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THE OPHTHALMOSCOPIC APPEARANCES OF THE OPTIC NERVE IN CASES OF CEREBRAL TUMOUR.

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[Read before the Medical Society of the College of Physicians—May 13th, 1874.]

THE value of the ophthalmoscope, as an important aid in the diagnosis of cerebral and other diseases, is, at length, beginning to be recognised, though tardily, by physicians in this country. Hitherto this instrument has been looked upon as the almost exclusive property of the ophthalmic surgeon, but now there appears to be an anxiety on the part of the profession in general to learn something of its use. To inquire into the cause of this awakened interest with regard to ophthalmoscopy would be foreign to the present subject; suffice it to say, it exists, and should be earnestly cherished and encouraged by the specialist, for it must be remembered that the field of research to which the ophthalmoscope, in the hands of the physician, is adapted is very extensive, and, to prove of any real value, it is most important that investigations should be carried on *conjointly* by the physician and ophthalmic surgeon.

It is not my intention on the present occasion to indicate the various diseases in which the ophthalmoscope may prove useful to the physician and general practitioner. If the Society will permit, I hope to bring this subject under their consideration at some future meeting, yet I cannot forbear quoting the following passage from a paper read before the Massachusetts Medical Society by my friend, Dr. Joy Jeffries, of

Boston,[a] which illustrates very forcibly the value of the ophthalmoscope to the general practitioner. The author has just been speaking of some of the more abstruse and difficult points in connexion with ophthalmoscopy.

"But now," he says, "aside from the nicer points in medical ophthalmoscopy, to be appreciated and used in diagnosis, perhaps still a long time, only by those familiar and expert with their presence and meaning—is the eye-mirror of as direct practical value to the general practising doctor as the microscope in determining vegetable parasites or urinary casts? I would reply most certainly, and especially to all at work away from centres of population, where till now ophthalmic surgeons alone find enough remunerative work, and to whom a patient may be readily sent. Let me here give a few examples in proof of my assertion. A patient awakes in the morning, seeing only the half, or a portion, of an object. This is a natural cause of fright to him and to the physician called in, who endeavours hurriedly to recall the cerebral troubles in which half vision occurs. At last, however, his wit is baffled, and the terrified man or woman is sent, perhaps, hundreds of miles by stage-coach, steam-boat, or car to some ophthalmic surgeon. A glance with the eye-mirror shows him a partially detached retina, to become wholly so, very likely, by the necessary journey home. Surely, it would have been worth something to that village doctor, and still more to the patient, had the former been able to look into the globe, and diagnosticated what is as apparent as a torn or rumpled shirt-bosom—namely, separation of the retina."

In these days of educational reform, when it is apparent we are on the eve of some important changes with regard to medical education, it might be worth considering whether a course of ophthalmoscopy should not form a necessary part of every medical man's study, at all events before he is admitted to the higher degrees. The undoubted services rendered by the ophthalmoscope, both in the study and practice of medicine, warrant the belief that the day is not far distant when the physician's education will be considered incomplete till he has mastered its use.

The ophthalmoscope appears to be specially adapted for assisting in the investigation of the large class of diseases known by the title of intracranial disorders, and the subject of the present paper has reference to what it reveals in cases of tumours situated within the cranium. I shall, first of all, describe the appearances presented by the optic nerve in cases of cerebral tumour, and then endeavour to give a *résumé* of the theories which are held regarding the mode in which the condition giving rise to these appearances is produced.

[a] The Value of the Ophthalmoscope to the General Practitioner. By B. Joy Jeffries, M.D., Harv. June, 1872.

The diagnosis of cerebral tumours is a subject which has always presented very considerable difficulties to the physician. Indeed, till within a comparatively recent period, any attempt at an accurate diagnosis of the presence of a cerebral tumour could scarcely be looked upon as much better than mere guessing. The study of this form of disease has, however, of late years received a great impetus, followed so far by such good results, that we are fully justified in expecting that the day is fast approaching when, not only the presence, but even the exact situation, of cerebral tumours will be diagnosed with as great accuracy as any of the well-known lesions of the lungs or heart.

Two circumstances account for the very remarkable advance made in this branch of medical diagnosis:—

1. The profound researches into the minute anatomy of the brain, especially with reference to the origins of the cranial nerves; more accurate observations with regard to the physiological functions of the latter, and the phenomena exhibited when the due exercise of those functions is in any way interfered with.

2. The discovery of the ophthalmoscope, and its application to the diagnosis of cerebral disease.

Von Graefe was the first to recognise and describe the peculiar appearances presented by the optic nerve in cases of cerebral tumour, and to offer a theory as to the cause of their production. He also very clearly laid down the features which distinguish these appearances from those presented by the other forms of neuritis optici. Unfortunately, subsequent observers have not sufficiently attended to these distinctions, hence some confusion has arisen, and a vast amount of valuable material has been wasted. For the future, however, any misapprehensions of this kind will be inexcusable, since such admirable works as, for instance, Dr. Allbutt's Treatise on the Ophthalmoscope place the necessary information within the reach of all who have already made themselves masters of that instrument. The following is the description given by Von Graefe of the ophthalmoscopic appearances presented by the first case which drew his attention to this important subject. It may be taken as a type of the condition of the optic nerve, which is generally, if not always, present in cases of cerebral tumour:—

"The optic papilla was considerably and irregularly swollen in such a manner that it rose abruptly on one side, and on the other sloped down almost imperceptibly to its ordinary level. The normal transparency of its tissue had disappeared, giving place to a greyish tint, with a very strong shade of red; the adjacent portions of the retina exhibited exactly the same change, so that the choroidal margin of the papilla was

[a] On the Use of the Ophthalmoscope in Diseases of the Nervous System and of the Kidneys. By Thomas Clifford Allbutt, M.D. London, 1871.

hidden from view. The retinal opacity was uniform, presenting, nevertheless, with the erect image, a slightly striated aspect, which followed the course of the optic nerve fibres. The retinal veins were larger than normal, extremely tortuous, very dark coloured in parts, and issued in a very irregular manner from the opaque tissue; the arteries were relatively diminished in size. The opacity of the retina progressively decreased from the border of the papilla, forming, on the whole, a zone of 4 mm. in breadth, including, with the papilla, a circle of about 10 mm. in diameter."[a]

Such is the description given by Von Graefe of this remarkable appearance of the optic nerve, and it only requires to be added that, in general, small hæmorrhages are found scattered over the papilla.

The patient in this instance died six weeks later, during an epileptiform attack, and the *post-mortem* revealed a very extensive sarcomatous tumour in the right hemisphere. Subsequent observations in precisely analogous cases led Von Graefe to the conclusion, that there was some relation between the tumour and this peculiar condition of the optic nerve, but, after very careful investigations, he finally decided that the latter was merely due to the increased intra-cranial pressure caused by the presence of the tumour. How he explains this we shall see further on. But though he thus concluded that there was no *direct* connexion between the tumour and the changes in the optic disk, he distinctly expresses the opinion[b] that the latter "plays an important rôle in the diagnosis of a cerebral tumour, inasmuch as where it is present in a very marked degree it is almost invariably accompanied by a tumour." As I before mentioned, Von Graefe insisted upon there being two distinct forms of neuro-retinitis—the one, of which the description I have just given is an example, is characterised by remarkable prominence, redness, and loss of transparency of the disk, and this he looked upon as due to *mechanical hyperæmia;* the other, which generally accompanies encephalitis or encephalo-meningitis, he considered a *neuritis descendens—i.e.*, an inflammation spreading from the brain.

"In this (the latter) form," he says,[c] "the disk is also swollen, but not to the same extent, and it does not rise abruptly on one side; it is of a greyer colour, at the most of a reddish tinge; but it never presents the intense red of the other form. Moreover, the morbid process, which, as a rule, seems to develop more gradually, extends to a much greater distance beyond the disk, and attacks all the layers of the retina where it may manifest its presence by white patches, not to speak of numerous hæmorrhages."

This form of neuro-retinitis need not occupy our attention further;

[a] Archiv für Ophthalmologie, 1860, Vol. VII., Part II., p. 58.
[b] Loc. cit. [c] Loc. cit.

suffice it to say, that subsequent investigations appear to prove the truth of Von Graefe's supposition—namely, that in this latter form the whole length of the nerve is engaged in the inflammatory process, whereas in the former the neuritic process stops short at the lamina cribrosa.

The drawing (Plate VIII.) is of a case I have at present under observation, which exhibited this congested and prominent condition of the disk in a very marked degree.[a]

The history of the case is briefly as follows:—

J. C., aged twenty-nine, baker, married; was sent to me on the 6th of May, 1873, by an eminent physician of this city, who had examined his eyes with the ophthalmoscope, and diagnosed the condition of the disks.

The patient, a phlegmatic-looking individual, presented the appearance of a person suffering from great lassitude and fatigue. His countenance exhibited a curiously-pained expression, which forcibly recalled to my mind a picture the late Professor Robert Smith used to exhibit at his lectures, illustrating the peculiar expression of features presented by a person who had recovered from traumatic tetanus. There was well-marked paralysis of the external rectus of the left eye, together with very considerable anæsthesia of the whole of the left side of the head and face.

History.—He had always enjoyed good health until three months ago, when, for the first time, he experienced a very violent pain in the back of the head. After some time it ceased at this point, and attacked the left eye, and finally it shifted its position to the forehead. It was so severe that he could "neither eat nor drink." He had no vomiting or sickness of stomach. For about seven months previously he had been drinking very hard, principally whiskey. The left eye began to turn inwards shortly after it had been attacked with the pain. He did not notice objects appearing double till about three weeks later. The whole of the left side of the head and face was "numb." This numbness extended exactly to the mesial line. The cornea might be touched without producing any reflex movements. He experienced considerable difficulty in opening his mouth to any great extent, as "the jaw on the left side felt as if it were locked." He complained of great lassitude and depression, and that he could not walk for any distance without wishing to sit down. At home he "would like to be lying down all day," though were he to do so he could not sleep; he slept badly at night; he had always to lie on the left side; were he to lie on the right side, or on the back, he immediately experienced intense pain in the head or in the left eye. There was no history of syphilis.

[a] For other drawings illustrative of this condition of the disk, see Liebreich's Atlas d'Ophthalmoscopie, 2nd Ed., Pl. XI., Fig. 2, and Magnus's Ophthalmoscopischer Atlas, Pl. III., Fig. 8, Leipzig, 1872.

On testing his vision I found he could read XX. (Snellen) at 15′. With the ophthalmoscope both eyes presented almost similar appearances; the disks were enormously congested, and very prominent; the margins ill-defined and hazy; the veins were greatly engorged and tortuous, and presented well-marked curves at the edges of the swollen disks. Owing to the zone of effusion surrounding the margin of the disks, the veins were veiled, or were completely hidden for some distance; the arteries were greatly reduced in size and number, the few that were visible being quite small and thread-like.

The treatment consisted in the administration of five grain doses of the iodide of potassium three times daily. After continuing this treatment for some time, the patient expressed himself as greatly better, and indeed there was a marked improvement in his appearance. His countenance had lost the peculiarly pained expression to a great extent, and, on the whole, he looked much brighter; he slept much better now. The bromide of potassium was now combined with the iodide.

The following month feeling had returned to the left side of the head and face, with the exception of one small portion of the lower lip. He continued to improve rapidly, and with the ophthalmoscope the veins could be traced much more distinctly at the margins of the disks. He was now able to resume his work, and stated that he felt almost as well as ever.

Towards the end of last August he again presented himself. His countenance exhibited the same peculiarly pained expression that it did at first, and he stated that for the last few weeks he had suffered greatly from the frontal pain. He was obliged to give up working, and he would "fain" be constantly lying in bed. The left pupil was dilated, but responded to light. No change could be detected in the condition of the disks, and vision remained the same. His memory was very defective; he forgot my name a few minutes after he was told it.

I now lost sight of the patient for about two months, and when I next saw him he was an inmate of one of the general hospitals in this city, where he had been admitted with well-marked exophthalmos of the left eye, and ptosis of the left eye-lid. I then examined him with the ophthalmoscope, but could detect little or no change in the disks—perhaps they were not quite so prominent.

I saw nothing more of the patient until December, when he again came to me. He had been suffering intense pain across the forehead, the left side of the head and face, and in the left eye. The exophthalmos and ptosis had greatly diminished.

He was admitted into the South Union Workhouse, where I attended him. A subcutaneous injection of morphia relieved the pain somewhat. He was ordered the iodide of potassium; in a few days the pain lessened, and in about a week he left the Workhouse. The exophthalmos and

ptosis gradually subsided. The patient now returned to work, but still continued taking the iodide of potassium, and visited me regularly. By-and-by I noticed a slight droop in the right eye-lid, which increased rather rapidly until there was well-marked ptosis. The patient did not complain of any pain, but, on the contrary, stated that he felt perfectly well. Pari passu with the ptosis, the right oculomotorius became almost completely paralysed. The swelling and prominence of the disks had subsided, and both optic nerves showed signs of atrophy. The patient continued taking the iodide of potassium, and was able to pursue his employment.

On the 24th of March his wife brought him to the National Eye and Ear Infirmary. She stated that four days previously she noticed a strangeness in his manner; at one moment he would be cheerful and even boisterous, and then shortly afterwards he would become morose, and inclined to quarrel. She attributed it to his having gone out that day with a friend, and partaken of some liquor. I should mention that, from the first, I had forbidden him to take any stimulants, and I have every reason to believe that, up to this date, he obeyed my injunctions.

On examining him I found him greatly changed; he looked heavy and stupid; he complained of great pain in the right eye; his memory was defective, for he had forgotten my name, though he recollected the day of the week, &c.

He was again admitted into the South Dublin Union, and the same evening, it appears, he was rather violent, and had to be restrained. Subsequently he became quiet, and remained so the rest of the time he stayed in the Workhouse. He had frequent fits of crying—in fact, if he saw any one with whom he had formerly been acquainted, he was immediately moved to tears. I prescribed the iodide of potassium, finding it of such service before.

On the 30th of last month (April) his wife came to me, and stated that on visiting him that morning she had found him very ill; that he had lost the power of one side, and could not speak. I saw him the same day, and found him hemiplegic on the right side; his speech was quite thick and unintelligible, and he was frequently crying. The ward-man stated that he found him in this condition in the morning when he went to get him out of bed. Contrary to my wishes, his wife insisted on taking him home. I have seen him twice since; he is regaining some power over the leg and arm, and his speech is also improved.

Such is the history of this very interesting case. I am fully satisfied in my own mind that it is one of tumour in the brain, for the symptoms warrant such a conclusion, and the appearance of the optic nerve is typical. At the same time I find very considerable difficulty in arriving at any very definite conclusion as to the locality of the tumour.

I now pass on to consider briefly the theories which have been put forward to account for this congested condition of the disk in cases of cerebral tumour; and first in order stands that proposed by Von Graefe. According to him, pressure upon the cavernous sinus is the starting-point of the process. "This pressure," he says,[a] "necessarily produces a stasis in the retinal veins, which become very large and tortuous. The swelling of the disk from serous effusion and hypertrophy of the cellular tissue, which in course of time follows, is also very easily accounted for by this mechanical hyperæmia."

Another very important factor in the production of these conditions, and one which Graefe lays great stress on, is the unyielding sclerotic ring, which, as he expresses it, "acts the part of a multiplier."

This is the explanation given by Von Graefe as to the mode in which the Stauungs Papilla, as he terms it, is produced, and greatly modified, as it has been lately, by the investigations of Schwalbe and Schmidt, the "pressure theory," if I may so term it, still counts the largest number of supporters. The theory which stands next in chronological order is that propounded by Benedict.[b] He looks upon the neuro-retinitis as due to a morbid innervation of the sympathetic, which is itself a symptom of the most varied cerebral diseases. A full account of this theory may be found in Dr. Allbutt's admirable work, already referred to, where it is also criticised in a most able and masterly manner.[c]

Dr. Hermann Pagenstecher, who is an upholder of Benedict's theory, in an interesting paper on Optic Neuritis,[d] published in the London Ophthalmic Hospital Reports, enumerates the following objections against Graefe's theory:—

"1. The cavernous sinus is a blood canal surrounded with such impervious walls as are rarely to be met with, and a pressure sufficient to really compress this must, since the pressure within the cranium must be regarded as equal in all directions, exercise enormous pressure on all the other blood-vessels."

"2. The vena ophthalmica superior, and vena ophthalmica inferior anastomose extensively, both with one another and also with the facial vein. And although the vena centralis retinæ empties itself almost immediately into the cavernous sinus, yet it previously anastomoses freely with the vena ophthalmica superior. But besides these anastomoses, it is quite indifferent whether the discharge takes place at the vena ophthalmica or into the cavernous sinus, since both are continuous, and the return of the blood suffers no hinderance so long as the way through the facial vein is patent."

[a] Loc. cit.

[b] Elektrotherapie, Wien., 1868, p. 249, et seq.

[c] Op. cit., p. 119.

[d] The Royal London Ophthalmic Hospital Reports, Vol. vii., Pr. ii., p. 160.

This objection was first raised by Sesemann, who has written a very interesting paper on the orbital veins, in Du Bois Reymond's Archives.[a] I shall merely quote one passage from it: —

"I am decidedly of the opinion," he writes, "as the result of my investigations, that in most cases the blood from the ophthalmic vein flows both into the sinus and into the facial; but, indeed, I think that by far the greater part empties itself into the latter. I arrived at this conclusion from the fact that the diameter of all the openings into the facial is greater than that into the sinus cavernosus, which is sometimes so small that only a very little of the blood can find its way through it. . . . In my opinion the inferior ophthalmica vein serves not only to carry away the blood out of the other orbital veins, but also serves as an outlet, a so-called 'emissary vein' of Santorini for the sinus cavernosus. All the other sinuses have such emissaries, why should not the ophthalmic have the same relation to the sinus cavernosus? The emissaries, as a rule, empty themselves into the sinus, and it is only when the pressure in the latter is increased above what it is in the other veins connected with it, that the blood finds its way through them. This is what occurs in the ophthalmic, as much blood as can make its way through the narrow opening into the sinus does so, the rest flows into the anterior facial. But should the pressure in the sinus, through any circumstance, be increased, the ophthalmic not only discharges its contents into the facial, but, moreover, carries off the blood from the sinus."

If Sesemann's investigations be accepted, they must prove fatal to the "pressure theory," as expounded by Von Graefe, and indeed they appear to be generally viewed in this light by most recent writers on the subject.

To return to Dr. Pagenstecher's objections.

"3. Not every increase of cerebral pressure is followed by neuritis, and, undoubtedly, neuritis occurs when there is no such increased pressure.

"4. Optic neuritis is sometimes one-sided, and, indeed, has been often observed on the side opposite to the cerebral lesion, whilst the eye on the same side has remained perfectly normal."

The latest theory is that advocated by Schmidt, and is based upon some experiments he has made (similar to Schwalbe's) of injecting fluid into the arachnoid space.[b] He asserts that the injection fills the intra-vaginal space of the optic nerve, and that it "then empties itself into a 'canal system' which ramifies in the lamina cribrosa. He concludes therefrom that the Stauungs Papilla arises from increased intra-ocular pressure, due to Stauung of the injected fluid in the canal system continuous with the arachnoid cavity."[c]

[a] Archiv. f. Anat. u. Phys., 1869, No. 2.

[b] Archiv. f. Oph., Vol. xv., Pt. ii., pp. 193, 197.

[c] Allbutt. Op. cit., p. 57.

This theory has very recently been called in question by Dr. Forlanini, in the Italian Annals of Ophthalmology.[a] Dr. Forlanini has repeated Schmidt's experiments frequently, but without success.

Pagenstecher says,[b] "one would be inclined to accept this theory as soon as one became convinced of the existence of such a system of canals in the lamina cribrosa as are presupposed;" but, he adds, that hitherto he has been unable to demonstrate it.

Such are the theories held regarding the mode in which the Stauungs Papilla is produced. It will be seen that the question is far from being definitely settled yet. Perhaps I ought to mention one practical point in connexion with the subject, which may possibly be urged in favour of Schmidt's theory. At the meeting of the International Ophthalmological Congress, held in London the year before last, Dr. de Wecker, of Paris, read a paper on an operation he had devised for the treatment of neuro-retinitis. It consists in making an incision in the sheath of the optic nerve and sclerotic ring, and so giving exit to the contained fluid. He had performed this in only two cases, both of them supposed to be cases of tumour in the cerebrum. The neuro-retinitis was regressive in both cases. Nevertheless though there was little or no improvement in the vision, the intense head-ache was in one case relieved; and in the other case the patient, who, before the operation, was affected with weakness of the legs, was afterwards able to stand more firmly and answer questions promptly. He appeared greatly pleased with the result himself. An account of the operation will be found in the report of the Congress.[c]

In the last volume of the St. Bartholomew Hospital Reports, Mr. Power records an interesting case of optic neuritis,[d] in which he performed this operation. He states, that "it seemed to relieve the pain, which was intense."

In concluding, I would wish to correct a rather widely spread, but most erroneous impression, which is this—that Von Graefe regarded the Stauungs Papilla as *absolutely* diagnostic of the presence of a cerebral tumour. Such is not the case. Graefe looked upon this condition of the optic disk as merely the *expression* of increased intra-cranial pressure, and, consequently, that whatever caused an increase of the pressure would also produce this swollen state of the disk. That it may be present in cases where there is no intra-cranial tumour there is no possible doubt, and Graefe did not deny it. This drawing, which I made from a case under Dr. Gordon's care, exhibits the prominence and swelling of the disk in a very high degree; yet, I believe there is no

[a] Annali di Ottalmologia. Pt. I. 1871.

[b] Loc. cit.

[c] Report of the Fourth International Ophthalmological Congress, held in London, August 1872, p. 11.

[d] St. Bartholomew's Hospital Reports. Vol. IX. 1873. p. 196.

possible doubt that this was a case of very severe meningitis. The patient, a young girl, was in a semi-comatose state when I made this drawing. She recovered, but the sight is gone. There is complete atrophy of both optic nerves.

I am aware that an objection may here be urged to the effect, that if the same appearance can be produced by a cause other than tumour of the brain, such appearance is after all of very little practical value as a diagnostic sign. To this I would answer, that apart from a most careful study of all the symptoms in any particular case, it can scarcely be looked upon as of any special diagnostic value; but that, on the other hand, due regard being paid to those symptoms, it must prove of invaluable assistance in forming a diagnosis. "My own opinion certainly is," says Dr. Allbutt,[a] "that changes either of a congestive, neuritic, or atrophic character may be found in the disks, at some time or other, in the course of almost all cases of intra-cranial tumour. The diagnosis of a case of this kind is therefore incomplete unless the eye-mirror has been carefully and repeatedly used."

[a] Op. cit., p. 118.