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Wm Jessop

INTRA-OCULAR TUBERCULOSIS.

BY

WALTER H. JESSOP, F.R.C.S.

1794-1800

INTRA-OCULAR TUBERCULOSIS.

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WALTER H. JESSOP, F.R.C.S.

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.

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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 choriocapillaris 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.

Case	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		Facile			
1	M.	27	L.	Eye congested, headache	---	Diffused yellow choroidal-retinal swelling; ret. hemorrhage	Meningitis	---	+	4 d.	Yellow-grey tumour 3 mm. nodules	Tubercular meningitis	x	Giant cells, caseation, tubercle stroma	---	Infiltrated thickened	Normal
2	M.	8½	L.	Eyes congested	---	Peripheral pink-grey tumour nodulated	Peritonitis; cerebellar tumour	---	+	5 w.	Pink-grey tumour nodules	Old peritonitis, cerebellar tumour—brain nodules	---	x	---	Infiltration perforation	Slightly turbid
3	M.	8	L.	Opisthotonus	---	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	R.E. papillitis. R.E. large, milk-white nodular swelling above O. D. Ret. hemorrhage	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-bag tumours outer border cornea, hypopyon	---	Exc.	---	---	Choroidal tumour extra-bullar with perforation of sclerotic	---	---	x	---	Thickened perforated	Numerous cells
7	F.	13	R.	---	2 hrs. 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	---	---	x	x 9 years after	Involved	---
8	M.	33	---	Syph. int. kerat. Irido-choroiditis Iridectomy	---	---	---	Exc.	---	---	Nodular tumour from choro-ciliary border	---	---	x	---	Affected	---
9	M.	62	L.	Injury 51 years ago. Iridectomy hyphema	ch. knee tubercle w.d. of phth.	---	---	Exc. and Extent	---	2 yrs. after, sound	Large tumour	---	---	x	x	Thickened	---
10	F.	1½	L.	---	---	---	---	Exc.	---	10 yrs. after, phthisis	Choroidal tumour, ciliary body affected	---	---	x	x	---	---
11	M.	½	L.	---	f. phth.	R.E. iritis; L.E. 3 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	---	x	---	---	---
12	F.	7	L.	---	---	Eye red; post synechia sclerotic and choroid tumours	Peritonitis; fistula in arm	---	---	---	---	---	---	x	---	---	---
13	M.	5	L.	---	---	L.E. enlarged; post. synech. lens disturbed, vessels congested	Thoracic wall abscess; cervical glands	Extent	---	---	Globe much enlarged; large tumour, nodules	---	---	x	---	Affected, and discharge from it	Turbid
14	F.	18	L.	---	f. d. phth.	Enlarged vessels; big white tumour over O. D.	Both apices and pleuris	Exc.	---	---	Aggregated tumour; small nodule near it	---	---	x	---	Nodules	Turbid
15	F.	4	R.	---	---	L.E. yellow-white tumour	Swelling of knee	---	+	23 d.	Small hemorrhage	Tubercular meningitis; cerebral and cerebellar tumour	x	x	None	Infiltrated	---
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	---	---	---	x	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.	---	---	Choroidal mass 4 mm.	Submax., axillary and groin glands	Exc.	---	---	Large tumour, 9 mm.	---	---	---	---	---	Normal
20	F.	16	L.	---	---	Conjunct. congested, papillary pseudo-gloma	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	x	x	x	Involved and perforated	---

(1) WARD. *Arch. f. Ophth.*, 1877, Bd. 23, 4, p. 118.

(2) HAAR. *Arch. f. Ophth.*, 1879, Bd. 25, 4, p. 224.

(3) MAXE. *Klin. Monatsk. f. Augenheilk.*, 1881, Band 19, p. 18.

(4) HIRSCHBERG. *Neurolog. Centralbl.*, 1882, Band 1, p. 533.

(5) MAXE. *Augen-Tuberkulose*. Thesen, Straßburg, 1884, p. 33.

(6) SCHAFER. *Klin. Monatsk. f. Augenheilk.*, 1884, Band 22, p. 307.

(7) HAAR. *Klin. Monatsk. f. Augenheilk.*, 1884, Band 21, p. 392.

(8) NEENE. *Arch. f. Augenheilk.*, 1886, Bd. 16, p. 267.

(9) WAGENMANN. *Arch. f. Ophth.*, 1888, Band 34, IV, p. 158.

(10) LIEBRECHT. *Arch. f. Ophth.*, 1890, Bd. 36, 4, p. 241.

(11) GUTHANK. *Arch. f. Augenheilk.*, 1890, Bd. 31, p. 158.

(12) NYE. *Klin. Monatsk. f. Augenheilk.*, 1900, Band 38, p. 752.

(13) RENZ. *Klin. Monatsk. f. Augenheilk.*, 1901, Band 39, 2, p. 531.

(14) SALOMON. "Solitare Tuberkulose der Choroidea." Thesis, 1902.

(15) MACKENZIE. *Trans. Ophth. Soc.*, III, p. 119.

(16) BARLOW. *Trans. Ophth. Soc.*, III, p. 134.

(17) JESSOP. *Trans. Ophth. Soc.*, XXIII, p. 50.

(18) JESSOP. *Trans. Ophth. Soc.*, XXIII, p. 55.

(19) McHARDY. *Trans. Ophth. Soc.*, vol. VIII, p. 179.

(20) St. Bart's Hosp. Ophthalmic Ward Notes, 1896.

					phth., m. lung
9	M.	33	R.	...	...
8	M.	33	...	Syph. int. kerat. Irido-choroiditis Iridectomy	...
9	M.	12	B.	Injury 51 years ago. Iridectomy hypæmia	ch. knee tubercle w.d. of phth. plasm brpr. sup pr. & s. d. of
10	F.	11	L.	...	...
1	M.	13	B.	...	...
11	M.	12	L.	...	f. phth.
13	M.	8	R.	Obisprotonos	...
5	M.	81	R.	Elev. congest.	...
13	M.	5	L.	...	...
1	M.	51	R.	resqatere Elev. congest.	...
14	F.	18	L.	...	f. d. phth.
15	Elev.	Y86.	Elev.	Elev. H.	Elev. H.
16	M.	5	R.	...	...
17	F.	9	R.	2 years signs of tubercle	br. d. of tub. mening.
18	F.	20	R.	...	m. & br. d.

published the drawing—originally in black and white, but lately in colours—very much resembling the drawings taken of my case (No. 17). Von Graefe⁽¹⁴⁾ first described the condition microscopically in a large conglomerate choroidal tubercle in a pig's eye. Chelius⁽¹⁵⁾ and Arlt⁽¹⁶⁾, in the pre-ophthalmoscopic days, spoke of a choroiditis serophulosa and tuberculosa. (See Table.)

Though a rare condition, I have been able to collect and arrange notes of 20 cases; I have carefully excluded from my list all doubtful ones. A table of these cases is appended in order to bring out and compare the chief points of interest.

Sex.—The proportion is nearly equal: nine females and eleven males.

Age.—Eleven cases were under 10 years of age, showing that chronic tubercle is generally a disease of early life. Of these eleven cases one was under 1 year, two between 1 and 2 years, eight between 2 and 10; of the other nine cases one was over 60 years, four between 20 and 40, and four between 10 and 20 years of age.

Eyes.—The left eye only was affected in 10 cases, the right in 6; both eyes in only 1 case; there are 3 cases in which the side was not mentioned. This shows that it is very rare to find both eyes affected.

Family History.—Although tubercular strain found in only 7 cases (35 per cent.), yet in only one was the direct negative mentioned. In the notes of the other cases no mention is made of the subject.

Other Clinical Tubercular signs were found in no less than 16 cases (80 per cent.) at time of visit or soon afterwards; in 1 case (10) signs of phthisis were noted ten years afterwards. Of the remaining 3 cases (6, 8, 9) no mention is made of other signs.

The evidence of these cases is very much against the choroidal tumour being the primary focus of the tuberculosis. Of the other foci of tubercle in these cases tumour of the brain was the most frequently met with—viz. in no less than six patients (Nos. 2, 3, 4, 11, 15, 16), or 30 per cent.; and if the 8 fatal cases are only taken, in every case but two (75 per cent.); tubercular meningitis was found in three cases (1, 15, 20), active pulmonary phthisis in 3 cases.

Signs of local chronic tubercle in other parts—sometimes called surgical tuberculosis—were found in 12 cases, or 60 per cent. This is a very important point as far as diagnosis and prognosis are concerned, as such cases are generally very chronic, and do not by any means necessarily assume the

acute state. Looking over the 8 cases without notes of surgical tuberculosis, I think that, with the exception of the two (1 and 2), in which a post-mortem examination was made, they probably also might have been included with the 12. The list below gives the local lesions in the 12 cases.

3. Bronchial glands, caseous and chronic tubercle of most other organs.
5. Maxillary, auricular, clavicular, subclavicular glands affected.
7. Osteitis of thumb metacarpus.
11. Bronchial glands, lupus, submaxillary gland, rickets.
12. Brachial fistula.
13. Cervical glands, abscess of thoracic wall.
15. Gonitis.
16. Bronchial glands.
17. Cervical and episternal glands, many sinuses in arms and legs.
18. Mammary abscess.
19. Submaxillary, axillary, and groin glands.
20. Lumbar and cervical abscesses.

Death ensued in 8 cases, and in 7 of these notes of the post-mortem examinations are given. Of these 7 cases 3 had tubercular meningitis and 5 coarse tubercle of the brain.

The Examination of the Eye is recorded in 15 cases out of the 20. There was generally one large tubercular mass in the choroid, but occasionally two tumours. In almost every case the tumour was nodular in part; the colour was grey (from a yellow to greenish tinge), white, or white with pink tinge. The position was, as a rule, near the optic disk, and the growth tended to overshadow the disk.

The retina at first passed unaltered over the tumour, and was only implicated later in the disease. In some cases detachment took place owing to tension due to the size of the tumour, as happens in malignant disease. In one case (17) retinal changes occurred as the tumours subsided, and in three cases retinal hæmorrhages were present.

The *vitreous* was stated to be clear in 4 cases, disturbed in 4, and with numerous cells in 1 case. Of the 5 cases in which the vitreous was abnormal, 3 had signs of iritis, and the 1 with marked opacities had hypopyon. With the exception of this last case the expressions "turbid" or "slightly turbid" are too vague to indicate necessarily pathological changes in the vitreous. My own opinion is that as long as the tumour does not involve the ciliary body or anterior portion of choroid vitreous opacities are not found.

Let me enumerate the appearance of a solitary tubercle as seen by the ophthalmoscope in the early uncomplicated stages of the disease.

The tumour, of a greyish or white colour, is generally found as a spherical more or less nodular subretinal swelling. It is situated, as a rule, near the optic disk, which it tends to overshadow. The retina passes with the retinal vessel clearly over it, but may be detached at the periphery of the tumour. Signs of degeneration — as yellowish spots — may be seen, and occasionally retinal hæmorrhages. Vitreous opacities are rarely if ever present, unless the ciliary body is implicated.

The *sclera* was thickened, infiltrated in 13 cases, and in 2 cases perforated; in 2 cases there was definite scleral swelling.

Microscopical.—The chief signs are giant cells, proliferation of the endothelium and adventitia of the blood-vessels, and areas of caseation; these were found in every case out of 15 examined. Bacilli were only noted in 4 cases, and in one of these cases the specimen had been nine years in spirit. (At St. Bartholomew's Hospital tubercle bacilli were found in a specimen which had been seventy years in spirit.)

Operations.—In nine cases the eye was removed, and one of these only was followed by death from meningitis. In 7 of these cases the operation was excision only; in one (9) excision followed by exenteration for an orbital extension of disease; and in one case (13) exenteration was done at once.

After History.—Of 7 non-fatal cases unfortunately I can find no records; of 4, 1 was alive and well five years after, 2 four years after, and 1 two years after.

Diagnosis.—These cases may be mistaken for glioma, sarcoma, or gumma.

From the intra-ocular stage of malignant disease they may, as a rule, be recognised by there being signs of inflammation or conjunctival congestion, keratitis, iritis, scleritis; the tension, too, is generally rather reduced as against increased or normal tension in malignant disease. In both conditions vitreous opacities are rarely if ever met with, unless the ciliary body is affected or perforation into the vitreous has taken place. Signs of tubercle in other parts of the body aids the diagnosis, as does also injection of tuberculin T. R.

From a syphilitic gummatous mass tubercle of the choroid differs in not being accompanied by vitreous opacities, marked black pigment changes in the choroid and retina, and in not being improved by mercurial treatment.

By the microscope the diagnosis is made from the presence of giant cells, epithelioid stroma, caseation, and sometimes tubercle bacilli.

In all cases of doubt, when the material can be obtained,

the surest way is the inoculation of an animal with a portion of the growth.

Prognosis (1) As to Life.—This depends mostly on the other foci of tubercle, which are generally of the chronic variety. In the eight cases of death no less than six had tumours of the brain.

(2) *As to Vision.*—Of the twenty cases the affected eye was removed in sixteen, thus leaving only four for consideration (5, 12, 17, 18). Of 5 and 12 there is no note of vision; in case 17 after four years the vision was $\frac{6}{12}$, and in case 18 after five years the vision was $\frac{6}{5}$.

(3) *As to Ophthalmoscopic Signs.*—Of this I have only my two cases (17 and 18) as proof. Fortunately there are drawings during the whole time (four years) the cases have been under observation. Notwithstanding the gross initial lesions in case 17, the fundus has gradually cleared, leaving very little change except at the periphery below. Throughout vitreous opacities have been absent, black or grey pigmentation of the choroid is absent except slightly now at the extreme periphery, and there is scarcely any change to be seen in the retina where the changes were so marked.

In case 18 the choroidal signs quite cleared up without pigment change; vitreous opacities were absent throughout.

Treatment.—I have had no experience of the effect of tuberculin T.R. in such cases, but I should certainly give it a trial when another case comes under my care.

Of my two cases of recovery, No. 17 has been treated as far as possible by living in the open air and frequent visits to Margate. She has also had cod-liver oil, syrup of iodide of iron, and, locally, atropine and tinted glasses. The usual treatment recommended in such cases has been excision of the eyeball, mainly as a preventive of general dissemination. The after history of cases 17 and 18 certainly negatives this procedure, as does also the extreme doubt of the primary focus being ever intra-ocular.

IRIS.—*Tubercle of the Iris* was first described by Gradenigo⁽¹⁷⁾ in 1869; but till lately such cases were known as granulomata of the iris and were scarcely ever really diagnosed. In a perforating staphyloma Köster⁽¹⁸⁾ first described bacilli.

Tubercular disease of the iris may be divided into three typical classes: (1) miliary tubercle; (2) solitary or chronic tubercle; (3) tubercular iritis, generally associated with cyclitis.

(1) Miliary tubercle, in which the nodules are found on the surface of the iris, mostly discrete and near the ciliary border

or the margin of the pupil. The tubercles are generally small grey or yellowish points varying in number from five to twenty-five, sometimes with vessels on their surface; the condition may be acute or chronic, and is accompanied by marked ciliary congestion; as a rule the younger the patient the more acute the process. There is usually a tendency for the nodules to coalesce and fill the anterior chamber; the cornea becomes hazy (keratitis profunda) with a deposit of lymph on its posterior surface; the ciliary body soon is affected.

Occasionally the tubercles disappear, but as a rule the eye becomes disorganised and lost for vision, the choroid, sclera, and cornea becoming involved and the eye giving way at the sclero-corneal junction or through the cornea, a staphyloma being first formed.

In some cases general infection may occur, but sometimes the nodules grow slowly and become absorbed. (Leber's "attenuated tubercle.")

(2) The solitary tubercle like that of the choroid is generally a definite tumour, yellow-grey in colour, and nodular (aggregated) in form; it grows steadily and slowly, but is not necessarily accompanied by severe iritis; the position is generally from the lower part of the iris (Haab), or from the ciliary region and intermediate zone of the iris.

Microscopically.—It is seldom circumscribed; there are giant cells, leucocytes, epithelioid cells. Some of the giant cells may be pigmented; caseation soon ensues. Out of ten cases, in seven the ciliary body was also invaded.

In most cases the cornea is soon affected; lymph is present in the anterior chamber and on the posterior surface of the cornea; cyclitis, choroiditis, and scleritis may occur.

The growth is generally forwards and may fill the anterior chamber, but, according to Lagrange, rarely involves the ciliary muscle. When perforation takes place it is at the limbus or near the iridic angle.

(3) Tubercular iritis is of chronic nature and generally occurs with great thickening of the iris and punctate condition of the cornea.

Tubercular iritis has been described as primary by several observers. Denig⁽¹⁹⁾ in 80 cases found 67 with no other signs of tubercle; of these 67, 40 were sound in every way, whilst 27 were suspect from hereditary taint, but in 39 of these cases later notes show 19 had tuberculosis of other organs; but 5 had no symptoms for some years.

As far as I know, in every case of tubercular iritis in

which a post-mortem examination has been made, another tubercular focus has been found, and I am inclined to believe with Vossius⁽²¹⁾ and Wagenmann⁽²⁰⁾ that primary iritis has not been proved in human eyes.

Diagnosis.—From sarcoma, it is very difficult to be sure in the later stages, but in the early stages the tubercular mass is generally accompanied by marked superficial congestion. From gumma it is almost impossible to diagnose, but the position of the syphilitic lesion is generally nearer the pupillary border. The only perfect method of diagnosis is by injection into the anterior chamber of an animal of some of the material. Tuberculin T.R. may aid diagnosis, as also may mercury.

Treatment.—According to some authorities the eye should always be excised when the case is severe, but I am sure there is great danger of dissemination and tubercular meningitis, as the sclerotic is generally affected. Iridectomy for the solitary form has been practised; iodoform in the anterior chamber (Haab), hetol (Pflüger), air (Köster) have been tried, but tuberculin (T.R.) is probably the best treatment.

RETINA.—Of tubercular disease of the retina, except secondary to that of the choroid, I have had no experience. Arnold Knapp⁽²²⁾ has described a case of localised tuberculosis at the head of the optic nerve, and Sattler has described a somewhat similar case, but in neither was the change only in the retina, though the choroid was less affected.

CONCLUSION.—In order to direct and limit the discussion on intra-ocular tuberculosis, I have drawn up seven headings, comprising points on which opinions are specially needed and invited. I have, as introduction, briefly considered these points myself.

I. *What is the Relative Frequency of Primary Intra-ocular Tuberculosis?*—Cases of primary intra-ocular tuberculosis have been described, but I have not yet seen a case, and am exceedingly doubtful as to their existence. In most cases it is impossible to be certain, unless an examination after death has been performed. Many such cases were originally described, and I think the chief reason for such statements was the fact that the injection of tuberculous material into the anterior chamber of a rabbit was soon followed by general tuberculosis.

Among the supporters of primary tuberculosis are Köster⁽¹⁸⁾, v. Michel, Deutschmann, Schmidt-Rimpler, Bach⁽²⁵⁾, Denig⁽¹⁹⁾, Lagrange⁽²⁶⁾, Parinaud⁽²⁷⁾, Greef⁽²⁸⁾, &c.; the extreme opponents are Leber⁽²⁹⁾, Fuchs, whilst Wagenmann⁽²⁰⁾,

Vossius⁽²¹⁾, &c., are uncertain, though more inclined to oppose than to support the theory.

II. *How often is Choroidal Tubercle met with in Acute Miliary Tuberculosis?*—The percentage varies greatly, according to different observers, as high as 82 being recorded; the probability, I think, is that choroidal tubercle is found in about 50 per cent. of the cases post mortem, and in less than that by the ophthalmoscope before death—from 30 to 35 per cent.

III. *What is the Value of Tuberculin (a) as an Aid to Diagnosis, (b) as Treatment?*—On these points I have had little experience, but certainly agree with most observers now that the old tuberculin is not only unreliable, but sometimes a very dangerous remedy. With the new tuberculin T.R. I have never seen bad results. Von Hippel⁽³⁰⁾ is quite enthusiastic as to its use, and says that even in the most severe cases it effects a cure. His cases have remained cured even for as long as nine years. He uses tuberculin T.R. in hypodermic injections of $\frac{1}{500}$ m.g. of the dry substance, at first every three days if there is no increase of temperature. It is very important to take the temperature day and night. If there is a marked rise of temperature it is expedient to have longer intervals, and not to increase the strength of the dose. If no rise of temperature occurs, then the dose should be raised by the same amount, $\frac{1}{500}$ m.g. till it becomes $\frac{1}{30}$ m.g. After this the immediate increase should be less, and the greatest amount given at one time should not exceed 1 m.g. In very severe cases the treatment may last six months. Schieck⁽³²⁾ collected thirteen cases which were all cured by this treatment. Looking at these facts I should certainly treat every case with tuberculin, especially as in Rogman's statistics⁽³¹⁾ after excision the mortality from tubercular meningitis is so high. Uhthoff, Hess, and Jacoby have all given me proofs of the value of this drug in ocular tuberculosis.

IV. *What is the Danger of General Dissemination as a Result of Excision of the Eye in Intra-ocular Tuberculosis?*—The operation of excision which has been suggested as a general treatment in cases of intra-ocular tuberculosis must fall or stand by the results. Does it lessen or increase the risk of tubercular meningitis or general tuberculosis? Is the disease stayed by it? Is there a tendency in some cases to recovery of vision? The operation of excision of the eye is a mutilation which should only be resorted to in most cases if there is danger of sympathetic inflammation, or if the health is affected to a serious extent by the changes in the eye.

In tubercle in the early stage excision could only be justi-

fiable on the ground that the eye was the only focus of infection, and certainly not if it was only one of many foci. In later stages much pain, great growth of the tubercular changes with complete blindness, may suggest excision. Rogman⁽³¹⁾ has collected eleven cases in which death ensued soon after the eye had been excised for tubercle. Of these eleven cases one was over 20 years of age, five between 10 and 20, four between 6 and 10, and one under 2 years.

The time after the excision that death occurred was within one month, three cases; between one and two months, four; between two and three months, one; and in one year and over, two cases. These last two cases died of pulmonary phthisis, and the six months case of general miliary tuberculosis. The eight who died within three months all died of meningitis, and this seems more than suggestive of dissemination, and indicates the risk of excising a tuberculous eye. The sclerotic was affected in all these cases, and this fact doubtless increases the danger.

In my opinion from these facts I should hesitate very much before excising a tuberculous eye—in the earlier stages because in some cases the manifestations clear up; in the later stages owing to the risk of general dissemination, especially of tubercular meningitis; in all stages because tuberculin has produced such good results; and, lastly, because the ocular is probably never the primary lesion. A very great contrast to Rogman's⁽³¹⁾ eleven cases of excision, with no less than eight deaths from meningitis within three months, is afforded by Schieck's⁽³²⁾ thirteen cases treated with tuberculin without a fatal result and with cure of the symptoms.

V. *In Tuberculous Affection Limited to the Choroid is there Little Tendency to Pigmentation or Scarring of the Retina or Choroid, and are Vitreous Opacities Seldom Present?*—In acute miliary tubercular choroiditis I have never found vitreous opacities, and in my two cases of chronic tubercle (17 and 18) they were not present.

As in malignant disease limited to the retina or choroid, so I think in chronic tubercle of the choroid a very important aid to diagnosis is the absence of vitreous opacities.

As to pigmentation and scarring I have been surprised how little remains after severe tubercular disease. As shown in the drawings of case 17 there is scarcely any pigmentation now. Stephenson and Carpenter⁽⁶⁾ have described cases with marked pigmentation, especially in the macular region, but cases like their drawings I have generally associated with hereditary syphilis and congenital changes.

VI. *How often in Chronic Phthisis, especially Pulmonary, are there Choroidal Lesions?*

In 466 cases at St. Bartholomew's Hospital of chronic pulmonary phthisis I could find no note of chronic choroidal change. Carpenter and Stephenson⁽⁶⁾ found in 119 cases of chronic tuberculosis in children choroidal changes in 11, that is, 9.24 per cent.

VII. *In Chronic Choroidal Tubercle, what are the Signs of "Obsolescent" Tubercle?*

As to this point my own two cases are the only ones I can use, as in them the tubercle bacilli or tubercular inoculation experiments made the diagnosis of tubercle sure, and the lapse of years—four and five—has enabled the so-called "obsolescent" changes to be watched from the commencement. In these, as the drawings show, the changes were not in the macular region, but started near the disk, as was the condition in most of the twenty cases described above. The absence of much scarring and of marked pigmentation seems to distinguish these cases from the syphilitic type.

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