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When asked to undertake the opening of a Discussion * on Ocular Tuberculosis, I little thought the subject would cover so much ground. I soon found myself obliged to alter the title to Intra-Ocular Tuberculosis, thereby eliminating the extra-ocular diseases, and also those of the protective tissues of the eye (sclerotic and cornea). Even with these excisions my subject is too comprehensive, and I have devoted most attention to tubercular disease of the choroid, especially the chronic form. I must apologise for the way in which some important points have been slurred over, but the short time at my disposal makes it impossible to more than allude to many of them.

TUBERCULOSIS OF THE CHOROID may be conveniently divided into two main sections—(A) miliary tubercle, and (B) the rarer form of solitary or chronic tubercle. Some observers, as von Michel, have described cases of chronic choroiditis of the disseminated type as tuberculous, but this I do not think is yet conclusively proved.

A. *Miliary Tubercles in the Choroid* were first found and described anatomically by Autentrieth in 1808. In 1855 their appearances, as seen by the ophthalmoscope, were recognised by Ed. Jaeger, and in 1858 Manz (1) published their microscopical characteristics.

As far as I know, miliary tubercles of the choroid are never primary. They are generally met with in patients the subject of acute miliary tuberculosis, but the proportion of such cases, in which miliary choroidal tubercles have been found, is given very differently by observers.

* Intra-Ocular Tuberculosis Discussion at the Leicester Meeting of the British Medical Association, July 1905.

Till 1867, when Cohnheim (2) stated that tubercles were commonly found in the choroid after death in cases of acute miliary tuberculosis, the association was considered very rare.

Since then the percentage recorded has varied somewhat from Cohnheim's 100 per cent. in 18 cases. Litten (3) in 52 cases of acute miliary tuberculosis, examined after death, found choroidal tubercle in 39 (75 per cent.); Bock's (4) percentage was 82.7; Angel-Money (5) 14 out of 44 cases, or 31.8 per cent.; Stephenson and Carpenter (6) twenty-one times in 42 cases, or 50 per cent., diagnosed by the ophthalmoscope during life. Dr. Thursfield tells me that he found a percentage of about 30 in cases at the Children's Hospital, Great Ormond Street, examined ophthalmoscopically.

I have, with the aid of Mr. Holroyd, looked up the cases of acute general miliary tuberculosis at St. Bartholomew's Hospital for the last ten years, and find that the total number is 244. Of these about 200 were examined by the ophthalmoscope, but not necessarily more than once, and therefore percentages based on such cases would not be very reliable, as it is absolutely necessary that the eye should at all events be examined shortly before death. Of these 244 cases the eyes were examined in 48 cases in the post-mortem room, and tubercle of the choroid was found fifteen times, giving a percentage of 31.25 of cases examined. Of these cases 6 were diagnosed by the ophthalmoscope before death (one twelve days before, and another eleven days before death). Of the 48 cases 47 had tubercular meningitis and the one without meningitis had miliary tubercle of the lungs, peritoneum, spleen, and kidneys.

Relation to Tubercular Meningitis.—For many years it was thought that tubercle of the choroid was rarely found in cases of tubercular meningitis. Dr. Garlick (7) (1869) in 25 cases found the choroidal lesion in only 1 case; Gruening (8) in 50 cases examined after death only in 2 cases; Baxter (9) in twelve years had not a single case; Sharkey only once in three and a half years; Schieck (32) once in 20 cases. In 15 cases of miliary choroidal tubercle at St. Bartholomew's Hospital, no less than 14 had tubercular meningitis.

The percentage is naturally much higher anatomically than ophthalmoscopically as the lesions often occur late in the disease, when it is very difficult to examine the patient. Added to this the lesion being deep in the choroid and covered by the retina it may be easily overlooked by the ophthalmoscope.

The original statement (10) of Gowers, Cohnheim, and Horner, that choroidal tubercle is rarer in tubercular meningitis than in general miliary tuberculosis without meningitis is not

according to the latest views. Horner stated that: "It seems as if the pia cerebri takes the place of the pia oculi," and therefore if the pia mater of brain is tubercular, the pial sheath (choroid of eye) is immune.

Gowers ([10]) observed that choroidal tubercle is more common in cases of tuberculosis without meningitis than those with meningitis. My own opinion is that it is rare to find miliary tubercle of the choroid without tubercular meningitis; just as tubercular meningitis is seldom met with without general tuberculosis. Osler says that tubercular meningitis is always secondary.

Miliary Tubercles of the Choroid occur, as a rule, as small discrete grey round or oval nodules, varying in size from a mere speck, 0.2 mm. to 1 mm., rarely larger unless some nodules become confluent, when the size may be 2 to 3 mm.; the nodules are very slightly if at all raised, the retinal vessels passing uninterruptedly over them. They are generally two, three, or four in number, but as many as sixty-two have been found in the same eye. By the *ophthalmoscope* they are seen as small white, grey, yellowish, or rose-pink discrete spots; they are very slightly if at all raised; the edges are soft and have a moth-eaten appearance; the retina over them is clear, and the contour of the retinal vessels is uninterrupted; in some cases there is a grey stippled appearance due to numerous minute white or grey specks (tubercular dust). The nodule, as seen by the ophthalmoscope, is really much smaller than the real lesion, as owing to its depth in the choroid only the most prominent part from atrophy of overlying tissues becomes visible. It is probably this fact that accounts for the sudden and apparently rapid appearance of the tubercles.

There is no tendency to marked pigmentation, though at times the edges are slightly tinged with greyish black pigment; retinal hæmorrhages are rarely to be found; the vitreous is clear, no opacities being present. Optic neuritis may be present; in 15 cases of miliary choroidal tubercle at St. Bartholomew's Hospital, optic neuritis was said to be present 9 times. The neuritis in these cases was probably due to the accompanying meningeal or cerebral lesion, and quite distinct from the choroidal lesion.

The *position* of the nodules is generally near the optic disk or yellow spot region, and therefore within the equator; but they may, if multiple, extend towards the periphery; a favourite situation is near the retinal veins.

The *acuity of vision* is probably little affected by choroidal

tubercles, and this accounts for the fact that their presence gives rise, as a rule, to no definite symptoms.

Microscopical.—The changes are deep—generally in chorio-capillaris layer and from adventitia of the larger vessels. Duckler says that the giant cells are rich in pigment; but Margulies, on the contrary, states that giant cells have no pigment, and are derived from endothelial and connective tissue elements; there is always to be found the tubercular reticulum, numerous endothelial cells, and, quite early in the disease, caseation.

Tubercle bacilli are often to be met with. Haab, who first described the bacilli in tuberculous choroiditis, found them in nearly every case; Lawford ([13]) in only 2 out of 6 cases, though in all 6 cases tubercle bacilli were found in the meninges.

Ocular Lesions.—The sclera is affected rather than the retina; the lesions are often difficult to see post mortem, unless the retina be stripped off.

Diagnosis.—The absence of black pigmentation and of the ringed spots distinguishes choroidal tubercle from disseminated choroiditis. It is sometimes difficult to diagnose from spots of choroidal exudation, but in tubercle the nodules are rounder, the colour greyer or more yellow, the edges not so soft and with the peculiar moth-eaten appearance; in the exudation due to syphilis vitreous opacities are present.

If the nodules are found early in the disease they are an important aid to diagnosis; I have by these means been able to diagnose cases of tubercular meningitis from typhoid fever ten days or so before death.

Prognosis.—As far as I know, patients never recover when the choroid is affected by miliary tubercles, as is also the case in acute miliary tuberculosis.

In the St. Bartholomew's Hospital statistics in 1896 some cases of diagnosed acute miliary tuberculosis did not die, but since that time all such cases have succumbed.

Treatment is confined to relieving the general symptoms of the patient, and no local treatment is of use. I have no knowledge of the effect of tuberculin in such cases.

B. *Chronic, Solitary, Aggregated, or Conglomerate Tubercle of the Choroid* presents clinically quite a different picture to that associated with miliary tubercle of the choroid. In a few cases, however, the later result has been a secondary miliary tuberculosis of the meninges from absorption of tubercle virus from the first focus.

The condition was first diagnosed by Horner ([11]) in 1878 in the case of a boy 8½ years old (Case 2), and Haab ([12]) has

Analysis of Twenty Cases of Chronic Choroidal Tubercle, by Walter H. Jessop.

	Sex.	Age.	Eye.	Prev. H.	Family H.	Present Condition.	Other Clinical Tuberc. Signs.	Op.	Result.	Time after first seeing.	Macroscopic Examination.		Meningitis.	Microscopic.		Sclerotic.	Vitreous.
											Ocular.	General.			Bacilli.		
1	M.	27	L.	Eye. congest. headache	...	Diffused yellow choroido-retinal swelling; ret. hæmorrhage	Meningitis	...	†	4 d.	Yellow-grey tumour 3 mm. nodules	Tubercular meningitis	×	Giant cells, caseation, tubercle stroma	...	Infiltrated thickened	Normal
2	M.	8½	L.	Eye. congest.	...	Peripheral pink-grey tumour nodulated	Peritonitis; cerebellar tumour	...	†	5 w.	Pink-grey tumour nodules	Old peritonitis, cerebellar tumour—brain nodules	...	×	...	Infiltration perforation	Slightly turbid
3	M.	8	L.	Opisthotonos	...	White tumour near O. D.	Miliary tubercle of lungs, brain tumour	...	†	5 w.	Many aggregated nodules	Miliary tubercles of lung bronchial glands; most other organs tubercle; many cerebral nodules	...	No exam.	...	Much thickened	...
4	M.	13	R.	...	br. & s. d. of phth. and brain	B.E. papillitis. R.E. large, milk-white nodular swelling above O. D. Ret. hæmorrhage	Tumour of pons	...	†	3 m.	not	made	...	...	...	...	Normal
5	M.	15	R.	...	...	2 large white tumours above and outer side O. D. nodules. L.E. grey nodules on iris	Maxillary, auricular, clavicular, subclavicular glands	...	...	...	...	...	...	...	...	...	Slightly turbid
6	M.	22	L.	...	...	2 yellow-grey pea-big tumours outer border cornea, hypopyon	...	Exc.	...	...	Choroidal tumour extra-bulbar with perforation of sclerotic	...	...	×	...	Thickened perforated	Numerous cells
7	F.	13	R.	...	2 brs. d. of phth., m. lung	Eye inflamed. Iritis, yellow reflex pupil; scleral protuberance	Osteitis of metacarpus of thumb	Exc.	...	4 yrs. after, sound	Choroidal tumour	...	...	×	× 9 years after	Involved	...
8	M.	33	...	Syph. int. keat. Irido-choroiditis Iridectomy	...	...	...	Exc.	...	...	Nodular tumour from choroido-ciliary border	...	...	×	...	Affected	...
9	M.	62	L.	Injury 51 years ago. Iridectomy hyphæma	ch. knee tubercle w.d. of phth.	...	...	Exc. and Exent.	...	2 yrs. after, sound	Large tumour	...	...	×	×	Thickened	...
10	F.	1½	L.	...	...	...	...	Exc.	...	10 yrs. after, phthisis	Choroidal tumour, ciliary body affected	...	...	×	×	...	...
11	M.	5/12	L.	...	f. phth.	R.E iritis; L. E. 5 mm. round grey-white tumour	Rickets, bronchial glands; enlarged spleen	...	†	3 m.	Choroidal tumour, size hemp-seed, above O. D.	Left epididymis caseous, cerebral nodules	...	×	...	...	...
12	F.	7	L.	...	...	Eye red; post synechiæ sclerotic and choroid tumours	Peritonitis; fistula in arm	...	...	...	...	...	...	×	None	Affected, and discharge from it	Turbid
13	M.	5	L.	...	...	L. E. enlarged; post. synech., lens disturbed, vessels congested	Thoracic wall abscess; cervical glands	Exent.	...	...	Globe much enlarged; large tumour, nodules	...	...	×	...	Nodules	Turbid
14	F.	18	L.	...	f. d. phth.	Enlarged vessels; big white tumour over O. D.	Both apices and pleurisy	Exc.	...	...	Aggregated tumour; small nodule near it	...	...	×	...	Infiltrated	...
15	F.	4	R.	...	...	L. E. yellow-white tumour	Swelling of knee	...	†	23 d.	Small hæmorrhage	Tubercular meningitis; cerebral and cerebellar tumour	×	×	None	...	...
16	M.	8	R.	...	...	R. E. large tumour L. E. optic neuritis	Cerebral tumour	...	†	13 m.	Confluent tumour	Bronchial glands, caseous cerebral tumour, no miliary	...	...	...	...	...
17	F.	9	R.	2 years signs of tubercle	br. d. of tub. mening.	2 large spherical masses over O. D. Scleral swelling.	Cervical, episternal; arm, leg, abscesses	...	...	V. good 4 yrs. after	...	...	...	×	None	Nodule	Normal
18	F.	23	R.	Mammary abscess tub. bacilli	m. & br. d. of phth.	Above O. D. small mass. Ciliary congestion	Scar of mammary abscess	...	...	V. normal 5 yrs. after	...	...	...	...	...	...	Normal
19	F.	6	L.	Nil	...	Choroidal mass. 4 mm.	Submax., axillary and groin glands	Exc.	...	...	Large tumour, 9 mm.	...	...	×	None	Infiltrated	...
20	F.	16	L.	...	...	Conjunct. congested, pupil irreg. pseudo-glioma	Abscess scars lumbar, cervical, soft, painful, nodules scalp and back	Exc.	†	2 yrs.	2 large choroid tumours	Tubercular meningitis; scalp nodules; lungs tubercle; old peritonitis	×	×	×	Involved and perforated	...

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