HYALOID REMNANTS IN THE EYES OF PREMATURE BABIES*

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THE discovery that retrolental fibroplasia was a cause of blindness in premature infants (Terry, 1942) and of the role of oxygen in the causation of the disease (Ashton, Ward, and Serpell, 1953) has led to regular examination of the eyes of premature babies. In the search for evidence of this condition, the appearance of the immature fundus has become familiar. The pallor of the retina and disc, the thread-like vessels, and the vitreous haziness seen in the more immature are now well known. Careful examination of the eyes of the newborn is not a new idea, for Seissiger (1929) examined the eyes of 500 infants aged from 1 to 8 days and found, for instance, pupillary membrane remnants in 95 per cent. of them. Despite this, there has been little mention of the persistence of remnants of the hyaloid artery (*Brit. med. J.*, 1960). Brown (1960) gives a good account of the eye of the premature infant, and states that the entire length of the hyaloid artery may be visible in a 28-week baby, while a remnant may be seen posteriorly at 32 weeks, which disappears by 38 weeks. Roper-Hall (1960) found complete hyaloid remnants in ten of eleven babies weighing between 2 and 3 lb. at birth; and remnants were seen in 58 per cent. of 55 weighing between 3 and 4 lb. and in 36.5 per cent. weighing between 4 and 5 lb. Forrester (1960) rarely failed to see remnants in babies of less than 3 lb. but found them uncommon in larger infants.

Embryology

The eye forms from a hollow protrusion from the anterior primary cerebral vesicle. The distal end of this protrusion enlarges to form the optic vesicle, the remainder becoming the optic stalk. The ectoderm of the side of the head overlying the optic vesicle becomes thickened and depressed to form the lens. The distal, swollen part of the optic vesicle is invaginated to form the optic cup, with the embryo lens lying in its mouth. While the cup is being formed the ventral wall of the stalk and vesicle is also invaginated to form a cleft, the choroidal fissure, in which the hyaloid artery is developed. This is enclosed, as the fissure closes in from behind forwards, to become the central retinal artery. Within the optic cup the vitreous body develops. This soon becomes very vascular, and is chiefly supplied by the hyaloid artery traversing the centre of the vitreous, lying in the canal of Cloquet. On reaching the back of the lens the artery divides into many branches to form the tunica vasculosa.

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* Received for publication May 1, 1962.

During the 7th month of intra-uterine life the artery becomes impervious to blood in its middle part and ruptures near the centre. The two ends retract and the anterior part remains faintly visible attached to the back of the lens throughout life. The posterior part is thought to disappear (Mann, 1957), but Mann goes on to say that it is more difficult to examine the posterior part of the vitreous and that minimal remnants attached to the disc may be more common than is generally supposed.

Three types of persistent hyaloid artery may occur:

(1) *Whole Vessel*.—This is rare and probably arises as a result of some influence retarding development in the 7th month. The vessel is seen to pass from the optic disc across the vitreous to its attachment at the back of the lens.

(2) *Anterior Portion*.—As previously mentioned, a faint remnant is commonly seen attached to the rear of the lens, but occasionally a fibrous cord may be present attached anteriorly to the lens with the posterior end lying free.

(3) *Posterior Portion*.—This is rarely found after birth, but when present is seen to consist of a strand attached to the optic disc with the anterior end lying free in the vitreous.

Present Investigations

During routine examination of the eyes of premature infants, I was struck by the apparent frequency and variability of visible remnants of the hyaloid artery. In order to investigate the matter further, a series of one hundred premature infants who survived was examined ophthalmoscopically, and the presence and type of hyaloid artery remnants were recorded. During the same period a control series of one hundred infants judged to be mature was also examined in the same manner.

The observations recorded below deal entirely with posterior remnants.

Material

Premature Infants.—The birth weight varied from 1 lb. 13 oz. to 4 lb. 15 oz., and the maturity was estimated at from 26 to 38 weeks (Table I); 44 were boys and 56 were girls.

TABLE I
WEIGHTS OF PREMATURE INFANTS AT BIRTH

Weight (lb.)	No. of Infants
Under 2	2
2 to 3	14
3 to 4	47
4 to 5	37
Total	100

Usually the eyes were first examined when the infants were 1 to 2 weeks old, but the most immature were always re-examined later, as vitreous haze made retinal details impossible to see at a very early age.

Mature Infants.—The birth weight varied from $6\frac{1}{2}$ to 10 lb.; 46 were male and 54 female.

All the eyes were examined within one week of birth.

Method.—The pupils of each infant were dilated with 1 per cent. homatropine drops about one hour before the examination. The baby was examined in a darkened room and no sedative was given. In most cases no difficulty was experienced in obtaining a good view of the fundus, but when the child was restless, as sometimes happened with the older ones, a bottle feed was given, and this usually led to complete relaxation. In a few cases, when the view obtained was poor, the examination was repeated a day or two later. By this means all the infants selected were examined.

Results

Premature Infants.—In 95 of the 100 babies a definite remnant was seen in one or both eyes, usually the latter. In the remaining five, none was seen.

Mature Infants.—In 97 of the 100 babies no remnant was visible.

TYPES OF REMNANT.—In the present series, only the posterior remnants of the hyaloid artery are recorded. These took a number of forms which could be classified into eight different types (Table II):

TABLE II
TYPES OF POSTERIOR HYALOID REMNANTS OBSERVED

Type No.	Description	In Both Eyes	In One Eye
1	Filament	28	36
2	Filament with Broad Base	8	9
3	Filament with Basal Blob (inverted comma)	2	3
4	Filament with Terminal Blob (comma)	1	3
5	Sail-shaped	—	4
6	Collapsed Sail	3	10
7	Short Broad Sheet	2	5
8	V-shaped	—	2
Total		44 pairs	72 single eyes

(1) *Filament.*—A hair-like dark streak attached posteriorly to the optic disc. The proximal free end was seen to wave about in the vitreous, and by noting its movement it became possible to assess its length very roughly by comparing it with the breadth of the disc itself. The longest examples exceeded two disc breadths.

(2) *Filament with Broad Base.*—Here the hair-like filament expanded posteriorly so that the attachment at the disc was broader than the shaft.

(3) *Filament with Basal Blob* ("inverted comma").—Here the base was rounder than in (2) and the shaft was curved.

(4) *Filament with Terminal Blob* ("comma").—The shaft was narrow at the base but terminated anteriorly in a rounded expansion.

(5) *Sail-shaped*.—The remnant had a broad base and tapered slightly to a narrower extremity which was not filamentous, but of a delicate veil-like texture.

(6) *Collapsed Sail*.—The remnants resembled those of Group 5 but appeared to lie on the disc collapsed in a heap.

(7) *Short Broad Streak*.—The delicate veil-like appearance of Groups 5 and 6 was lacking and the remnant appeared to be short and thick.

(8) *V-shaped*.—In two cases two filaments were noted, united at the base and diverging anteriorly.

General Observations

Site of Origin.—In the great majority the remnant arose from near the centre of the optic disc, but in a few the point of origin was eccentric.

Stage of Maturity.—There was no definite correlation between the stage of maturity and the type of remnant, but the most immature usually had the longest filaments, often with broad bases. Conversely, seven of the fourteen babies considered to be of 37 weeks' maturity or more had no visible relics in one eye (two of them in neither eye). As a rule both eyes contained similar types of remnant, but this was by no means always so, and in no less than twenty infants one eye appeared clear while the fellow eye contained one or other of the remnants described.

In some of the "normal" premature eyes a barely visible dot was seen on the optic disc. This was probably the final stage before the disappearance of the remnant. A similar minute dot was seen in six eyes of mature infants.

Follow-up.—Many of the premature babies lived at some distance from the hospital and could not be followed, but it proved possible to re-examine a number of them, and 26 were followed until all traces of the hyaloid remnants had disappeared. (Table III, opposite). The children were not seen very frequently, usually at intervals of about one month, so that the recorded time of disappearance may have been over-estimated in some instances.

The filaments gradually shortened until only a minute dot on the disc was visible, and this duly disappeared. Sometimes a filament changed to a "collapsed sail" (Type 6) or the base appeared to broaden before it became invisible. In every one of the 26 all traces had vanished by the time of the final examination.

In one child of unusual immaturity (birth weight 1 lb. 4 oz., length 13"), who was examined by courtesy of Dr. J. M. Garvie and is not included in this series, a complete hyaloid vessel stretching from the disc to the lens was seen in the right eye only. This

TABLE III

TIME OF DISAPPEARANCE OF REMNANTS IN 26 INFANTS FOLLOWED

Estimated Maturity at Birth (wks)	Estimated Maturity at Time of Disappearance (wks)
32	40
34	42
29	45
36	48
36	46
38	50
30	38
33	41
35	37
30	42
36	42
32	40
26	42
33	39
36	46
35	45
37	42
36	42
37	42
35	47
34	46
31	43
36	42
30	40
33	45
26	46
Range 26-38	Range 37-50

gradually disappeared, passing through the stages of filament, filament with broad base, and collapsed sail, to dot.

Twins.—The infants included fourteen pairs of twins, but the types of remnant seen in each pair varied just as much as between any pair of singletons of the same period of maturity.

Exceptional Cases.—The five premature infants, in whom no remnants were seen, were of the following birth weights: 4 lb. 3 oz. (36 weeks), 3 lb. 5 oz. (37 weeks), 4 lb. 5 oz. (36 weeks), 4 lb. 4 oz. (36 weeks), and 3 lb. 9 oz. (37 weeks). It is possible that minute filaments were missed in these cases and none of them was very immature.

In three mature infants some evidence of the hyaloid vessel was seen; two showed a very small relic of collapsed sail in one eye only, and there is good reason to believe that one of these babies was in reality 2 weeks premature. The third showed minute filaments (Type 1) of less than half a disc in length in each eye.

My experience is similar to that of Forrester (1960) in that a complete hyaloid vessel was practically never seen. The involutional process appeared to be inexorable and was uninfluenced by oxygen administration or any other therapeutic measures undertaken in the management of these babies.

Conclusions

In the majority (95 per cent.) of premature infants, hyaloid remnants are visible. These remnants disappear by the time full maturity has been reached or at latest after a few weeks. The incidence of hyaloid remnants in mature infants is low—probably less than 3 per cent.

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