

Findings of intelligence quotient in cerebral paragonimiasis

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Paragonimus westermani is the causative agent of pulmonary paragonimiasis, a benign parasitic disease prevalent in the Far East, and in the South East Asia. It is transmitted to man by the ingestion of raw crabs and crayfish.

Though the lung is the primary site of infection, other organs are not uncommonly involved. Chief among these ectopic sites is the brain, and when cerebral infection occurs, the disease can no longer be considered benign. Cerebral paragonimiasis results in severe neurological manifestations and is often fatal.

From the previous study in Korea, it has been established that 0.8% of patients with active pulmonary paragonimiasis develop cerebral infection and there are about 4,000 cases living in Korea as of January 10, 1966 (Oh, 1967). Therefore, cerebral paragonimiasis has been a major neurological problem in Korea.

Cerebral paragonimiasis is predominantly a disease of male children and adolescents and may simulate a large number of neurological conditions from meningitis to tumor. In our series of 62 cases, mental retardation has been one of sex major

symptoms, others being seizure, headache, motor weakness, sensory disturbance, and visual disturbance. Dementia has been also one of five major signs, others being hemiplegia, unilateral hypesthesia, homonymous hemianopsia and optic atrophy (Oh, 1967).

Despite a high frequency of involvement of intellectual capacity in cerebral paragonimiasis, psychological test findings have not previously been reported. This report will present the results of Intelligence Quotient (I. Q.) testing in cerebral paragonimiasis and discuss its clinical implication.

Materials and Method

A total of 62 cases of cerebral paragonimiasis, over a six-year period from 1958 to 1964, were observed at the Neurology Department, National Medical Center, Seoul, Korea. There were 46 males and 16 females. Average duration of symptoms was 5.5 years.

The diagnostic criteria for cerebral paragonimiasis follows:

- 1) Infestation of paragonimiasis was confirmed by a positive skin test.
- 2) Paragonimiasis was diagnosed by the detection of *P. w.* ova, by the positive

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titer in the complement fixation test, and then,

3) Cerebral paragonimiasis was diagnosed by the presence of eosinophile in the spinal fluid, by the positive complement fixation test in the spinal fluid, by the characteristic "radiological signs" (Oh, 1967), or/and by pathological study.

Intelligence testing was carried out in 21 of the total 62 cases, employing the Korean Wechsler Intelligence Scale (KWIS) prepared by the Korean Education Research Institute.

Results

Table 1 presents the results of intelligence testing and other clinical findings. The mean Full Scale I. Q. for the sample tested is 72. Nine of the 21 patients (or 43%) fall in the clearly mentally defective range. Two additional patients fall the Borderline Defective category, making a combined total of 11 (52%) with subnormal intelligence. This 52% is comparable with an expected 8.9% in these categories within the

general population (Wechsler, 1956). There is, then, a far greater prevalence of borderline and clear-cut mental subnormality in our sample than in the population at large. Emphasizing the low intellectual level of this group is the fact that no patient obtained a Full-Scale I. Q. above 99 (100-exact normal) and the fact that only 2 patients, or roughly 10%, had measured intelligence anywhere in the normal range.

With respect to Verbal and Motor-performance I. Q.'s, (see Fig. 1), the results are compared. Only three patients obtained normal-range or higher Verbal I. Q.'s, and only two obtained normal-range or higher motor-performance I. Q.'s. The mean Verbal I. Q. is 76.7, and the mean Motor-performance I. Q. is lower, at 68.5. The tendency to lower Performance I. Q. in our group is better seen in the fact that 15 of the 21 patients had higher Verbal than Performance I. Q.'s, a finding which is statistically reliable beyond the 0.05 confidence level.

Table 1 Intelligence Quotient and clinical data in cases

Case No.	I. Q.			Duration of symptom	Atrophy in PEG	Calcification in X-ray	Seizure	Severity of neurological deficits
	Full	Verb.	Perf.					
1	54**	48	62	6 yrs	Slight subcortical	(+)	(+)	Mild
2	49**	52	48	5 yrs		(-)	(+)	Severe
3	56**	53	58	21 yrs	Marked subcortical	(-)	(+)	Severe
4	71*	79	62	8 yrs	Moderate subcortical and cortical	(+)	(+)	Severe
5	84	85	84	5 yrs	Moderate cortical	(+)	(-)	Mild
6	71*	82	59	13 yrs	Slight subcortical & cortical	(+)	(+)	Mild
7	60**	80	37	3 yrs		(+)	(+)	Severe
8	51**	52	51	3 mon.		(+)	(-)	Severe
9	83	86	82	5 yrs	Marked subcortical	(-)	(+)	Mild
10	81	81	82	3 yrs	Marked subcortical	(+)	(+)	Severe
11	84	81	91	10 yrs		(+)	(+)	Severe
12	68**	79	64	6 mon.		(+)	(+)	Severe
13	80	84	76	24 yrs	Moderate subcortical	(+)	(+)	Severe
14	99	115	75	4 yrs	Moderate subcortical	(+)	(+)	Severe
15	88	96	78	5 yrs	Normal	(+)	(-)	Mild
16	81	79	84	26 yrs	Moderate subcortical	(+)	(+)	Mild
17	91	80	107	3 yrs	Moderate subcortical	(-)	(+)	Mild
18	49**	50	48	15 yrs	Normal	(+)	(+)	Mild
19	62**	68	59	8 yrs	Slight cortical	(-)	(+)	Mild
20	68**	79	58	7 yrs	Marked subcortical and cortical	(+)	(+)	Severe
21	83	92	73	3 mon.	Marked subcortical	(-)	(-)	Mild
Mean	72.0	76.7	68.5					

* borderline defective range ** mental defective range

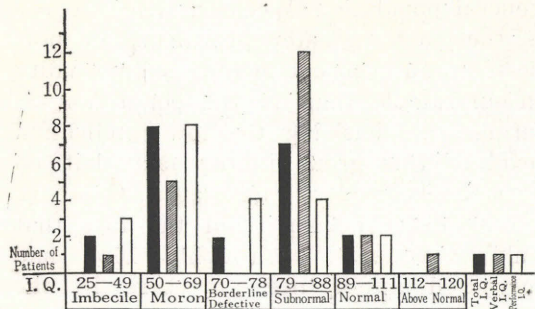


Fig. 1 Distribution of patients to level of I. Q.

The relationship between Full Scale I. Q. and several clinical data was attempted in the form of two-by-two contingency tables with statistical evaluation of results by the Fisher Exact Probability test. In no case is I. Q. significantly associated with the clinical variables, although in four or five variables examined, increase in degree of clinical severity tends to be associated with lower I. Q. In the case of cerebral atrophy as determined by pneumoencephalography, the relationship with I. Q. is paradoxically reversed.

Case Report

Case one :

15 years old Korean male with progressive mental retardation, weakness of left extremities, and rusty sputum for 4 years, and with left Jacksonian seizure and episodic meningitis for 7 months was found to have mental retardation, left homonymous hemianopsia, left spastic hemiplegia, and left unilateral hypesthesia. Positive *P. w.* skin test, increased protein in the spinal fluid, and angiographic evidence of space-occupying lesion in the right hemisphere were the pertinent findings. Craniotomy revealed *Paragonimus* granuloma. Two year post-operative pneumoencephalography showed marked bilateral central (subcortical) atrophy with more dilatation on the right lateral ventricle. I. Q. test done at 17 years of age showed total score 99, performance score 75 and verbal score

Table 2 I. Q. test in reported cases

	Case 1 (# 14)	Case 2 (# 3)	Case 3 (# 2)
Information	14	0	4
Comprehension	15	3	2
Arithmetics	11	4	4
Similarity	11	0	5
Digit span	10	4	6
Vocabulary	16	5	0
Digit symbol	8	3	3
Picture comprehension	10	3	5
Block design	4	6	0
Picture arrangement	19	5	4
Object assembly	6	6	5
Verbal I. Q.	115	53	52
Performance I. Q.	75	58	48
Full scale I. Q.	99	56	49

indicate number in Table 1

115 (See Table 2).

Comment: This is a good example case in which there is disparity between degree of cerebral atrophy and I. Q. test.

Case two :

29 years old Korean male with generalized seizure, stationary right hemiplegia, and episodic dull headache since meningitis episode at 9 years of age. Physical findings consisted of marked mental retardation, mixed global aphasia, primary optic atrophy, right homonymous hemianopsia, spastic right hemiplegia with right unilateral hypesthesia. Typical cystic calcification is noted in the left parieto-occipital area in the skull X-ray and positive complement fixation test in serum. Pneumoencephalography showed marked central (subcortical) atrophy: only half thickness of cortex was noted. I. Q. test showed total score 56, performance score 58, and verbal score 53. (See Table 2).

Comment: This is a good example case in which degree of mental retardation is well comparable with degree of cerebral atrophy.

Case three :

15 years old Korean female with adverse seizure to the left and rusty sputum for 4 years. Marked mental deterioration, brisk deep tendon reflexes in the right extremities but with positive Babinski sign in the

left, were found in physical examination. Chest x-ray showed typical cysto-nodular infiltration in the left middle lung field. Positive skin test and ova in sputum were found. Protein in the spinal fluid was increased but pneumoencephalography showed almost normal configuration of ventricles. I. Q. test result were total I. Q. 49, verbal score 52, and performance score 48. (See Table 2).

Comment: Despite normal ventricles in pneumoencephalography, this patient showed the lowest I. Q. score in our series.

Discussion

In our series of 62 patients, 25/or 40% had complained of impaired mental function, and in clinical examination 34/or 55% were found to have mental deterioration. Similar findings were reported previously also by Kim & Walker (1961) and Sim (1964).

Our study confirms the clinical impression that mental retardation is quite common in cerebral paragonimiasis. Further, this study suggests that the KWIS is approximately as sensitive to mental impairment as clinical examination. As noted above, 55% of the entire group showed dementia by clinical examination. As noted above, 55% of the entire group showed mental impairment by clinical examination, while 52% (11 of 21) of the patients given the KWIS fell in the borderline or clearly defective range of measured intelligence.

The superiority of verbal over Motor-performance I. Q.'s in a significant proportion of the series bears out the frequent observation that, in the presence of brain damage, verbal skills are more spared than perceptual motor skills (Morrow & Mark, 1955).

According to pathological studies (Kim & Walker, 1961; Diaconita *et al.*, 1957), the lesion of cerebral paragonimiasis is usually bilateral and more extensive than clinically supposed. Pneumoencephalographic study in our series showed bilateral

subcortical (central) atrophy in 73% of 37 cases. Appraisal of cortical atrophy is more important in regard to evaluation of mental retardation, but because of the subarachnoiditis noted in paragonimiasis, about half the patients show no air at all in the subarachnoid space. For this reason, the assessment of cortical atrophy by pneumoencephalography in this type of case is not feasible. However, since diffuse cortical lesions have been pathologically and surgically proved in previous reports (Kim & Walker, 1961; Sim, 1964; Diaconita *et al.*, 1957), it is suggested that diffuse cerebral atrophy is responsible for the frequent occurrence of mental retardation in cerebral paragonimiasis, but that in our series a clear-cut measure of atrophy was not obtained. For this reason, we are probably justified in dismissing the paradoxical relationship between pneumoencephalography-measured sub-cortical atrophy and intelligence as inaccurate, the more so since our remaining clinical indicators are associated with I. Q. in the expected direction of relationship. The fact that none of the clinical indices is related to I. Q. to a statistically reliable degree may indicate either that unexamined variables may be contributing importantly and partly masking the relationships we were investigating or that the combination of multiple indices are responsible. If, so, replication of our study on a larger sample might provide the statistical power needed to demonstrate relationships generalizable beyond the present sample.

Summary

KWIS was done in 21 patients with cerebral paragonimiasis. I. Q. was sub-normal in 90% of cases. The superiority of Verbal over Motor-performance I. Q.'s was seen in a significant proportion of cases. No clear-cut relationship between I. Q. and clinical factors examined was found in our study. Mental retardation in cerebral paragonimiasis is most likely due

to the diffuse involvement of the brain. Three illustrative cases were presented.

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脳肺吸虫症における知能指数について

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1958年より1964年の間にみられた小児脳肺吸虫症62例(男46例,女16例)中21例について,韓国教育研究所の考案になるKWISによる知能検査を実施した。

21例のI.Q.は平均72で,その中9例(43%)は明らかに知能欠陥の範囲にあった。これにボーダーラインにある他の2例を加えた計11例(52%)は正常以下の知能であり,彼らの知能がいかに低いかはI.Q.99以上のものが一例もなかったことでも明らかである。

次に言語及び動作I.Q.について比較検討してみると,

平均値は各々76.7, 68.5であり,21例中15例では,言語I.Q.の値は動作I.Q.のそれよりも高く,統計的にも両者の間には有意の差があった。しかし,I.Q.と臨床所見との間には,統計的に明らかな関係は認められなかった。脳肺吸虫症における知能の発育遅延は,恐らくは脳皮質のびまん性の障害に起因するものの如くである。これらの説明として,3例について臨床所見及び知能検査成績などを示し論議した。