prævia is discussed. Stress is laid on the avoidance of vaginal examination under anaesthesia in cases of major degrees of placenta prævia.

Placentography is of the greatest importance in the diagnosis of placenta prævia before the occurrence of ante-partum haemorrhage and will permit definitive treatment.

The exclusion of placenta prævia by placentography in cases of ante-partum haemorrhage makes it possible to send some of these patients home to await delivery, thereby saving hospital beds.

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CYSTICERCOSIS OF THE BRAIN

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Cerebral cysticercosis has been known for many years. Ramler is said to have described a case in 1558, and in 1650 Paracelsus came to the conclusion that the epileptic fits of one of his patients were due to this condition. Nowadays it is rare, the highest incidence being in India and South America.

Here is reviewed a personal series of 65 cases seen at the Postgraduate Institute of Medicine, Bucharest, during the years 1935 to 1955. The patients came from all over Rumania.

Aetiological Factors and Associated Cerebral Disease

Cerebral cysticercosis is commoner after the age of 20 (see Table). Of our 65 patients (37 males and 28 females), 23 were under 30. Changes in the mucous membrane of

Age Distribution of 65 Cases of Cerebral Cysticercosis

Age Group (Years)	No. of Cases	Age Group (Years)	No. of Cases
0-	2	30-	16
10-	4	40-	15
20-	17	50-	11

the alimentary tract and a diminished gastric acidity are recognized as being two of the most important factors that determine infestation with cysticerci. In the patient's personal history there may sometimes be a record of taeniasis. This was so in six of our cases. Neurological symptoms appeared shortly after the intestinal disturbance, and in such cases auto-infestation is almost certain.

Cysticerci are usually found limited to a single organ, and only exceptionally in several. In 90% of our cases the cysticerci were limited to the brain; a second tissue besides the brain was affected in only 10%—muscles (4%), subcutaneous tissues (4%), retina (2%). Cysticercosis may co-

exist with a primary or metastatic brain tumour, with syphilis, or with cerebral injuries. One of our cases had a primary glioma of the brain stem, and in two cases there were multiple cerebral metastases of pulmonary origin; in one case there was associated syphilis (four patients had a positive blood Wassermann reaction); in one patient who died from a cerebral injury cysticercosis was discovered at necropsy.

Clinical Manifestations

The duration of symptoms prior to admission to hospital varied from a few weeks to several years. Twenty-three of our cases were admitted less than six months after the onset of symptoms, 19 between six and twelve months after onset, and 23 more than a year after. In one-third of our cases the onset was sudden, while in the remainder it was gradual. In about two-thirds of our cases the course of the disease was intermittent.

Clinical symptoms arise solely from the presence of cysticerci within the nervous system. They depend both on the number of parasites and on their precise loca-

FIG. 1.—Microscopic view of an intracerebral cysticercus, showing hooklets. (Reproduced by courtesy of D. Bagdasar, F. Bagdasar, and I. Bazgan from *Bull. Soc. med. Hôp. Bucarest*, 1935, **17**, 6.)

tion within the brain. Such other factors, as whether the cysticercus is alive or dead and the tissue reactions within the brain (cerebral oedema, arachnoiditis, ependymitis), are also of importance.

Onset

Symptoms of the initial stage of cysticercosis comprise: (1) early and very intense signs of intracranial hypertension; (2) epilepsy; and (3) a pseudomeningeal reaction. Fifty-two of our patients had signs of intracranial hypertension at the onset, usually headache and less often vomiting. In 26 cases epileptic seizures were the first symptom, occurring either alone or associated with headache. Very often epilepsy remains the only symptom of the disease for quite a long time, the case then perhaps being regarded as one of idiopathic epilepsy. In five of our patients the onset consisted in only mild and transient meningeal symptoms, which sometimes recurred.

When fully developed, cerebral cysticercosis may give rise to a syndrome of marked intracranial hypertension, as occurred in 56 of our cases. Headache, vomiting, vertigo, and changes in the optic disks are the chief manifestations. Headache was found in all 56, either alone or, as in 29 cases, associated with vomiting. Depending on the number and location of the cysticerci, headache may be slight (when there are few parasites), severe (when there are many), intermittent (when there are parasites within the ventricles), or continuous. Vomiting was always associated with headache. Fundal changes were found in 39 cases, 35 showing papilloedema and 4 secondary optic atrophy.

Mental disturbances, due to involvement of the brain as a whole and mostly confusional in type, may accompany intracranial hypertension. They occurred in eight of our cases, being met with equally in cortical and basal cysticercosis.

Epilepsy and Meningeal Symptoms

Epilepsy is common in cysticercosis of the brain. It occurred in 31 of our cases during the fully developed stage of the disease. The incidence of epilepsy and its clinical variants depended on the situation of the parasite within the cerebral cortex; on the proximity to the so-called epileptogenic area; on the number of parasites and hence of potential epileptogenic foci; and, lastly, on whether the cysticercus was living or dead. At the time of infestation and during the stage of calcification of the cysticercus, a larger amount of toxin is elaborated, giving rise to more severe symptoms and also to epileptic seizures. At these times Jacksonian or generalized convulsions may occur frequently, and sometimes even a "status epilepticus." This last condition may persist for several days, being followed by a symptomless period of a few months or even years; it may, however, recur in the same way as before. In 10 of the 31 cases in which epilepsy occurred the fits were grand mal in type; in 20 there were Jacksonian fits, starting sometimes in one segment, sometimes in another; and in one there were akinetic seizures.

Epilepsy may occur without any regular periodicity; the fits may be intermittent, or they may occur in outbreaks of several fits at short intervals. In 10 cases the fits occurred without any periodicity, in 16 they were intermittent, and in 5 there were outbreaks of several fits at a time.

Meningeal symptoms included fever and stiffness of the neck. Attacks of meningitis occurred, lasting some hours or days, then subsiding for a while and reappearing after a symptomless period. Such meningeal symptoms are provoked by toxins liberated by the cysticerci. The toxins circulate in the cerebrospinal fluid and cause a meningo-ependymitis.

Various Neurological Syndromes

The neurological syndromes in cerebral cysticercosis are related to the anatomical location of the parasites and to their actual number. A single parasite, or only a few

FIG. 2.—Vertico-frontal section through brain. Cysticerci are localized in cortex. A somewhat bigger subpial cysticercus is visible.

cysticerci situated within a silent area, may not give rise to symptoms, and may be found incidentally at necropsy. Cysticerci in the motor or sensory areas will always give rise to epileptic seizures, but symptoms of intracranial hypertension are uncommon and usually mild, the Jacksonian or generalized epileptic seizures being the only clinical manifestation. The fits occur in groups of repeated convulsions over the course of a few days, followed by a long symptomless period; Jacksonian epilepsy may be unilateral or bilateral (alternating Jacksonian seizures). If there are many cysticerci in the brain, in addition to intracranial hypertension and epilepsy, there may be various

focal manifestations depending on the areas affected. In our series 18 cases had a cortical cysticercosis (Figs. 2 and 3).

One or more cysticerci may be found within each lateral ventricle, or in the third or fourth ventricle. They float freely in the ventricular fluid, and produce symptoms of intraventricular tumours.

In our series 10 cases had ventricular cysticercosis.

At the base of the brain cysticerci are usually numerous and large in size. Here they may block the basal cisterns and cause severe internal hydrocephalus. Cysts in the posterior fossa give rise to severe symptoms of intracranial hypertension and mild cerebellar symptoms, which may be unilateral or bilateral. Cysticerci may lodge near the brain stem or within the ponto-cerebellar angle, on one side or both, giving rise to symptoms characteristic of these sites. Cysticerci may occur in the middle or anterior fossa at the base of the brain, the symptoms varying according to the site. Frequently,

basal cysticercosis involves the whole base of the brain and thus gives rise to a complex supra- and sub-tentorial group of symptoms, to which are added symptoms of a severe leptomeningitis. Generalized epileptic fits, and infratentorial tonic seizures due to brain-stem disturbances, may also occur. In our series there were 19 cases of basal cysticercosis.

Generalized and Suppurative Cysticercosis

In diffuse generalized cysticercosis there are hundreds of parasites. The course of the disease is rapid, with a marked oedema due to the toxins of the parasite, intracranial hypertension, mental disturbances, epileptic seizures, meningeal symptoms, fever, drowsiness, and diffuse neurological symptoms. Eighteen of our cases had diffuse generalized cysticercosis.

Suppurative cerebral cysticercosis is very rare. It is due either to the transportation of bacteria with the oncospheres or to delayed secondary infection. In either case a cerebral reaction may occur after the death of the parasite and thus an aseptic suppuration may take place. We had a single example of aseptic suppuration, in a case of long-standing calcified cysticercosis. The patient was an adult with a hydrocephalic skull.

Clinical Course

The progress of the disease depends on the number of parasites, their location, and the reaction of the nervous system to the infestation. If the infestation is massive there will be severe symptoms of intracranial hypertension, and

FIG. 3.—Cysticerci situated at junction of grey and white matter of brain.

FIG. 4.—Cysticerci situated in thalamus near the ventricular wall.

the patient soon seeks medical aid. If there are few cysticerci they may lead only to epilepsy, without any other symptom developing for years.

The course is intermittent, with acute phases followed by long intervals of improvement during which both subjective and objective symptoms are entirely in abeyance. In patients in whom the onset of symptoms is abrupt the prognosis is bad, whereas in those with a gradual onset the general outlook is much better.

Ancillary Investigations

There are certain biological reactions due to the effects of the toxin elaborated by the parasite. We found that the blood eosinophil count was above 3% in 19 cases, and above 6% in 13 cases (in one it was as high as 20%, in another 16%). In the cerebrospinal fluid eosinophilia may occur, with lymphocytosis, a high albumin content, and a colloidal-gold curve similar to that in syphilis.

Serological tests, which may be positive, include Vosnia's specific precipitation test, using an antigen prepared from mealy pork, and a complement-fixation test with an antigen prepared from cysticerci from pigs. These reactions are positive while the brain is being invaded by cysticerci or when they die—that is, when toxin is being elaborated—but negative in the silent periods of the disease.

Ophthalmoscopy and general physical examination (skin, muscles) may also help by revealing the presence of cysticerci at various other sites.

Radiographical Appearances

Plain radiography of the skull may yield a normal picture, or there may be evidence of intracranial hypertension and

FIG. 5.—Lateral skiagram of skull showing signs of increased intracranial pressure, as well as many small round intracranial calcifications.

FIG. 6.—Pneumo-encephalography; antero-posterior view. Calcified suppurative cerebral cysticercosis. Both frontal horns are compressed by the suppurative process. Multiple intracranial calcifications are shown.

a number of round, discrete areas of calcification may be seen, each the size of a millet grain, distributed either haphazardly (Fig. 5) or in lines. Radiography of the skeletal muscles may reveal calcified cysticerci which are elongated bodies resembling a grain of rice. Plain radio-

FIG. 7.—Filipov's sign (see text).

FIG. 8.—Mechanism of Filipov's sign in cysticercosis.

graphy of the skull showed no abnormality in 40 of our cases, intracranial calcifications in 7, and signs of intracranial hypertension in 18.

If there is no papilloedema, pneumo-encephalography may be performed; if papilloedema is present, ventriculography is indicated. Pneumo-encephalography usually shows no abnormality, but there may be severe hydrocephalus from basal leptomeningitis or signs of cortical atrophy. In early cases without marked leptomeningitis it may be possible to demonstrate Filipov's sign of the "clear vesicle" (Figs. 7 and 8). On the skiagram translucent spherical or ovoid areas, the size of a lentil or a bean, may be seen, with a very clear centre, darker towards the edges and with a sharply defined outline.

Ventriculography may prove normal, as when there are few parasites with a cortical distribution; or it may show small ventricles (multiple cortical parasitic cysts). There may be a hydrocephalus with dilatation of the third ventricle, as when cysts lie in the posterior fossa; or hydrocephalus with an upward displacement of the third ventricle (Fig. 9) if parasites have invaded the base of the brain. The ventricles may show irregular margins (ventriculitis), and occasionally a cysticercus may be seen attached to the ventricular wall (Fig. 10). Ventriculography was carried out in 35 of our patients. In 32 a symmetrical internal hydrocephalus was found; in one the appearance was normal; in one there were very small ventricles; and one gave a picture suggesting a brain tumour.

Differential Diagnosis

A positive diagnosis can be based upon such pathognomonic signs as intracranial calcifications, the pneumo-encephalographic signs of Filipov, and the serological test of Vosnia. The diagnosis is suggested by an intermittent development of clinical symptoms with remission, evidence of raised intracranial pressure, and few and diffuse neurological symptoms. To these suggestive clinical pictures may be added evidence, such as may be found in the above-

mentioned ventriculographic findings, a history of infestation with *Taenia solium*, and the presence of cysticerci in other parts of the body (retina, muscles).

The differential diagnosis must exclude any intracranial space-occupying process, such as cerebral tumours, including tuberculomata and metastases, abscesses, subdural haematoma, and pseudo-tumour cerebri.

The course of the disease, the previous history, the present condition, and the auxiliary tests may establish the diagnosis by itself.

Prognosis and Treatment

The prognosis is poor in generalized, basal, or ventricular cysticercosis. Patients die as a result of raised intracranial pressure or ventricular block. Cortical cysticercosis runs a more chronic course. In cortical cases with only a few cysts there may be spontaneous remissions followed by relapse.

The only non-operative treatment is the administration of anticonvulsant drugs if there are fits. In cortical or ventricular forms, however, the parasites may be excised surgically. In generalized or basal cysticercosis extensive bilateral decompression should be performed to relieve the severe intracranial hypertension.

We operated on 48 of our 65 patients; in 20 cases large decompressive craniotomies were performed, in 7 a decompression according to Cushing's technique, and in 21 the posterior fossa was explored. Wherever possible the cysticerci were excised during the operation. The operations

were well tolerated and complications rare. Cerebral oedema was treated by massive dehydration and daily lumbar puncture. In the ventricular form, if collapse occurs after tapping the ventricles the patients must be rehydrated.

In the successful cases the signs of raised intracranial pressure disappeared, as did most of the neurological signs. Convulsions, however, continued. Of the 48 patients submitted to operation 11 died at or within a short time of operation, and two more 1 and 2½ years post-operatively respectively. There was no operative mortality with the 12 cases of cortical cysticercosis; but 2 of the 6 ventricular cases, 4 of the 17 basal cases, and 5 of the 13 generalized cases died after operation.

Summary

A personal series of 65 cases of cerebral cysticercosis seen in Bucharest is presented.

Their clinical features and the results of laboratory and radiological examination are described. Operation was performed in 48.

Differential diagnosis and prognosis are discussed.

PROTEUS INFECTION OF URINARY TRACT, WITH SPECIAL REFERENCE TO TREATMENT WITH NITROFURANTOIN

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Infection produced by potentially pathogenic commensal organisms resistant to the chemotherapeutic agents in general use is becoming prevalent as their more virulent competitors are eliminated by these agents. Among such resistant organisms discussed by Bryer (1955) are members of the *Proteus* group. In the last few years there have been several reports in the American literature on the use of nitrofurantoin ("furadantin") in infections of the urinary tract due to proteus, notably by Richards *et al.* (1955). This relatively non-toxic drug, active *in vitro* against many Gram-positive and Gram-negative bacteria, including the *Proteus* group, is excreted in high concentration in the urine following oral administration, although effective blood and tissue levels are not produced.

The *British Medical Journal* (1955) and the *Lancet* (1955) suggested that it might prove a helpful addition to the established urinary antiseptics, especially in the treatment of proteus infections, but there have been few reports of its use in the British literature. Heffernan *et al.* (1955) and McGeown (1956) recorded only moderately satisfactory results in a small number of cases.

The sensitivity tests performed *in vitro* in this laboratory against *Proteus* strains showed that many were resistant to the commonly used antibiotics but sensitive to nitrofurantoin. A series of patients with a known proteus urinary infection was therefore studied so as to determine whether the response to treatment reflected these observations.

Material and Methods

The series consisted of a group of 58 patients (23 males, 35 females) with a proteus urinary infection. There was no complicating disease of the urinary tract in 12 (21%),

FIG. 9.—Ventriculograph of a case of basal cysticercosis; antero-posterior view. Both lateral ventricles are dilated. The third ventricle is dilated and displaced upward.

FIG. 10.—Ventriculograph showing a cysticercus attached to the wall of the lateral ventricle.