

Talc Pneumoconiosis

by

S.H. EL-GHAWABI, G.H. EL-SAMRA and H. MEHASSEB

Ministry of Labour, Cairo, and the Department of Industrial Medicine and Occupational Diseases, Faculty of Medicine, Cairo University.

Pure talc a (hydrated magnesium silicate) is similar in chemical composition to asbestos. It is a flaky mineral but occurs also in a fibrous form which, may be more fibrogenic^{6,11}. Impure forms of talc have been known as steatite, soap stone and french chalk which is used by tailors to mark cloth. When crushed, talc occurs as a smooth bland powder which is used for a variety of purposes.

The chief deposits of talc and soap stone occur in altered magnesium-rich calcareous rocks and altered basic rocks such as serpentines and mica schists^{8,13}; it is therefore rarely found in association with free silica.

In Egypt the good quality talc is present in Hamata area, Abu Ghosson and Dehrib in the Eastern Desert. In 1965-66 its production amounted to 2900 tons.

The first account of talc pneumoconiosis was given by Thorel in 1896. The numerous investigations that have been carried out thereafter have left little doubt that talc dust on its own can cause pneumoconiosis. While some forms of talc have been thought to be innocuous¹⁹. Impairment of pulmonary ventilation and diffusion have been reported in workers exposed to talc, the fibrous forms being more harmful than granular forms^{9,10,11,12}.

Despite the large amount of talc mined, milled and handled in Egypt no cases of talc pneumoconiosis have so far been reported.

The present report gives the results of a study that was carried out in a plant for milling of talc with the objective of investigating the prevalence of talc pneumoconiosis among the workers.

Material and Methods

The plant surveyed is specialized for milling of talc and lies in the industrial area of Ghamra . At the time of the study it employed 50 workers all of whom were exposed to talc. The mill is an old, poorly ventilated building with a permanent cloud of dust which permits the air in the work place. The raw material is crushed into smaller pieces which are subsequently pulverized by an electric mill. The powder is then shovelled into sacs. Personal protective equipment and engineering control of dust are completely lacking.

Chemical analysis of the raw materials was carried out in the laboratory of the plant.

The Midget impinger was used for evaluating the degree of dustiness in the work environment using distilled water and alcohol as the sampling medium. The collected samples were then analysed for dust counts and particle size distribution of the air-borne dust using an ordinary microscope (magnification 100 x) and a Spencer cell. Samples were taken at the breathing level of the workers and several samples were taken at each work place.

Examination of the workers included inquiry about the occupational, past and present medical histories as well as family history in addition to the age and smoking habits. Clinical examination was then carried out and the chest of each worker was X-rayed on a large film. Films were commented upon by 3 different specialists. Sputum examination for tubercle bacilli was carried out in some cases by direct smear and in each case at least 3 such examinations were made. The ventilatory function was evaluated using a Godart 9-liter spirometer. The vital capacity was expressed in percent of the predicted, the forced expiratory volumes for 1 and 3 seconds

were expressed in percent of the total forced vital capacity and the indirect maximum breathing capacity was also expressed as percent of the predicted.

Results and Discussion

Results of chemical analysis of the different types of talc obtained from different mines are shown in Table 1 and it can be seen that free silica is completely absent. Table 2 shows the results of the environmental investigations.

Table 1 — The quantitative chemical analysis of talc from different mines.

M i n e	Silicate	Fe ₂ O ₃	Al ₂ O ₃	CaO	MgO	Acid Cr ₂ O ₃	Moisture
Derhib mines	57.35	1.6	3.02	1.71	28.6	—	0.05
El-Angohria mine	61	0.35	1.15	0.18	32.95	0.18	0.05
Omm-Solimat mine	60.1	0.48	3.02	0.28	33.13	0.32	0.05
Abu Gerdi mine	60	0.83	2.17	0.28	32.59	0.1	0.02
Kriem-mine	59.7	0.64	1.04	0.71	32.2	0.1	0.18
Abu Marw mine	59.4	4.55	1.54	0.14	30.77	0.14	0.04
Omm Kriem mine	55.83	5.95	3.05	0.17	30.49	0.27	0.06
Al-Nekhala mine	57.9	5.1	1.9	0.13	30.41	0.09	0.07

Table 2 — Results of air analysis.

A r e a	No. of samples	Dust counts MPPCF			Mean particle size distribution				
		Maxim.	Minim.	Mean	—2.5μ	5 μ—	10 μ—	20 μ—	40 μ+
In front of mill	12	83	54	68.5	49%	50%	1 %	—	—
Behind mill	12	35	25	30	40%	55%	5 %	—	—
Package area	12	111	73	92	69%	30%	1 %	—	—

Table 3 — Workers distributed according to age, duration of exposure and X-ray diagnosis.

Age years	X-ray findings *	Duration of exposure				
		5 years	5—	15—	25+	Total
20—	P,M,N,A,B,C					
	L					
	Total	4	2			6
30—	P,M,N,A,B,C			1		1
	L		1			1
	Total	7	10	1		18
40—	P,M,N,A,B,C			2	1	3
	L	1		3	1	5
	Total	3	5	6	3	17
50+	P,M,N,A,B,C			3	3	6
	L					
	Total	2	1	3	3	9
Total	P,M,N,A,B,C	—	—	6	4	10
	L	1	1	3	1	6
	Total	16	18	10	6	50

* Classified according to ILO classification of radiographs of pneumoconiosis⁷.

Results of medical examination :

Fifty male workers were examined, none of whom had a past occupational history of exposure to any kind of dust. Table 3 shows the distribution of workers according to age, duration of exposure to talc and the X-ray findings. The classification of radiographs of the pneumoconiosis recommended by the ILO in 1958 was used to describe the X-ray findings⁷. 52% of the workers were above the age of 40 years and 32 % were exposed for 15 years or more. Nodular and conglomerate shadows were observed in 10 workers all of whom were exposed for periods of more than 15 years and all except one were more than 40 years old. Linear and reticular opacities were observed in 6 workers between the ages of 30-49 years after periods of exposure to talc of less than 5 to more than 25 years. Three cases had X-ray shadows which were classified as suspect or Z and 2 had X-ray findings suggestive of tuberculosis.

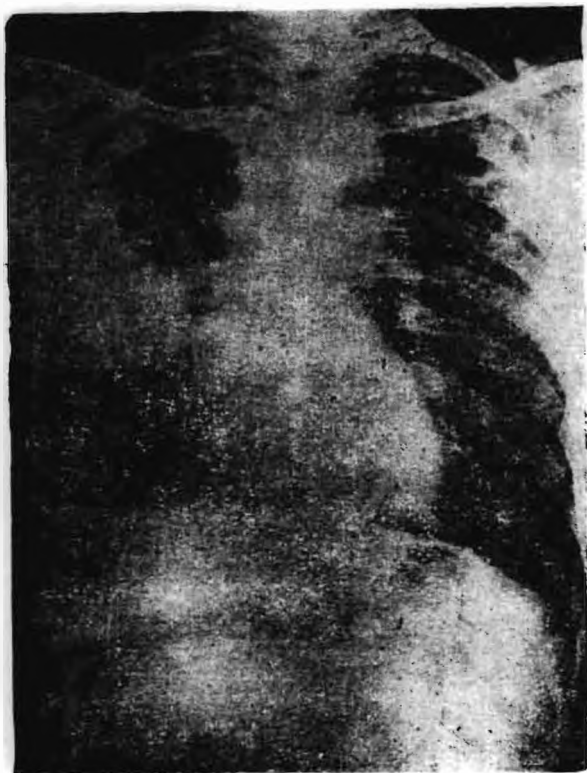
None of the workers below 30 years of age had X-ray abnormality.

Cases of Talc Pneumoconiosis

The diagnosis of talc pneumoconiosis in the present study was based upon the criteria suggested by Kleinfeld et al.¹¹ which are a history of adequate exposure (prolonged exposure to concentrations greater than 20 million particles/ft³ of air) and a chest roentgenogram consistent with the diagnosis. The X-ray appearance in talc pneumoconiosis was described as consisting of fine lacy mottling⁴ and nodular shadows distributed over both lung fields which may coalesce and in the later stages may show tumour like masses, mostly ill-defined^{5,6,8}. Enlargement of hilar glands⁸ and increased linear markings¹⁵ were reported. In addition, plaques of opaque material were described^{3,6,1}, in the periphery of the lungs which varied from single linear deposits in the region of the diaphragm to massive bizarre deposits over large parts of the lung fields. These were called talc plaques.

In the present study exposure to dust concentrations

Figure 1.

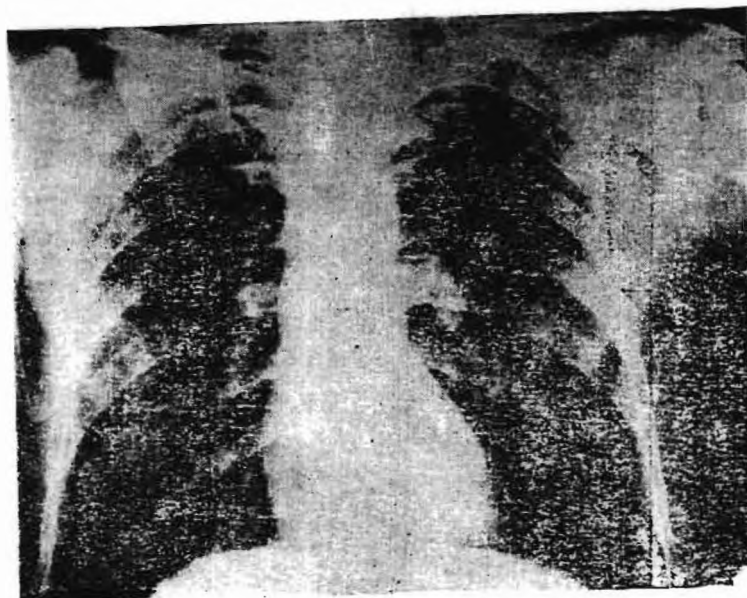


exceeding the threshold limit values for talc has been proved by the environmental studies¹⁷.

The prevalence of cases of pneumoconiosis among the workers examined was 32%. Among these exposed for more than 15 years the prevalence was 87.5%. Siegal et al.¹⁶ found a prevalence of 14.5% of cases with evidence of fibrosis in talc miners and millers; among those exposed for more than 10 years they observed a prevalence of 25.9%. Kleinfeld et al.¹⁰ reported a prevalence of 37% in talc millers who had an average period of exposure of 19 years. Tolk, however, found a prevalence of 67% of talc pneumoniosis among workers exposed for 10 years or more¹⁸.

Results of examination of the 16 cases of pneumoconiosis revealed that the youngest of the group was 30 years old

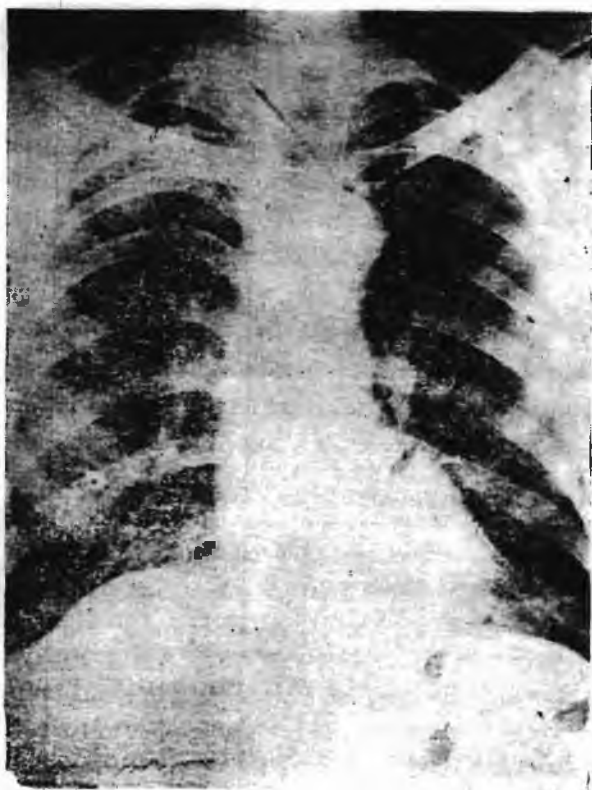
Figure 2.



while the oldest was 59 years. The average age in the 10 cases with nodular and conglomerate opacities was 50.4 years while in the group with linear and reticular shadows it was 41.8 years. The average duration of exposure of all cases of pneumoconiosis was 21.6 years. In those with nodular and conglomerate opacities it ranged from 17 to 35 years with an average of 24.2; the average duration of exposure in cases with linear and reticular opacities was 17.5 years and the range 4-35 years. Allivisatos et al.¹ reported on cases who developed evidence of talc pneumoconiosis after periods of exposure ranging from 16-24 months, probably because of exposure to unusually high dust concentrations. Kleinfeld et al.⁹ reported on 16 talc millers who developed pneumoconiosis after exposure for periods varying from 13-26 years (average 20.4 years); the mean weighted average exposure was 68.9 million particles per cubic foot of air.

Clinical picture: Thirteen (81%) of the 16 cases of talc pneumoconiosis had no symptoms. Productive cough was

Figure 3.



present in 3 cases and dyspnoea on moderate exertion was present in 2 cases; in whom conglomerate opacities were observed. One case, however, had no complaint despite the presence of nodular and conglomerate opacities. Clinical signs were not pathognomonic and were absent in 75% of cases. Cases of talc pneumoconiosis with slight or no disability have been reported^{2,8}. But Kleinfeld et al.⁹ found dyspnoea to be a predominant symptom in 14 of their 16 cases. It would be reasonable to assume that the presence and degree of dyspnoea would vary with the extent of the pathological or radiological findings. However, Kleinfeld et al.¹⁶ found dyspnoea to be the predominant symptom in 29 talc millers 15 of whom had no radiological evidence of pneumoconiosis. Cough was the next in frequency. They also observed basal crepitations and clubbing of the fingers in 12 and 8 of the 43 workers, respectively.

X-ray Findings: In the present series the observed X-ray findings were: (1) Linear and reticular opacities affecting both lung fields. (2) Very small punctate opacities (size up to 1.5 mm) distributed over both lung fields and varying in density in different cases. (3) Micronodular (size 1.5-3 mm) and nodular (size from 3-10 mm) opacities were observed in 4 cases and were diffusely affecting the 2 lung fields. (4) Large confluent opacities mostly with ill-defined borders and of varying sizes affecting more commonly the upper and middle zones but also the lower zone in one case. In another case the large opacities had very well defined borders. (5) Obliteration of the right costophrenic angle and irregularity of the diaphragmatic outline was observed in one case (Fig. 1). Similar radiological abnormalities were reported^{1,2,4,8,16}. Alivisatos et al.¹ suggested that tumour-like shadows were not due to fibrosis alone but to concretions of talc obstructing the bronchioles and causing areas of atelectasis with secondary fibrotic reactions. Others believed that secondary tuberculosis was responsible for such shadows.

Ventilatory Functions: In one case there was evidence of slight restrictive ventilatory impairment consistent with the amount of fibrosis observed radiologically. Ventilatory functions in the rest of the group were within normal limits. Kleinfeld et al.^{9,10,11} found evidence of impaired ventilatory function and diffusing capacity for carbon monoxide in a group of talc millers with and without radiological evidence of pneumoconiosis.

Other Cases with Radiological Abnormality: Three cases were diagnosed as having suspect opacities (Z) or increased lung markings. These could be early cases of talc pneumoconiosis; this diagnosis, however, is difficult to make without follow up of these cases for a sufficient period of time, in view of the wide variety of conditions that may cause an increase of lung markings. Two cases had X-ray shadows suggestive of tuberculosis one of them having extensive pulmonary and pleural fibrosis and marked impairment of ventilatory function. The question of increased susceptibility to tuberculosis in talc workers has been brought about by

Siegel et al.¹⁸. Cases of talc pneumoconiosis associated with tuberculous infection have been reported^{8,14}. Whether tuberculous infection in talc industry presents the same risk that it presents in workers exposed to silica dust is not yet clear.

Other Chest Conditions: Five cases had cough, dry or productive, for periods of time varying from 3 months to 2 years and had no X-ray abnormality,

Summary

The environment and working population of a talc milling plant were surveyed. The level of talc dust of the respirable sizes was found to be much in excess of the MAC in all the work areas. Sixteen cases of talc pneumoconiosis were diagnosed out of the 50 workers employed in the plant and who have been exposed for periods of time varying from less than 5 to more than 25 years. Some cases of talc pneumoconiosis had cough, dyspnoea on exertion while others were free of symptoms. The X-ray findings included linear and reticular opacities, nodular as well as confluent opacities. The ventilatory function was within normal limits in all cases except one who had moderate fibrosis.

Acknowledgement: The authors wish to thank Mr. F.F. El-Enany for doing the environmental studies.

References

- 1 — Alivisatos, C.P., Ponikakis, A.E. and Terzis, E.: *Brit. J. Industr. Med.*, 12, 43, 1955.
- 2 — Cavigneaux, A., Charles, A., Fuchs, S. and Tara, S.: *Archiv. Malad. Professionnelles*, 11, 34, 1950.
- 3 — Greenburg, L.: *Yale J. Biol. Med.*, 19, 481, 1947.
- 4 — Hale, L.W.: Symposium on Industrial Pulmonary Diseases. Churchill, London, 1960.
- 5 — Holt, P.F.: *Pneumoconiosis*. Arnold, London, 1957.

- 6 — Hunter, D. : The Diseases of Occupations, 3rd Ed., English Universities Press, London, 1963.
- 7 — International Labour Office: *Occupational Safety and Health*, 9, 63, 1959.
- 8 — Kipling, M.D. and Bech A.O.: *Trans. Assoc. Industr. Med. Officers*, 10, 85, 1960.
- 9 — Kleinfeld, M., Messite, J., Shapiro, J., Swencicki, R. and Sarfety, J.: *J. Occ. Med.*, 7, 12, 1965.
- 10 — Kleinfeld, M., Mersite, J., Shapiro, J. and Swencicki, R.: *Archiv. Environ. Hlth.*, 10, 431, 1965.
- 11 — — — — — , Kooyman, O. and Swencicki, R.: *ibid*, 9, 559, 1964.
- 12 — Lanza, A.J. : The Pneumoconioses. Grune and Stratton, New York, 1962.
- 13 — Namay, A. : Economic Geology, El Araby Booshop, U.A.R., 1958.
- 14 — Parmeggiani, L. : *Ress. Med. Industr.*, 17, 16, 1948.
- 15 — Scansetti, C., Basetti, L. and Geheni, F. . *Med. Lavoro*, 54, 764, 1963.
- 16 — Siegal, W., Smith, A.R. and Greenburg, L.: *Am. J. Roentgenol.*, 49, 11, 1943.
- 17 — Threshold Limit Values for 1960 : *Archiv. Environment Hlth.*, 1, 140, 1960.
- 18 — Tolk, J.J.C. : CIS Abstract, 1812-1964, 1967.
- 19 — Weiss, B. and Roettner, E.A. : *Archiv. Environm. Hlth.*, 14, 304, 1967.