THE ADRENALINE PACK IN THE TREATMENT OF GLAUCOMA.

ITS VALUE IN TEMPORARILY REDUCING THE INTRAOCULAR PRESSURE.

BY

R. E. WRIGHT, M.D., C.I.E.,
LIEUTENANT-COLONEL I.M.S.,
SUPERINTENDENT, GOVERNMENT OPHTHALMIC HOSPITAL, MADRAS;
AND

K. KOMAN NAYAR, L.R.C.P. AND S., D.O.M.S.,
ASSISTANT SUPERINTENDENT.

In the last decade a large amount of experimental work and clinical investigation has centred round the non-operative treatment of glaucoma. The mass of published material reveals one method which not only has a very practical value, but also raises points of great theoretical interest. We refer to the use of the adrenaline pack. Of the newer non-operative aids to treatment in this condition three stand out prominently: first, the instillation

and the patient, and in our hands less frequently of value than the adrenaline pack.

The intravenous injection of hypertonic salines we have only found of service as an emergency measure in acute intractable glaucomas as a preliminary procedure to an emergency iridectomy. However useful, therefore, in a large hospital in occasional cases, it is unsuited for purposes of general utility.

The third method, on the other hand, has proved such a simple and expeditious aid to treatment that we wish to express ourselves in support of those who have favoured its use. We would, however, like to make it perfectly clear that in our experience the best single non-operative method of treatment is the efficient instillation of eserine, that no combination of non-operative methods of which we are aware obviates eventual operative treatment by decompression, and that of such operative procedures we prefer trephining in the majority of cases. It is in chronic primary glaucoma that we have found the adrenaline pack of greatest use. In such cases it may frequently be expected to act as a powerful adjunct to ordinary non-operative treatment. We do not suggest that it gives constant results, but it will sometimes reduce the tension

CHART 1.

CHART 2.

CHART 3.

CHART 4.

CHART 5.

CHART 6.

CHART 1.—Man, aged 75. Primary glaucoma, chronic non-congestive; posterior segment type; shallow anterior chamber. In each of the charts the continuous line refers to the right eye, and the dotted line to the left eye.

CHART 2.—Woman, aged 35. Glaucoma, chronic congestive. Anterior chamber normal. Deep cupping both eyes.

CHART 3.—Woman, aged 60. Glaucoma, chronic congestive; posterior segment type; shallow anterior chamber. Continuous eserine, left eye, throughout.

of the "glaucomans" advocated by Hamburger; secondly, the intravenous injection of hypertonic sodium chloride solution (30 per cent.) as described by Duke-Elder; and thirdly, the employment of a pledget of cotton-wool soaked in adrenaline and placed in the superior fornix of the conjunctiva, originally advocated by Gradle, and subsequently reported on favourably by S. R. Gifford and others.

During 1928-29 we pursued a clinical study of over a hundred cases of primary glaucoma from different points of view, but chiefly with the idea of exploring non-operative methods of treatment. The analysis of the series has not yet been published and will take time. Meantime, we consider that it may be of interest to indicate briefly our experience of the three methods referred to, and illustrate by charts some interesting features of the adrenaline pack.

With regard to the first, after a number of observations on the effect of glaucoman drops and amino-glaucoman, we are inclined to agree in the main with the somewhat unfavourable conclusions arrived at by Duke-Elder and Law in their recent article in the *British Medical Journal* of March 30th (p. 590). Of the two, we found that amino-glaucoman, although inconstant in its action, was preferable. It is, however, more troublesome both for the doctor

CHART 4.—Man, aged 60. Glaucoma, primary simple. Anterior chamber normal. Cupping each eye. Continuous eserine treatment.

CHART 5.—Man, aged 56. Glaucoma, primary chronic congestive; posterior segment type; shallow anterior chamber.

CHART 6.—Woman, aged 35. Glaucoma, chronic congestive; posterior segment type; shallow anterior chamber. Continuous eserine treatment throughout.

where intensive eserine treatment in combination with other measures fails, and sometimes in a most dramatic manner. It also proves of the greatest value in controlling the tension prior to operation. Usually the first effect of the pack on the glaucomatous eye is to raise the tension. This preliminary rise takes place in the first eight hours; soon a fall sets in, which brings the tension below its original level inside twenty-four hours. The fall tends to continue, and may not reach its maximum till the third day, or possibly later. The preliminary rise may not occur, especially in moderate tensions, or it may be greatly diminished or even prevented by the frequent instillation of eserine, 1/2 per cent., before and after the pack. The fall is temporary, and may in certain cases be small and of short duration. We have known it to fail altogether or to be well marked, but succeeded by a rise in a few hours. Sometimes after several apparently good responses the tension settles down at a higher level than before the treatment was instituted. In moderate cases the fall can be prolonged by the use of eserine. The pack may be used, therefore, to give eserine a start, as it were, and allow it to exert its maximum effect. When the tension starts rising again, in spite of miotics, massage, etc., there appears to be no reason why the pack should not be

repeated. We have effectively repeated this procedure five and six times at short intervals. Up to now we have chiefly used the method in cases where the ordinary non-operative treatment was practically ineffective and in which we desired to get the eye into a more favourable state for operation. It is not our object in this communication to do more than draw attention to the frequently favourable results of the adrenaline pack on the tension in glaucoma of moderate extent. At the same time, we would like to show some effects of considerable theoretical interest in connexion with its use in very high tension cases.

The Method.

The eye is anaesthetized by two or three instillations of 2 per cent. holocaine. The tension is taken with an instrument (we usually use a Bailliart's tonometer) if it is desired to make accurate chart records. If we wish to try and obviate the initial rise of tension due to the adrenaline it is desirable to give eserine frequently before and after the pack—say, six instillations in the hour before, and six half-hourly instillations after. A small flattened pledget of wool is soaked in ordinary adrenaline chloride solution (1 in 1,000, P., D. and Co.), and whilst the patient looks down and the lid is elevated with a retractor, it is laid in the superior fornix and the eye closed. It is left there for five minutes. Should eserine not be used in conjunction with the adrenaline the tension is more likely to rise, but even with marked rises we have not seen an untoward result; there has always been a fall again the following day. In the ordinary case of primary glaucoma the reactions are moderate, and may be slight and hard to demonstrate with the tonometer, although the fall is usually definite.

In badly damaged eyes with excessive tensions, however, more startling effects may be obtained, some of which are quite contrary to what might be expected, and more interesting in view of the fact that the vascular tunic in such eyes is markedly atrophic. A few selected charts will better illustrate various responses to the adrenaline pack.

Chart 1.—A case of moderate tension in which there was no rise immediately after the pack on the first occasion and actually a fall on the second. Eserine was freely instilled as described above, before and after the pack. Operation was undertaken before the fall due to the second pack had passed. Eserine alone at first reduced the tension, but it rose on the sixth day.

Chart 2 shows the effect of numerous packs in a case where there was high tension in both eyes. The first pack in the right eye acted well on both, but the second pack, given in the left eye, did not reduce the tension in the right. Thereafter packs were given on both sides. The last packs were not very effective.

Chart 3 shows marked rises immediately after the packs in an eye of moderate tension. The value of the pack in such a case would appear to be doubtful. Small corresponding rises are shown in the untreated eye, which was apparently normal.

Chart 4 shows a marked late fall of tension due to the adrenaline pack without an immediate rise. The tension in the other eye, which did not get adrenaline, shows corresponding variations of tension. The fall due to the pack (in spite of eserine) is not well maintained after the first pack. It is of somewhat longer duration after the second. The patient was eventually treated by operation.

Chart 5 shows the effect of the pack on an eye of very high tension. The rises immediately following the pack are small; the falls are comparatively small and of short duration. A curious feature is the effect on the opposite eye, where the tension behaves in a converse manner to that in the treated eye.

Chart 6 shows the effect of eserine and the adrenaline pack with corresponding falls in the untreated eye. Eventually, after a number of badly sustained falls, a low-level tension of longer duration was obtained.

THE ACETIC ANHYDRIDE TEST OF THE SPINAL FLUID.

BY

G. L. PIOTROWSKI, M.D. GENEVA, M.R.C.S., L.R.C.P.,
PRIVAT-DOCENT AT THE FACULTY OF MEDICINE OF GENEVA.

J. G. Greenfield and E. A. Carmichael have investigated the value of the acetic anhydride test. The reaction was found to be positive in 15 out of 16 cases of dementia paralytica, and a positive reaction might also occur in secondary neurosyphilis; cases of cerebral degeneration were said to give a weak reaction. Greenfield and Carmichael suggested that the reaction might be due to an increased cholesterol content of the spinal fluid.

I have investigated the acetic anhydride test in 88 cases, and give here my first impression on its value. When the investigation could not be undertaken at once we always kept the fluid in the ice-chest, but never waited more than twenty-four hours. One cubic centimetre of fluid is measured in a test tube, and 0.3 c.cm. of acetic anhydride is added; it is then shaken so as to produce an emulsion, and then, drop by drop, 0.8 c.cm. of pure sulphuric acid is introduced. As we often proved, it is of the utmost importance to add the sulphuric acid very slowly; a negative fluid may give a positive result if the sulphuric acid is run in too quickly. In the case of a positive reaction a lilac tint of varying shades appears, but in my opinion is not so fleeting as the authors describe it.

The numeration of the cells of the cerebro-spinal fluid was made with the Nageotte's counting chamber, and the quantity of albumin estimated with the Sicard and Cantaloube process (precipitation by trichloroacetic acid); the globulins were detected by the Nonne-Apelt and the Pandy tests. The following are the results in a few diseases.

General Paralysis of the Insane (10 cases).—No relation was found between a positive Wassermann reaction and a positive acetic anhydride reaction, and no association between it and the presence of globulins. In the four negative cases the number of cells per cubic millimetre was always below 3, and the albumin below 0.035 per cent. The acetic anhydride test was strongly positive in two cases, and positive in four patients; in all these cases the cell count was more than 20 cells per cubic millimetre.

Tubes (5 cases).—None of the cases we investigated had more than 5 cells per cubic millimetre in the spinal fluid, and all gave a negative test.

Meningitis (15 cases).—In 6 cases of tuberculous meningitis we had 4 positive reactions and 2 negative; of these last cases one contained 37 cells per cubic millimetre and the other 15 cells, with an albumin content of 0.044 and 0.025 per cent. In three of the positive cases the diagnosis was confirmed by a post-mortem examination. In one case of staphylococcal meningitis of unknown origin (the patient was comatose when admitted to the hospital), with thrombosis of the cavernous sinus, there was a strongly positive acetic anhydride reaction, the spinal fluid being almost pure pus. In two other cases of meningitis there were positive reactions; in one of these an abscess of the temporal lobe was found at the necropsy, but no organism could be found, and the origin remained unknown. In these three cases the albumin was as high as 2.0 per litre, and the cells were innumerable.

Syphilitic Meningitis and Cerebral Lucs.—A negative test was obtained in an old-standing case, treated when the cerebro-spinal fluid was normal; in two other cases the test was doubtful. Cytological examination of the spinal fluid revealed 6 and 16 cells per cubic millimetre; 0.025 to 0.035 per cent. of albumin was present, and the Wassermann reaction was positive. In the other cases the test was strongly positive; the meningeal reaction was also positive, there being 80 to 310 cells per cubic millimetre.

Congenital Syphilis.—Two cases, with a negative fluid and a negative test.

Meningeal Haemorrhage (4 cases).—Negative test in all; the spinal fluid contained blood.

Cerebral Degeneration (10 cases).—We could only investigate the anhydride acetic test in 10 cases; the number of cells was never above the usual figure, and the quantity of albumin was always normal. In seven patients in whom degeneration was marked there was a positive or a subpositive reaction.

Cerebral Tumours.—The test was always negative; none of our cases had more than 3 cells per cubic millimetre.

Epidemic Encephalitis (5 cases).—The reaction was always negative, although the number of cells was three times above the normal (up to 27).

Zona.—Three cases, always negative results, and slight meningeal reaction.

Poliomyelitis.—Two cases, each reacting slightly positively.

Various Cases.—In 20 other cases there were 9 of meningism (fracture of the skull, headache, neurasthenia, hysteria). In 5 a weakly positive reaction was found, although there was no question of cerebral degeneration or of syphilis. In all these cases the spinal fluid and the results of the clinical examination were completely normal.

If we except the cases with a slight positive reaction we only get a positive test in general paralysis, in meningitis, and in cerebral degeneration. There is a certain relation between the number of cells per cubic millimetre and a positive reaction; the nature of the cells seems to have