

Retinal haemorrhages in newborn infants

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Although neonatal retinal haemorrhage is a common pathological finding in about 20 per cent. of newborn infants, the cause of this condition is still not well understood.

Jäger (1861) is generally accepted as the first author to have reported the condition. Estimates of its incidence have varied from 2·6 to 50 per cent. (Duke-Elder and Dobree, 1967). Chace, Merritt, and Bellows (1950), in a study of more than 1,000 newborn infants, found retinal haemorrhages in 2·6 per cent.; Belmonte González (1947) in 27·4 per cent. of 124; Cavrot (1956) in 20 per cent. of 421; Kauffman (1958) in 18·2 per cent. of 7,727; Giles (1960) in 40 per cent. of 100 infants.

The types of retinal haemorrhage have been described by many authors, including Mezey (1952) and Schenker and Gombos (1966). They were classified by Richman (1938) into four groups:

- (a) Flame-shaped;
- (b) More or less circular in the deeper layers of the retina;
- (c) Sharply circumscribed, perfectly round, and deep red;
- (d) Subhyaloid.

Many possible causes have been suggested. Schleich (1884) thought they were due to increased venous pressure within the cavernous sinus with congestion of the ophthalmic veins. Naumoff (1890) found retinal haemorrhage in a patient with compression of the central retinal vein. Ehrenfest (1922) stated that a haemorrhagic diathesis was present in infants who manifested retinal haemorrhages at birth. Pietrowa (1956) attributed them to vitamin K deficiency. Chace and others (1950), Musini and Grassi (1950), and Singer, Sgallova and Kudrnovsky (1956) thought that prothrombin deficiency was the cause.

On the other hand, most investigators (Schleich, 1884; Paul, 1900; Lemmingson and Stark, 1957; Sanchez Ibañez, Belmonte González, and Navarro Martinez, 1963) suggested that they resulted from obstetric trauma. Krauer-Mayer (1966) found 50 per cent. and Neuweiler and Onwudiwe (1966) 72 per cent. in cases of forceps delivery in which ophthalmoscopic examination had been performed within 24 hours after birth.

Material and methods

In this study, 1,238 newborn infants were examined in the Department of Gynaecology and Obstetrics of the Faculty of Medicine at Istanbul University. One hour after the instillation of 5 per cent. homatropine solution, Sauer's speculum was inserted for the examination of the infant's eye and the Jena ophthalmoscope was used for fundus examination, the head being held by a nurse.

709 were seen within the first 24 hours after birth, 304 within 25 to 48 hours, and 225 between the 3rd and 5th day. All infants with retinal haemorrhages were examined at approximately 24-hr intervals and were followed until the haemorrhages disappeared.

The mother's age, parity, illness before or during pregnancy, premedication, technique of delivery, duration and stages of labour, time of rupture of the foetal membrane, prematurity, and the Apgar score of the infant, were all recorded.

In twenty newborn infants with retinal haemorrhages, the prothrombin time was measured by Quick's method.

Results

The incidence of retinal haemorrhage varied according to the time of examination. Those undertaken within the first 24 hrs revealed an incidence of 18.9 per cent. in 709 cases; between the 2nd and 3rd day in 12.5 per cent. of 304 cases; and between the 3rd and 5th days in only 2.6 per cent. of 225 cases (Table I).

Table I *Relationship between time of examination and percentage of retinal haemorrhages*

<i>Hours after birth</i>	<i>Percentage in which retinal haemorrhage occurred</i>
1-24	18.9
24-48	12.5
72-120	2.6

Of the 1,238 newborn infants examined, 178 (born to 175 mothers) were found to have retinal haemorrhages.

MOTHER'S AGE

The 175 mothers were divided into three age groups; under 20, 20 to 30, and over 30 years; 36 mothers of affected infants (20.6 per cent.) were found to be over 30 years of age while in the corresponding control group there were only nineteen (10.9 per cent.).

The comparison between cases and controls for each group is shown in Table II ($\varepsilon = 2.2$; $0.22 < \alpha < 0.03$).

Table II *Percentage of neonatal retinal haemorrhages in relation to mother's age compared with controls**

<i>Mother's age (yrs)</i>	<i>Mothers in whose infant haemorrhage occurred</i>		<i>Controls</i>	
	<i>No. of cases</i>	<i>Per cent.</i>	<i>No. of cases</i>	<i>Per cent.</i>
Under 20	40	22.9	39	22.3
20-30	99	56.5	117	66.8
Over 30	36	20.6	19	10.9
Total	175	100	175	100

* Controls comprised 175 mothers matched for parity

PARITY

In the 175 mothers of affected infants, there were 81 primiparae (46.4 per cent.) and 94 multiparae (53.6 per cent.). The difference between these figures and the group as a

whole was significant ($P < 0.001$), retinal haemorrhages being more commonly seen in the babies of primiparae (Table III).

Table III *Parity and occurrence of retinal haemorrhages*

Parity	Primiparae		Multiparae		Total	
	No. of cases	Per cent.	No. of cases	Per cent.	No. of cases	Per cent.
<i>Mothers in whose infants haemorrhage occurred</i>	81	46.4	94	53.6	175	100
Total cases	406	33	832	67	1,238	100

ILLNESS BEFORE OR DURING LABOUR

One case of multiple sclerosis, one of asthma, two of heart disease, and five of eclampsia or pre-eclampsia were recorded.

DELIVERY TECHNIQUE

The greatest number of retinal haemorrhages occurred in infants delivered by vacuum extraction, 25 out of 62 (40.3 per cent.) being recorded. Of nine delivered with the aid of forceps three showed retinal haemorrhages (33.3 per cent.). By contrast, in 125 cases of Caesarean section, there was only one case of retinal haemorrhage (0.8 per cent.).

1,042 cases were delivered spontaneously; of these 147 cases exhibited retinal haemorrhages (14.2 per cent.).

PREMEDICATION

In twelve of the 175 mothers of affected children pituitary extract had been used to accelerate the delivery.

DURATION OF LABOUR

In sixty of the 175 mothers of affected children the duration of the second stage of labour was prolonged; in 23 the total duration of labour was prolonged but in four of these the second stage was shortened.

PREMATURITY

61 of the 1,238 deliveries were premature, and retinal haemorrhages were recorded in fifteen (24.6 per cent.) of these infants.

APGAR SCORE

This was accepted as a criterion for asphyxia of the newborn. In 131 cases, the score was recorded as normal (10 or 9); and in 47 as lower than normal (less than 9).

PROTHROMBIN TIME

This was measured by Quick's method. Of twenty affected infants, four had severe and ten moderate prolongation of the prothrombin time (Table IV, opposite).

Table IV *Prothrombin time measured by Quick's method in twenty cases with retinal haemorrhages*

Case no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Prothrombin time (sec.)																				
Normal	12	12	12	12	12	13	13	13	13	13	13	13	13	13	16	17	12	12	12	12
Measured	13	13	50	15	17	13	14	13	13	17	16	14	13	16	16	17	12	25	13	24

Type, density, and duration of retinal haemorrhages

(1) FLAME-SHAPED

These occurred everywhere in the fundus except at the extreme periphery. They were seen mainly at the disc area or towards the periphery along retinal vessels. They were bright red in colour and of varying density. They were rare in the macular area. In some cases they occurred first at the disc border or at the bifurcation of the central retinal vein.

They occasionally disappeared within 24 hours, usually within 3 days, and sometimes remained as long as 5 days.

(2) WIDE, VERY BRIGHT RED, IRREGULAR, AND SUPERFICIAL

These were thought to originate from superimpositions of flame-shaped haemorrhages and occurred in the same areas.

(3) ROUND, RED, AND DEEP

These were rarer and occurred mostly at the posterior pole. From the topographical point of view there was no relationship between these haemorrhages and the retinal vessels. Occasionally they occurred even in the macular area.

They usually disappeared after 14 to 21 days. In one case a haemorrhage of this type, which was situated on the macula, disappeared 6 weeks after birth leaving no ophthalmoscopic damage.

In the investigation of the aetiology and density of all types of retinal haemorrhage the following case provides a very good example.

Case report

A woman aged 39 years, a multipara, was admitted to hospital in April, 1968. The foetal membrane ruptured spontaneously 7½ hours after onset of rhythmic uterine contractions. The second stage of labour was prolonged to 3¾ hours (usual duration for multiparae 1 hour or less); the heart sounds of the foetus became arrhythmic many times during labour, signifying asphyxia. Pituitary extract was given and labour was completed successfully. The Apgar score of the infant was 5, and it died 12 hours after because of intolerable asphyxia. An ophthalmoscopic examination was made and fundus photographs were taken 2 hours before death. The right and left fundi were full of haemorrhages with marked oedema and the retinal vessels were congested. The appearance of the fundi was very similar to that of central retinal vein thrombosis.

Discussion and conclusion

The variety of percentages given in the literature for the incidence of neonatal retinal haemorrhages seems to be related to the time of examination after birth. This study showed (Table I) that the later the time of examination the fewer retinal haemorrhages were found.

In primiparae, especially in older women, rigidity of the neck of the uterus and resistance of the pelvis to delivery are greater than in multiparae. If there is any connection between obstetric trauma and neonatal retinal haemorrhages, as suggested by some authors, the incidence of retinal haemorrhages should be higher in primiparae. This is confirmed by our findings (Tables II and III).

Similarly a higher percentage was found in cases of vacuum extraction (40.3 per cent.) and a low percentage after Caesarean section (0.8 per cent.).

Kauffman (1958) emphasized that either very short or very prolonged labour would give rise to retinal haemorrhage in the infant. In the first instance this is due to a sudden decrease of venous pressure, and in the latter to increased pressure in the intracranial veins. In this study, sixty of 178 cases of retinal haemorrhage were associated with a prolonged second stage of labour, and four with a shortening of total labour time.

It has been suggested by Cavrot, Humblet, and Richard (1955) that the fragility of the bloodvessels is higher than normal in infants whose birth weight is below 3,000 g., and Ayberk (1954) reported that the incidence of retinal haemorrhages was higher in premature than in full-term infants. In this series, 24.6 per cent. of 61 prematures showed retinal haemorrhages, while the total percentage was 14.3. On the other hand, Kauffman did not find that prematurity was associated with retinal haemorrhages.

Cavrot (1956) reported that retinal haemorrhages due to increased fragility of the blood vessels could be treated by using a "nontoxic antifragility substance", of vit. B, vit. K, vit. E, rutine, and hesperidine. He found that the average incidence of retinal haemorrhage in the newborn infant was 34 per cent. in untreated controls, but only 7 per cent. in those in which this substance had been given to mothers. Pray, McKeown, and Pollard (1941) observed that the incidence of retinal haemorrhages was reduced in infants of mothers treated with a vit. K preparation during or before labour. Nevertheless, Kauffman (1958) found that the incidence of phlebitis was increased in mothers who had been treated with vit. K. Millan, Ady, and Beltron (1950) and Singer and others (1956) suggested that the insufficiency of the blood-clotting mechanism of the newborn infant might increase the incidence of retinal haemorrhage. Of twenty cases investigated, four showed severe prolongation of prothrombin time, ten showed moderate prolongation, and six were normal.

The major factor in the pathogenesis of retinal haemorrhage, however, has been shown by this study to be foetal circulatory disturbance.

Summary

Types of retinal haemorrhage in newborn infants are described and the pathogenesis of such haemorrhages is reviewed with reference to the literature. Of 1,238 newborn infants investigated, 178 (14.3 per cent.) were affected. Examination within 24 hours revealed a percentage of 18.9 but between the third and fifth day the figure was only 2.6 per cent. It is concluded that the later the time of fundus examination the less the incidence of retinal haemorrhage found. Comparative studies of the incidence and aetiology of retinal haemorrhages have shown that the difference between primiparae and multiparae is

significant ($P < 0.002$); retinal haemorrhages were more common in the babies of primiparae, confirming the role of obstetric trauma in the pathogenesis of neonatal retinal haemorrhages.

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