

RADIOLOGICAL FINDINGS IN PULMONARY PARAGONIMIASIS HETEROTREMUS

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INTRODUCTION

Paragonimiasis is endemic in Thailand and Laos; three endemic areas Saraburi and Nakhon Nayok in the central region (Vajras-thira, 1969) and Loei province in the north-eastern region on the Mekong river (Bunnag *et al.*, 1981) have been reported in Thailand; in Laos the endemic foci are Suvannaket, Vientiane, Xieng Khouang, Phong Sali, Sedone, Luang Prabang and Houa Phan (Soh, 1973). The species that caused human paragonimiasis in Thailand and in Laos has been reported to be *Paragonimus heterotremus* Chen and Hsia, 1964; (Miyazaki and Harinasuta, 1966; Miyazaki and Fontan, 1970; Fontan and Sacdpraseuth, 1977; Vanijanonta *et al.*, 1981).

The flukes and their eggs produce pathological lesions in the lung by mechanical damage to the tissues, toxic substances produced by them and immune response of the host. The pathomorphic picture of this disease evinced specific as well as non specific lesions. Acute and chronic lesions are found in the same patient considered to be caused by the migrating habit of the flukes. The specific lesions represents as "worm cysts" or abscess cavities, and foreign body granulomata due to the eggs. When the flukes lodge in the lung, there is inflammatory reaction surrounded by eosinophils and neutrophils. A fibrous cyst 1-2 cm in diameter develops around the flukes. The center of the cyst becomes necrotic and filled with a thick brown fluid containing cellular debris, eggs and Charcot-Leyden crystals. The cysts

rupture and release the content into the bronchus. Tunnels or burrows joining cysts are also formed. There may be one or two flukes in a cyst but empty cysts are occasionally found (Bunnag and Harinasuta, 1983).

Many types of lesions in the chest roentgenograms have been observed. Suwanik and Harinasuta (1959) reported the radiological findings in 38 patients. The purpose of this study is to re-evaluate the radiological findings, distribution of the lesions and attempt to correlate the duration of illness, number of eggs output per day to the lesions seen in the postero-anterior chest films in a larger number of patients.

MATERIALS AND METHODS

A retrospective study of 93 patients suffering from pulmonary paragonimiasis probably caused by *P. heterotremus* was carried out; 59 came from the endemic areas in Central Thailand who were admitted to the Bangkok Hospital for Tropical Diseases during March 1978 to November 1983, and 34 Laotian refugees and Thai inhabitants of Loei Province, Northeastern Thailand. The diagnosis was based on the finding of *Paragonimus* eggs in the sputum. Those with other pulmonary diseases especially pulmonary tuberculosis were excluded. For the in-patients, the hospital records were reviewed; the history of illness and the eggs output per day were noted.

The postero-anterior chest roentgenograms were re-evaluated. The number of films

available in individual case varied from 2 to 12, the average being 4.4.

A roentgenographic-pathologic typing of the lesions was made, based on the recognition of the following features and components as seen in the films in each case : single cystic formation, multiple cystic formation, linear infiltration, exudative infiltration, nodular infiltration, pleural thickening, pleural effusion, loculated pleural effusion, hilar enlargement and extensive infiltration. The location of the lesions are either in the right or the left lung or both; in the upper lobe, middle lobe, lower lobe, or at the hilar region. Single and multiple lesions in each individual subject was also recorded.

The lesions were graded according to the classification of lesions in pulmonary tuberculosis and modified as follows:

- Grade O - no abnormality seen
- Grade I - linear patchy infiltration or ill-defined nodular of small part of one lung or both.
- Grade II - moderately advanced, grade I with cavitation, area affected not more than one lung or equivalent.
- Grade III - far advanced, multiple types of lesions, affected both lungs.

Correlation of the duration of history of illness, eggs output per day and the lung lesions were analysed.

RESULTS

Of the 93 patients, 44 were males and 49 were females. Their ages ranged from 12 to 79 years with a mean of 34.8 years. Twelve of 93 patients (12.9%) showed normal films. Eighty-one patients (87%) had abnormality with 316 lesions; 18 patients (22.2%) had single lesion and 63 (77.7%) had multiple

lesions. The percentage of different characteristic lesions are shown in Fig. 1. The percentage distribution of the lesions seen in the films were 50.3 in the right lung : 17 in the upper lobe, 1.3 in the middle lobe and 26.9 in the lower lobe, and 5.1 in right hilar region; 49.6 were in the left lung : 22.2 in the upper lobe, 23.6 in the lower lobe, and 3.8 in the hilar region (Fig. 2).

Single cystic formation were usually seen as a small cyst of 1-2 cm in diameter located in any part of the lung field; they appeared as a thin-walled cavity (Fig. 3). Only seven of 84 single cystic lesions showed classical "corona ring" shadows. Multiple cysts appeared as a cluster of a single lesion with varying degrees of pericystic inflammatory reactions (Fig. 4) in 35.4% of cases. Linear type of chronic infiltration was the third common roentgeno-pathological finding (Fig. 5). The exudative infiltrations were usually multiple and located closely together (Fig. 6). They were variable in size ranging from 1-2 cm in diameter. Nodular infiltration (Fig. 7), pleural thickening, pleural effusion, loculated pleural effusion, extensive lesions and hilar enlargement were less frequently observed. There were 4 cases (1.3%) of bilateral extensive infiltrations of various types (Fig. 8); two of the four were misdiagnosed as advanced pulmonary tuberculosis with failure to antituberculous treatment in the provincial Hospital.

The duration of illness before admission ranged from 3 months to 14 years with a mean of 3.4 years. The correlation of duration of illness and lesions seen in the radiological films are shown in Table 1. The longer the duration of illness the more extensive lesions were seen in the films.

The number of eggs output per day varied from 400 to 300,000 with a mean of 10,400. The correlation of the number of eggs output and lesions seen in the roentgenograms are

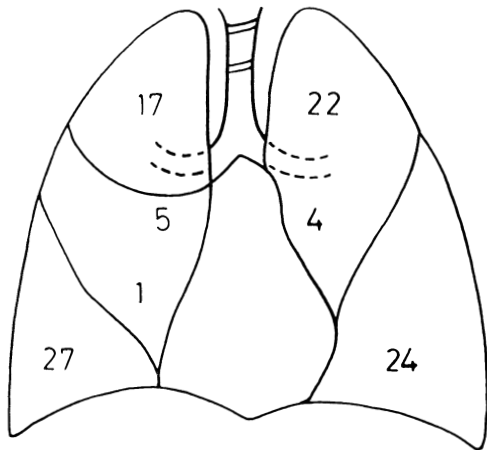
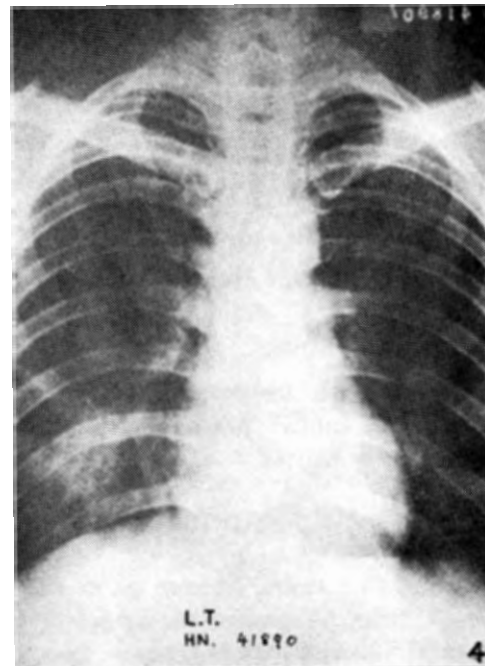
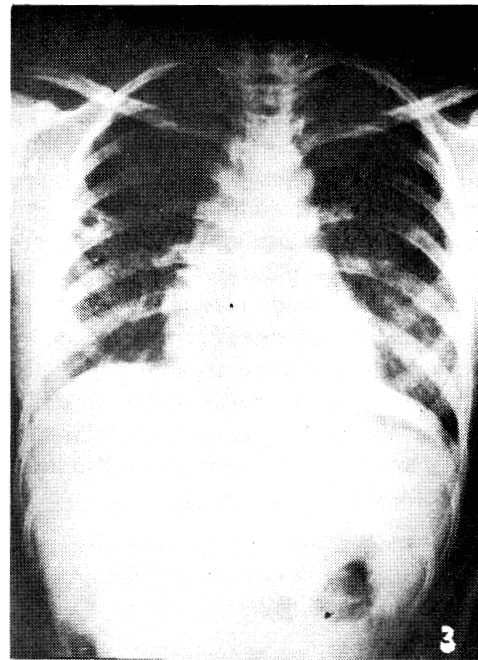
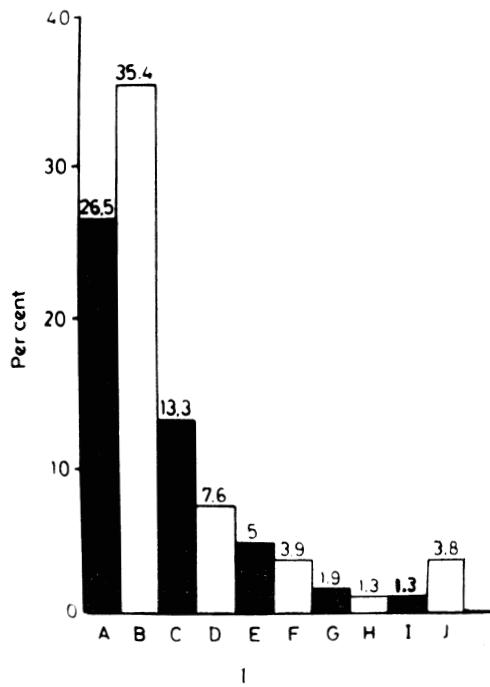


Fig. 1—Roentgenological characteristics of 316 lesions caused by *Paragonimus heterotremus*, in 81 patients.
 A = Single cystic lesion, B = Multiple cystic lesion, C = linear infiltration, D = exudative infiltration,
 E = nodular infiltration F = pleural thickening, G = pleural effusion, H = loculated pleural effusion,
 I = extensive bilateral infiltration, J = hilar enlargement.
 Fig. 2—Percentage (to nearest whole number) distribution of the lesions in the lungs.
 Fig. 3—Single cystic formation with pericystic infiltration in the right upper lobe.
 Fig. 4—Multiple cystic formation with fibrosis in the right lower lobe.

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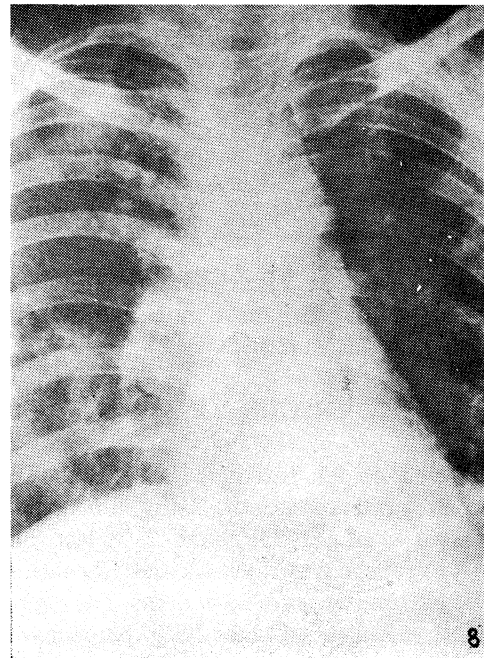
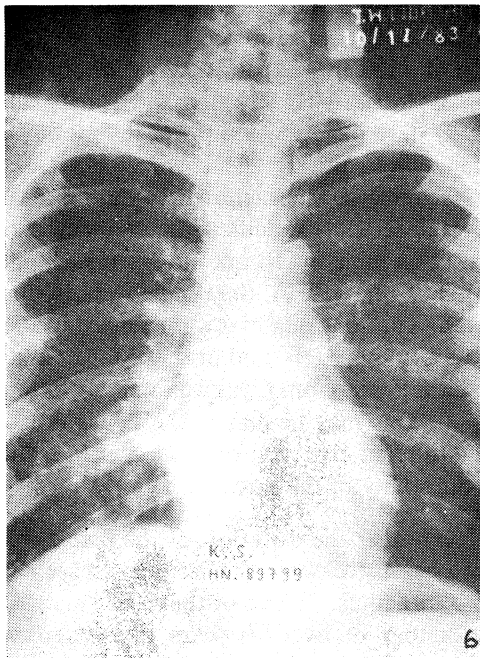
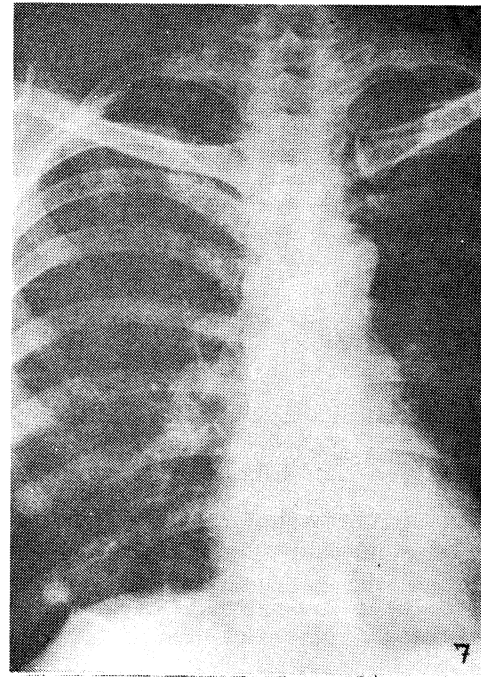
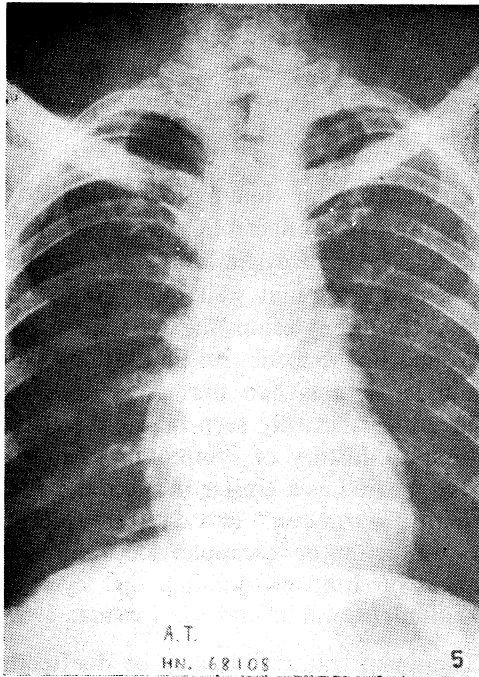


Fig. 5—Linear infiltration in the left upper lobe.

Fig. 6—Multiple exudative infiltrations in right hilar region, right middle and lower lobes.

Fig. 7—Single nodular lesion in the right lower lobe with fibroatelectasis.

Fig. 8—Extensive bilateral infiltration with various roentgeno-pathological findings; ill defined patchy infiltration, multiple cystic formation, linear infiltrations in the right lobe. Thick-walled cystic formation, thin-walled cystic lesion fibroatelectasis in the left lower lobe.

Table 1

Correlation between duration of illness and pulmonary lesions seen in roentgenograms.

Duration of illness (years)	No. of patients	Grade of lesions			
		0	I	II	III
< 1	1	0	1	0	0
1-2	13	4	6	3	0
3-5	17	5	0	12	0
6-10	12	0	7	5	0
> 10	4	0	1	0	3

Table 2

Correlation between *Paragonimus* egg output per day in patients with paragonimiasis and pulmonary lesions.

Egg output per day	No. of pt.	Grade of lesions			
		0	I	II	III
<1000	1	0	1	0	0
1001-5000	22	6	11	5	0
5001-10,000	9	0	6	3	0
10,001-50,000	15	3	4	8	0
>100,000	9	0	3	3	3
Total	56	9	25	19	3

shown in Table 2. The higher number of eggs output per day the more extensive the pulmonary lesions were seen.

DISCUSSIONS

Twelve of 93 patients (12.9%) showed normal postero-anterior X-ray films while Ogakwu *et al.*, (1973) found 21% but only 5% was reported by Suwanik and Harinasuta (1959) in their series of 38 patients. The pathological changes of the lung parenchyma may be too mild or too small, or hidden beneath the ribs or the mediastinum or diaphragmatic shadows; the routine roentgenological examination is not sensitive

enough to detect the lesions. If lateral or oblique views were taken or sophisticated technique such as tomogram or computerized tomogram had been used, the lesion might be visualized.

Roentgenogram findings correspond to the pathology produced by the flukes and/or their eggs: single cystic lesions of 1-2 cm in diameter correspond well with the "worm cyst". In recent lesions the cysts are usually surrounded with exudative infiltrations while the older lesions had fibrosis. Exudative infiltration is usually seen in those patients with short history of symptoms. Multiple cysts appeared as a cluster in a lesion present as multi "worm cyst" in a cluster. In broncho-tomogram or computerized tomogram tunnels or burrows joining this cyst are visualized (Suwanik and Harinasuta, 1959).

The linear infiltration may be due to the migration of the fluke. Only seven of 84 (8%) single cystic lesions showed thin-walled cavity with a crescent-shaped opacity along one side of the border. Suwanik and Harinasuta (1959) described the lesion as resembling a solar eclipse during the corona stage; and considered it as characteristic, found in 82% of their series. Calcification and pneumothorax as seen by Roque *et al.*, (1953) and Yang *et al.*, (1959) were not seen in this series. The abnormalities were mostly located in the left upper lobe and both the lower lobes which differed from Ogakwu and Nwokolo, (1973). This may be due to the behaviour of the different species of *Paragonimus* and susceptibility of the host.

The longer the duration of the illness, the more extensive were the lesions as seen in the X-ray films. Three of the 4 patients with the history of over 10 years had extensive lesions (grade III, Table 2). This may be due to repeated infections as the patients had stayed in the endemic area and practised the same habit of eating raw crabs. Another

factor is that the fluke has a long life span of over 10 years and with its migrating habit, it is not surprising to see patients with long history of illness to have extensive lesions of mixed types.

As expected, the higher the number of eggs output per day the more extensive were the lesions (Table 2). This could be related with the larger number of flukes in the lungs.

There were 2 patients in this series misdiagnosed as advanced pulmonary tuberculosis. It should be emphasized that the roentgenogram in pulmonary paragonimiasis may mimic any disease of the lung especially pulmonary tuberculosis; sputum examination with vigilant search for *Paragonimus* egg is essential, and this simple method will confirm the diagnosis. In the endemic areas, all patients with abnormal roentnograms, pulmonary paragonimiasis should always be excluded.

Following specific treatment with Niclofolan or Praziquantel, the lesions gradually improved and disappeared within 3 to 26 months depending on the severity of the disease (Vanijanonta *et al.*, 1980).

In this series many types of roentgenographic lesions have been observed. Lesions suggestive for paragonimiasis are cystic lesion, multiple or single, located in the lower lobes, extensive lesions consisting both of acute and chronic of different types in patient with a long history of blood stained sputum but very little general constitutional disturbance.

SUMMARY

The routine chest roentgenogram of pulmonary paragonimiasis heterotremus were evaluated in 93 Thai and Laotian patients. They were 44 males and 49 females; the ages ranged from 12 to 79 years; the history of illness ranged from 4 months to 14 years and

the egg output per day was 400 to 300,000. Twelve patients, 12.9% had normal roentgenologic films and 81 patients (87.1%) had abnormalities with 316 lesions; 22.2% had one lesion and 77.7% had multiple lesions. The common lesions were cystic formation, multiple or single and linear infiltration.

Both lower lobes of the lungs and the left upper lobe were the common sites but any part of the lung may be affected. There were correlation between the duration of illness, number of eggs output per day and the extent of the lesions. The longer the duration of illness or the higher number of eggs output per day the more extensive lesions in the X-ray films have been observed.

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