

PERIPHERAL RETINAL CHANGES FOLLOWING BLUNT TRAUMA*

BY *William Tasman, MD*

INTRODUCTION

THE RELATIONSHIP BETWEEN TRAUMA AND RETINAL DIALYSIS IS SOMETIMES uncertain, although traumatic dialyses are a common cause of retinal detachment in all age groups and are the major cause of detachment in children and young adults. At times the diagnosis of retinal detachment secondary to dialysis is not made until after central vision has been affected due to the infrequency of routine examination of the extreme retinal periphery. Since these detachments always begin in the periphery and progress slowly, it is theoretically possible to prevent macular involvement by early surgery if the dialysis can be diagnosed before it has gone on to cause retinal detachment or before a detachment has extended to the macula.

The time interval between ocular contusion and the clinical appearance of a retinal detachment is extremely variable. Several authors have emphasized the latent period between the occurrence of injury and the diagnosis of retinal detachment.¹⁻⁶ Cox et al.³ found that 12 per cent of detachments following blunt trauma occurred immediately, while 30 per cent were detected within one month, 50 per cent within eight months, and 80 per cent within two years. Hagler and North⁵ in their series reported that in 52 per cent of patients with retinal detachment due to dialysis the symptoms were present in excess of one month and in 42 per cent of patients they were present longer than three months. In addition, they noticed concentric demarcation lines in 50 per cent of all patients, and from these findings calculated that 28 per cent of their patients had a duration of detachment longer than six months.

Weidental and Schepens⁷ have shown by experimental work on hog

*From the Retina Service of the Wills Eye Hospital, Philadelphia, Pennsylvania. Supported by the Retina Research and Development Foundation, Philadelphia, Pennsylvania.

eyes that upper nasal dialyses, frequently with avulsion of the ciliary epithelium, may be produced after blunt trauma to the center of the eye, and inferior temporal dialysis may be produced by trauma to the temporal limbus. The question then arises as to whether or not there is a true latent period between the onset of trauma and the occurrence of retinal dialysis, or whether, in fact, the dialysis occurs at the time of injury, but is not detected until later when a detached retina involves the macula.

MATERIALS AND METHODS

Fifty-two patients with ocular contusion were examined within the first three weeks after injury and were followed prospectively from February through September of 1969 to December of 1971. The following criteria were used in the study:

- 1 history of blunt trauma unilaterally;
- 2 objective signs of contusion in the affected eye; and
- 3 absence of visible vitreoretinal degeneration of the types known to cause retinal breaks in the affected and fellow eyes.

In this report many of the same objective signs of ocular contusion used by Cox, Schepens, and Freeman³ were utilized in order to establish the significance of the reported injury. The signs observed included vitreous hemorrhage and hyphema, development of traumatic chorioretinal atrophy and pigmentation, lid laceration and ecchymosis, corneal abrasion, iridodialysis, peripheral and posterior retinal edema, and choroidal rupture.

PRESENTATION AND DISCUSSION OF DATA

The data obtained from a study of 52 patients with ocular contusion due to blunt trauma were analyzed with respect to the following characteristics:

- 1 age and sex relationships,
- 2 refractive error,
- 3 latent interval,
- 4 ocular findings, and
- 5 treatment.

1. AGE AND SEX RELATIONSHIPS

In Table 1 the patient population has been tabulated by sex. A statistically significant prevalence of males (84.6 per cent) was found in the 52

TABLE 1. OCULAR CONTUSION - SEX

	No. of patients	Percentage
Male	44	84.6
Female	8	15.4
TOTAL	52	100.0

TABLE 2. OCULAR CONTUSION - AGE (52 PATIENTS)

Range in years	5-52
Average age	17.9 years
Median age	15 years

TABLE 3. OCULAR CONTUSION - TYPE OF INJURY

	No. of patients	Percentage
Missiles	32	61.5
rocks	16	
baseball	1	
squash ball	9	
tennis ball	4	
bottle cork	1	
BB	1	
Direct blow	20	38.5
fist	16	
knee	1	
chain	1	
crowbar	1	
acetylene torch	1	
TOTAL	52	100.0

patients with ocular contusion. As one might expect, the patients in this study were characteristically young (Table 2). The median age of patients with ocular contusion was 15 years and the average age was 17.9 years. A meaningful comparison between the age distribution of males and females cannot be made because of the small number of females. The age and sex characteristics of this population reflected the frequent participation of young males in hazardous activities. These activities are shown in Table 3, where the various etiologies of the ocular contusions are tabulated. The majority of the patients (61.5 per cent) were injured by missiles, most of which were thrown by hand.

TABLE 4. MYOPIC REFRACTIVE ERROR
(9 PATIENTS)

	No. of patients	Dialysis
0-2 diopters	6	1
2-4 diopters	3	0

TABLE 5. TIME INTERVAL
BETWEEN INJURY AND
DIAGNOSIS OF DIALYSIS
(10 PATIENTS)

No. of days	No. of patients
0-7	4
7-14	3
14-21	2
21 or more	1

2. THE REFRACTIVE ERROR

An eye was considered myopic if a lens of minus spherical equivalence had been prescribed for distant vision. The incidence of myopia in the series was 17.3 per cent and was generally of a low order (Table 4). Particularly notable was the fact that there was only one patient with myopia who sustained a dialysis from ocular contusion, and his correction was less than 1 diopter in each eye.

3. LATENT INTERVAL

The time interval between the ocular contusion and the clinical appearance of retinal pathology was usually within the first three weeks after injury, although four patients were found to have retinal dialyses within the first week after injury (Table 5). The one dialysis not discovered until later was found after a vitreous hemorrhage had cleared from the superior nasal portion of the globe. However the patient was examined periodically over a four-month period until clearing of the hemorrhage permitted a view of the previously obscured area.

4. OCULAR FINDINGS

Ten of the 52 patients sustained retinal dialysis following ocular contusion. In three patients two dialyses were present in the injured eye for a total number of 13 dialyses, which were distributed fairly equally between the superior nasal and inferior temporal quadrants (Figure 1). In addition, two patients with dialyses had associated vitreous hemor-

DISTRIBUTION OF DIALYSES

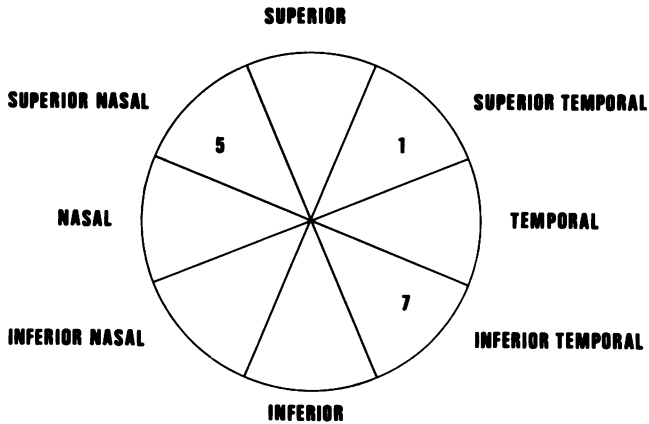


FIGURE 1
Blunt trauma.

TABLE 6. OCULAR CHANGES SECONDARY TO OCULAR CONTUSION

	No. of patients	Associated with dialysis
Dialysis	10*	
Vitreous hemorrhage	6	2
Hyphema	7	2
Chorioretinal scarring vitreous base	2	1
Peripheral choroidal rupture	1	0
Iridodialysis	1	1
Peripheral retinal edema	2	0
Edema posterior pole	3	0

*Thirteen dialyses were found in ten patients; three eyes had two dialyses.

rhage and hyphema, although a total of seven patients had vitreous hemorrhage and six had hyphema (Table 6). Other ocular findings were chorioretinal scarring in the area of the vitreous base in two eyes, peripheral choroidal rupture in one eye, peripheral retinal edema in two eyes, and edema of the posterior pole in two eyes (Table 6).

5. TREATMENT

Of the ten patients with dialysis seven were treated with transconjunctival cryotherapy. Two patients were treated with segmental buckles, one because the dialysis ran for 90°, and the other because a small amount of subretinal fluid was present. A tenth patient was not treated

because no edge of a break along the anterior or posterior border of the vitreous base could be opened despite the fact that the vitreous base had been avulsed. All of these patients have subsequently done well, and none have required further therapy.

DISCUSSION

In this study 52 patients who had sustained ocular contusion were followed prospectively for a period of two years. Dialysis of the peripheral retina was diagnosed in nine patients within three weeks of injury depending on circumstances such as presence or absence of hyphema, ecchymosis, and tenderness of the lids. In one patient a dialysis was found four months after injury when hemorrhage cleared from the peripheral retina in the area of the break. In none of the 52 patients was a retinal dialysis seen to occur over the ensuing two year follow-up.

This series suggests that retinal dialysis occurs at the time of contusion and, if not recognized initially, may go undetected until symptoms develop. Because this study does not completely eliminate the possibility that dialysis may occur later from vitreoretinal pathology secondary to the injury, the ophthalmologist is obligated periodically to reexamine patients who have had blunt trauma. This is especially true when vitreous hemorrhage obscures part of the retinal periphery. A dialysis hidden in such an area can easily go undetected if the patient is not periodically reexamined until all of the hemorrhage has cleared permitting adequate ophthalmoscopy of the entire ora serrata.

SUMMARY

Fifty-two patients who had sustained ocular contusion were followed prospectively for two years. Nine patients had dialyses diagnosed within three weeks of injury while a tenth patient was found to have a dialysis when his vitreous hemorrhage cleared four months after injury. In none of the 52 patients was a delayed dialysis seen to occur. Following sealing of the dialysis in seven patients with cryotherapy and in two patients with a localized buckle, no retinal detachment has as yet developed.

REFERENCES

1. Hagler, William S., Retinal dialysis as the cause of a special type of retinal detachment, *Southern Med. J.*, 58:1475, 1965.
2. Tasman, William, Retinal detachment in children, *Trans. Amer. Acad. Ophthalm. Otolaryng.*, 71:455, 1966.

3. Cox, M.S., C.L. Schepens, and H.M. Freeman, Retinal detachment due to ocular contusion, *Arch. Ophthalmol.*, 76:678, 1966.
4. Tasman, William, Juvenile retinal detachment, *J. Ped. Ophthalmol.*, 5:160, 1968.
5. Hagler, W.S., and A.W. North, Retinal dialyses and retinal detachment, *Arch. Ophthalmol.*, 79:376, 1968.
6. Hilton, G.F., and E.W.D. Norton, Juvenile retinal detachment, *Mod. Probl. Ophthalmol. (Basel/New York, Karger)*, 8:325, 1969.
7. Weidenthal, D.T., and C.L. Schepens, Peripheral fundus changes associated with ocular contusion, *Am. J. Ophthalmol.*, 62:465, 1966.

DISCUSSION

DR ROBERT B. WELCH. The hallmark of blunt trauma to the eye has long been recognized by ophthalmologists as commotio retinae or Berlin's traumatic edema. This entity, as well as the development of crescentic choroidal ruptures, first described by Von Graefe, is classically found in the posterior pole and leads to the appearance of a macular hole, and atrophic crescentic choroidal scars.

With the development of examination techniques which permit visualization of the peripheral retina, such as indirect ophthalmoscopy, scleral depression, and the 3-mirror contact lens, the peripheral effects of blunt trauma have been increasingly recognized. These are primarily due to defects related to the immediate area of impact and contrecoup injuries. Contrecoup injuries to the peripheral retina primarily reflect the compression and expansion of the globe with the transmission of momentum forces to the vitreous and its attachments at the ora serrata. Hence in young individuals, where isolated vitreoretinal adhesions posterior to the vitreous base are infrequent, dialysis is the most frequent cause of retinal detachment following blunt trauma.

Dr Tasman has discussed a series of patients suffering blunt trauma, and illustrates both the practical, as well as the prognostic, value of a thorough examination of the peripheral retina following injury. When the retinal periphery over a full 360° showed no evidence of dialysis, no retinal detachment developed in a two-year follow-up period. The implication is that dialysis occurs at the time of trauma and that early examination may allow diagnosis prior to the development of a detachment and permit prophylactic therapy if a dialysis is found. It should be stressed, however, that complete coverage of the ora by scleral depression may be difficult, especially in young children when the eye is swollen and tender. The nasal periphery where pathology is apt to occur may be very difficult to examine. This point is amplified by the realization that dialysis may occur at the anterior insertion of the vitreous base which is located over the pars plana. Thus it would seem wise to reevaluate these patients periodically until we can obtain a thorough examination of the peripheral retina.

Although in Dr Tasman's patients dialysis was the only cause for retinal detachment, it should be noted that other types of tears may occur even when eyes with obvious vitreoretinal pathology such as lattice degeneration are

excluded. Thus horeshoe tears, round tears with or without pulled out operculi, and tears associated with choroidal rupture do occur.

It is of interest that inferior temporal dialysis was as frequent as nasal dialysis in Dr Tasman's patients. In a series of 24 examples of retinal detachment in young individuals following blunt trauma seen at the Wilmer Institute, 13 had dialysis and 11 of these were located in the nasal half of the eye.

I would like to commend Dr Tasman for calling to our attention still another situation where the knowledge of the natural history of a disease, combined with proper examination techniques, makes it possible for us to apply preventive therapy and prevent the development of a more serious ophthalmic problem.

In closing I would like to pose the following question to Dr Tasman: Is the statement that nasal dialysis is due to trauma, while inferior temporal dialysis is often due to congenital weakness, rupture of a retinal cyst, or the result of retinoschisis, a valid concept, or indeed are all dialyses really secondary to trauma?

DR JAMES W. JERVEY, JR. I have a short case report which seems to me pertinent to the matter under discussion at the moment. Only last week I had a fine young man come to me who had been injured by a flying missile from a rotary lawnmower. Before I forget it, I would like to emphasize what I feel to be our duty — to warn our patients about the dangers of these rotary instruments.

Now to the case: This young man came in with about two-thirds of his anterior chamber filled with blood. One could see the upper edge of the pupil, and strangely enough he had 20/30 vision, yet the eye appeared to be terribly injured. I don't think I have ever seen such an extensive scleral flush. I patched both eyes and kept him quiet, and within four days all of the blood had been absorbed. There was some retinal edema. The media were perfectly clear.

One of the most interesting things about the case was something that I have never seen before — almost a 360° recession of the ciliary body, with no dialysis. This to me is very striking, and I thought it was worth reporting.

DR ARTHUR E. SHERMAN. I would like to bring up one related point, and this should be stressed to residents in ophthalmology: Occasionally blunt trauma of the type under discussion can cause a posterior rupture of the sclera, which may be missed if one considers the case as one of simple abrasion of the cornea and does not look for other signs, such as "saucer-shaped" recession of the iris, hemorrhage into the vitreous, etc.

A case in point occurred in the summer of 1968. A young man was helping to string a wire fence in northern New York State. The wire snapped back and struck him in the eye. He had a painful abrasion of the cornea, which was treated as such by the local ophthalmologist, with ointment and a firm dressing. The serious diagnosis was missed. Even though the patient phoned

the doctor the next day because of severe pain, he was not seen but was told that the dressing should be left in place until the following day. On that day, much to his surprise, the doctor found marked edema of the lids, proptosis, congestion, chemosis, etc. He made a diagnosis of panophthalmitis, even though there had been no break in the anterior coats of the eye from the trauma. The correct diagnosis of posterior rupture of the globe had been missed entirely.

Rather than enter a hospital in northern New York, the patient flew home to Newark, New Jersey, and had fourteen days' hospital treatment for "panophthalmitis." At the end of that period the eye was already shrinking.

I first saw him six weeks after the original injury, at which time the cornea, as well as the remainder of the eye, was about half normal size. Because of subconjunctival brown pigment in the nasal equatorial region it was evident that he had had a rupture. Microscopic section confirmed this; in fact, the rupture had been large enough to permit posterior extrusion of the lens, which was entirely absent from the sectioned eye.

DR ARIAH SCHWARTZ. I want to add a comment as a corollary to Dr Jervey's observation. In examining approximately 15 patients who had suffered contusion to the eye in which a detachment of the base of the vitreous was found, every one of these patients on gonioscopy showed contusion deformity of the anterior chamber angle.

DR TASMAN. I would like to thank Dr Welch for his very cogent remarks and his kind discussion. I certainly agree that there are other types of tears which can result from blunt trauma in addition to the dialysis we have described.

Regarding the etiology of inferior temporal dialyses, in our experience we have found an even number or perhaps a predominant number of dialyses occurring inferiorly temporally where there has been a definite history of trauma elicited. However undoubtedly inferior temporal dialyses occur where there is no history of trauma, and quite possibly these are congenital in origin. The possibility of congenital dialysis is heightened when they are located bilaterally in the inferior temporal quadrants.

I thought Dr Jervey's remarks about the case he had seen were of particular interest, and I was glad Dr Schwartz mentioned angle recession. Thirty-eight of the patients in this series were examined for angle recession, but none was noted. This is in contrast to the findings of our glaucoma service, which has found that 75 per cent of hyphema patients do have angle recession. Dumas, in the International Ophthalmology Clinics, has correlated angle recession with dialysis and has found a high incidence of correlation, often with the dialysis and the angle recession located in the same quadrant.

Finally, I agree with Dr Sherman that diagnosis of posterior rupture can be difficult to make, and I think we should all be cautious in following up blunt trauma, especially in this medico-legal era.

Thank you.