

MORBIDITY OF SILICOSIS IN SINGAPORE

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In 1955, a Silicosis Clinic was started in Medical Unit II. 62 workers from the Singapore Granite Quarry were investigated and followed-up. Of these, 80.6% were reported (Khoo and D'Souza 1961) to have radiological evidence of silicosis by comparison with standard films obtained from the Pneumoconiosis Research Unit, Cardiff. 21.9% and 24.2% had complicated pneumoconiosis and silico-tuberculosis respectively, the highest occurrence of both being in the crusher-stone truckers who were exposed to the greatest concentration of dust from the crusher plant. A definite relationship between the length of service, and hence, of exposure, and these complications were also established.

In a five year follow up in 1960, 52 of the original 62 cases were reviewed. 4 of the other 10 had died of progressive massive fibrosis while still under treatment for silico-tuberculosis. The rest could not be reached or had simply refused to attend. In this study, the incidence of silicosis was found (Khoo 1961) to have increased to 96% and of silico-tuberculosis to 28.8%. No normal radiographs were seen as against 12 in 1955.

40 of these remaining 52 patients were regularly attending the clinic and have been in the present study of the prolonged effects of exposure to dust. The rest have been lost due to reasons similar to the above. 8 of these 40 patients have since died, the others are still at work in the quarry. 2 of these cases are presented in some detail to illustrate the natural history of the disease, with emphasis particularly on its progressive nature and the deteriorating radiographic changes despite removal of the initial causative factor, such as the patients stopping work and going away from the quarry for a time.

Fig. 1 shows the various categories of workers and their numbers in the original, the 5-year follow-up and the present studies.

Nature of work	Number of workers		
	First seen 1955	Followed up 1960	1968
1. Drillers	6	5	5 (2)
2. Crusher-stone Trucker	11	8	8 (3)
3. Crusher-feeder	4	4	3 (1)
4. Block-Trucker	11	9	4
5. Stone-Breaker	18	16	13 (1)
6. Excavation Worker	2	2	1
7. Blasterer	2	1	2
8. Blacksmith	2	2	2
9. Oiler	1	1	-
10. Kepala	3	3	1
11. Clerk at Crusher	1	died	
12. General Worker	1	1	(1)
Total	62	52	40 (8)

*FIGURES IN () SIGNIFY THOSE WHO
HAVE DIED

Fig. 1. Shows the No. of Workers in the Three Surveys.

RESULTS

In the present survey, of 32 survivors only 1 is found to be in completely good health. The rest have silicosis, some with lung complications and others without. Clinically 24 have weight loss. 19 have active lung disease of one form or another as evidenced by raised sedimentation rates.

(1) The incidence of silicosis and silico-tuberculosis is as shown:

	1955	1960	1968
Silicosis	80.69%	96%	96.7%
Silico-tuber- culosis	24.2 % (15)	28.8% (15)	43.7% (14)

Although only 14 cases of silico-tuberculosis are seen, this however is a true increase over the previous years as 5 of the 8 who died had silico-tuberculosis.

LUNG COMPLICATIONS IN
PNEUMOCONIOSIS
(1968 REVIEW)

1. Chronic Bronchitis	-	-	5
2. Lung Abscess	-	-	2
3. Emphysema	-	-	10
4. Tuberculosis	-	-	14
5. Pneumothorax	-	-	NIL

Fig. 2. Lung Complications in Pneumoconiosis.

(2) Lung complications are seen in a large number (18) of the survivors. Many have more than one lesion in addition to silicosis.

		No. of Patients.
WEIGHT	SAME	3
	GAINED	5
	LOST	24
		32
BSR. (WESTERGREN)	1-7 mm/hr.	13
	8-15 mm/hr.	10
	>15 mm/hr.	9
		32

Fig. 3. Clinical status of patients, showing weight loss in the majority and active lung disease.

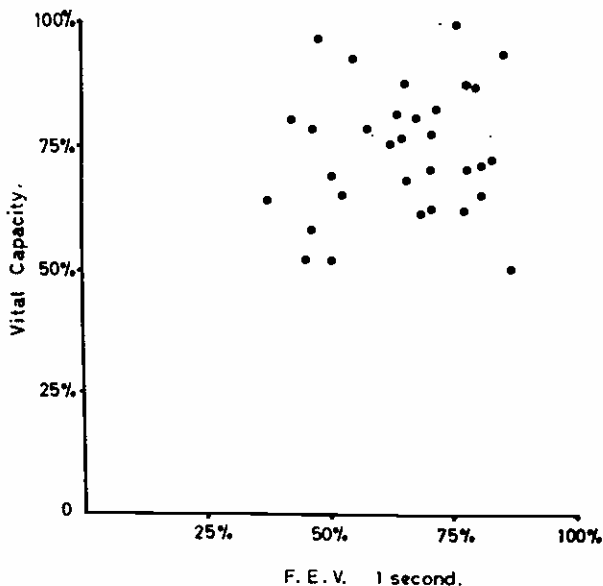


Fig. 4. Pulmonary function tests show a wide scatter.

The commonest chest complications being, in order, tuberculosis, emphysema, chronic bronchitis and lung abscess. No case of pneumothorax is noted though one patient who died had recurrent attacks. (Fig.2).

(3) Clinically, 24 had loss of weight and 19 active lung disease of one form or another (Fig. 3). The pulmonary function test show a wide scatter (Fig. 4).

No. Died — 8
CAUSES OF DEATH

1. Pneumothorax. Cerebral Embolism.
2. Emphysema. Carcinoma Liver.
3. Severe Silico-TB. Carcinoma Oesophagus.
4. Severe Silico-TB.
5. Severe Silico-TB/Lung Abscess.
6. Severe Silico-TB/Pneumothorax.
7. Carcinoma Bronchus.
8. Unknown.

Fig. 5. Causes of Death.

(4) Death in the 8 cases was due to the following cases (Fig. 5):

- (i) pneumothorax/cerebral embolism.
- (ii) emphysema. Carcinoma liver.
- (iii) Severe silico-tuberculosis. Carcinoma oesophagus.
- (iv) Severe silico-tuberculosis.
- (v) Severe silico-tuberculosis. Lung Abscess.
- (vi) Severe silico-tuberculosis. Pneumothorax.
- (vii) Silico-tuberculosis. Carcinoma bronchus.
- (viii) Unknown. (had silicosis).

CASE REPORTS

A.S., when first seen in 1955, had already been working for 21 years at a granite quarry, 17 at loading stones to trucks and 4 at the crusher plant. She was already complaining of effort dyspnoea at the time. Her initial chest films showed fine mottlings and increased pulmonary markings. Some calcified spots in the RLZ and nodular opacities in the LLZ were seen. Clinically, she weighed 101 lbs., her BSR was 27, and vital capacity 2.1 L/min. She was diagnosed as having simple pneumoconiosis.

In 1959, she stopped working at the quarry because of her breathlessness. During the 1960 survey, she was found to have complicated pneumoconiosis with silico-tuberculosis. Anti-TB therapy was started and continued to 1964.

In 1962, systemic steroid was also started. The patient improved and repeat X-rays of the chest showed only lung fibrosis, suggestive of progressive massive fibrosis, without evidence of tuberculosis. In late 1964, she had to resume work at the quarry as her T.B. allowance was terminated. An unsuccessful attempt to obtain workman's compensation was made. Clinically, in 1960 she was found to have lost weight (96 lbs.) had BSR 60 and vital capacity 2.4 L/min.

At present, her chest radiograph shows only P.M.F. Present clinical results are compared with the earlier ones in Table I.

Sequential Radiological Changes

Year	Reports
July 1955	Fine mottlings. Increased pulmonary markings. Calcified spots RLZ = Nodular opacities LLZ. (Fig. 6a)
Feb. 1962	Patchy opacities with radiolucent areas in both upper and mid-zones. (Fig. 6b)
March 1968	P.M.F. (Fig. 6c)

CASE-REPORT No. 2

C.P.S. was 45 years old when first seen in 1955. He began work in the quarry as a blasterer for 3 years, changing later to crusher stone-trucker. The patient had a 4 year history of cough with expectoration and was an opium addict. He had taken to opium to drown the smell of dynamite. The chest X-ray was radiologically normal. He weighed 147 lbs. and had vital

capacity of 2.6 L/min. BSR was only 6. 3 years later, in 1958, his chest X-ray showed pin-head size mottlings with suspicious tuberculosis. Clinically his chest disease was reflected by a loss of weight (12 lbs.), raised BSR 18 mm/hr. and decreased vital capacity, 2.6 L/min. He was started on anti-TB therapy. There was no response and in 1961, the patient was forced to stop work at the quarry due to his chest condition. He became a cake-seller.

In June 1963, deterioration took a rapid turn in the form of pneumothorax, with collapse of the upper lobe on the right side. A month later, a similar lesion appeared on the left. Thereafter he was repeatedly admitted for recurrent pneumothorax. In 1965 he died of bilateral pneumothorax. At the time of death, he weighed only 98 lbs., had BSR 29 mm/hr. and the Vital Capacity was only 1.4 L. His progress is charted in Table II.

At postmortem, dark slatey grey lungs were seen. They felt hard and gritty, with emphysematous bullae. Histology showed extensive fibrosis arranged in whorls around birefringent pigment material. There was marked increase of anthracotic pigment. The unaffected alveoli were emphysematous. No evidence of TB was seen.

Sequential Radiological Changes

Year	Reports
May 1956	Normal. (Fig. 7a)
Sept. 1962	Extensive nodular shadowing. Superimposed infection. (Fig. 7b)
June 1963	P.M.F. and Lt. pneumothorax. (Fig. 7c)

TABLE I

Year	Wt.	BSR	V.C.	X-ray
1955	101 lbs.	27	2.1 L	simple pneumoconiosis
1960	96 lbs.	60	2.4 L	complicated pneumoconiosis and silico-t.b.
1968	109 lbs.	6	1.95 L	P.M.F.

The patient continues to have severe effort dyspnoea and asthma-like attacks.

TABLE II

Year	Wt.	BSR	V.C.	Report X-rays
1955	147 lbs.	8	2.6 L	minimal changes
1960	139 lbs.	18	2.6 L.	silico-tuberculosis. Cavities
1965	98 lbs.	29	1.4 L.	P.M.F. Emphysema. Silico-TB

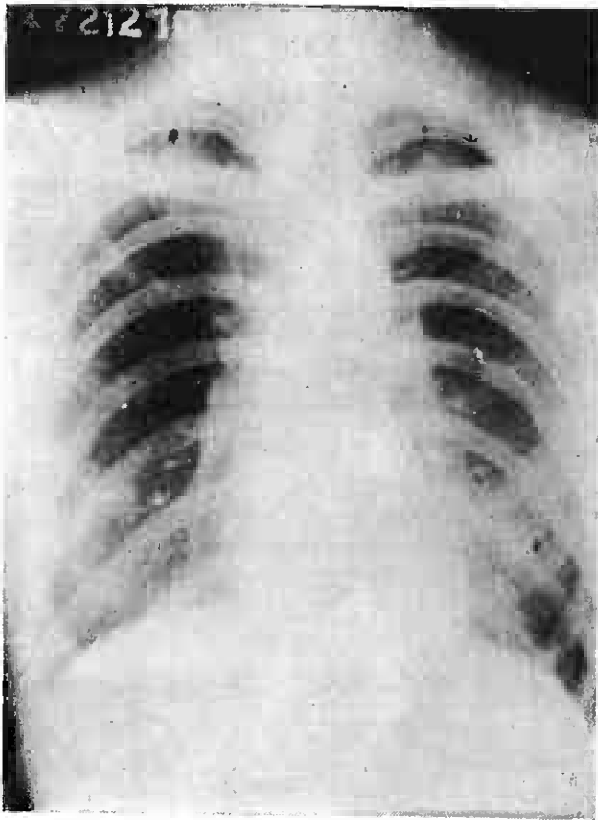


Fig. 6 (a). Fine mottlings. Increased lung markings. Calcifications in RLZ. Nodular opacity in LLZ.

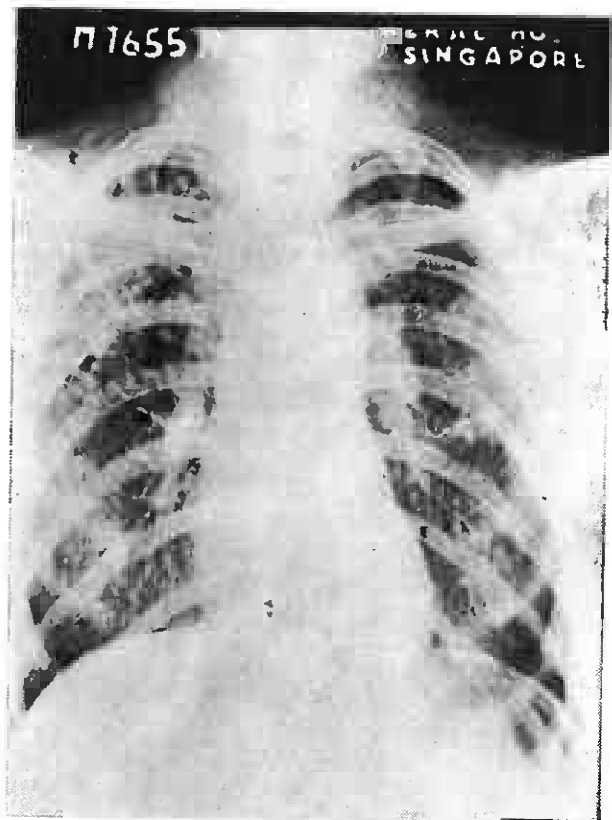


Fig. 6 (b). Patchy opacities with radiolucent areas in both upper and mid-zones.

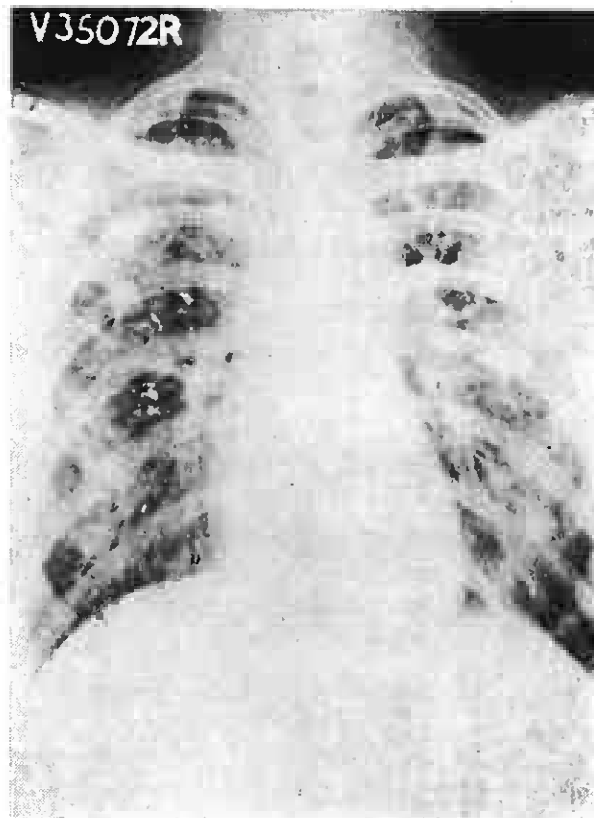


Fig. 6 (c). Progressive massive fibrosis.

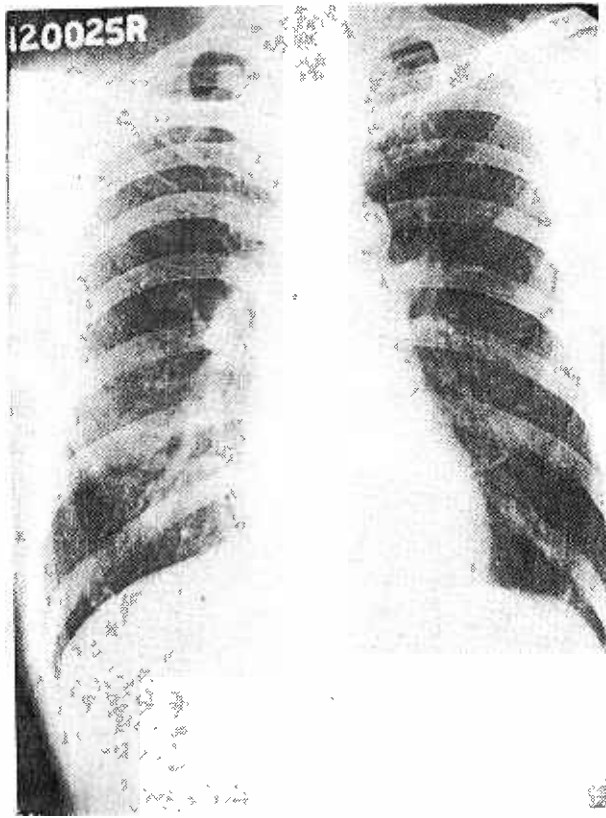


Fig. 7 (a). Normal.

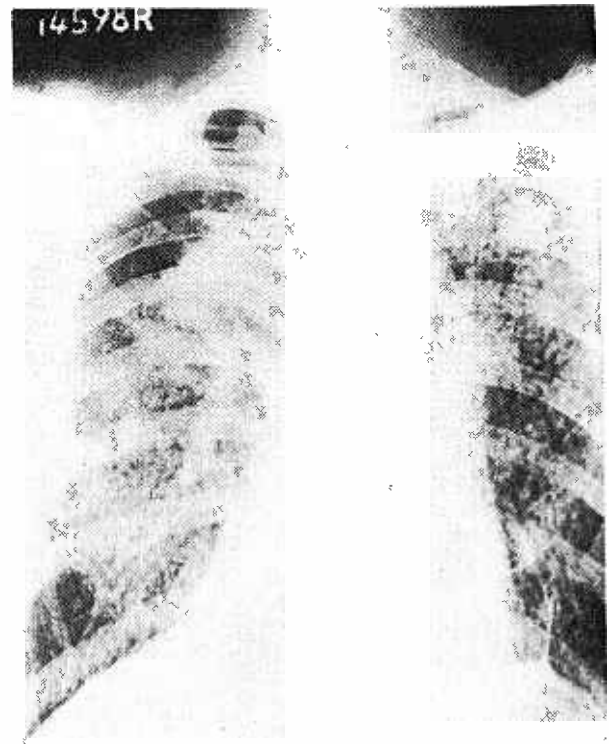


Fig. 7 (b). Extensive nodular shadowing.
Pneumothorax.



Fig. 7 (c). Progressive massive fibrosis with left
pneumothorax.

DISCUSSION

40 of the original 62 workers have been followed up. 8 are definitely known to have died of causes largely related to the disease.

Of the survivors, only 1 is in completely good health. The rest have silicosis and the majority with complications. In reviewing the known complications, pulmonary tuberculosis heads the list, followed by emphysema, chronic bronchitis and lung abscess. The absence of pneumothorax is unexpected as the cause of death in at least two persons was due to this.

There is a slight increase in the incidence of silicosis since 1960 but the incidence of tuberculosis is markedly raised. The silico-tuberculosis is also rather refractory and resistance to anti-tuberculosis drugs is not uncommon. Most of those who died had advanced silico-tuberculosis.

Despite the rather extreme and severe radiological changes, clinically the patients are fairly well. Breathlessness and weakness are the principal symptoms. Simple lung functions tests showed a wide scatter. At least one patient with severe progressive massive fibrosis, severe effort dyspnoea and bronchospasm is still at work, of all places, at the crusher. (This is A.S. in Case No. 1).

Crusher stone truckers, drillers and crusher-feeders are seen to experience the greatest morbidity and mortality. As previously described elsewhere, the process of greatest exposure and therefore hazard occurs at the rotatory sieve after the rocks are crushed, particularly at the opening of the hopper containing stone dust. Feeding rocks into the crusher expose the worker to less dust which is also less fine but there is

still overall exposure. Working with a pneumatic drill raises a local dust cloud which is sufficiently large to be inhaled.

Three patients who died had malignant neoplastic disease, one of the liver, another the oesophagus and a third the bronchus. No definite relationship between bronchogenic carcinoma and silicosis has been established.

SUMMARY

40 of an original 62 cases seen at the Silicosis Clinic since 1955 are reviewed. The following are found:

1. The incidence of silicosis has increased by 16% from 80.69% in 1955 to 96.7% in 1968.
2. Silico-tuberculosis has increased from 24.2% to 43.7%.
3. Highest mortality and morbidity is seen among crusher-stone truckers, crusher-feeders and drivers.
4. Resistant tuberculosis and pneumothorax are the main causes of death.

ACKNOWLEDGEMENT

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