THE BRITISH JOURNAL
OF
OPHTHALMOLOGY,
DECEMBER, 1927

COMMUNICATIONS

SOME REMARKS ON LAGRANGE'S SURGICAL
TREATMENT OF DETACHMENT OF THE
RETINA

BY

DR. J. A. VAN HEUVEN

UTRECHT, HOLLAND

IN the beginning of the year I ventured to put in a plea for the colmatage of Felix Lagrange as an efficacious and perfectly harmless remedy in cases of detachment of the retina. The treatment consists in making a triple row of punctures with a galvano-cautery or thermo-cautery in the sclerotic after first loosening the conjunctiva round the cornea. The conjunctiva is then replaced and fixed by means of a suture.

According to Lagrange the following consideration must be taken into account. In practically every case of detachment of the retina, tension is lowered and, taking into consideration the fact that there is an increase of intra-ocular pressure after colmatage, the already detached retina is once more pressed down against the wall of the eye; for it was an axiom with Lagrange that every case of colmatage gave rise to increased intra-ocular pressure. This, in his opinion, might be accounted for as follows:

By the formation of a cicatrix at the cauterized spot a constricting ring would be formed at the place where the fluid in the eye normally escapes. Now intra-ocular pressure did increase in the

case of several patients treated by me according to this method—and in some cases an improvement in vision and field of vision sets in.

Let me give here a short summary of the results obtained by this method. I treated 15 eyes with colmatage and for that purpose chose every case of detachment of the retina that came under my observation without selecting any particular case. The consequence was that the most divergent cases of detachment of the retina were treated with colmatage. I was convinced beforehand by experiments on rabbits that by doing so no harm would accrue and moreover, in this manner, was able to arrive at definite indications as to when colmatage might be performed, which may be stated briefly as follows:

That favourable results must not be expected from colmatage in those eyes in which detachment is of long standing, or those which are extremely myopic, or those in which the lens is absent. In the most favourable cases, eyes in which there exists a traumatic detachment of the retina, and eyes which are comparatively speaking normal, the prognosis after colmatage is better than after the usual conservative therapy. We do indeed meet with cases in which the retina shows a tendency to become re-attached even when treated according to the older method, especially after rest in bed, bandaging, injection of atropine; but as soon as the patient is discharged a relapse nearly always ensues. This is not the case after colmatage. The retina which has once become attached, remains united even after the patient has been discharged. Moreover, it is clearly shown from the series of eyes treated, which so far amount to forty-seven, that in each case the intra-ocular pressure increases after colmatage. I have never met with a single exception, either in treating human eyes, or in the case of those tests performed on animals. This increase of intra-ocular pressure has a good effect where, as is generally the case in detachment of the retina, the eye has an abnormally low tension.

In conclusion, I might add that colmatage never has an injurious effect, and is sometimes, in particularly favourable instances, certainly more beneficial than the older methods.

However auspicious these cases may be in an affection which, as regards improvement or cure, is considered so intractable, I felt in the first place the need of a somewhat firmer theoretical ground to stand on than mere hypothesis—even though it has originated in the ingenious brain of Lagrange. It was with the desire to arrive at greater theoretical certainty that I started the following experiment.

I first of all noted the effect on intra-ocular pressure in rabbits after colmatage. By performing colmatage early in the morning, it was possible to establish a continuous series of measurements of intra-ocular pressure for 15 hours in succession. The results obtained will appear from the following tables and curves:

TABLE I.

7-8-1926. Rabbit, weight 4500 gr.
T.O.D. before and immediately
after colmatage = 19mm. Hg.

after 1 hour	17	"
" 2 hours	16	"
" 3 "	16	"
" 4 "	16	"
" 5 "	17	"
" 6 "	18	"
" 7 "	20	"
" 8 "	22	"
" 9 "	23	"
" 10 "	23	"
" 11 "	23	"
" 12 "	23	"
" 13 "	23	"
" 14 "	23	"
" 15 "	23	"
" 24 "	24	"

TABLE II.

7-8-1926. Rabbit, weight 4500 gr.
T.O.S. before and immediately
after colmatage = 19mm. Hg.

after 1 hour	18	"
" 2 hours	17	"
" 3 "	16	"
" 4 "	17	"
" 5 "	17	"
" 6 "	18	"
" 7 "	18	"
" 8 "	19	"
" 9 "	20	"
" 10 "	20	"
" 11 "	21	"
" 12 "	21	"
" 13 "	22	"
" 14 "	22	"
" 15 "	22	"
" 24 "	23	"

After a fall, which as a matter of fact commences directly after colmatage—indeed it already amounts to 2 mm. Hg. and lasts several hours, the pressure slowly begins to rise until it has reached its original position $6\frac{1}{2}$ hours after colmatage.

This rise goes on at first rapidly and afterwards at a slower rate. A value considerably in excess of the normal is reached.

Although differences exist between these values and those found in the right eye of the same rabbit, the remarkable coincidence will at once strike one; to make assurance doubly sure a third test was made.

TABLE III.

9-8-1926. Rabbit, weight 3900 gr.
T.O.D. before and immediately
after colmatage = 22mm. Hg.

after 1 hour	21	"
" 2 hours	19	"
" 3 "	18	"
" 4 "	19	"
" 5 "	19	"
" 6 "	20	"
" 7 "	20	"
" 8 "	21	"
" 9 "	22	"
" 10 "	23	"
" 11 "	24	"
" 12 "	25	"
" 13 "	26	"
" 14 "	26	"
" 15 "	26 $\frac{1}{2}$	"
" 24 "	29	"

Here again one is struck by the fact that, though there are generally speaking, comparatively slight variations, the intra-ocular pressure, 24 hours after colmatage, is practically uniform with those obtained by previous tests as is shown in the curve (Fig. 1).

What then will be the course of intra-ocular pressure during the next few days? To a certain extent this may be gathered from the curve in Fig. 2, which gives the course of intra-ocular pressure in the case of four human eyes during the first six months after colmatage.

FIG. 1.

FIG. 2.

The course of the curve which registers the intra-ocular pressure is very nearly the same and consistently uniform. After a rapid rise during the first week there is a fall, which is at first more rapid than afterwards, and which subsides very rapidly. There is after six months have elapsed a higher degree of intra-ocular pressure than before colmatage.

A summary of the foregoing results leads me to infer that colmatage is followed by changes of intra-ocular pressure. After a comparatively slight fall which lasts a few hours, there is a considerable rise, which, it is true, decreases, but so gradually that the pressure is higher after six months have elapsed than before colmatage.

Another problem which has engaged my attention is an estimation of the percentage of albumen in the fluid of the anterior chamber. There exists a fairly extensive literature on the subject and there are various methods of determining it. Generally speaking, one gathers from the literature that with a concentration of albumen of 0.1 per thousand, the method most to be recommended is to ascertain the superficial tension. Dieter indicates a way of ascertaining this. In cases of concentration of albumen from one per thousand to one per cent. chemical methods should be used. Wesseley in particular attaches much importance to this method. Wesseley's method of estimating the percentage of albumen is of great value on account of its simplicity and reliability, at least, when the concentration of albumen in fluids is between one per thousand and one per cent. If the percentage of albumen is higher it is better to use a refractometer. Wesseley's method is very often wrongly applied and he calls our attention to this. The point is to compare the density of the turbidity which arises when Esbach's reagent is added to the serum. If the mixture is no longer fresh and therefore already precipitated, it should be well shaken before being used. Standardization necessary for this, is obtained by first determining the percentage of albumen in fresh serum, for instance, by precipitation and weighing or by using the refractometer. By then diluting the serum with a physiological solution of chloride of sodium we get the concentration of albumen to 1/1000 per cent.; a small quantity of which is then taken, for instance, four drops, and the same amount of Esbach's reagent added to it. Wesseley then corks and seals the tubes and keeps them in a good state of preservation for several weeks. By melting them, after first adding a trace of carbolic acid, I have succeeded in keeping them for months, and I opine they might be kept for an almost indefinite time.

I have, in this manner, endeavoured to determine the percentage of albumen in rabbits, both before and several times after colmatage. But here a difficulty presented itself, for the formation of albumen in the fluid after puncture had to be taken into consideration. We

have to reckon with the increase in the percentage of albumen. The amount is, according to Wesseley, far higher in rabbits than men.

Wesseley found that in the case of fully grown rabbits there was a percentage of albumen in the first fluid in the anterior chamber from 0.02—0.03 per cent. and 3.5—4.5 per cent. in the second.

In these tests, however, the second puncture of the fluid in the chamber was made a short time (16 to 20 hours) after the first and the percentage of albumen is not nearly so high a few weeks after the first puncture. A slight rise, however, may be attributed to the regeneration of the fluid in the chamber. This of course holds good only in the second instance but not in the first.

It was therefore of importance to measure the percentage of albumen in the fluid of the chamber in eyes that had not first been punctured. It was impossible first to determine the percentage of albumen in the same eye, afterwards to perform colmatage, and then determine the percentage of albumen again. This difficulty was overcome by selecting rabbits with normal eyes. The percentage of albumen in the fluid of the chamber was first determined in one eye and then colmatage performed on the other eye, and, at various times afterwards, the percentage of albumen in the fluid was determined; it being of course assumed that the percentage of albumen in the fluid was the same in both eyes; an assumption to which there can be very little objection.

The results were as follow :

TABLE IV.

Weight of rabbit in grammes.	Percentage of albumen in the liquid of the anterior chamber. O.D.	Percentage of albumen of the anterior chamber after colma- tage, after one day. O.S.	After one week.	After one month.	After two months.
3100	<0.02	0.5	—	—	0.02
3600	>0.02	—	0.1	—	0.02
3050	<0.02	—	—	0.3	0.02
3200	>0.02	0.4	—	—	0.03
3450	0.03	—	0.2	—	0.04
3300	>0.02	—	—	0.4	0.04
3550	0.03	0.4	—	—	0.03
3250	0.03	—	0.3	—	0.02
3350	>0.03	—	—	0.3	0.02
On an average	>0.02	0.4	0.2	<0.04	>0.02

It is therefore a fact that the percentage of albumen in the fluid of the chamber increases after colmatage as is shown in Fig. 3.

The question is, can this, wholly or in part, explain the increased intra-ocular pressure?

The most recent views on the subject may be epitomized as follow:—We may, basing our assumptions on the above-mentioned data, regard intra-ocular pressure as the intra-ocular blood pressure in the capillaries which is directed to the fluid in the chamber diminished by the colloid plus crystalloid pressure in the blood, which is directed against it. In the same manner—to the fluid in the

FIG. 3.

chamber—the crystalloid and colloid osmotic pressure of the fluid in the chamber is directed. If therefore the colloid osmotic pressure increases—and this is the crux of the matter—there will also be an increase of intra-ocular pressure. So we see that the increase of the percentage of albumen in the fluid of the chamber is without doubt one of the causes of the rise in intra-ocular pressure after colmatage. It appears however, from the course of the curve, that there is considerable incongruity between the two. This proves that the increase of intra-ocular pressure is certainly not due to the percentage of albumen alone.

Another question that arises is, can the width of the blood-vessels be an explanation of increased intra-ocular pressure after colmatage?—or to put it more accurately—what rôle does the width of the blood-vessels play in the case?

In order to enable us to form an opinion the following facts must be taken into consideration. Ocular pressure is determined by the

blood pressure in the capillaries and influenced by osmotic changes. Now it is evident that no direct relation exists between blood-pressure and the pressure in the capillaries. This is obvious from the intra-ocular capillary pressure as found in normal eyes. There is but slight variability in capillary pressure, whereas the blood pressure varies considerably. For metabolism the most important part is the capillary region. Everything is adapted so as to ensure the most favourable conditions as regards pressure and circulation. The pre-capillary arterioles play an important part as regulative agents. Arterial pressure is determined by the aggregate amount of the peripheral resistances and whenever arterial pressure is high (nephritis) a steady pressure is kept up in the capillaries automatically.

By his investigations Wesseley has proved that by using adrenaline, which causes the blood-vessels to contract, intra-ocular pressure decreases with increase of blood pressure. Adrenaline makes the capillaries contract. But the mass of the contractile elements is slight, compared with the arteries and arterioles, with the consequence that while pressure increases up-stream it decreases down-stream. So pressure diminishes in the capillaries and this causes a fall in intra-ocular pressure. In contrast to this, amyl nitrite causes great general dilatation of the blood-vessels and decrease of blood pressure which brings about increased intra-ocular pressure.

To epitomize all that has been published about *the width of the blood-vessels* in connection with intra-ocular pressure would be going too much into detail. To put it briefly, the action of specifics is vascular. One theory is certain, *viz.*, that the width of the blood-vessels has an influence on intra-ocular pressure. The *hyperaemia*, which sets in after colmatage, and usually lasts from 10 to 20 days, may in itself be regarded as a factor which tends to increase the pressure. If, however, a stimulus excites a tissue, it first reacts by producing an anaemia of short duration by contraction of the vessels, followed by hyperaemia, and, if the stimulus has been exceptionally strong, by symptoms of inflammation. In this way it may be possible to find a cause for the initial decrease of ocular pressure after colmatage and to regard it as a reflex cramp of the vessels. The exposure of the sclera is in itself a factor which might tend to diminish pressure.

The fact has already been established, that increase in the percentage of albumen in the fluid of the chamber and vascular dilatation are important factors in the explanation of the increased ocular pressure after colmatage. Both these factors are due to the stimulus which is applied to the wall of the eyeball round the cornea. They are both factors, which might be brought about by stimulating the same place in a different manner, until these inflammatory symptoms appeared; in other words, there is no specific "colmatage-action."

On one of the first occasions that he saw colmatage performed, Professor Snellen made the following remark: "I wonder whether the loosening of the conjunctiva does not also give rise to increase of pressure." And a light is thrown on this remark by the following account. For if the pressure-increasing action of colmatage is due to symptoms of inflammation as shown by the increase in the percentage of albumen and in the width of the vessels the simple fact of the loosening of the conjunctiva must have a similar though less pronounced effect. The right eye of a rabbit of 3100 gr. had a tension of 20 mm. Hg.; after the conjunctiva had been loosened the pressure remained 20 mm. Hg. Here pressure increased very little, but may have risen temporarily. The left eye of the same rabbit had a percentage of albumen in the fluid of the chamber of 0.03 per cent. There was in the fluid of the chamber of the right eye a percentage of albumen of 0.05 after ten hours. Here there is an appreciable rise. Both these figures show that in principle Snellen was right. In short my contention is, that Lagrange's opinion, that increase of pressure after colmatage is caused by a constricting ring formed by cicatrization, has never been definitely proved.

Most decidedly it is not the only cause of increase in pressure. Certainly colmatage does bring about an increase of intra-ocular pressure. There is a considerable increase in the percentage of albumen in the anterior chamber of the eye. And the question arises; does not this increase, which is considerable even in rabbits with normal eyes, become more pronounced in eyes in which there is a detachment of the retina? *

The views entertained at present about hydrodynamic and osmotic forces in their relation to intra-ocular pressure, make it reasonable to suppose that the rise of colloid osmotic pressure in the fluid of the chamber will be followed by an increase of intra-ocular pressure. Here we have at any rate one factor that certainly plays an important part. Then what we know about the width of the vessels in the eye in connection with intra-ocular pressure also fits into our scheme. It is not impossible that the constricting ring of Lagrange may play a more or less important rôle in some cases. In any case the discharge will be impeded on account of the increase of viscosity of the fluid in the chamber. These are all factors which make for increase of pressure in the eye, and there may be others with which we are at present unacquainted.

Tension increases; now the question is, does the fact of the increase of intra-ocular pressure also imply that the retina is pressed against the wall of the eye. An answer in the affirmative is not possible until the matter has been more thoroughly investigated.

The condition which exists in detachment of the retina may be conceived of thus: in a space filled with liquid, the eyeball, a membrane partially detached is suspended—in other words—the

membrane is surrounded on both sides by liquid. Pressure exercised on one part of this liquid mass does not force the retina against the wall—the fluid at the back preventing any such pressure being effective. A part may perhaps be forced out through the lymph paths, but owing to the great increase in the percentage of albumen in a part of the retina, there will undoubtedly be osmotic action in which the retina acts as a semipermeable membrane.

This explains why fluid enters in front of the retina and is discharged at the back.

I consider the effect of colmatage is partly due to this, and that it plays an important rôle in these cases in which the retina adheres after colmatage.

REFERENCES

- Dieter.—*Arch. f. Augenheilk.*, Vol. XCVI, 1925.
 van Heuven.—*Klin. Monatsbl. f. Augenheilk.*, Vol. LXXVI, 1926.
 Lagrange.—*Glaucome et Hypotonie*. Paris: Doin, 1922.
 Wesseley.—*Arch. f. Ophthal.*, Vol. L, 1900; Heidelberg Congress, 1920;
Arch. f. Augenheilk., Vols. LX, LXXVIII, LXXXIII, and LXXXVIII.

THE HISTORY OF OPHTHALMOLOGY IN EGYPT

BY

A. F. MACCALLAN, C.B.E.

LONDON

An important communication on the history of ophthalmology in Egypt was made by Dr. Meyerhof at the Annual Congress of the Ophthalmological Society of Egypt in this year. It deals mainly with the Nineteenth Century, but his preface contains some items of great interest concerning earlier times. The excavation work of Dr. Reisner near the Pyramids of Giza is well known to Egyptologists, and his recent discovery should be known to ophthalmologists. He has found the funeral stele belonging to the earliest known oculist of human history, whose name is PEPI-ANKH or IRI. He practised both as an oculist and a magician at the court of one of the kings of the Sixth Dynasty, about 2500 B.C. This interesting document will shortly be published by Professor Junker of Vienna in the *Aegyptische Zeitschrift*.

The development of ophthalmology as shown in early Arabic literature has been studied also by Meyerhof, and an article on the subject appeared in the February number of this journal.

The first famous medical traveller in Egypt was the Venetian, Prospero Alpino, who sojourned in Cairo from 1580 to 1584. He published in Venice a book which saw many editions, the last