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CYSTICERCOSIS OF THE NERVOUS SYSTEM: LESS FREQUENT CLINICAL FORMS

III — SPINAL CORD FORMS

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The spinal forms of the cysticercosis of the nervous system are rather rare. It must be emphasized, however, as Henneberg [9] already did, that the incidence of these forms can not be precisely evaluated since the intraspinal structures are not systematically examined in the necropsies; besides, the spinal symptomatology frequently is overlooked or even masked by the outstanding and severe cerebral manifestations.

Rocca [16], who has the greater series of cases in this field, remarks that the spinal cord forms are four times rarer than the cerebral ones, this proportion being much alike that of neoplasms. This finding, which concerns the cysticercosis of the nervous system in a general way, could be explained by the difference of nervous mass inside the skull and the spine. Harder to explain is the great disparity between the parenchymatous cysticercosis in the brain and the spinal cord; actually, in a survey of the literature we found only 7 cases of intramedullary cysts, while the extramedullary localization was reported in 35 cases (table 1).

The parasite could follow two main routes in his way to the intraspinal space: the subarachnoidal migration, by passive transport in the cerebrospinal fluid current, or the hematogenic route. The first pathway, which would imply in the secondary feature of the spinal localization, could account for the perimedullary meningeal forms, but only the blood route could apparently explain the primary intramedullary localization of the cysticercus.

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Author	Year	Cysticercosis cerebri associated	Diagnosis	Clinico-pathological form				
				Meningo-myelitis	Meningoradi-culitis (tabetiform)	Intra-medullary	Extra-medullary	
							Sub-dural	Extra-dural
Walton (apud Guccione [7])	1881	o	Necropsy	—	—	C_3-C_4	—	—
Hirt (apud Guccione [7])	1887	o	Necropsy	—	+	—	—	—
Richter (apud Guccione [7])	1891	+	Necropsy	—	—	—	C_4 & T_{10}	—
Minor (apud Guccione [7])	1899	+	Necropsy	—	—	—	Thoracic	—
Pichler [14]	1900	+	Necropsy?	—	—	T_{11}-L_1	—	—
Wollenberg [22] (a)	1905	+	Necropsy	—	—	—	C & L	—
Wollenberg [22] (b)	1905	+	Necropsy	—	—	—	Filum terminale	—
Oppenheim (apud Guccione [7])	1911	o	Necropsy	—	+	—	—	—
Henneberg [9]	1912	+	Necropsy	—	+	—	—	—
Rosenblath [17]	1913	+	Necropsy	+	—	—	—	—
Knapp [16]	1919	+	Surgery	—	—	—	T_5-T_5	—
Vasiliu [20]	1921	o	Necropsy	+	—	—	—	—
Bertrand & Medakovitch [2]	1924	+	Necropsy	+	—	—	—	—
Verga & Dazzi [21]	1926	+	Necropsy	+	—	—	—	—
Morawieka [13]	1927	+	Lumbar puncture	—	—	—	+	—
Busse [4]	1931	o	Surgery	—	—	—	T_4 & T_{11}	—
Guillain *et al.*[8]	1933	+	Necropsy	+	—	—	—	—
Monteiro-Salles [12]	1934	+	Necropsy	—	—	T_6-T_7	—	—
Barini [1]	1954	o	Surgery	—	—	T_9-T_{11}	—	—
Pennybacker (apud Dixon & Lipscomb [6])	1956	+	Surgery	—	—	—	Cervical	—
Rocca [16] (17 cases)	1959	?	Surgery?	—	—	T_7-T_{10}	15 cases	+
Cabieses *et al.*[5] (a)	1959	o	Surgery	—	—	—	T_1-T_4	—
Cabieses *et al.*[5] (b)	1959	o	Necropsy	—	—	T_4	—	—
Cabieses *et al.*[5] (c)	1959	+	Surgery	—	—	C_5-C_6	—	—
Ricciardi-Cruz [15] (a)	1961	o	Surgery	—	—	—	T_{11}-L_2	—
Ricciardi-Cruz [15] (b)	1961	o	Surgery	—	—	—	T_5-T_9	—

Table 1 — Cases of spinal cysticercosis reported in the literature.

The extreme rareness of such site led Rocca [16] to suggest that the spinal cord is endowed with a particular ability to fight the cysticercotic infestation.

We suggest a third route for the approach of the parasite to the spinal cord parenchyma: the ependymal route. The viability of the central canal is anatomically demonstrated and one can accept that, in cases of intraventricular hypertension, this canal would dilate, allowing the caudal displacement of cysticerci arrived at the fourth ventricle. This hypothesis could explain the finding of parasites lodged in the upper cervical cord tissue.

On the other hand, the involvement of both the spinal cord and the meninges could result from an allergic reaction to the toxins freed by cysticerci lodged in the intracranial structures. This pathogenic mechanism was invoked by Verga & Dazzi [21] in an attempt to explain, conversely, the cerebral meningitis found in a case of racemose spinal cysticercus.

Spinal cord manifestations associated with basilar cysticercosis had been already recorded in 1905, by Wollenberg [22], who, in two autopsy cases, found parasites in the dorsal roots and cysticercotic membranes in the filum terminale. A survey of the literature (table 1) shows, as one would expect, that the diffuse cerebrospinal involvements prevail over the exclusively spinal forms.

Walton (apud Guccione [7]) seemingly was the first to report, in 1881, a case of spinal cysticercosis in which the parasite was localized in the anterior horn of the cervical cord. Hirt (apud Guccione [7]) reported a case with tabes-like symptomatology, the post mortem examination having disclosed several cysts in the cauda equina. Minor (apud Guccione [7]), in 1899, reported the first case of spinal cord compression by a cysticercus placed under the pia mater of the thoracic cord.

Trétiakoff & Pacheco e Silva [19] and Brinck [3] described three syndromes produced by spinal cysticercosis: meningomyelitis, compression, and tabetiform pictures. The syndrome of parenchymatous lesion is an additional picture, displaying either a poliomyelic or a funicular pattern.

The meningospinal varieties commonly prevail in the posterior aspect and in the cervicothoracic segments (Schmite [18]), sometimes giving way to pachymeningitides or meningoradiculitides close to the tabetic picture. The extradural localization is exceptional (Sehmans' case, cited by Guccione [7], and Rocca's [16]).

The case reported by Meyer [11] is worth mentioning: his patient had cysticercosis with cerebral symptoms associated with a syndrome of lateral amyotrophic sclerosis, which currently would be interpreted as a syndrome of the anterior spinal artery due to the cysticercotic periarteritis seen in the post mortem examination.

Monteiro-Salles [12] (1934) was the first to report, in Brazil, a case of spinal cysticercosis: in a patient with cerebral infestation the necroscopic examination disclosed an intramedullary parasite at the level T_6-T_7.

No.	Name	Age (years)	Sex	Race	Serum CFT	Cerebrospinal fluid								Skull X-rays (micronodular calcifications)
						Spinal				Cisternal				
						Cells (total)	Eosinoph. cells (%)	Proteins (mg.%)	CFT	Cells (total)	Eosinoph. cells (%)	Proteins (mg.%)	CFT	
1	JR	42	M	W	Positive	52	3	80	—	12	5	15	Positive	—
2	AB	46	M	W	—	80	2	20	Positive	24	0	15	Positive	Absent
3	BSG	55	F	W	Positive	19	0	20	Positive	—	—	—	—	Present
4	BB	36	M	W	Negative	32	14	20	Positive	4	0	15	Positive	Absent
5	BDT	33	M	N	AC	0	—	30	Positive	—	—	—	—	—
6	DMB	64	M	W	—	8	0	25	Positive	—	—	—	—	—
7	MCFB	27	M	W	—	18	0	350	Negative	29	7	44	Positive	Absent
8	IB	26	M	W	Negative	18	5	65	Positive	10	1	37	Negative	Absent
9	LML	32	F	W	Negative	0	—	200	Negative	—	—	—	—	—

Table 2 — Spinal cysticercosis: identification of cases and laboratorial diagnosis. Sex: *M, male; F, female.* Race: *W, white; N, negro.* CFT: *complement fixation test for cysticercosis.* AC: *anticomplementary.*

Case No.	Associated cerebral symptoms	Neurological picture	Level of superf. anesth.	Manometry (spinal puncture)	Myelographic block (vertebral level)	Surgical therapy		Conservative treatment * Results
						Level of laminectomy	Results	
1	No	Radiculo-medullary compression	No	Partial block	T_{12}	T_{11}-L_2	Unchanged	Unchanged
2	No	Meningomyelitis	No	Partial block	T_1-T_2 T_6-T_7	—	—	No follow-up
3	Yes	Combined degeneration of spinal cord	No	Normal	—	—	—	No follow-up
4	No	Meningomyelitis	T_{11}	Normal	—	—	—	No follow-up
5	No	Tabetiform	No	Normal	—	—	—	No follow-up
6	No	Tabetiform	No	Normal	—	—	—	No follow-up
7	No	Radiculo-medullary compression	T_7	Total block	T_8	T_5-T_9	Unchanged	Improved
8	No	Radiculo-medullary compression	No	Partial block	T_{12}	—	—	Death 2 months after hospital discharge
9	No	Radicular compression	S_1	Total block	L_1	T_{12}-L_2	Recovery	—

*Table 3 — Spinal cysticercosis: symptomatology, topographic diagnosis and therapeutic results. * Sulfa drugs and corticosteroids.*

The variety displayed by the parasite is seldom referred. Racemose forms were reported by Hirt and Richter (apud Guccione [7]), Knapp [10], Henneberg [9], Busse [4], Verga & Dazzi [21], Ricciardi-Cruz [15], and Cabieses et al.[5].

Among 296 cases of neurocysticercosis observed in the Department of Neurology of the University of São Paulo Medical School from February 1945 to December 1962 we have found 8 patients with spinal cord involvement, either isolated (7 cases) or associated with cerebral symptoms (case 3); to these cases we added one of private clinic (case 9). The scarcity of this clinical form of neurocysticercosis, the possible diagnostic mistake with other inflammatory or tumoral conditions, and the good results sometimes achieved with conservative or surgical therapy seemed to us sufficient reasons for the publication of the present paper.

The identification of our cases and laboratorial data for the etiologic diagnosis are seen in table 2; the neurological symptomatology, topographic diagnosis, and therapeutic results are seen in table 3.

COMMENTS

The exclusively spinal cord forms of neurocysticercosis are rather rare. In a survey of the literature we found reference to 42 cases only. Among 296 cases of this parasitosis of the nervous system examined in our Service the incidence of such clinical form was 2.7%.

In spite of this rarity, the cysticercotic etiology must always be kept in mind of the especialist in cases of subacute or chronic involvement of the spinal cord, moreover taking into account that the symptomatology of this spinal parasitosis is polymorphous, simulating meningomyelitides, tabes dorsalis or radiculospinal compressions.

The etiologic diagnosis was based, in 8 of our 9 cases, on the positive result of the complement fixation test for cysticercosis in the cerebrospinal fluid, sometimes ratified by the finding of eosinophile cells in this fluid, by the positive result of the same reaction in blood serum, and/or the demonstration of intracranial micronodular calcifications. In case 9, however, the complement fixation test in the cerebrospinal fluid was negative and the diagnosis was not established but in the operating room, through the remotion of a subdural macrocystic cysticercus at the level of the first lumbar vertebra. The parasite was surgically removed in 2 additional cases.

In cases 1, 2 and 8 simultaneous spinal and cisternal punctures were performed. In case 1 greater pleocytosis was found in the spinal than in the cisternal fluid; however, in this latter the eosinophile cell count gave higher figures. In cases 2 and 8 the eosinophile cell count and the total cytometry prevailed in the sample withdrawn by spinal puncture; these facts suggest that, although generalized, the meningeal reaction to the parasite did predominate in the spinal compartment.

The determination of the protein contents (table 2) and the results of the manometric tests (table 3) showed that, in cases 1, 2, 7, 8 and 9 there was a spinal block, complete or partial (increase of the protein contents

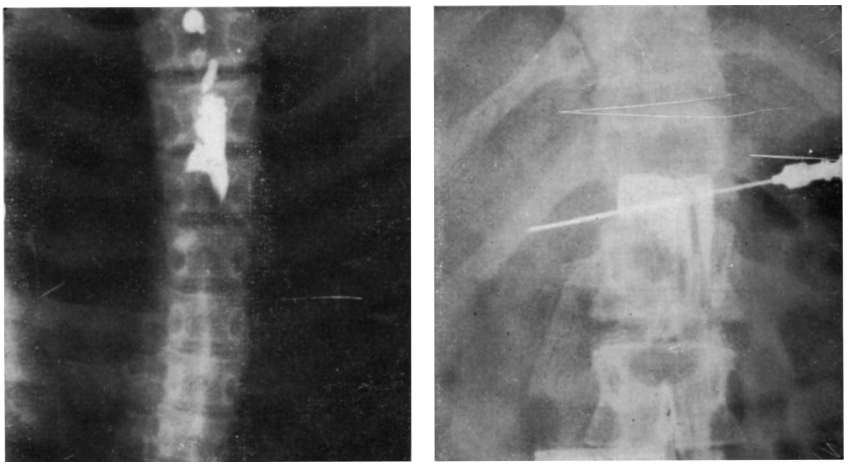

Fig. 1 — Myelograms. At left, case 7: the injection of the contrast medium by lumbar route with retrograde study of the spinal canal shows a complete and lasting block at the level T_{v_8}. At right, case 9: the injection of the contrast medium by cisternal route shows a complete and lasting block at the level $T_{v_{12}}$-L_{v_1}.

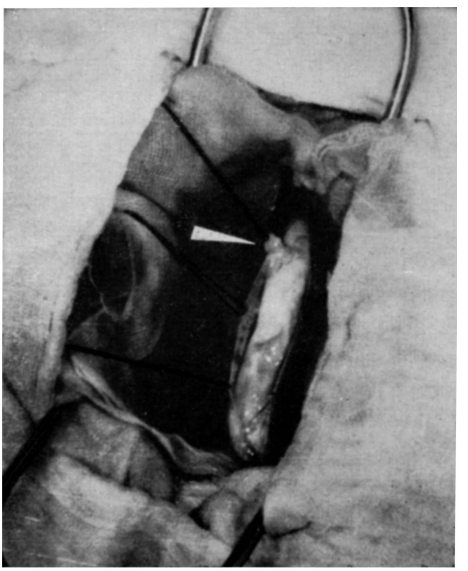

Fig. 2 — Case 1. Photograph of the operative field (total laminectomy from $T_{v_{11}}$ to L_{v_2}) showing the lower thoracic level of the spinal cord and, in the upper limit of the dural opening, a Cysticercus vesicle (arrow).

was found in all these cases but one). Myelogram, performed in all these 5 cases, confirmed the block (fig. 1). These data supported the indication for laminectomy in cases 1*, 7* and 9, allowing the remotion of cysticerci lodged in the subdural space (fig. 2). They assumed the racemosus type in the first 2 patients and the cellulosae variety in case 9. Surgical results were excellent in case 9, in case 1 the conditions remained unchanged, whereas in case 7 good results were afforded by subsequent intrathecal administration of hydrocortisone.

The prevailing neurological picture was that of spinal cord and/or nerve root compression (4 cases). In 2 patients a syndrome of the dorsal funiculi was present, closely simulating tabes dorsalis; this impression was made stronger, in case 5, by the finding of Argyll-Robertson's sign. In other 2 cases the neurological manifestations suggested meningeal and spinal involvement with no systematization.

In two patients (cases 4 and 7) a level of touch, pain and temperature anesthesia could be determined, in this way ratifying the spinal topography of the process. In case 9 there was sensory impairment in the area of the first sacral root. In case 7 the cystometric examination showed impairment of the bladder sensation.

In case 3 the spinal symptomatology pointed to a lesion in the lateral and dorsal funiculi; the association of achlorhydria could make the cysticercotic etiology questionable, if it were not the following facts: (a) this was the only case in which symptoms suggestive of cerebral cysticercosis (headache, vomiting, seizures) were associated, the skull roentgenogram showing micronodular calcifications; (b) the degree and the pattern of the cerebrospinal fluid changes, pointing to a chronic parasitic meningitis, as the complement fixation test for cysticercosis did indicate (strongly positive with 0.1 ml.).

SUMMARY

The spinal forms of cysticercosis are rather rare (2.7% of 296 cases of neurocysticercosis recorded in the Department of Neurology of the University of São Paulo Medical School). In a survey of the literature only 42 cases were found, most of them associated with cerebral symptoms. The reasons for this low incidence, as well as the possible routes followed by the parasite in its approach to the spinal cord, are discussed.

After a review of the first cases reported in the literature, the authors refer the main syndromes (meningomyelitides, tabetiform pictures and spinal cord compressions) and some of the clinico-pathologic features of spinal cysticercosis.

Nine cases of spinal cysticercosis are reported. The diagnosis was based on laboratorial data (mainly the complement fixation test for cysticercosis

* Cases already published by one of us [15].

in the cerebrospinal fluid) or in the results of surgical therapy. Other cerebrospinal fluid findings (presence of eosinophile cells, protein contents, and the results of the manometric tests) are discussed. Myelographic block was demonstrated in 5 cases. Three of these patients were submitted to laminectomy, with variable results.

The prevailing neurological picture was that of spinal cord and/or root compression (4 cases). Two patients showed a dorsal funiculi syndrome closely simulating tabes dorsalis. Two other patients presented a picture of meningomyelitis with no systematization. One patient had a syndrome suggestive of subacute combined degeneration of the spinal cord, but the presence of cerebral symptoms and the laboratorial data pointed to cysticercosis as the main disease process.

RESUMO

As formas medulares da neurocisticercose são relativamente raras (2,7% de 296 casos desta parasitose registrados na Clínica Neurológica da Faculdade de Medicina da USP). Em revisão da literatura só encontramos 42 casos, na maioria dêles ocorrendo associação com sintomas encefálicos. São discutidas as razões desta baixa incidência, assim como as possíveis vias seguidas pelo parasito a fim de alcançar a medula.

Após reverem os primeiros casos registrados na literatura, os autores destacam as principais síndromes (meningomielítica, tabetiforme e de compressão medular) e alguns dos caracteres clínicos e anátomo-patológicos da cisticercose medular.

São relatados 9 casos de cisticercose medular. O diagnóstico baseou-se em dados laboratoriais (especialmente a positividade da reação de fixação de complemento para cisticercose no líquido cefalorraqueano) ou nos resultados cirúrgicos. Outros aspectos do exame do líquido cefalorraqueano (presença de eosinófilos, proteinorraquia e resultados das provas manométricas) são comentados. A perimielografia demonstrou existência de bloqueio do canal raqueano em 5 casos. Três dêstes pacientes foram submetidos a laminectomia, com resultados variáveis.

O quadro neurológico predominante foi o de compressão da medula e/ou das raízes nervosas (4 casos). Dois pacientes apresentavam uma síndrome cordonal posterior que simulava a tabes dorsal. Dois outros pacientes apresentavam um quadro de meningomielite não sistematizada. Um paciente tinha uma síndrome sugestiva de mielose funicular, mas a presença de sintomas cerebrais e os resultados dos exames de laboratório levaram a considerar a cisticercose como a etiologia mais provável.

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