A case of cerebral paragonimiasis

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Infestation of the human brain by the lung fluke, *Paragonimus westermani*, has been known for many years. Otani (1887) of Japan reported the first case; he found an adult worm in the brain of a patient dying from widespread infestation. Since then many cases have been reported: from China by Lei and Yen (1957), from Korea by Busch and Cooper (1952), from Formosa by Chung, Wu, Lee, and Yang (1953), and from the Philippines by Garduño and Carpio (1950).

AETIOLOGY

Cerebral paragonimiasis is an example of extrapulmonary paragonimiasis. In reviewing 247 cases of paragonimiasis Kulka and Barabás (1955) found that 2% were extrapulmonary. On the other hand Chang, Wang, Tu, Hsu, and Fang (1958), in their study of 200 adult cases of paragonimiasis, found evidence of neurological involvement in as many as 25% of their cases. The helminth deviates from its usual destination, the lungs, and lodges in a variety of other tissues. For example, Germer (1955) reported five cases in which the extrapulmonary habitat of the adult worm was respectively brain, meninges, pleura, testis, and subcutaneous tissue.

A patient becomes infested by eating raw, pickled, or half-boiled fresh-water crab or crayfish, the soft tissues of which contain encysted metacercariae of *P. westermani*. The larvae hatch out, penetrate the intestinal wall and migrate upwards, traversing the diaphragm to enter the lungs. In the case of cerebral paragonimiasis the larva wanders from its usual path, traverses the soft tissues of the mediastinum and neck, passes into the skull through one of the basal foramina and enters the brain, where it develops into an adult worm. Being hermaphroditic, it lays eggs in its path as it wanders in the brain substance.

PATHOLOGY

The pathology has been fully described by Busch and Cooper (1952), by Mitsuno, Takeya, Inanaga, and Zimmerman (1952), and by Lei and Yen (1957).

The brain reacts to invasion by the worm by forming granulomata and cysts. These lesions develop along the track taken by the worm in its

wanderings and the worm is contained within one of them. The radius of movement of the worm is not usually great, consequently the lesions are often grouped closely together like a cluster of grapes. Their individual size is between 0.5 and 2.0 cm., though larger cysts have been reported (Chung *et al.*, 1953). The centrum ovale of a single area of the cerebral hemisphere is the commonest site of affection. The cortex and basal ganglia may be involved. The worm may not be found at necropsy, so presumably it has died and disintegrated. Microscopically numerous ova of the worm are found in the walls of the cysts; calcification has been found in some lesions (Mitsuno *et al.*, 1952).

The patient may die from the lesions caused by the infestation, or the worm may die, the active stage of the disease subside, and the patient survive, but with permanent cerebral damage.

CLINICAL FEATURES

There are three clinical stages of the disease (Hung and Lin, 1966): the initial stage of invasion and meningeal irritation, the stage showing features of a space-occupying lesion, and the late stage of arrest with sequelae. Any one or two of these stages may be absent from the clinical picture.

The symptoms of the late stage are epilepsy and permanent disturbance of neurological function, *e.g.*, hemiplegia, hemianopia, dysphasia, dementia, depending on the area of the brain involved. Marked calcification of the intracranial lesions may be seen radiologically and it has a characteristic appearance (Hung and Lin, 1966). There are multiple rounded homogenous opacities clustered together in a single region of the brain. They are the end-results of the cysts and granulomata found in specimens of affected brain removed at operation or found at necropsy in the earlier stages of the disease.

CASE REPORT

An unmarried Formosan (Chinese) woman, aged 22, was admitted to hospital on 16 July 1956 with a 10-year history of epileptic seizures. At the onset these consisted of attacks during the night of sudden loss of consciousness, frothing at the mouth, and change in facial colour. There

was sometimes incontinence of urine and faeces. The frequency was about two attacks a month; after four years the seizures became less frequent.

During the final two years she suffered from episodes of clouding of consciousness for a few seconds; she would not fall but might sink to the ground or she would drop things out of her hand. There were no convulsions. These episodes increased in frequency so as to become an almost daily occurrence. In neither type of attack were there any premonitory focal symptoms and no visual, auditory, gustatory, or olfactory accompaniments.

Her general health was good. She had no headache, vomiting, giddiness, speech difficulty or other disturbance.

At the age of 3 or 4 years she had eaten raw crab pickled in vinegar, with other members of her family. At the age of 5 she developed a chronic cough with occasional bloodstained sputum and some headache (the history is uncertain on this point). These symptoms followed a fluctuating course for some years. She was thought to have pulmonary tuberculosis and was so treated. At the age of 12 she was diagnosed as a case of pulmonary paragonimiasis and was treated with a full course of parenteral emetine. The pulmonary symptoms disappeared and did not return but at about this time her epileptiform seizures began.

There was no epilepsy in the family but there was evidence that some members had suffered from pulmonary paragonimiasis in the past.

She was an intelligent but somewhat introspective young woman. There were no abnormal physical signs in the nervous system except for a complete left homonymous hemianopia shown by confrontation tests. She had hitherto been unaware of its presence. She was right handed.

The skull, heart, lungs, abdomen, and skin were normal. Blood pressure was 105/60 mm. Hg. The urine was normal, and no parasitic ova were found in the faeces.

A full blood count gave Hb 12.0 g.%, R.B.C. 3,880,000, W.B.C. 6,700 (neutrophils 70%, eosinophils 3%, basophils 1%, lymphocytes 25%, monocytes 1%).

Lumbar puncture produced watery clear cerebrospinal fluid at a pressure of 150 mm.

The Queckenstedt test was normal, and a cell count gave 6 lymphocytes/c.mm. The Nonne-Apelt and Pandey tests were negative, as was the Venereal Disease Reference Laboratory test. The glucose level was 78 mg. per 100 ml.

A radiograph of the chest (in another hospital) was normal.

Radiographs of the skull (Figs. 1 and 2) showed that in the posterior parietal region and in the occipital lobe near the falx there was a constellation of homogeneous rounded opacities ranging from 0.5 cm. to 1.5 cm. in diameter. A similar but smaller group was present in the posterior temporal region.

Air encephalography (40 ml. air was introduced) showed that there was considerable dilatation of the posterior end (trigone) of the right lateral ventricle which outlined irregularly. The septum pellucidum appeared to be shifted to the right side by 0.5 cm. The E.E.G. record on the left side was normal. On the right, over the temporal and occipital areas, the alpha rhythm

FIG. 1.

FIG. 2.

FIGS. 1 and 2. Radiographic appearance of calcified cysts.

was replaced by irregular theta activity which appeared mixed with waves in the delta range.

The patient was discharged from hospital on 30 July 1956. While in hospital and after returning home her attacks were completely controlled with phenobarbitone and phenytoin sodium. She has been able to follow a business occupation. She was seen again in 1958 and again in 1961 when she had moved to reside in Japan. Contact was made with her by letter in 1963. Her attacks were controlled provided she took anticonvulsant drugs regularly.

COMMENT

This patient presented as a case of uncontrolled epilepsy. The discovery of a left homonymous hemianopia pointed to a focal lesion; that she was hitherto unaware of its presence indicated that the lesion had developed in childhood. The history of

pulmonary paragonimiasis was, in the absence of competing evidence, sufficient to justify a diagnosis of cerebral paragonimiasis in the late stage.

The pattern of calcification seen radiologically in this case did not seem to accord with that seen in other intracranial lesions which may calcify, such as glioma, meningioma, arteriovenous malformation, cysticercosis, tuberosc sclerosis or toxoplasmosis; craniopharyngioma does not grow in the part of the brain involved in this patient. In none of the above diseases, except possibly craniopharyngioma, is there a grouping together of rounded shadows of the size seen in this case. The radiological appearance is distinctive of cerebral paragonimiasis in the late stage. According to Hung and Lin (1966) the most frequent radiological feature in cerebral paragonimiasis is multiple finger-tip sized nodular densities which are irregularly conglomerated into a huge mass. 'This x-ray finding is so characteristic that it bears special diagnostic value.'

It is difficult to say how long a time must elapse between the initial cerebral infestation and radiologically detectable calcification. In one of the cases reported by Mitsuno *et al.* (1952), there was a seven years' neurological history and one of the lesions was found to contain calcified material at necropsy. Hung and Lin (1966), in their extensive review of cerebral paragonimiasis, state, when describing the pathology, that there is microscopical evidence of calcification in the central necrotic material and in the eggs in granulomata of one or two years' duration, but that it usually takes longer before gross calcification can be seen. Such extensive calcification was found in one of their cases with a nine years' clinical history. When describing the radiological findings the same authors state that calcified shadows are often seen in patients with a long history, especially when the disease process has become inactive. In 17 patients with a clinical history of more than four years the incidence of radiologically evident calcification was 76%. They state categorically that 'it is very rare to see calcified shadows in roentgenograms in the first few years of the disease'.

The irregular dilatation of the posterior part of the right lateral ventricle indicates some atrophy of the centrum ovale in the area of the lesion. The drawing over to the right side of the septum pellucidum is an indirect effect of this.

It is noteworthy that the patient and her family could not remember her having definite symptoms of the early stages of cerebral involvement. The headache said to be present at the age of 5 was questionable. For some decades emetine hydrochloride has been used for the treatment of paragonimiasis but its effect is weak and uncertain. It is doubtful whether the treatment by emetine in this

case enabled the patient to survive the early stages. Rather, her survival into the late stage was the outcome of the natural history of the disease.

Neurosurgical consultation was considered with a view to surgical ablation of the affected area in order to remove the epileptic focus but the idea was discarded because the lesions appeared to be too extensive.

Conservative treatment was followed and the seizures were controlled. The prognosis for this stage of cerebral paragonimiasis, provided the seizures are controlled and other disabilities are not too crippling, would seem to be good.

All patients living in Far Eastern countries (or who have resided there), undergoing investigation for epilepsy, should be asked whether they have in the past eaten raw, pickled, or half-cooked freshwater crab or crayfish, and whether they have had a chronic cough with bloodstained sputum. As the danger of eating these articles is emphasized in public health education, so will the number of cases of all forms of paragonimiasis diminish.

SUMMARY

A case of cerebral paragonimiasis in the late stage is described. A brief review of the aetiology, pathology, and clinical and radiological features is given.

I wish to thank Dr. R. A. Henson for encouraging me to describe this case, the photographic department of the National Hospital, Queen Square, for photographing the x-ray films, Dr. T. P. Hung of the University Hospital, Taipei, Formosa, for performing the E.E.G. and for much help, and the staff of my own hospital for their cooperation.

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