ACETYLCHOLINE IN EMBOLISM OF THE RETINAL ARTERY

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Acetylcholine has been used on several occasions for thrombosis and for spasm of the retinal arteries, but we can find no complete record of a simple embolism being so treated. In those cases reported the injection was given intramuscularly, and in our cases subconjunctivally. Before describing our own case of retinal embolism it may be of interest to give brief notes of an earlier case—that of an elderly man—in which arteriosclerotic changes in the retina gave rise to recurrent attacks of visual defect. The enormous dilatation of the fundal vessels which followed administration of acetylcholine, and resulted in relief of the ocular symptoms, suggested the possibilities of this drug in retinal embolism.

A patient, J. T., was sent to one of us (H. C. O.) by Dr. J. A. R. Wells on October 15th, 1934. He was 67 years of age, and his occupation was a steel trap manufacturer. He complained that fourteen days earlier the left eye had become "glimmery." On closing his right eye he saw everything with a purple tinge with his left eye. This was immediately followed by vision in a small portion of the left temporal field, the remainder of the field being blank. He lay down to rest, and the complete visual field returned in a short time. This experience recurred a week later, and since then had returned frequently, especially after walking. On the date of examination the vision in the right eye was one letter of 6/36 line and with glasses 6/9. In the left eye one letter of 6/24 line and with glasses 6/9. The pupils were dilated with homatropine and cocaine. The right fundus showed a small haemorrhage about one disk diameter above the right macula. The arteries showed advanced sclerotic changes. During the examination he complained that the field of vision in the left eye had contracted, and that he had only a small visual area in the paracentral field. On examination the left fundus showed well-marked pallor of the disk, with irregular spasmodic contraction of the retinal artery. The column of blood could be seen moving along sluggishly and in a jerky stream. Acetylcholine, 3 minims, was injected under the temporal conjunctiva in each eye, and the fundi were kept under observation constantly. One could then observe the considerable increase in size of the fundus vessels. Both arteries and veins enlarged enormously. The whole visual field in the left eye returned completely, and the patient said that he could see much more clearly. When the dilatation was great the blood stream slowed down considerably, and with the Gullstrand ophthalmoscope the blood cells could be seen rolling over and over in their passage down the vessels. Camphor in oil was injected intramuscularly and the patient was sent home. On his second visit the fundi had returned to normal for a man of his age. There had been no recurrence of visual defects, and glasses were ordered. Since then the patient has had no return of ocular symptoms.

A Case of Retinal Embolism

R. M., aged 26, a rubber-worker, reported at the outpatient department of this hospital at 6.30 p.m. on December 17th, 1934, complaining that "when he woke up this morning he had lost part of his sight: he could not see the roof of the room with his right eye, and people had eyes and nose but no forehead when looked at with the right eye." He had no pain, and the rest of his field of vision appeared normal. The left eye was normal. There was a twelve-hour interval between the time the condition was noticed and his report to the hospital. There was no evidence of functional or organic nervous disease in the family, and the patient's mother, father, sisters, and brothers were quite healthy.

The patient himself had never been to see the doctor before for his health. There was no history of rheumatism, and

no suggestion of sympathetic nervous instability, or any question of venereal disease. He smoked three ounces of tobacco per week, but took no alcohol. There was no history of chilblains. On examination he was of strong, athletic type, six feet in height, and in good condition. There was no evidence of goitre, or functional tremor in hands or tongue. The teeth were good. The sinuses and antrum were clear and the tonsils small, with no disease in the crypts. Dr. R. L. Mackay examined him at the Royal Hospital, and confirmed the absence of any defect in the circulatory, respiratory, and nervous systems. The Wassermann reaction was negative. He had had herpes on his right upper lip for five days.

OCULAR EXAMINATION

The right pupil was dilated with one drop of atropine to "fix" the pupil so that the ensuing phenomena could be studied more accurately.

The right fundus was clear and well defined, but showed pallor in its lower inferior temporal quadrant. The blood vessels as they emerged from the disk were quite normal, no abnormal kinking or spasm being present. On tracing the

FIG. 1.—Perimeter charts. Top left = 6.50 p.m., December 17th, 1934. Top right = 8 p.m. the same evening. Bottom left = 9.30 a.m., December 18th, 1934. Bottom right = January 4th, 1935.

vessels to the periphery, however, the right inferior temporal branch of the retinal artery was blocked five disk diameters along its course by a blackish mass, which was partially obscured by whitish exudate. Beyond this point the artery divided into two branches, both of which were empty for a distance of one disk diameter, and this was followed by a column of purplish-blue blood, broken up into distinct segments, each segment being about $1/5$ disk diameter in length. The vessels walls were normal, there being no undue thickening or calcification, and no irregularity in the walls or lumen of the vessels. The fundus reflex in the inferior temporal region was definitely pale, and extended upwards to the macula lutea and inferiorly to the junction of the nasal and temporal segments. The right inferior temporal artery bisected this area of pallor. The colour of the fundus reflex was altered, giving the appearance of oedema. The field of vision of both eyes was investigated, the left being normal. The right field of vision was defective in the upper nasal quadrant and extended to the point of fixation (see perimeter chart), there being absolute blindness in the area for all colours. The vision in the affected eye was 6/18.

A diagnosis of embolism was made, and in view of the extreme pallor, and of the fact that the macula was involved, and the blockage had been present at least fifteen hours, we decided to use a more powerful therapeutic agent than is usually advocated in these cases.

SUBSEQUENT CLINICAL COURSE AND TREATMENT

Acetylcholine (B.D.H.), 8 minims, was injected subconjunctivally—4 minims on the lower temporal quadrant and

4 minims in the lower nasal quadrant, as far back as the equator of the globe. The patient was thereafter under constant observation for four and a half hours (7 p.m. till 11.30 p.m.). Ten minutes after his primary injection (7.10 p.m.) the ocular vessels, conjunctival and retinal, were greatly enlarged (about three times their original size), while the retinal and choroidal veins became engorged. The area of pallor became well delineated.

At 7.30 p.m. the whitish exudate was becoming absorbed. At 8 p.m. the embolism moved into the arterial branch B (as shown in the diagram), while the branch A filled up with blood. At 8.30 p.m. (one and a half hours later) the embolism started to move down artery B, there being a distinct junction between the red advancing column of blood and the purplish-black embolus. The column of blood was convex at its advancing edge. The whitish exudate was much less, the arterial function now being evident. At 9.30 p.m. the whitish exudate had completely disappeared, and the embolus had reached the next arterial junction on the artery B. The fundal pallor was definitely receding, and started from the more peripheral borders bounding the horizontal and the vertical margins of the area, so that the macula lutea was freed from arterial strangulation.

FIG. 2.

FIG. 3.

FIG. 2.—Fundus showing area of pallor (shaded) when first observed. FIG. 3.—Diagram showing movements of embolus in right inferior temporal branch of retinal artery.

Acetylcholine, 5 minims, was again injected. This time the patient complained of extreme fullness of the globe ("as if it was bruised"), but said that he could see people distinctly. At 10.30 p.m. (three and a half hours later) the embolus was still fixed at the arterial junction of artery B. The pallor was receding very slowly. The acuity of vision had risen to 6/6, while only a small portion of the upper and inner field was missing. It was thus obvious that his central vision had been saved, even though he might not have a full peripheral field. At 11.30 p.m. the embolism remained fixed in the same position. Investigation was suspended till 9.30 a.m. the next day, when the entire retinal system appeared normal, and although there was still pallor present this was limited to an area along the course of this vessel. *The retinal vessels were still dilated*, while the ocular conjunctiva was oedematous. The visual acuity was now 6/4, and the field of vision showed a defect in the upper inner quadrant smaller than that shown before the injection of the previous day and not interfering with central vision. The accompanying fields of vision show the progressive increase in the field of vision. For the next few days the pallor of the affected area of the fundus persisted, but visual acuity was still 6/4 in the right eye. On the fourth day the field of vision was normal, and was still so on January 4th, 1935.

Summary

1. The use of atropine did not alter the action of the acetylcholine on the vessels.
2. No symptoms of collapse were present, and the effect appeared to be purely local.
3. The first injection was relatively painless, but the second was slightly painful for about five minutes.
4. The retinal exudate was absorbed within three and a half hours.
5. The conjunctival oedema following the first injection subsided within fourteen hours, but that following the second injection lasted thirty hours.
6. The effect of acetylcholine on the vessels appeared to be sustained by giving a second injection.
7. There was no corresponding dilatation of the blood vessels of the left eye.
8. Subconjunctival injections of acetylcholine appear to be the best form of treatment for embolism of the retinal artery.

AVERTIN AS A COMPLETE ANAESTHETIC IN CHILDREN

A SURVEY OF 700 CASES

BY

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This paper represents an attempt to produce surgical anaesthesia in children by the use of avertin without the aid of inhalation anaesthetics. This being so, almost all the earlier patients who came to operation in the Belfast Hospital for Sick Children were given avertin as a routine, so that the cases were not specially selected. The total number of cases was 700, of which more detailed notes were kept of 350. These 700 included most of the usual children's operations which one meets in intern hospital practice.

Technique

The technique of avertin administration in this series followed fairly closely that laid down by the manufacturers, except that the child was usually given the avertin in the general ward without any attempt being made either to darken the ward or to keep down the noise.

Fifteen minutes after giving the avertin the child received a hypodermic injection of morphine and atropine in doses varying with the age as follows:

Under 2 years	... morphine	1/40 grain
Between 2 and 6 years	... "	1/20 "
Between 6 and 10 years	... "	1/12 "
Over 10 years	... "	1/10 "

Children under 10 years of age had atropine 1/180 grain, while those over 10 had 1/150 grain. The hypodermic injection of morphine and atropine was given fifteen minutes after the avertin for two reasons: (1) the pain from the hypodermic injection may cause the child to expect a similar pain when the avertin is being given, and thus induce him to fight against it and return it; and (2) if the avertin anaesthesia seems too deep the morphine is withheld or the dose lessened.

In some of the later cases the injection of 1 per cent. novocain was made into the subcutaneous tissues of the field of operation, even into those areas into which the towel clips were to be inserted.

Discussion of Results

The 700 cases included children of all ages from 3 months to 13 years. The range of weights was from 11 lb. to 9 st. 1 lb. The average time between the administration and the bringing of the patient to the theatre was forty-five minutes; the average duration of operation was thirty minutes, varying between the limits of five minutes and one hour fifty minutes.

In classifying the quality of anaesthesia we considered those who needed an inhalation anaesthetic throughout the operation as though they had had no avertin as "poor," and those who needed a little for the skin incision only as "fair." Those who needed no inhalation anaesthetic were classed as "good."

The dose of avertin given to each patient was increased gradually as time went on. In a study of Tables I and II we see the gradual decrease of those requiring ether in addition to avertin as the dose of avertin was increased. The reason for the gradual improvement with the dose of 0.175 gram from 1932 onwards was improved technique and case selection.

The reason for the variation in the effects produced by a dose of 0.175 gram per kg. body weight was mainly because some of the patients returned the solution before it had time to be absorbed. Of the thirty-one cases (Table I) in which the anaesthesia produced was poor twenty cases (64 per cent.) returned some of the solution