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OCULAR CYSTICERCUS CELLULOSAE*

Report of a case of parasite in vitreous

BY

C. COCKBURN, Major R.A.M.C.

THIS case is considered worthy of being put on record because of the rarity of the condition, and more especially because of the ophthalmoscopic picture presented, a picture which was indeed remarkable. Moreover the entoptic observations herein recorded must be unique.

On August 9, 1944, while working in a British General Hospital in Italy, caring for Jugo-Slavs, I was asked to see a patient in one of the surgical wards who was complaining of defective vision in his right eye. A quick examination revealed a peculiar cystic mass in the lower vitreous, and for proper examination the patient was taken to the ophthalmic department. On first examination in the dark room the condition was not diagnosed definitely—there was a large brilliantly coloured globular cyst in the vitreous, and once or twice I got a glimpse of what seemed like a little tail projecting below—something quite new to me. The patient was returned to the ward with diagnosis of (?) parasite in vitreous. Later that same day it suddenly occurred to me—could this cyst not be the cystic stage of a tape worm and the “tail” the scolex? and straightway I went to the ward. To my astonishment I found that this was indeed so; by careful examination through

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the considerable vitreous haze, the head, neck and tiny segments could be made out.

The following day the patient was again examined in the ophthalmic department, when a complete history was obtained and drawings made of the appearance presented.

History.—In 1938, while chopping sticks, was struck by splinter on the right eye. Eye was inflamed for 3-4 days, then cleared up leaving vision unaffected. In April, 1944, had typhus fever and was desperately ill. Gangrene of both legs developed, necessitating double amputation. (Jugo-Slav Hospital.) Nothing of importance was made out from his personal history. Before the war he had worked in a barrel factory.

On April 16, he was admitted to the British Hospital with flexion deformity at both knee joints. On June 10, he first noticed a fog in front of his right eye—a uniform grey haze—and this remained unchanged until July 26, when a well-defined object “shaped like a pear-leaf” became superimposed. Further, this “pear-leaf” had a “stem” attached and this “stem” was constantly changing its position. The patient was quite an intelligent individual and described well, of his own accord, just exactly what he saw. He spoke of the “leaf” as having a well-defined clear centre surrounded by a grey zone (“like a spider’s web”) and then a dark band at the periphery. The “stem” was of a uniform dark grey colour with a knob at the end shaped “like a serpent’s head.” Usually the “stem” projected upwards—sometimes it swayed to the right, but more often to the left. Sometimes it folded itself along the periphery of the “leaf” or it seemed to go in front of or behind the “leaf.” Of special note was his statement that the “stem” sometimes retracted into the “leaf,” the head only projecting, the remainder swelling into a mass like an “electric bulb.” At no time was there complete withdrawal of the “stem.” He stated quite definitely that since first noticed the “pear-leaf” had not increased in size—neither had the “stem.” The “pear-leaf” was quite stationary in the field of vision moving only with the eyeball. The patient kindly consented to reproduce on paper the appearances of the “leaf” with its “stem” in various positions. Result (untouched) as in diagrams.

Examination.—Right vision = 5/60. Left vision = 6/6. Nil abnormal noted in left eye. Right eye—white, deep linear central corneal scar with several adherent spots of iris pigment (perforating injury 1938). After homatropine and cocaine:—Pupil dilated and circular—ring of iris pigment on anterior lens capsule. No “K.P.” Two cuneiform opacities above, otherwise lens clear. There was considerable vitreous haze with many dense freely moving opacities. The upper fundus and optic disc were fairly well seen

and could be passed as normal. In the lower vitreous there was a highly lustrous, almost completely spherical cyst. The colouring was indeed remarkable—the brilliant blue-green above passing to a russet-brown at the centre shading off to a lemon tint below. The upper periphery was surrounded by a narrow brilliant golden halo. (The colouring astonished me as much as the first time I looked at a cat's fundus.) Careful focusing failed to reveal any structure within the cyst. It was estimated that the cyst was about 8 mms. in diameter and situated near the equator of the eye. At the lower margin was the miniature tape-worm constantly changing its position in a low swaying movement. Sometimes it disappeared completely behind the cyst—sometimes only the head appeared round the edge and then gradually its whole length appeared. Two pigmented marks on the head were reckoned to be suckers, while still more anteriorly from a little depression, tiny nipple-like structures were protruded and retracted. I am unable to say what these tiny nipple-like structures were. I thought at first they might be hooklets, but hooklets are too small to be seen with the ophthalmoscope. Whatever they were, only one at a time was seen to be protruded. Apart from the general undulating movement of the scolex, the head itself possessed powers of movement, swaying around in a circular fashion as if feeling its way about.

At the extreme periphery of the fundus, extending from "3 - 4 o'clock" there was a large irregular yellowish area—like acute choroiditis. Careful and repeated examinations were made but no retinal detachment was made out. Tension was normal in either eye. Drawings were made getting the relative size of the optic disc, vesicle and scolex and coloured as accurately as possible. From these drawings the artist has been able to produce a picture of the parasite which is considered to be an accurate representation of the ophthalmoscopic picture.

A thorough general examination was made but no palpable cysts could be found. Nor could any calcified or calcifying cysts be seen by X-ray. X-ray report on skull was: "There are spotty rarefactions in the skull which are more like Schüller Christian's disease than anything else." Repeated examination of stools revealed ova of *ascaris lumbricoides* and *oxyurias vermicularis*, but no segments of *taenia*. Blood examination showed no increase in eosinophils. Casoni test was negative.

At this stage several interesting points might be noted. 1. The fog in front of his eye denoting the entrance into the vitreous of exudates from the inflamed choroid; 2. The sudden appearance of the "pear-leaf" with "stem" denoting the bursting through of the parasite from the subretinal tissues; 3. The verification of entoptic imagery by ophthalmoscopic appearances. Interesting

from an optical point of view was the statement that since the pupil had been dilated with atropine, the "pear-leaf" and "stem" were both reduced to half their previous size.

Owing to exigencies of war time the patient was liable to be transferred from hospital at a few hours' notice, so operation was decided upon for August 12.

Operation.—Surface cocaine and novutox 3 per cent. into Tenon's capsule. With the same technique as I have used for posterior route magnet extractions, the sclera was exposed (in this instance) between the inferior and internal recti muscles, a traction suture inserted into insertion of inferior rectus, and the eye gently rotated upwards, the patient being instructed to keep looking up all the time. Unfortunately diathermy was not available and cautery was used to make a ring of points on the sclera near the margin of the inferior rectus and at a safe distance from the limbus. Two scleral sutures were inserted and the sclera incised between them for a distance of 7 mms. Gentle traction was then put on the scleral sutures so as to expose the choroid which was incised along the length of the scleral incision. As was expected, there was considerable loss of fluid vitreous and this loss was aggravated by the patient's behaviour. In spite of this, a fine scleral hook was introduced into the vitreous and after several attempts the cyst finally appeared at the lips of the wound. It was immediately transferred to warm saline. Scleral sutures were tied and the conjunctival flap replaced. Both eyes were bandaged. It had been hoped that introduction of a scleral hook into vitreous could be watched with the ophthalmoscope, but due to vitreous loss and corneal haze, this was impossible.

Post-operative notes.—On the day following operation the eye was slightly injected with a fairly large hyphaema. Two days later the hyphaema had almost disappeared, but the next day patient complained of some pain in the eye and a large hyphaema was present again. It was impossible to keep the patient still in bed. This may or may not have been a contributing factor in causing the haemorrhage. One week later the eye was almost white, but still a small hyphaema and blood clot could be seen in vitreous. On October 3 (day of discharge) the eye was white. Vision = hand movements at 1 metre. Soft eye. Much blood clot in vitreous. Light projection good.

Cyst removed from vitreous.—The cyst was examined with a corneal loupe. It was seen to be a smooth oval white body about 5-6 mms. in diameter. Careful search was made for the scolex, but none could be found and it was believed that it had got broken off in the process of extraction. It was noted that in the centre of the cyst was a dense white spot (see photo) but the significance of this "milk spot" was not realised. Later it was demonstrated

FIG. 2.
Cysticercus in vitreous.

FIG. 1.

Entoptic observations showing various positions of scolex. (Drawn by patient).

FIG. 3.

Photograph of cysticercus in normal saline—scale in mms. Note "milk spot," the invaginated scolex.

FIG. 4.

Microscopic appearances, showing size and shape of hooklets and four suckers.

FIG. 5.

Diagram showing development of cysticercus (after Belding). (a) Oncosphere with hooklets. (b) Cavity formed by liquefaction of central cells. (c) Invagination of bladder wall with scolex developing at base. (d) Further stage of development of scolex. (e) Scolex evaginated.

that the "milk spot" was the scolex invaginated into the vesicle. One can almost imagine that during the operation the scolex realised that something untoward was happening and promptly withdrew to the safety of the vesicle. Truly "the smallest worm will turn when trod on"!

Next the cyst was mounted on a slide and examined with the slit-lamp, but no structural details could be made out. Unfortunately it was not possible to get a definite diagnosis of the parasite in Italy. Hooklets were found but their identity could not be established although from their shape they were thought to be those of echinococcus. On return to England I was able to get Sir W. P. MacArthur to examine the specimen, and he reports: "The hooklets of the specimen measure 0.172 - 0.174 mms. (large) and 0.114 mms. (small). Those measurements are right for *taenia solium*, whereas hooklets of echinococcus measure 0.022-0.03 mms. (large) and 0.018 - 0.022 mms. (small). Also the roots of the hooklets are quite different from those of echinococcus and conform in every way with those of *taenia solium*." It should be noted that the size of the hooklets is the distinguishing feature. Dr. H. A. Baylis of the British Museum very kindly got an artist to reproduce the microscopic appearances and under his direct supervision a very accurate picture has been obtained (see diagram).

Notes on Taenia Solium.—As is well known the life cycle of *taenia solium* involves an intermediate host, usually the pig, man being the definitive host. In this particular case, however, man is the intermediate host, and it is worth while to consider the life history of the parasite until its arrival in the vitreous. The patient must have become infected by the ingestion of food or water containing ova (really oncospheres) of *taenia solium*. It is stated that auto-infection by regurgitation of oncospheres into the stomach by reverse peristalsis can occur, but in this particular case infection by adult *taenia solium* was definitely not present. In the intestine the oncosphere or hexacanth embryo with its six hooklets penetrated the intestinal wall and either by way of lymphatics or portal vessels eventually found its way into the systemic circulation and so up to the ophthalmic artery and thence along posterior ciliary artery (probably long) to lodge in the choroid. In the choroidal tissues the oncosphere loses its hooklets and the central cells liquefy, forming a spherical body with a peripheral lining of active cells surrounding a collection of fluid. Subsequently there is an invagination of bladder wall at one point and at the base of this invagination a scolex is formed (see diagram). Normally in soft tissues a firm fibrous capsule surrounds the cysticercus, but in the choroid no such capsule can be produced and thus we find the parasite able to burst through into the vitreous chamber. It

is difficult to explain why there wasn't a retinal detachment—one would have expected it with such a relatively large cyst in the subretinal tissues. If the oncosphere had lodged in a branch of the retinal artery, earlier entrance of the parasite into the vitreous would have occurred. Moreover, the extensive area of choroidal involvement points to a primary lodgement in the choroid.

Notes on the Literature.—No attempt will be made to give a comprehensive review of the literature on ocular cysticercus cellulosae. This has been done by Duke-Elder (*Text-Book of Ophthalmology*, Vol. III). But here some relevant points will be noted and some of the recorded cases studied in more detail.

The frequency of cysticercus infection depends on the habits and hygiene of the people concerned. Thus in war time when hygienic conditions are poor we find a corresponding increase in the infection—noted after the First Great War in Germany and Rumania (Elschnig and Michail). A similar increase may be expected now, remembering the appalling conditions under which so many peoples in Europe have lived during the Second Great War. Cysticerci, of course, may develop in any tissue or organ of the body—order of frequency, according to Belching being subcutaneous tissues, brain, eye, muscles, heart, liver, lung and peritoneum. But it is highly probable that its frequency in the eye is only apparent, for there the parasite definitely makes its presence felt. In England indigenous cysticercus infection is rare, but MacArthur has pointed out its occurrence in British soldiers returned from overseas service and emphasizes its importance in the aetiology of epilepsy—a fact which should be known to all ophthalmologists.

In 1865 Teale described a case of cysticercus in the vitreous—"About the centre of the posterior surface of the lens there is a brilliant white spot which is prolonged backwards into the vitreous by a dull grey neck which then rapidly swells out into a balloon-shaped body." It was thought to be harmless from its fixity in the "vitreous canal" and no attempt was made to remove it.

In 1886 Leber described his method of removal of cysticercus from the vitreous by scleral section and reports 11 successful cases out of 14. In 1897 Griffith describing two cases writes: "In each case one saw with the ophthalmoscope a large spherical bluish-white cyst, and springing from this the neck of the animal like an alabaster pillar, surrounded by the head and suckers, which, with its slow regular and graceful movements, reminded one of an elephant's trunk—the whole appearance presenting a picture once seen never to be forgotten"—certainly a very graphic description. In 1925 Elschnig described a case which closely resembles my own. Important points are: 1. The cyst with scolex was freely movable in the vitreous changing its position from

day to day. 2. A strip of sclera 10 mms. long by 3mms. wide was hinged backwards so as to get adequate access to the vitreous. 3. Two attempts by "suction spoon" (Barraquer) and one by forceps were made but failed to extract the parasite. A third attempt by Barraquer's sucker was successful. During these manipulations the parasite was kept under observation by ophthalmoscope with considerable difficulty due to corneal haze and partial collapse of the globe. 4. Parasite was kept alive for five days in blood serum. 5. Visual acuity was reduced from 6/36 to light perception due to extensive vitreous haemorrhages.

In 1935 Michail described 12 cases including the remarkable case where the vesicle was in the vitreous and the head in the suprachoroid and neck surrounded with scar tissue. Michail thinks this scar tissue might have eventually strangulated the parasite. In 1935 Bruck advocates Krönlein's operation for removal of cyst from posterior segment of the eye and describes three cases where subretinal cysts were removed by that technique.

Discussion

First, was the attempt to remove parasite from the vitreous justified and what was the prognosis if left alone? It is believed that in the course of a few months death of the parasite would have occurred. Indeed just how it derived nourishment within the globe is a problem. Further, the dead parasite acts as a strong irritant and leads to complete disorganisation of the eye. There are numerous cases in the literature of this happening (Michail and Griffith). MacArthur 1933 writes—"Cysticerci while alive usually enjoy a relative tolerance on the part of the host, but after death they act as strong irritants."

Next anaesthesia. Local anaesthesia was found to be quite inadequate, but I was unfortunate with my patient. Indeed it was impossible to get blood from a vein for W.R., so "agonising" was the needle prick.

The question of Krönlein's operation being the method of choice was considered. But in view of the fact that the patient had large prominent eyes and the cyst was near the equator, it was considered that adequate access could be gained by rotation of eye upwards. But it is agreed that for cysticercus far back in the globe and in a deep set eye, Krönlein's operation would be necessary.

The chief difficulty in the operation is loss of fluid vitreous with partial collapse of the globe and consequent corneal haze. It is difficult to see how such loss can be prevented. In theory, at any rate, it might be a good scheme to trephine the sclera (2 mms.) and introduce a hook or sucker with exactly the same diameter. Vitreous would thereby be prevented from escaping and the parasite watched with ophthalmoscope. Once the parasite was

brought to the sclera, lateral incisions could be made to enlarge the opening and so allow extraction, and previously inserted scleral sutures could be tied at once to minimise vitreous loss. The difficulty is vitreous loss *before* the parasite can be grasped, and by some such scheme as above this might be prevented.

The latest report May 1, 1945: Right eye white. Vision = good light perception. Tension normal. Projection doubtful from above.

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TANGENTIAL DISPLACEMENT OF THE IRIS IN CHRONIC GLAUCOMA*†

BY

W. J. B. RIDDELL

GLASGOW

THE advanced atrophy of the iris stroma which is seen in patients suffering from chronic glaucoma of long standing is well known to all ophthalmologists. The condition with which this paper is concerned may be the early stage of this atrophy but it can be found in the early stages of the disease. In certain cases the normal radial arrangement of the iris stroma is replaced by a distribution running at a tangent to the pupillary margin. This change may involve a considerable segment, or even the whole iris. When the condition is well marked the pupil appears to have rotated around its own axis.

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