Comparison of Peripheral and Central Adaptation

(a) In each there is a lowering of sensitivity at the onset of decreased illumination, followed by an increase after a lapse of time; usually 10-15 minutes for the field, 30 minutes for central perception with the velvet screen, less with those having a proportion of white in the screen.

The essential differences between these two sets of tests are:—

(b) In the field test the object is moved, in the central it is fixed; in the field test the increased sensitivity is registered spatially, in the central as an increase in intensity of sensation. But it should be noted that, if any one spot in the field be taken, this would show an increase in intensity of sensation, as shown in the graphs A-I for the adapted eye, as compared with the graphs 1-17.

(c) In the field test the object has a fixed proportional value, in the central test this is altered as the adaptation progresses.

(d) While the central adaptation follows to some extent Weber's law, no mathematical formula was found to express the field adaptation.

(e) A tendency to exhaustion was found in the field which was never noticed in the central tests, the portion of the field tested extending to 45° from the line of vision. This is striking, for this was the 3/1000 field, which is relatively the most stable portion of the field in glaucoma and cavernous atrophy, thus contrasting with the tendency to exhaustion under physiological conditions.

If it be assumed that in the field adaptation tests the exhaustion is in the retinal visual elements, and that in glaucoma and cavernous atrophy the resistance is in the nerve fibres, a feasible explanation is found.

In conclusion the writer wishes to express his thanks to Professor Newman, D.Sc., of the University College of the South West, for much help and advice during the conduction of these experiments.

A CASE OF UNILATERAL ANOPHTHALMOS WITH A CYST

BY

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JAPAN

ANOPHTHALMOS is one of the rare congenital anomalies in which, in spite of the name, a small or rudimentary eyeball is found usually in the lower lid. It is bilateral in almost all cases; and if the orbital integument is prolonged and covers the partially developed eyeball, then it is called cryptophthalmos.

FIG. 1.

Before operation, showing the projection of the skin of the left lower lid.

FIG. 2.

After operation, with the insertion of an artificial eye into the conjunctival sac.

FIG. 3.

The excised ocular cyst. The white corpuscle may be the remains of the crystalline lens.

In the writer's case, the patient K. K. was a little boy of five years old, in whom the anomaly was unilateral, with normal eyelids and conjunctival sac.

Family history.—His father is 48 and his mother is 41 years old. He has five brethren. The eldest daughter is 18, the second sister is 14, the third is 11, the fourth is 9, the younger brother is 3 years old, and his elder brother died at 3 years of age. The parents are not related and the other brethren are all healthy.

The parents brought the child to me on July 25, 1932, but operation was postponed till December 15 of the same year on account of family affairs.

History.—Before the birth of the child, the mother stumbled and fell down at the water closet and struck the lower part of her abdomen against an edge of the pot. This accident occurred in the fourth month of pregnancy, but there was no grave consequence, and the child was born easily at term. At the time of birth, this anomaly was already present, also an atresia in another part of the body. This latter anomaly was operated on soon afterward by an orthopaedic surgeon, but the ocular one was left as it was without operation.

State on admission.—The child is apparently well nourished, although he seems to be a little weaker than the ordinary children of the same age. There are no anomalies in other parts of the body. Hearing and speech are both normal. There is no appearance of mental weakness. The circumference of the cranium is 48 cm. X-ray examination of the breast and the abdomen reveal no affections.

The right eyeball is abnormal, a convergent squint of low degree is present, together with micro-cornea, of which the vertical diameter is 8 mm. and the horizontal 6 mm. so that it is longitudinally oval in shape. Probably the eyeball itself is somewhat smaller than normal. The iris is partially defective in its lower part, showing a coloboma of this membrane; and there remains a network of fine filaments of a persistent pupillary membrane across the longitudinally oval pupil. There is neither cataract nor opacities of the dioptric media. In the fundus there can be seen a large area of congenital coloboma of the choroid which extends from the lower edge of the papilla to the region of the ora serrata. Probably this choroidal coloboma is continuous with that of the iris above mentioned. There is a gross lateral nystagmus of the globe. The eyelids are normal, and the length of the lid along the margin estimates 30 mm., and the distance between the inner canthi of both eyes is also 30 mm.

In the left eye, the lids and the conjunctival cul-de-sac only are normal. The lids have the same size as the right ones and the conjunctival sac is quite empty, so that the upper and the lower

fornices are directly continuous with each other. The depth of the conjunctival sac is estimated at 19 mm.

In the left lower lid, as it is seen in the accompanying figure, there is a projection of the skin under which the rudimentary eyeball is hidden. Although the cyst is mainly obscured by the skin of the lower lid, it is also partially covered by the lower palpebral

FIG. 4.

A part of the coat of the cyst. Low-power magnification. A. Proliferation of the connective tissue and its hyaline degeneration in the internal part of the coat. B. A distinct ring-shaped deposition of lime in the wall of a blood vessel. C. Fibres of coarse connective tissue in the outer coat. D. Infiltrations of poly- and mononuclear leucocytes. E. Sections of the blood vessels filled with red cells. F. Granular and linear deposits of lime in the parts where there is distinct hyaline degeneration of the connective tissue, together with proliferation of the latter tissue in the internal layer of the coat.

conjunctiva. The skin of the lower lid is a little prominent and tinged with slightly bluish colour. The brows are normal on both sides.

On palpation, both the upper and the lower margins of the left orbit are normal, and the hidden eyeball moves more or less freely within the orbital cavity. It also moves freely with the motion of the skin of the lid, and is felt on palpation to be somewhat softer than the right eyeball and seems as if there were a small rubber ball under the skin. When it is pressed upward

and a little backward with the finger from above the skin, the bottom of the empty conjunctival sac is projected at the same time. It is impossible to put an artificial eye into the conjunctival sac, because of the projection of the wall of the sac.

Operation.—The operation was done on December 15, 1932, under local anaesthesia with 1 per cent. solution of neocaine. I

FIG. 5.

High-power magnification. A. Proliferation of the connective tissue and its remarkable hyaline degeneration in the inner layer. B. A distinct ring-shaped deposit of lime in the whole section of the coat of the blood vessels and the red blood cells therein. C. More or less scattered cell infiltrations. D. Linear and reticular deposits of lime. E. Stratified deposits of lime, under which a mass of the same deposition and cells which contain haemosiderin are also seen.

preferred the following method of removal of the hidden eyeball, which I assumed to be the best. An incision was made in the skin of the projection, leaving the conjunctival sac quite intact for the purpose of insertion of an artificial eye into it after the operation. The incision was 2 cm. long, about 5 mm. from the lid margin and parallel to it. The cyst was soon reached on opening the subcutaneous tissues. It was a soft cyst full of fluid and was attached by coarse adhesion to the lower wall of the orbit. The intra-orbital tissues surrounding the cyst were very poorly developed. There were no insertions of the ocular muscles upon

the surface of the cyst. The cyst seemed to be composed of three chambers by a slight stricture. Among these three parts, the right was the biggest, the left was the next to this and the middle was the smallest; and this was rather hard and seemed to be the root of the whole cyst which was in tough attachment partly with the periosteum of the upper wall of the orbit and partly with the subconjunctival tissue of the upper palpebral conjunctiva, so that

FIG. 6.

Low-power magnification. A. Arrangements of columnar cells of the endothelium of a duct. B. Lumen of the duct and the mucous fluid in it. C. Section of a blood vessel. D. A thick layer of sclerotic fibrinated connective tissue.

when the cyst was pulled forward with forceps and a little downward, the upper lid and its palpebral conjunctiva were pulled simultaneously in the same direction. This hard attachment was divided with scissors. On cutting, there was a firm resistance, and the cyst was ruptured. A transparent corpuscle of about 5 mm. in diameter came out from the orifice of this cutting with a yellowish muco-serous fluid like bile juice.

After the excision of the cyst, the cavity in the orbit and the wound were tamponaded. Six days later the tamponade was removed and the ends of the wound were sutured carefully. And six days later the suture was removed and the union of the wound was complete. An artificial eye inserted into the conjunctival sac maintained its position. The right eye, tested with

Löhlein's Test Types for children, resulted in 0.3 with a slight improvement by a concave spherical lens. The acuity of vision of the same eye when tested on February 12 last year, was 0.2 with improvement to 0.3 by a -1.5 D. spherical lens.

Pathological observations.—The cyst is coated with a comparatively thick wall of greyish-white appearance and a tendinous lustre. At the orifice of the middle part of the cyst which was made by the operation, the inner surface is seen as a dark brown coat. The cyst was fixed in 10 per cent. solution of formalin and after having been embedded in celloidin, was sectioned. Sections were stained with eosin-haematoxylin, together with van Gieson's as well as Planter's stains for elastic tissue, using resorcin-fuchsin; an iron reaction for the haemosiderin pigment was also tried.

The wall of the cyst consisted roughly of two layers, of which the outer one was composed mostly of adipose tissue and the inner of old connective tissue. The proliferation of the connective tissue was very remarkable, and some parts of the preparations showed hyaline degeneration. In and around these places where there was hyaline degeneration, there was also a deposition of lime in the shape of a network or in a little mass. In the wall of the small blood vessels, there was also a ring-shaped deposition of lime. Around the blood vessels or independently of them, there was a small extent of cell infiltration, in which lymph cells, plasma cells and polynuclear leucocytes were mostly found, and some mononuclear white cells, surrounding which were pigment cells containing yellowish or mahogany-brown pigment. These pigments were positive in reaction to iron. The polynuclear leucocytes formed a dense aggregation in the connective tissue of the adipose tissues of the outer layer.

In the inner layer of the wall of the blood vessels, there was degeneration so that the coat was atrophied on account of the pressure of the proliferation of the connective tissue as well as hyaline degeneration together with the deposition of lime, consequently the calibre of the vessels was diminished. In the outer layer of the walls of the blood vessels, however, an infiltration of polynuclear leucocytes was seen and the capillaries were engorged.

In the inner wall of the cyst, there were also pigment cells which contained a yellowish and mahogany-brown pigment, which gave the iron reaction so that it was supposed to be haemosiderin. These pigment cells were seen here and there around the deposition of lime and separately from the latter too.

The elastic tissue was seen only in the middle part of the wall of the cyst between the inner and the outer layers, it was very scarce in amount and its fibrils were quite faint. This tissue was

atrophied or almost extinguished in those parts where there was evident degeneration and deposition of lime in the walls of the blood vessels.

In the innermost part of the inner layers of the wall of the cyst, there was a single coat of columnar cells, in which the nuclei were either columnar or spindle-shaped and unpigmented. In the inner layer, there was nervous tissue which was atrophied by the pressure of the proliferation of the connective tissue and almost extinguished. There could be seen more or less scattered segments of the inner as well as of the outer granular layers of the retina.

Considering these pathological observations as above mentioned, it can be seen that two aspects of new and old changes of inflammation are seen at the same time throughout the preparations. As for example, polymorphonuclear leucocytes are a sign of a recent acute inflammation on the one hand, and the evident proliferation of the connective tissue, its hyaline degeneration and the deposition of lime are that of a long standing chronic inflammation on the other hand. It is, however, impossible to certify from these observations whether the older alterations are those of the embryonic stage or not—say those present at the time of birth,—for the child is now five years old so that the cyst has existed for a long period. The changes showing recent inflammation, may be considered as secondary and have nothing to do with the occurrence of this anomaly.

As is evident from the history, I suppose that the development of the ocular structures of the child had been obstructed by the accident of his mother during pregnancy. As an anophthalmos, this is an interesting case in which it is seen only on one side which has the normal lids and conjunctiva. The excised ocular cyst, though it does not show the proper structure of an eye in these preparations, is considered to be a rudimentary eyeball which is the same as that of a cryptophthalmos. The state of the child is largely improved by the operation as well as by the insertion of an artificial eye into the conjunctival sac.

For the kindness of making histological preparations from the cyst and information upon the pathology, I am indebted to Professor Dr. N. Kubo, chief of the department of pathology of the Taihoku Medical College and Professor Dr. M. Kudo of the same department (March 14, 1935).

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