill with respiratory limitation. Crackles, mainly inspiratory, were audible on auscultation in the lower regions. Chest x-ray findings were more prominent than the clinical abnormalities and included nodular, patchy, and irregular opacities, especially in the proximal areas of the lower zones (Fig. 1).

Respiratory function tests revealed severe limitation of the vital capacity and, in six cases, airways obstruction. Only in two patients the ratio of $FEV_1$ to vital capacity was normal (Table 2). Three patients were not able to perform the tests. There was no evidence of asthma on clinical examination and on respiratory function tests.

On bronchofiberoscopy considerable changes were observed in the larger airways of all cases consisting of generalised congestion and edema of trachea and the visible bronchi. The outstanding findings, however, were numerous plaques of grey-black pseudomembranes on the surface of bronchial mucosa (Fig. 2). These were mostly located in the main bronchi and their first and second divisions were just distal to their bifurcation and at the diversion of the air stream. They were firmly attached to the bronchial wall, penetrating the mucosa. On touching the fiberoscope, they were easily bruised and yielded a mild hemorrhage. Biopsies from these areas showed left superficial bleeding ulcers. Narrowing of the bronchial lumen was obvious due to the thickening of bronchial walls and there were localised areas of obstruction, especially during expiration.

Histologic studies were carried out on the small samples that could be obtained during fiberoptic bronchoscopy. Open lung biopsy was not feasible due to the restricted respiratory reserves, and none of these patients died so far. Even though, interesting changes were noted: submucosal infiltration of inflammatory cells was seen mainly with mononuclear cell, some of them containing brown-black anthracotic pigments. The pigments were also seen in the stroma as well as in the small pieces of the adjacent lung tissue. Other inflammatory cells included lymphocytes, plasma cells and

neutrophil polymorph, in one case with equal proportions in granulation tissue. The stroma was reported hyalinised in one case. No granulomas or malignant cells were noted.

Anthracotic black and amorphous particles were also detected in the bronchial washings. A variety of not completely identified germs were reported; and, in two cases acidfast bacilli were detected but not identified because the cultures were negative. Anti-tuberculous treatment with a six-month regimen did not provide clinical or radiological improvement in these two cases, but further sputum examinations were negative for AFB. No mycobacteria were obtained in the other eight patients on direct examination or on culture (Table 1).

## DISCUSSION

Indoor pollution affects a large population all over the world. In most parts of the developing countries, however, the primitive conditions of living have hardly changed over thousands of years. Domestic baking and cooking is carried out using livestock excreta and wood by housewives and female children (4, 5). Heavy smoke evolves and, to maintain the fire, it is necessary to blow repeatedly with the mouth adjacent to the smoking fire. Subsequently, a deep inspiration inhales the aerosol of ashes and smoke directly into the lungs. During winters and in the cold weather, especially in the highlands baking is performed within enclosed spaces that become concentrated with smoke. The procedure takes several hours daily. The housewife is repeatedly required to leave her oven and come out to look after her children and the chores. Sudden changes from the hot air of the oven to the freezing cold weather provides additional physical effects to the deleterious smokes. The victim will suffer from recurrent respiratory infections while little or no medical facilities are available.

These would lead to irreversible pathological changes in the airways and pulmonary parenchyma. The survivors suffer from progressive pulmonary disorders to become respiratory cripples. The universal challenge of the problem demands extensive studies as well as public education for the prophylaxis of these extensive but preventable disabilitating destructed lungs.

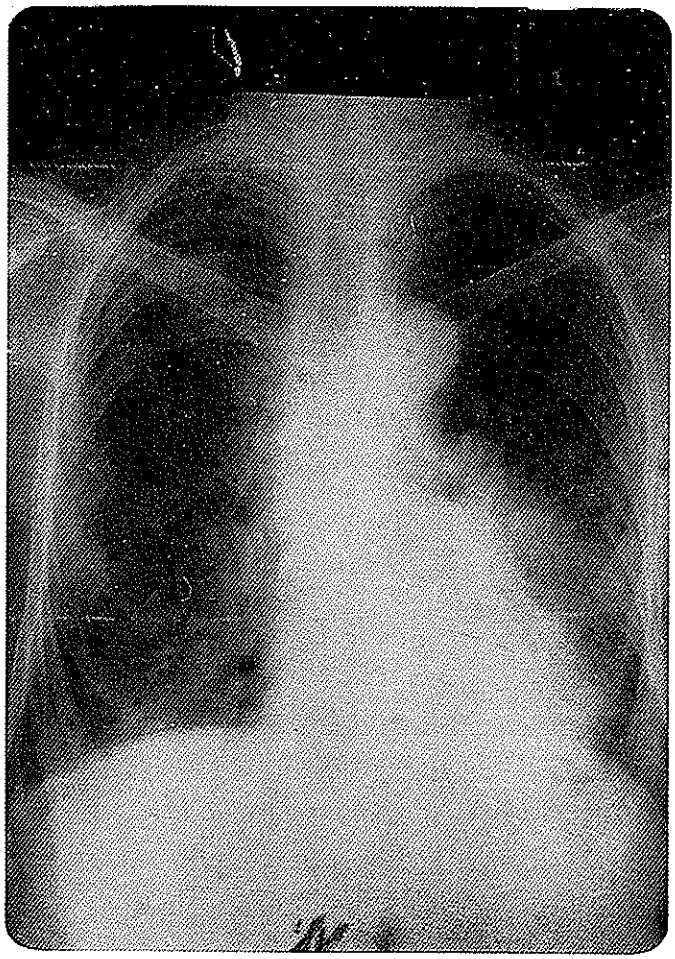

Figure 1. Chest x-ray of the patient (G.G.) showing confluent opacities in lingula and streaky as well as nodular shadows in the lower parts

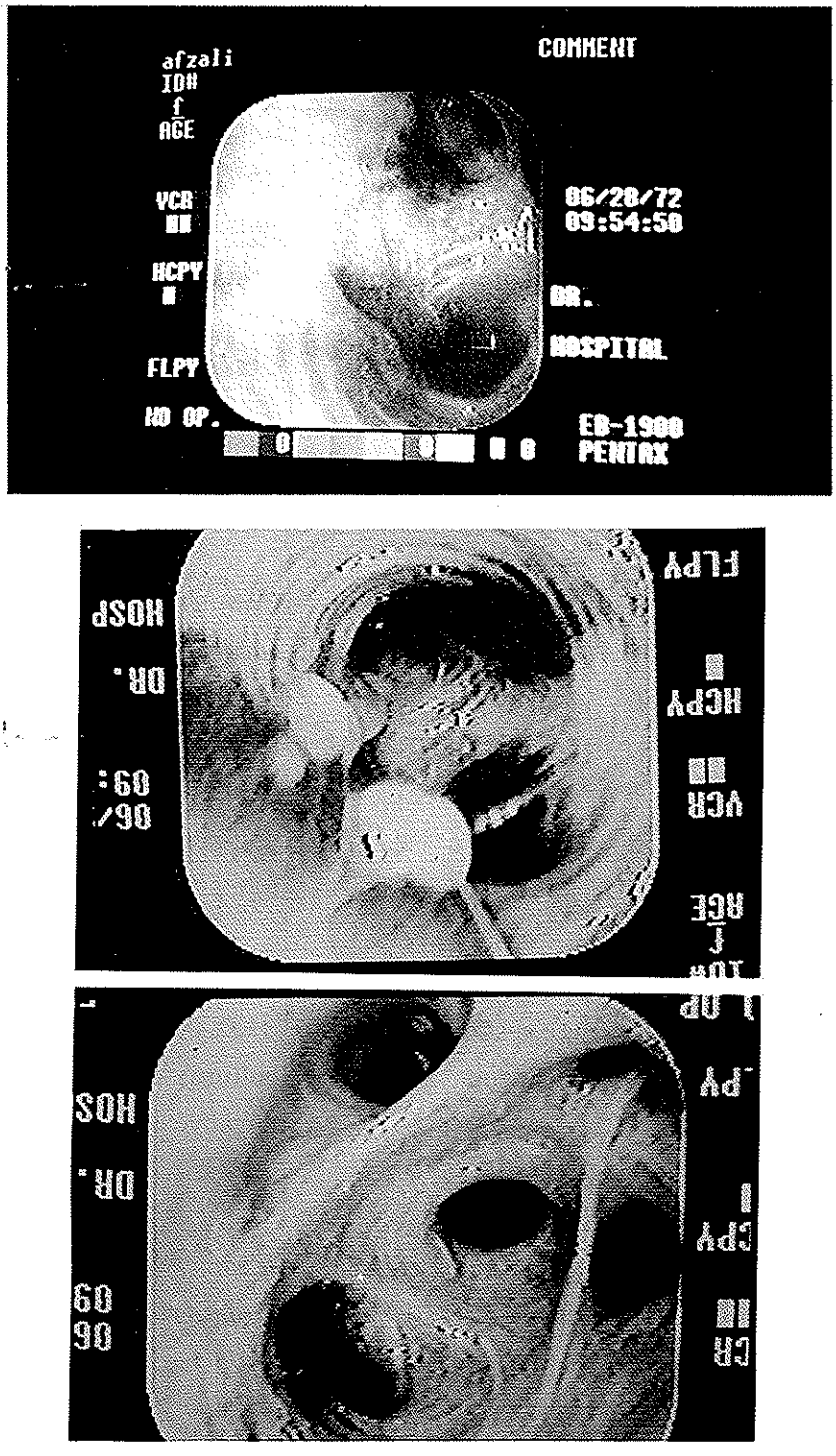


Figure 2. Bronchoscopic appearance of a patient with grey-black pseudomembranes in the main bronchi and their subdivisions

Globules and streaks of mucourulent sputum are visible extruding from the airway openings.

| No. | Case | Sex | Age | FOB findings plus black areas | Bacteriology black areas | Histology |
|---|---|---|---|---|---|---|
| 1 | K.K. | F | 55 | pale mucosa, mucopurulent fluids | *nonspecific germ* | chronic inflammation, anthracotic pigments |
| 2 | I.V. | F | 46 | congestion | *nonspesific germs* lung | anthracotic pigments in bronchi and lungs |
| 3 | S.K. | F | 60 | congestion, muco-purulent fluids especially in RML | *E.coli, Gram+cocci* | nonspecific mononuclear infiltration |
| 4 | H.S. | M | 75 | mucopurulent secretions | *fungi* | nonspecific inflammation, eosinophils |
| 5 | O.M. | F | 60 | mucopurulent sec-retions especially RLL | *Gram+ bacilli* | abundant mononuclears, anthracotic inclusions |
| 6 | S.S. | F | 60 | congestion, muco-purulent fluids in RML and RLL | *Klebsiella, AFB, culture negative* | PMN, otherwise unremarkable |
| 7 | B.B. | F | 72 | congestion | *nonspecific germs* | epithelial anthracotic pigments, infiltrates of lymphoid cells, PNM in subepithelial stroma |
| 8 | G.G. | F | 73 | congestion, obstruction of lingula | *AFD, Culture* culture negative | hyalinised stroma, anthracotic pigments, inflammatory cells, epithelial hyperchromatic angulated nuclei |
| 9 | S.N. | F | 70 | congestion, irregular tissue in RML | *E.coli, Gram+cocci* | no tumor tissue |
| 10 | S.R. | F | 63 | congestion, edema | *Hafnia, monilia* | epithelial mononuclear infiltration with black inclusions |

Table 1. Bronchoscopic findings in 10 patients with a history of indoor baking

| No. | Case | VC*/PVC** | $FEV_1$,***/VC |
|---|---|---|---|
| 1 | K.K. | 25.6 | 76.6 |
| 2 | S.K. | 36 | 66 |
| 3 | S.K. | 46 | 91 |
| 4 | H.S. | 72 | 63.5 |
| 5 | O.M. | 62 | 49 |
| 6 | S.S. | 31.6 | 80 |
| 7 | B.B. | unable to perform | |
| 8 | G.G. | unable to perform | |
| 9 | S.N. | unable to perform | |
| 10 | S.R. | 58.6 | 73 |

Table 2. Pulmonary function studies: Vital capacity as compared with the predicted (normal) values in each case and the ratio of $FEV_1$ to the vital capacity in seven patients who were able to carry out spirometry

* VC: Vital capacity ** PVC: Predicted vital capacity

*** $FEV_1$: Forced expiratory volume, 1st second

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