And so, coming back to our question, we have to acknowledge that the first branch most frequently is the medial one of the post. long cil. art. with a common trunk with the centr. ret. art. But it will not be the "norm" that was looked for so unsuccessfully by Meyer, it will be only the usual and more frequent order of branching, purposeful as far as all the long post. cil. art. - arise together in the first part (up to the first angle), and this gives them a great privilege from the haemo-dynamic point of view. But this purposefulness is only relative and may be changed in the reverse position, when the correlation with other tissues (for inst. the supporting one) will be changed, as we saw in our 2 variations with the "age" interruptions of the ophthal. art. (illustrations 17 and 18, cases 64 and 64a).

Here, in both cases, the first branch was the medial one of the long post. cil. art. by a common trunk with the cent. ret. art.; it looks like a "norm," but both of them, although in a different degree, proved to be unsatisfactory with appearance of the interruption due to age, because both of them probably possessed only weak anastomoses. At the same time, the third case of the same group (illustrations 19 and 20, case 68a) had at first quite an extraordinary one—a muscular artery, that even did not enter into our scheme—and it was quite successful in dealing with such an interruption, because in passing through embryonic variations it was provided with good anastomoses and they were brought into action, when needed.

TRANSPLANTATION OF VITREOUS*†

A Preliminary Report

BY

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NEW YORK

Introduction

THIS study was stimulated by the recent work that has been done on the transplantation of vitreous particularly by Cutler¹. Many attempts have been made in the past to remove vitreous without replacement or to replace it with saline solution, air, or animal vitreous. With the advent of the Eye Bank, and the availability of fresh human vitreous, we determined to conduct further studies. The

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present report is of a preliminary nature and we expect to amplify the studies with human material at a later date.

Literature

We shall not attempt to make an exhaustive survey of the literature as this will be published elsewhere with the clinical paper that is being prepared on the subject (Fritz²).

In 1890, Ford³, reported on the Proposed Surgical Treatment of Opaque Vitreous. He withdrew from ten to eighteen minims of vitreous through a needle inserted above or below the external rectus muscle. The procedure was repeated in three or four days and vitreous was withdrawn as many as four times. The amount withdrawn depended upon the consistency of the eyeball. Ford assumed that clear vitreous was resecreted.

In 1893, Deutschmann⁴, reported a few good results from the injection of animal vitreous into human eyes for the treatment of retinal detachment.

In 1911, Elschnig⁵, extracted vitreous and replaced it with saline as a method of replacing pathological vitreous.

In 1912, Rosentstein⁶, carried out forty-two vitreous aspirations on twelve patients who had traumatic vitreous opacities, disseminated choroiditis and iridocyclitis, and he observed no ill effect from the procedure.

In 1912, Komoto⁷, "washed out the vitreous" in two cases of eyes that were blind due to vitreous haemorrhage. He made a scleral incision and washed out with a 0.6 per cent. solution of sodium chloride.

In 1921, Erlanger⁸, removed 0.5 to 0.7 c.c. of vitreous and repeated it in ten days on an eye which had an infected Elliot's trephine. The procedure saved the eye with some vision.

In 1921, Blatt⁹, did vitreous aspirations on four patients, removing 0.6 to 0.8 c.c. with satisfactory results. He mentioned as indications, all forms of vitreous haemorrhage due to trauma and uveitis.

In 1922, Blaisch¹⁰, performed three punctures on successive days, removing 0.4 to 0.6 c.c. each time on an eye that had an intra-ocular infection following a perforating injury; the vitreous cleared rapidly and the eye was saved with corrected vision of 6/18.

In 1924, Hamburg¹¹, reported on fourteen cases of chronic iridocyclitis treated by vitreous punctures and aspiration. He reported good results in approximately 1/5 of his cases.

In 1924, Rochat¹², experienced failures in three cases using vitreous extractions for chronic uveitis.

In 1924, Bleidung¹³, reported on sclerotomy without vitreous aspirations in vitreous opacities or bleeding.

In 1925, Zirm¹⁴, did vitreous aspirations on four cases with

vitreous opacities. The result was good in one case, and the other three were doubtful.

In 1927, Bufili¹⁵, presented seven cases of vitreous extraction with good results. They were cases of vitreous haemorrhage, opacities and glaucoma.

In 1928, zur Nedden¹⁶, used aspiration of the vitreous in cases of ectogenous infections, vitreous bleeding, diffuse choroiditis, traumatic and haemorrhagic glaucoma and embolism of the central retinal artery, but he did not replace the aspirated vitreous.

In 1946, Cutler withdrew and replaced vitreous with vitreous from human donor eyes. In two out of three cases in which there was old haemorrhage, the transplant was successful in reducing the opacity.

Methods and Materials

Rabbits were used because of ease of handling and convenience. Thirty-nine eyes were experimented upon and several methods were employed to study the transfer of vitreous.

Group I. In five eyes the vitreous humour was withdrawn without replacement. In these eyes 0.5 to 1.1 c.c. vitreous was withdrawn through a 20 gauge needle at six o'clock, 5 mm. from the limbus.

Group II. In six eyes, the vitreous was withdrawn and saline was injected. In these eyes, 0.7 c.c. vitreous was withdrawn through a 20 gauge needle at six o'clock, 5 mm. from the limbus and replaced with sterile saline by injection through the same needle.

Group III. In four eyes 0.15 to 0.2 c.c. aqueous was withdrawn through a 26 gauge needle which was passed through the limbus and the fluid volume of the eye was restored by the injection of vitreous with a 20 gauge needle through the sclera at six o'clock, 6 mm. from the limbus.

Group IV. Vitreous was withdrawn and replaced in 24 eyes. Three different methods were used:

(a) In two eyes fixation sutures were used to draw the eye over and the region at six o'clock 7 mm. from the limbus exposed. A suture was placed in the sclera, and with a 17 gauge needle 0.5 c.c. of vitreous was withdrawn and replaced and the suture tied.

(b) In fifteen eyes, 0.7 c.c. to 1.0 c.c. vitreous was withdrawn from a donor eye through a 20 gauge needle and injected into the recipient with a 23 gauge needle through the same hole.

(c) In seven eyes, a mattress suture was placed 7 mm. from the limbus in the sclera at 6 o'clock. A 3 mm. incision was made with a Graefe knife between the arms of the suture and from 0.2 to 0.4 c.c. was withdrawn through a 20 gauge needle and injected simultaneously through a 23 gauge needle. The suture was drawn taut and tied as the needle was removed.

Results

Group I. In these five eyes the tension became very soft immediately after withdrawal of vitreous but returned to normal after two to four days. The vitreous became hazy, subsiding during the first week. In three cases, retinal detachment occurred with a hole noted at the site of injection. In two of these, the detached areas subsided within the first month and healed with a small area of fibrous tissue proliferation, forming a retinitis proliferans. In the third case, the detachment was still present on the fourteenth day and the rabbit died on the seventeenth day. Of the four cases that survived, all eventually showed pigmentation reaction around the site of puncture and clear vitreous with normal tension.

Group II. Of these six eyes, one remained clear and five developed vitreous haze. Three of those that developed haze also developed complete retinal detachment which did not subside. The other two cleared. After six months the three eyes which did not develop retinal detachment had completely recovered except for pigmentary reaction around the site of injection.

Group III. In these four eyes, a white, convoluted, fluffy opacity appeared at the site of injection immediately after introduction of new vitreous. The opacities cleared in the course of one week, in three instances, and in the fourth instance, it took four weeks. All the eyes remained with clear vitreous, normal tension and the typical pigmentary reaction around the scar.

Group IV. (a). In one of these two eyes, a cataract formed after the operation and the details could not be followed. In the other eye, a haemorrhagic reaction occurred in the region of the incision and cloudiness of the vitreous developed which took two weeks to subside. The vitreous remained clear, thereafter, and there was no detachment, although there was pigmentary reaction around the scar.

(b). In these fifteen eyes, vitreous remained clear in two and opacities developed in thirteen. The opacities were marked in ten and mild in three. Of those that were marked, six cleared within a period of two to four weeks; two cleared in a period of two months leaving an area of proliferated fibrous tissue and two did not clear. There were four retinal detachments, of which two healed and two remained detached (the two with persistent dense vitreous haze).

(c). In these seven cases, the vitreous was not as easily controlled and a certain amount was lost during the process of injection. In one case, a traumatic cataract formed which prevented visualization of the interior of the eye. In one case detachment occurred which subsided after seven days. Vitreous opacities occurred in all these cases and there was a small amount of haemorrhage near the puncture

Group	Total eyes	Retinal detach. which subsided	Retinal detach. which persisted	Pig. reac. with proliferation	Pig. reac with- out proliferation	Vit. haze which cleared	Vit. haze which persisted	Cataract
Group I	5	2	1	2	3	5	0	0
Group II	6	0	3	0	3	2	3	0
Group III	4	0	0	0	4	4	0	0
Group IV	24							
(a)	2	0	0	0	1	1	0	1
(b)	15	2	2	5	8	11	2	0
(c)	7	1	0	0	6	6	0	1

site in three. However, all of the eyes healed with clear vitreous and the usual amount of pigmentary reaction around the site of injection.

The follow-up period was six months.

Comments

It will be noted that the transplantation of vitreous is not without its complications. Although retinal detachments in rabbits are prone to heal spontaneously, nevertheless, a significant number occurred that did not subside. Cataracts occurred due to injury by the operator. The lens in the rabbit's eye is quite large and difficult to avoid when a large amount of vitreous is removed. Vitreous haze, we believe, is due to alteration in the physico-chemical properties of the injected vitreous and the uveal reaction around the puncture site was normal wound healing. No case of chronic uveitis was noted.

In the human, the pars planum approach to the vitreous is considerably easier, the lens is smaller, but the human eyes would not be normal eyes when selected for a vitreous transplant.

So far as the structural change in injected vitreous is concerned, there are undoubtedly significant alterations caused by the passage through a narrow needle, but from a clinical point of view, the transplant may still be successful and in our experience, vitreous transplantation is more successful than replacement with saline. The eye of the host may metabolize the injected vitreous and accept it into its own structure.

Summary and Conclusions

Transfer of vitreous was studied experimentally in thirty-nine rabbit's eyes with a follow-up period of six months. Several types of procedure were used which are described in the text and the comparison between these procedures in the experimental animal and in the human have been discussed.

Two traumatic cataracts were produced, six retinal detachments occurred which persisted and a localized fibrous tissue proliferation around the puncture site occurred in seven eyes. These complications, particularly the retinal detachment, are significant and should be borne in mind in the election of vitreous transfer as a clinical procedure.

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AUTOHAEMO-THERAPY IN HORDEOLOSIS*

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AUTOHAEMO-THERAPY seems to fall into oblivion. In this age of sulfonamides and penicillin it is regarded by many as a sort of mediaeval witchcraft. It has been tried and recommended in so many conditions, and the disappointment of bona-fide followers has frequently been so poignant, that it has fallen into discredit even in cases where its action is beneficial beyond doubt.

Autohaemo-therapy has been tried in asthma, serum sickness, urticaria; it has been employed in herpetic dermatitis and

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