ILO CLASSIFICATION OF THE STANDARD CHEST FILMS OF THE 1986 CHINESE ROENTGENO-DIAGNOSTIC CRITERIA OF PNEUMOCONIOSES

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ABSTRACT

As a preliminary step in joint Sino-American pneumoconiosis research efforts, the 32 standard chest films of the 1986 Chinese Roentgenodiagnostic Criteria of Pneumoconioses were interpreted according to the 1980 International Labour Office (ILO) Classification of the Pneumoconioses by three NIOSH-certified "B" reader radiologists. The Chinese interpretations on the films were obscured, and the films were read independently in random order. The median "B" reading was used in the analysis. The "B" readers' major category of profusion of small opacities agreed with the Chinese category in 27 of 34 cases. The Chinese category was included as either the major or alternative ILO profusion category in 32 of the 34 cases. The "B" readers' primary type of opacity agreed with the Chinese type in 24 of 32 cases, and agreed with regard to rounded or irregular lesions in all but one case. General agreement on zonal involvement and pleural plaques was also good. Four types of large opacities less than 1 × 2 cm (Chinese stage II+) were called either category "A" (3 cases) or coalescence of small pneumoconiotic opacities—"Ax" (1 case) by the "B" readers. Aspects of the Chinese classification without an ILO parallel include the concept of a bondary film, and the use of both profusion and zonal involvement to determine stage of disease. We conclude that, despite various differences, a clear correspondence can be made between the two pneumoconiosis classifications.

INTRODUCTION

A valid quantitative assessment of disease is a prerequisite to the development of appropriate dose-response relationships. The chest X-ray is the major tool in assessing the pneumoconioses, and in general has been found to be both valid and quantitatively accurate.[1-3] However, despite an international classification system for the pneumoconioses,[4] substantial differences in interpretation among X-ray readers in one country and among different countries are known to exist.[5-7] The differences between the Chinese and ILO classification systems pose another potential source of disagreement. Thus, before an effective exchange of epidemiologic pneumoconiosis data can take place, a clear correlation between the two classification systems is needed.

The 1986 Chinese Criteria is described in detail in another Proceedings paper (first authored by Lu Shixuan). In brief, the Criteria uses only a single (primary) type of small opacity (ILO letter system), the major category of small opacity profusion (ILO number system), a slightly modified large opacity classification, a simplified pleural disease evaluation, and similar "other symbols." In addition, the Chinese have stage symbols: 0, 0+, I, I+, II, II+, III, and III+, where 0 is normal and III represents large opacities (greater than 2 × 1 cm). The lower Chinese stages are determined by the number of lung zones involved as well as the profusion of small opacities. An abbreviated correspondence between the 1980 ILO and 1986 Chinese classifications is illustrated in Table I. For the first time, the Chinese Criteria in 1986 covers all pneumoconioses, and includes 32 standard films.

As a preliminary step in joint Sino-American pneumoconiosis research efforts, this study correlates the ILO and Chinese systems by evaluating 3 "B" readers' interpretations of the Chinese standard films.

METHODS

The 32 standard chest X-rays of the 1986 Chinese Roentgenodiagnostic Criteria of Pneumoconioses were interpreted according to the 1980 ILO Classification of the Pneumoconioses by three NIOSH -certified "B" reader radiologists. The Chinese interpretations on the films were obscured, and the X-rays were read independently in random order.

In the analysis the median "B" reading was used to compare to the Chinese interpretation. In a few cases, a simple median "B" reading of type of small opacity did not exist. In these cases the most frequent type (including primary and secondary) was selected. One Chinese film is divided into two sections and two into three sections; thus more than 32 comparisons are possible in some categories.

For profusion category, the kappa statistic[8] as well as the crude agreement value was calculated both between the Chinese and median "B" reading, and among the 3 "B"

Table I

Correspondence Between 1986 Chinese Criteria Stage and 1980 ILO Classifications of Pneumoconiosis

Chinese Stage	ILO Classification		
	Profusion of Small Opacities	Number of Zones	Comment
0	0/- ; 0/0	---	
0+	0/1	---	
I	1	2, 3, or 4	
I+	1	5 or 6	
	2	2, 3, or 4	
II	2	5 or 6	
	3	2, 3, or 4	
II+	3	5 or 6	
	--	---	Several types of large opacities < 2 X 1 cm
III	--	---	Large opacities > 2 X 1 cm but less than "C"
III+	--	---	"C" large opacity

readers. The statistic adjusts for the amount of chance agreement to be expected, and is expressed as:

$$\text{Kappa} = (PC—PE)/(1—PE)$$

where PC is the crude agreement (expressed as a proportion), and PE is the expected agreement. This is derived, as in a Chi-squared test of independence, from the expected numbers for the diagonal elements of the Table, which, in turn, are obtained using the products of the marginal totals. Kappa will equal zero if there is only chance agreement, and will be one with complete agreement.

RESULTS

The overall film quality was rated as quite good; all films having a median technical quality grade of 1 or 2.

Table II presents the reading data for the profusion of small opacities. The "B" readers' major category agreed with the Chinese category in 27 of 34 cases (79%). The kappa statistic, used to adjust the crude agreement, was 70%. By comparison, the average crude agreement among the three "B" readers was 61%, and the average kappa statistic 46%. The Chinese category was included as either the major or alternative ILO profusion category in 32 of the 34 cases. One of the remaining films, called 0/0 by median reading, was a "borderline" film in the Chinese classification. This film had profusion 1, but stage 0+ since the small opacities involved only one zone of the lung.

Table III presents the comparison of the type (size/shape) of small opacities. In all but one case, there was agreement with regard to rounded or irregular lesions. The "B" readers' primary type of opacity agreed precisely with the Chinese type in 24 of 32 cases. The only substantial disagreement was due to an apparent unwillingness of the "B" readers to report "t" opacities. In these 4 cases, however, the "t" opacity was recorded as the primary or secondary small opacity by either one (2 cases) or 2 (2 cases) radiologists. The comparison of zonal involvement is shown in Table IV. There was good general agreement, although it should be noted that over half of the cases had all 6 lung zones involved. All 4 examples of pleural disease were appropriately noted by the "B" readers.

The 1986 Chinese Standard Films contain examples of 4 types of large opacities (>1 cm) that are less than 2 × 1 cm. These abnormalities, all categorized as stage II+ are described as: 1. Aggregation of small opacities (analogous to the ILO "ax"); 2. Large opacities (which would be considered "A" lesions using the ILO scheme); 3. Definite shadows in appearance longitudinal, faint mottling in

Table II
Comparison of Small Opacity Profusion

Chinese Profusion Category	ILO Major Category				
	0	1	2	3	Totals
0	1				1
1	3	10	2		15
2		1	10		11
3		1		6	7
Totals	4	12	12	6	34

Table III
Comparison of Type of Small Opacities

Chinese Type	ILO Primary Type						
	P	Q	R	S	T	U	Totals
P	4	2		1			7
Q	1	5					6
R			6				6
S				5			5
T				4	1		5
U						3	3
Totals	5	7	6	10	1	3	32

Table IV
Comparison of Zonal Involvement

Chinese Standards	"B" Readers						
	1	2	3	4	5	6	Totals
1		1					1
2				1			1
3		1		1			2
4				6			6
5				1		1	2
6					1	14	15
Totals	0	2	0	9	1	15	27

peripheral parts of both upper zones; and 4. Homogeneous, hazy, and patchy shadows over both upper zones. The individual and median "B" readings for these films are presented in Table V. Abnormalities 1, 2, and 4 were graded as showing "A" size large opacities by the median "B" reading. Abnormalities 1 and 3 were marked "ax". There was agreement on the three other examples of large opacities.

DISCUSSION

The 1986 Chinese Roentgenodiagnostic Criteria of the Pneumoconioses represents a marriage between the older (1963) Chinese classification[9] and features of the 1980 ILO classification. The Chinese stage system is maintained since there is much experience in this format which is also related to compensation for pneumoconiosis in the People's Republic of China. Aspects of the ILO classification included in the 1986 Chinese Criteria enable researchers to make a clear correspondence between the two systems. From this small study, it appears that there is a good correlation between the type (size/shape) and profusion of small opacities between the Chinese and ILO classifications. The two classifications contain different standard films, and the Chinese standards represent boundary films as opposed to the mid-category standards of the ILO. In addition, the algorithm to determine the overall profusion category is slightly different. Thus it is not surprising that some small differences might exist.

In the important area of large opacities, the Chinese system makes several distinctions which do not exist in the ILO classification, particularly for what might be regarded as borderline large opacities. Although more readings are needed, it appears that the "B" readers also considered these abnormalities to be borderline or early large opacities (Table V). The other areas of comparison also showed good general agreement.

It should be emphasized that because of (sometimes substantial) variability among pneumoconiosis reading,[5,7] different results might be obtained with additional "B" readers. However, the overall conclusion is that despite various differences between the 1986 Chinese and 1980 ILO classification, a clear correspondence can be made.

Table V

"B" Reader Interpretation of Large Opacities Less Than 2 × 1 cm

Chinese Abnormality (all Stage II+)	"B" Reader Interpretation			
	Median	Reader #1	Reader #2	Reader #3
1. ax	ax, A	ax, A	ax, A	ax, A
2. A, < 2 X 1 cm	A	A	ax, A, R/O Ca	A, R/O Tb
3. Definite Shadows faint mottling	ax	ax	ax, A R/O Tb, Rp	0
4. Homogeneous, hazy & patchy	A	A	A, R/O Ca	B

R/O = Rule out; Ca = cancer; Tb = tuberculosis; Rp = Rheumatoid pneumoconiosis.

REFERENCES

1. Rossiter, C.E.: Initial Repeatability Trials of the UICC/Cincinnati Classification of the Radiographic Appearances of Pneumoconioses. *Brit. J. Industr. Med.* 29:407-419 (1972).
2. Rossiter, C.E., Bristol, L.J., Cartier, P.H., Gilson, J.G., Drainger, T.R., et al.: Radiographic Changes in Chrysotile Asbestos Mine and Mill Workers of Quebec. *Arch. Environ. Health* 24:388-400 (1972).
3. Morgan, R.H.: Proficiency Examination of Physicians for Classifying Pneumoconiosis Chest Films. *Am. J. Rad.* 132:803-808 (1979).
4. *Guidelines for the use of ILO International Classification of Radiographs of Pneumoconioses.* Revised Ed 1980. International Labour Office, Geneva (1980).
5. Reger, R.B., Amandus, H.E., Morgan, W.K.C.: On the Diagnosis of Coalworker's Pneumoconiosis; Anglo-American Disharmony. *Am. Rev. Respir. Dis.* 108:1186-1191 (1973).
6. Felson, B., Morgan, W.K.C, Briston, L.J., Pendergrass, E.P., Dessen, E.L., et al.: Observations on the Results of Multiple Readings of Chest Films in Coal Miners' Pneumoconiosis. *Radiol.* 109:19-23 (1973).
7. Reger, R.B., Morgan, W.K.C.: On the Factors Influencing Consistency in the Radiologic Diagnosis of Pneumoconiosis. *Am. Rev. Respir. Dis.* 102:905-915 (1970).
8. Cohen, J.: A Coefficient of Agreement for Nominal Scales. *Educ. Phychol. Meas.* 20:37-46 (1960).
9. Huang, J-Q, Hong, Y-Z: A comparison of Chinese Diagnostic Standards of Silicotic Radiographs and the ILO International Classification of Radiographs of Pneumoconioses. *Ann. Occup. Hyg.* 28:13-18 (1984).

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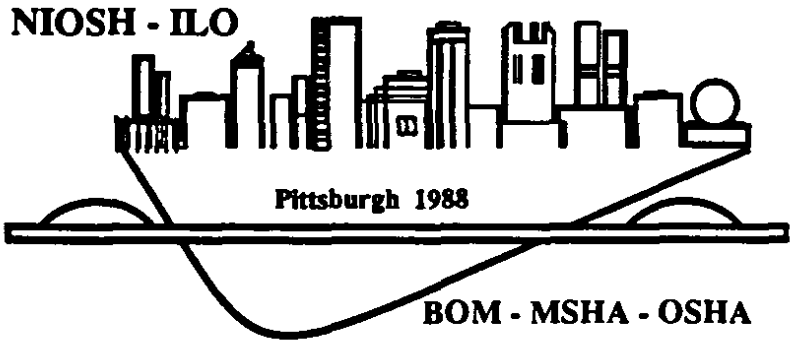

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