Detachment of the Retina
with Illustrative Cases

by

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While I was Assistant House Surgeon to the Hull Royal Infirmary and in charge of the ophthalmic department of that institution there were five cases of detachment of the retina admitted to, and treated in, the ophthalmic wards. Two of them were of an unusual and interesting nature occurring as they did in children under 10 years of age. I became very interested in the subject and though it is rather an unsatisfactory and disappointing one so far as therapeutics is concerned, still it occurred to me that the subject might prove an admirable and profitable one for a review in the form of a thesis. It is very desirable at times to review such apparently hopeless conditions so that we may see if ground is being gained in any way and to see if there is any reason for taking a more optimistic view of such conditions than our predecessors took.

Short Historical Review

I wish to devote myself more particularly to the more modern advances in treatment of detachment of the retina but it is interesting
to note that even in the end of the 18th and the beginning of the 19th centuries, conditions were described under the names of "hydrops sub-choroideal is" and "hydrops choroidal internus" which appear to be genuine examples of detachment of the retina.

That such a pathological condition was known in the pre-ophthalmoscopic days is evident from the following extract: "It has been ascertained by dissection that a watery fluid is sometimes present in sclerotic staphyloma between the sclerotica and the choroid, whereby the latter tunic is pressed inward and the former outward. There are also good grounds for believing that a similar effusion forms occasionally between the choroid and the retina. If the fluid collected in the latter situation is not evacuated by puncturing the staphyloma, it may accumulate to such an degree as to press the retina before it, and having at last produced, by means of its continued pressure, an absorption of the vitreous humour, it will gather the retina into a cord, as sometimes happens on
arthritic, and in mismanaged cases of syphilitic uphthalma.

At that time, however, the condition was rarely diagnosed, indeed it was only diagnosed when the detached portion lay so far forward as to be seen through a clean crystalline lens.

Ever since the introduction of the ophthalmoscope, of course, the condition has been well recognized and the ophthalmoscopic signs are well known. Von Graefe, very soon after the introduction of the ophthalmoscope gave a very complete clinical description of the disease.

There is a variety of causes (to be discussed later under etiology) producing the detachment, but the condition is one where the retina, in part or in whole, becomes detached from the choroid coat. This separation takes place practically in all cases between the hexagonal pigment layer and the layer of rods and cones, the latter remaining attached to the choroid. The detachment may be primary, the as stated
idiopathic detachment, i.e. there is no known cause for the condition—no accompanying or antecedent inflammation etc., or it may be secondary to some inflammatory condition such as cyclical arthritis etc. Tumour growths of the choroid give rise to detachment and rare cases occur where the myosis is responsible for it. Owing to this variety of causes and to the fact that serous fluid, blood, tumours etc., may be the medium actually producing the separation, it will readily be understood that the signs and symptoms vary considerably and it is well to mention these before discussing these.

**Subjective Symptoms.**

Premonitory. Usually on questioning a patient, e.g. Case 5, one discovers that for some time before the patient developed the more severe symptoms causing him to seek advice, he was troubled with black specks floating before his eyes (muscae volitantes) and that he had sensations of flashes.
of light, the latter sometimes coloured as well as uncoloured. The patient may seek advice regarding these but often they are slight and he pays no particular attention to them.

acute symptoms

When the detachment actually occurs, the symptoms vary with the suddenness of the onset, the amount and part of the retina affected and the state of the vision in the other eye. Usually the onset is sudden but usually also, one eye only is affected at one time so that the patient may not discover it till some time later.

"A cloud gradually falling over the sight from above" is a typical and suggestive description. This, of course, is noticed especially when the condition comes on suddenly and when the other eye is blind or defective e.g. Case 3. This cloud is frequently central and may result in total blindness, but often after a day or two the sight considerably improves though the upper part of objects looked at is hidden. This way mean
that the central part of the retina was at first detached, but that it has fallen back to its normal position, owing to the gravitation downwards of the subretinal fluid which produces a more peripheral detachment.

Often the outlines of objects looked at appear distorted and may be bordered by colour. The apparent irregularity too which they present is apt to be inconstant, and to change much like the images reflected from the wavy surface of disturbed water.

Night blindness too is a common symptom. This was marked in Case III. While he could manage fairly comfortably to move about in a good light, he appeared to be perfectly blind in a dimly lighted room.

There is also sometimes a tendency to confuse blue and green. Leber suggests that this may be due to absorption of the blue rays by the yellowish subretinal fluid.

The central visual acuity is diminished in about all cases of idiopathic detachment whether the detachment involved the macular region or not, and
This is probably caused by an oedematous condition of the macula.

The visual field is found to present a scotoma corresponding to the detached portion of the retina. This is more marked when the condition has lasted for some time. In recent cases the detached portion retains its function to some extent, and hence the restriction of the field of vision may escape observation unless the examination be made in subdued light. Sometimes the scotoma extends over a greater area than the corresponding apparent detachment, and this should be noted as one may thus learn that further separation has commenced. The boundaries of the scotoma are usually somewhat indefinite and irregular. The field of vision is usually more restricted for colours than for white light.

In the case of a tumour growth, the boundaries of the scotoma may be much more clearly defined and the central vision may be unaffected.
Objective Signs.

In ordinary idiopathic cases, as a rule nothing can be made out by direct inspection or by oblique illumination. Occasionally, however, (as in Cases 1 and 2) where the detachment implicates the whole retina which is then pushed forward in a funnel shaped manner, the grayish mass lying behind the lens may be seen by oblique illumination and even by inspection.

On throwing light into the eye from the plane mirror, the fundus reflex may be got but very often (as in Cases 4 and 5) only a part of the red reflex is got, the other part appearing of a bluish gray colour. Indeed it is sometimes more easily seen in this way than by direct examination. Very often some slight modification of the reflex may attract undue attention and this should be noted for it often gives one valuable information for further examination. Of course this is seen best when the eye is examined under the influence of a mydriatic, and this should be done in all cases unless
there is some plain contraindication.

Ophthalmoscopic Examination

Of the two methods, the direct method
gives by far the better results here and
will be described first.

As a general rule the appearances
presented is quite characteristic and the
diagnosis easy. Wherever the retina
is separated from the choroid, that part
of the fundus is altered in appearance
and the line of demarcation from the
rest of the fundus is usually distinct.
A small part only in the region of
the fundus may be affected, the macula
may be affected and part of the disc
obscured by the detachment extending
as far as its edge, or the whole of the
retina may be detached. When due to
subretinal fluid,—the ordinary cause—
the detachment is usually or at least
ultimately situated (situated) near the
equator at the lower part. The condi-
tion is more easy to diagnose when it
has existed for some time.

The normal orange-red aspect of the
The corresponding part of the fundus is generally found to assume a grayish, bluish-gray, semitransparent or opague appearance. Sometimes this is very beautiful, giving the appearance of water, as in case 4.

On endeavoring to see this part more clearly, it will be found that the focus required is quite different from that required for the rest of the fundus. A weaker concave or a stronger convex lens will be found necessary. The normal part of the fundus and the separated retina cannot be seen distinctly at the same time. When a considerable portion of the retina is involved, the surface may present an undulating rippled appearance, as in case 5.

In this case also, as in many others, especially when they have existed for a considerable time, the detachment was noticed to float about with each movement of the eye.

The retinal vessels, which run over the surface of the detached portion and
follow and dip into the undulations, are said to have the appearance of copper wire; they appear smaller than normal and of a dark red or even black color; the central light streak is not apparent either. All these effects are optical, and Biny explains them as follows: "The dark appearance which the vessels on the detached portion of the retina so often present is due to their being seen to a great extent by transmitted light, just as the streak in an incipient cataract appears black when examined with the ophthalmoscope. The diminution in the apparent size of the vessels when seen by direct ophthalmoscopic examination is accounted for by their lying in front of the focal plane of the eye. It is consequently more marked the deeper the detachment."

These are the appearances presented in an ordinary well marked case and there is no difficulty in the diagnosis, but in some of the more recent cases
where the retina retains its transparency and where the detachment is slight, it requires very careful examination to make out with certainty the nature of the disease causing the symptoms. In such cases, no help is given by the alteration in colour and one must depend on the facts that 1) an alteration in focus is required, 2) that the vessels are darker in colour and 3) vary in outline. A parallactic movement of the vessels over the red fundus can often be made out too, more especially if a choroidal vessel can be seen behind the detachment.

It is very seldom, however, that the detachment is so shallow all over that the diagnosis cannot be made certain of by attention to these points.

Difficulties may again be met with in some opacity of the media. An incipient cataract or haziness of, or opacities in, the vitreous may render an satisfactory ophthalmoscopic examination impossible. The opacities
in the vitreous or the baginess may, after a little time clear and allow a better examination.

In certain cases (some authors say "occasionally", others say "often") a rent or rupture may be seen in the retina. This varies in size and may be of sufficient size to allow the choroid to be distinctly through it. It may be seen at any portion of the fundus and there may be more than one rent. The margins of the rent may sometimes be seen turned in towards the vitreous. Their probable significance will be discussed later under pathology.

Berry mentions that in some cases, especially where the detachment has been haemorrhagic, there may be seen irregularly disposed straw coloured streaks or star shaped opacities in the retina. "These", he says, "might be taken for scars did they not frequently appear to interlace and lie behind perfectly intact vessels. They are in all
probability fibroinuous deposits at the back of the retina.

In old cases the retina becomes atrophied and at the time of exam-
ination may be converted into a more connective tissue membrane.
In old total detachments the retina examination may be found separ-
ated in the shape of a funnel or convolution with its apex at the
optic nerve and its base at the lens and ciliary region. In such,
a bluish gray mass is seen lying behind the lens.

By Indirect Examination the gray or bluish gray aspect of the detach-
ment is less apparent than by the direct method and unless the detach-
ment is sharply defined and the media clear, it is difficult to
ascertain the extent of the lesion.

The above are the ordinary opthalmoscopy and other signs in an
ordinary case of retinal detachment caused by subretinal fluid. Where a tumour growing from the choroid, or a tumour growing from the deep layers of the retina is the cause, then the appearances may be different. Where the growth is small the retina is usually adherent to it and then the alteration in level may be the only sign of a detachment. There is no rippling of the surface, no movement and the vessels may be normal. If the growth is pigmented, as in melanotic sarcoma, the retina over it will appear dark and the vessels of the neoplasm may be seen through the retina. Later, however, the detachment of the retina may take place beyond the the actual area of the growth and so cause great difficulty in diagnosis; this will be discussed more fully later.

Again the cysticercus cellulosae, the scolex of the Taenia solium, occasionally gives rise to detachment.
At this stage it is almost always possible from the colour and shape to diagnose the cause of the detachment. Hill Griffith gives the following description of the cases he had seen: "In each case one saw with the ophthalmoscope a very large spherical bluish white cyst, and springing from this the neck of the animal, like an alabaster pillar, surmounted by the head and suckers, which with its slow, regular and graceful movements reminded one of an elephant's trunk, the whole appearance presenting a picture never to be forgotten.

The tension of the eyeball in the vast majority of the ordinary cases of detachment is reduced. This is especially so where the detachment has existed for some time. In a small percentage of cases the tension is increased, not diminished. There may be some accompanying condition
to account for this such as iritis and total synechia but there may be no visible inflammatory changes in the anterior part of the eye and the increased tension may be due to coincident true primary glaucoma.

In intraocular tumours, the tension is almost always raised; indeed as a rule retinal detachment with increase of tension denotes a neoplastic growth. The tension, however, in these cases is occasionally not increased; it may be normal and even diminished; this is especially so if the growth involves the ciliary region. Great difficulty then arises in the diagnosis of the cause of detachment (See Diagnosis).

**Pathology and Etiology**

In this part of the subject we meet with great diversity of opinion and a review is beset with many difficulties. To begin with the diseases with which
the condition is associated are many and varied; indeed detachment of the retina is not in itself a disease but rather only a symptom of various diseases. Again the mechanism responsible for the production of the detachment varies vastly; one factor alone may be at work but in most cases probably several factors, whose action is imperfectly understood contribute to the actual production of the detachment. Under such unsatisfactory circumstances, a satisfactory classification of the pathological conditions is not possible.

To begin with, however, we shall deal with some generalities and afterwards with classification. Normally, the retina is kept, by the pressure of the intraocular fluids, merely in apposition with the choroid except at the optic disc and ora serrata where its attachments are firm. Hence it is that, in total detachments, when the preretinal has
filled the whole of the available space between the choroid and retina, the two sides of the retina are in contact with one another and the whole retina assumes the shape of a funnel or convoluted (to which it has been aptly compared) with its apex at the optic nerve and its base at the lens or ciliary processes.

Regarding the part of the retina most affected, there are differences of opinion; some state that the upper part is more commonly affected first; others state that the lower part is most commonly affected when serum is the cause. It is very difficult to state definitely which view is correct as by the time the case is seen, the subretinal fluid has very often gravitated to the lower part and while the upper part may have been affected, it may be replaced by the time of examination. Berry says: "The
retina may be detached at any part but in a large proportion of cases some part of the upper half is affected. Thus, of one hundred and twenty six cases occurring at Göttingen, only thirty nine were found not to involve some portion of the upper half of the retina. In the course of time the lower portions as well are apt to become detached by the gravitating of the subretinal fluid. Juler states it thus: "The detachment may be slight or extensive, it may involve the whole or part of the retina, but if due to subretinal fluid, it is usually situated near the equator at the lower part."

When the condition occurs idiopathically it not infrequently affects both eyes. Very occasionally however are the two eyes affected simultaneously; often a considerable time, may be a period of years, elapses before the second one is
affected.

For some unexplained reason, it is of more frequent occurrence in men than in women though Parsons states that in myopic cases it occurs more frequently in women.

Regarding the age of individuals affected with this condition, it is not very common in the young and tends to become more frequent with each decade, up to 60 at least.

Errors of refraction. Eyes presenting all the different states of refraction have been affected by the condition, though in the majority of cases (statistic differ but the average seems to point to about 60%) myopia is the most common error.

Line of separation. Regarding this, see under head "Pathology."

Complications. Of the complications associated with detachment of the retina, cataract is a very common one and the opacity of the lens not infrequently undergoes subsequent
calcaneous degeneration. As has already been mentioned, opacities in the vitreous are also very common and Berry states that this is almost always the case when the detachment has been caused by haemorrhage, either spontaneous or following injury to the eye. In these cases, the opacities are often membranous. These are the usual complications resulting merely from the detachment. The disease causing the detachment may of course give rise to many other complications.

Now let us consider the classification of the etiological factors.

After looking through the literature and noting the various ways in which the classification is done, I have decided on the following:

1. A group of cases in which the detachment is due (probably) to a diminution of the normal intraocular
Tension which keeps the retina in position.

2. A group in which the detachment is due certainly to the traction of bands stretching across the vitreous.

3. A group of cases due partly at any rate to pressure outside the retina forcing it inwards.

4. Hyopia. This is the most common cause of detachment and deserves to be classed by itself.

5. Idiopathic Cases.

Let us now take these in order.

1. A group of cases in which the detachment is due to a Diminution of the Normal Intraocular Pressure which keeps the retina in position.

The cause in these cases can be quite well understood. As has already been stated, the retina, normally, is kept merely in apposition with the choroid by the pressure of the intraocular fluids. If any accident occurs, therefore, which results in a diminution of this pressure, it may
be quite readily understood that the retina will tend to separate from the choroid, fluid very readily being thrown out from the choroidal vessels under such circumstances.

1) In this group may be placed all those cases caused by trauma—blow, wound etc., which result in rupture of the globe and allow an escape of vitreous or aqueous humour or both.

2) Perforating ulcers of the cornea may also allow of such a reduction in tension that detachment may occur.

3) In this class also must be placed those unfortunate cases of detachment which occasionally result from operation on the eye—especially after the operation for cataract extraction. This catastrophe may occur immediately or some time after the operation and it is especially liable to occur where the vitreous is more fluid than usual and (from some accident during the operation, such as squeezing by the patient, too
Peripheral an iridectomy, undue pressure during delivery of the lens partly escapes during the operation.

1) Possibly also may be placed in this group those cases where the vitreous is very fluid (synchysis) and the tension low.

2) A group in which the detachment is due certainly to the traction of bands stretching across the vitreous.

These traction bands may be caused by several conditions which may be grouped as follows.

a) Cyclitis and irido-cyclitis
b) Choroiditis, especially that from affecting the anterior portion of the choroid.
c) Haemorrhage into the vitreous.
d) Myopia - possibly.

A variety of diseases may, of course, be responsible for the setting up of the cyclo-irido-cyclitis, choroiditis. Some constitutional factor may be the cause, e.g. syphilis may account for them. Any infectious focus in the body may initiate an attack either as a septic embolic process or as a toxemic condition. Thus
In some cases, a retinal detachment may occur some time after haemorrhage into the vitreous humour. The contraction of the blood clot dragging on the retina.
it may occur from septic conditions of the mouth, ear or nose and its accessory sinuses or from some such condition as furunculosis. Again sympathetic ophthalmia usually takes the form of an irido-cyclitis. Trauma also, with resulting septic infection is responsible for many of these cases, especially perforating injuries of the ocular region or dangerous zone. The cause of the cyclitis is, however, often obscure. As a result of these various diseases puru lymph is formed and later becomes organised. During the process of organisation, fibrous strands are formed, stretch across the vitreous, become attached to the retina and ultimately by their traction action bring about detachment.

(see Mechanism of Detachment)

3. A group of cases are partly at least to Pressure Outside the Retina forcing it inwards. Such pressure may be produced by fluid or solid or both. The following are the chief members of this group:

a. Some forms of choroiditis and retinitis

b) Haemorrhage from constitutional and other causes
1) New Growth.

a) In choroiditis, local subretinal exudations may cause small detachments, but most commonly the anterior part of the choroid is affected with the ciliary body and this type would be placed in Group II. In this class should be mentioned the cases of pseudo-glaucoma, which are due either to a toxemia or a depot of pathogenic organisms in the choroid.

Albminuric Retinitis may cause detachment; in itself, albminuric retinitis denotes a bad prognosis as regards life and detachment seems to occur only towards the close of such cases. In the Albminuric Retinitis of Pregnancy, detachment may occur but here the prognosis both as regards life and sight is more hopeful. (As to the production of detachment in these cases, see discussion.

Diabctic retinitis and Retinitis Prolifera may be mentioned here as occasional causes.

b) Haemorrhage may occur from the choroidal vessels in arterio-sclerosis, various blood diseases such as haemophilia, anaemia...
Trauma may cause a subretinal haemorrhage and thus enter into this group. Trauma as an element in the production of detachment plays a more or less important part. It is for a supposed blow is responsible for the production of a detachment is difficult to say. Where a subretinal haemorrhage takes place immediately after a blow, the evidence seems pretty conclusive, but where serum is the cause it is difficult to convince oneself that the blow is altogether responsible. Those cases which occur a long time after a supposed blow I am certainly not inclined to put in this category. The analogy may be drawn between this and carcinoma of the breast which is often supposed to have started (after) by a blow inflicted may be months or years before. I am inclined to transfer all such cases to the idiopathic group unless some other cause besides the blow can be brought forward.

c) Swellings external to the retina include

1) Sarcoma of the choroid
2) Secondary Carcinoma in the choroid
3) Glioma Epiphytum
4. Tuberculous and Gummatus Tumours

5. Cysticercus.

The pathology of these various conditions of course, will not be entered into. It can readily be understood that any of these conditions may, by their growth, push forward the retina but they also cause a true form of detachment from an effusion of fluid between the chorioid and retina, probably the irritation from the presence of the tumour causing the exudation from the chorioid vessels. Their importance lies in their diagnosis from simple detachment of the differences and difficulties will be considered under that head.

4. Myopia. This, as has already been stated, is the most common error of refraction with which detachment of the retina is associated; indeed it is so common as a concomitant of the disease that one is led to think of myopia in itself as a causal factor in its production. How it acts is difficult to say and two prevailing theories exist but it is so common as an accompaniment of the disease that along with
Idiopathic cases, we shall discuss the mechanism of both together under that head. In the latter group of cases which form a considerable number of the total and with which we are more especially interested, no cause can be ascribed for the condition. The eye may be perfectly emmetropic, there may have been no previous inflammatory or other disease in the eye; there may be no present disease in the eye and no constitutional taint which may be blamed, and yet detachment occurs. These cases we must leave; perhaps with the advance of science and especially with the advance of scientific research regarding pathological conditions in the eye, we may yet come to have a clearer and more definite knowledge of the etiological factors responsible for this grave condition.

Besides the above classification a short clinical classification might be given:

1. Traumatic including concussion of
the eyeball, perforating injuries and perforating corneal wonds.

1) Progressive ulcers.
2) Inflammatory causas and acrido-choroiditis and panophthalmitis.
3) New growths.

2) Idiopathic Detachments.

Histology

The separation occurs almost entirely at the junction of the rods and cones layer of the retina with the pigment epithelium; these two layers are normally placed merely in apposition. The choroid is occasionally detached with the retina. The vitreous always shows changes: from disease in the adjacent membranes, cicatris, choroiditis, polymorphic cells invade the vitreous and are followed by the formation of fibrous tissue; in severe cases the vitreous shrinks and becomes separated from the retina by a space filled with fluid. In all cases of detachment where vitreocelular fluid has not been lost, it is probable that some amount of shrinking of the vitreous has occurred.
The fluid between the choroid and retina may be blood or serous fluid. Von Graefe supposed that although a sudden serous exudation might possibly take place, the fluid producing the detachment was, as a rule, blood. This view was shown to be erroneous when opportunities occurred for anatomical examination. It was then discovered that most frequently the subretinal fluid is serous, of a clear straw colour and exceedingly rich in albumen. It sometimes becomes turbid and may contain cholesterol. The Kettelship has described a case where crystals of this substance were found in the anterior chamber, having passed through an aperture communicating with the subretinal space. Besides the cholesterol and albumen, the fluid usually contains lymph, fat, blood, epithelial cells and pigment.

Atrophy soon begins to take place in the detached portion of the retina and ultimately all the nerve elements may be lost and the retina converted into a mere connective tissue membrane.

Usually a tear or hole in the retina can
be found on careful examination. Occasionally two or three can be found though this is unusual. This rent has been found in all parts of the retina.

The histological characters of the various tumours vary with the different nature of these.

**Mechanism of Detachment.**

Here especially does great diversity of opinion exist and as usual where the actual cause is unknown, speculation has been rife, and many theories have been brought forward to account for the production of the detachment of the retina. It seems to me that Berry's description of it in his book on "Diseases of the Eye" gives the best summary of these theories, and I give the passage in full:

"The pathology of detachment of the retina is not yet quite understood, although the researches of Leber and WORDENSEN have recently gone far to clear up the matter. Much more, however, is required before the explanation given by them can be regarded as applicable to all cases. The difficulty has always been to explain how
a sudden effusion of fluid could take place below the retina without giving rise to increased tension, or why indeed, as the intravascular pressure must tend to keep the retina pressed against the sclera choroid, there should be any possibility of its becoming separated unless some sudden loss of tension by perforation of the globe took place. Two main theories have been held for a long time. In the first place the detachment was ascribed to a process of shrinking in the vitreous. This had early been recognized as the result of anatomical examination by Arlt and Hübner in cases where the detachment was secondary to cyclitis. A similar cause was also apparent where a separation took place some time after haemorrhage into the vitreous, as here the contraction of the blood clot might drag on and detach the retina. But it was not easy to understand how, with a normal or nearly normal transparency of the vitreous, there could be exerted by it, a traction which could give rise to a spontaneous detachment of the retina, and yet this sudden detachment in an eye, in which the media were clear was
the most common case calling for explanation. The second explanation lay in assuming that an exudation took place from the choroid, and by accumulating between it and the retina caused the separation of the retina. This view was apparently supported when Rachmann propounded the hypothesis that such an exudation might readily be supposed to take place if the detachment were preceded by some alteration in the chemical constitution of the vitreous, which gave rise to an interference in the process of diffusion taking place between the blood in the choroid-capillaries and the presumably saline solution occupying the vitreous chamber. The untenability of this hypothesis, however, is apparent as Nordenson and others have pointed out, from the fact that the vitreous chamber contains exactly the same albuminous fluid as lies behind the retina. Besides it ascribes to the living retina in situ the same properties as far as osmosis goes, as a dead membrane, on which assumption it would be difficult to understand why it ever retains its position. Stellwag seems to have been
the first to maintain that there must be some diseased condition of the vitreous to admit of the possibility of detachment of the retina, while the trembling or shaking which can usually be seen in the detachment would only be possible if there were a fluid both before and behind it. A definite step in advance was made by Swanoff, who showed that the retinal detachment was always preceded by a detachment of the vitreous, the subvitreal space being occupied by fluid. After this discovery Wecken came with this hypothesis that the subvitreal fluid found its way behind the retina as soon as a rent occurred in the membrane.

Leber who had found that a process of fibrillary shrinking took place in the anterior portion of the vitreous leading to its detachment, and that the margins of the rent or rents formed in the retina were always turned in towards the vitreous, came to the conclusion that the shrinking vitreous, while maintaining its transparency, dragged on the retina, eventually causing
a rupture. When this rupture took place, he supposed that the fluid in the vitreous then passed in behind the retina, through the rupture, and filled up the space left by the membrane which was drawn forwards at the place of its attachment to the shrinking vitreous. This explanation has been very strongly confirmed by Norden'son's investigations. There can be little doubt that it represents, if not exactly, very nearly what actually happens in many cases.

A rupture in the retina would thus appear to be necessary for an idiopathic detachment to take place. As a matter of fact, such a rupture is sometimes to be seen with the ophthalmoscope, but by no means invariably. In 119 cases in which Norden looked for it he found it only in forty six. Her remarks are very truly, however, that the rupture, though present, might very easily escape detection with the ophthalmoscope, for a number of reasons — on account of opacity of the vitreous, by its being too peripheral, by being covered by a fold of retina, or owing to the reapplication of the portion of the retina which had been torn away, after
a sinking of the fluid had taken place behind it. In the cases where it was seen it was found in all parts of the retina which but most frequently in the upper and outer quadrants. Only very rarely indeed was there more than one rent in the same eye. In cases a deepening of the anterior chamber and retraction of the lens is observed along with detached retina, and is probably also due to shrinking in the vitreous.

The question naturally then arises, what gives rise to this consolidation and shrinking of the vitreous which appears from recent careful anatomical investigation to be an actual fact? The increase in the number of cases as age advances suggests the possibility of it being a simple change, and indeed the only difference in anatomical structure presented by the shrunken as compared with the normal vitreous, is the greater density and approximation of the fibrous or connective tissue elements, suggesting a loss of more or less of the water by which they are in the healthy state swollen out. Whether this takes place
without the occurrence of some form of choroidal inflammation, which gives rise to an interference with the nutrition of the vitreous, does not as yet seem quite clear. The greater frequency of the disease along with myopia is very probably due to the frequent association of choroiditis with that state of refraction, and not as was first supposed by von Graefe, to any dragging which the gradual distension of the elongated eye exerted on the retina. I have, for instance, seen detached retina in a father and 2 sons, aged 10 and 12 respectively, the father with myopia and the sons with some traces of choroiditis, but with emmetropic refraction. Here it is perhaps not too far fetched to assume that the sons inherited that condition of the vitreous and choroid, which in the father led both to an antero-posterior elongation of the globe and to the detachment from shrinkage, but in them merely to the latter. The occasional subsequent association with vitreous in cases of detached retina points also to a uveal origin of the pathological
condition of the vitreous, but it may well be that several causes exist for it.

In ordinary cases of idiopathic detachment the above is probably a fairly accurate account of what actually happens previous to, and at the time of, the separation. But is the explanation sufficient for its so frequent occurrence in cases of myopia? The frequent occurrence of choroiditis with myopia is certainly suggestive, but, on the other hand, detachment occurs in many cases of myopia where no symptoms or signs of choroiditis can be observed. It seems to me that seeing that myopia is the most common error of refraction in these cases, that the shape of the eye must have at least something to do with the greater tendency to its production in these cases. May it not be that some fibrillary shrinking of the vitreous occurs (indeed, apparently this seems to occur to a certain extent in all cases) perhaps from some antecedent slight choroiditis or other diseased condition of the tunics but that the shape of the eye renders...
the detachment of the retina more liable and easy to be produced? The fact that choroiditis is more frequent in the cases of high degrees of myopia and that detachment is less common that in such cases, would rather suggest that choroiditis was not altogether responsible for the condition, indeed, it has been suggested that the choroiditis in such cases may be responsible for a certain amount of plastic adhesion taking place between the choroid and retina and thus preventing the detachment. The following presents this view: "Myopia is perhaps the most frequent cause of detachment apart from that occurring in old shrunken eyes. In myopia, the antero-posterior diameter of the globe is lengthened, but the lengthening only affects the posterior part of the eye. As this goes on, the posterior part of the vitreous becomes torn away from the retina and the space filled with fluid; in every high myopia nearly the whole of the vitreous is fluid, a slight amount of solid remaining in front, at-

tacked to the ora serrata and its neighbourhood. The tunic of the eye continues to be stretched, and the retina may rupture spontaneously or as the result of slight trauma; fluid then passes through the rent into the post-retinal space. Curiously enough, as has been pointed out by Bécard and remarked by many other observers, it is the lower degrees of myopia that are commonly affected, up to eight or nine dioptres; this is possibly due to the fact that in the higher degrees of myopia patches of choroiditis are frequently met with; now sometimes these areas are merely atrophic thinning, but often a slight inflammatory change has been set up which has caused adhesions between the choroid and the outer layers of the retina; this adhesive process quite possibly inhibits the tendency to detach." It might be noted here that Parsons differs slightly from the above. His own words are as follows: "There is some relationship to the degree of myopia; it occurs in all grades but especially above 13 D."
Leber's researches and views on the subject have already been mentioned and his further researches lately still confirm of the truth of his views. (3) "Leber (Heidelberg) reports that the results of his recent investigations concerning the pathological changes in ordinary detachment of the retina confirm the view advanced by him some years ago that this trouble is produced by tension from within. The active agent appears to be the contraction of newly formed cellular fibrous tissue on the inner surface of the retina in the vitreous.

The following, I think, is a fair summary of the method of production. It begins with some condition must precede the consolidation and shrinking of the vitreous, which again apparently always precedes the actual detachment. What this antecedent condition is, is not always possible to affirm. It may be merely a senile change occurring in the vitreous; it may be some form of choroiditis; or some, may be very slight, form of inflammation.
tion of the other contours of the eye. At any 
rate a slight departure from the normal 
occurs in the vitreous humour whereby a 
shrinking (more or less) takes place in it 
and fibrillae form in its substance and 
become attached to the retina. This shrink-
ving vitreous way, all the time retain its 
transparency and with the ophthalmoscope 
no change may be visible; indeed it is only 
by very careful investigation that these 
slight anatomical changes were discovered. 
As this shrinking continues, the vitreous 
becomes drawn away from the retina, 
while at the same time the space between 
the vitreous and the retina becomes filled 
with fluid. The fibrillae already mentioned 
stretched across this space and are still 
attached to the retina. The space between 
the vitreous and retina varies in size, of 
course. The contraction of these fibril-
las still continues and ultimately produces 
a rent in the retina; this may occur 
spontaneously or after some traumatic im-
slight or severe. The fluid then passes 
into the post-retinal space and, once
There may cause a complete detachment.

That is the account of the probable method of production in the idiopathic cases but there are a few others still to be accounted for e.g. those cases where a new growth such as sarcoma of the choroid is the primary cause. "Here the retina is at first merely pushed forward by the tumour, but sooner or later a true floating detachment occurs, the fluid being probably here sucked from the choroidal vessels in response to the mechanical irritation of the tumour; the fluid gravitates to the lowest part and causes detachment of the retina there." It may be therefore that this fluid passes first into the vitreous chamber and by the same means as above described afterwards gains entrance to the post-retinal space. This has not been clearly made out. At the same time, the vitreous as in other cases has also undergone some change, leading to fibrillation and contraction, for it is often found shrunken after eversion of the globe.
albuminuria (including that of pregnancy) are usually associated with a general edema, and it is probable that the detachment is caused by a pathological exudation from the choroid, there being also antecedent shrinking of the vitreous. Parsons gives very definite information on the subject in his book on "The Pathology of the Eye", but says: "It will probably be found eventually that this (albuminuria) and some other forms of retinal detachment are due to osmotic conditions of which we at present know nothing."

In cases of marked cyclitis and chorioiditis where the so-called pseudo-glaucoma results, it is readily understood that after the subsidence of the active inflammatory changes, the purulent exudation slowly undergoes organization and the contraction of the fibrous tissue soon leads to detachment of the retina. In such cases a complete detachment often occurs and eventually phtisis bulbi results. Parsons gives a description of the organization which takes place
in cases following acute cyclitis and chronic fibrastic cyclitis but this in no way differs from the ordinary organization which takes place after any acute inflammatory process and will therefore not be described here the only important point being that "the retina is detached by the process, the globe finally shrinking and entering into the condition known as phthisis bulbi."

**Diagnosis**

The greater bulk of cases of detachment of the retina are diagnosed readily and the signs and symptoms already described should prove sufficient for this purpose but the important part in diagnosis is not so much the finding of a detachment of the retina, but, once having found it, the diagnosing of the cause of the detachment. Herein lies the difficulty and the interest of the condition.

An enquiry into the history of the onset of the symptoms is important and often very suggestive. As stated under "Subjective"
"Symptoms," "a cloud pulling over the right
from above" is a very common description
given by the patient and such a condi-
tion is usually the result of detachment.
Sudden blindness in a highly myopic
eye is also very likely to be due to an
detached retina.

The ophtalmoscopic signs are pathogno-
monic and only in slight and early cases
where the retina is transparent will
difficulty be experienced (see Objective Signs).

In all cases presenting doubt, indeed
unless there are some special contraindi-
cations, in all cases, the pupil should
be dilated in order to get a complete view
of the fundus and thus form a definite
idea as to the extent of the detachment.
In early cases the examination which
this allows of the peripheral portion of
the fundus is important as it allows
is in these early peripheral detachments
that a very careful examination is necess-
ary and it is in these early cases also
where early treatment with rest may have
more effect.
In some cases it may be impossible to see the details of the fundus for opacities in the lens or vitreous and other means must be had recourse to; later the opacities in the vitreous may clear and allow of fuller examination. In the case of an eye with an opaque lens the retina may be tested by requiring the patient to localise a beam of light thrown into the eye so as to fall on different parts of the fundus.

Juler states: "It may be stated as a rule, almost without exception, that vitreous opacities in a highly myopic eye denote retinal detachment."

Now let us pass to the differential diagnosis of the various causes of detachment. Our trouble consists in diagnosing the idiopathic detachments, including those occurring in myopia, from other conditions which have secondarily given rise to detachment. To begin with we may place out of account such conditions where the cause is perfectly obvious, e.g. those cases occurring after perforation of
the globe from trauma or after operation and where some obvious inflammatory trouble is at the bottom of the mischief or where some general condition such as albuminuria, arthritis is responsible.

What causes them are left?

1. Sarcoma of the bladder
2. Secondary Carcinoma
3. Glioma Eyephthium
4. Pseudo Glioma
5. Tuberculous Tumour
6. Syphilitic Tumour
7. Eysticercus.

Of these, the description of the presence of the cysticercus has already been given and requires no further consideration; its appearance is quite characteristic and should occasion very little difficulty.

Let us take the others in order.

1. Sarcoma of the bladder.

This tumour is probably more likely to give rise to confusion in diagnosis than any of the other conditions. For one thing, idiopathic detachment of the retina and sarcoma of the bladder both occur about the same period of life—middle
and later life, sarcoma is seldom seen till after 35 years of age and is very uncommon before the age of ten and detachment of the retina occurring in children is more likely to be due to a glioma of the retina.

As to the onset of the 2 conditions, sarcoma has not usually such a sudden onset. It usually commences in a manner so insidious as to be unnoticed by the patient until the tumour has attained considerable size. The patient may discover quite accidentally on closing 1 eye that the sight of the other is defective. Of course this may also happen in idiopathic cases and again a sudden effusion may occur in sarcoma causing a sudden onset of symptoms. But, on the whole, a sudden onset is more in favour of an idiopathic detachment.

Sometimes the growth of sarcoma is accompanied by local pain, flashes of light &c.

In testing the field of vision we may get valuable information for in sarcomata or any tumour growth the scotoma in the field is, as a rule, much more sharply defined; and when the tumour is peripheral and not affe
ing the macula in any way, relatively better central vision is generally found than in cases of simple detachment.

**Ophthalmoscopic Examination**

The appearances vary with the stage to which the growth has progressed. The tumours in the front part of the eye usually give rise to other signs of their presence, e.g., uveitis or iritis; they may be seen by the naked eye, but it is the growths in the posterior part of the eye which are more likely to cause detachment that we are concerned with. At first, the retina may be slightly pushed forward in front of the growth and still adherent to it, but the nuclei of the growths, which at an early stage may appear as a brownish or yellowish prominence, on looking into the eye, should translucency be seen coming from this detached portion, a growth must be suspected. This translucency is due to choroidal vessels supplying the tumour. This is an important point.

Then the presence of any fragmentation in that part is also very suspicious of a new growth. Haemorrhages may also be present. Another very important point to notice is
whether the detachment is movable or not. In idiopathic cases, it usually is mobile; in those resulting from sarcoma, it is usually motionless.

Again the edges of the detachment are very often quite steep. Let me here quote a passage from Freisch's "Text Book of Ophthalmology" (20):

"In the beginning the retina lies everywhere in contact with the surface of the tumour, so that with the ophthalmoscope, a sharply circumscribed gibbous detachment of the retina is found, rising steeply from the fundus. This, for obvious reasons, does not fluctuate through the retina we can often recognize the vessels of the choroid or of the tumour, and also the yellow or brown colour of the latter. In this the diagnosis of sarcoma is easily made.

"It is an additional argument for the existence of sarcoma if the anterior ciliary veins are found markedly dilated upon one side or the other."

The position of the detachment is of extreme importance. If due to sub-retinal fluid, the lowest part of the retina will usually be detached, while if due to growth, it may be
detached alone with perhaps a second detachment below. There may of course be only one.

Tension. The tension is very important. As a general rule, the tension in simple detachment is reduced. "In 126 cases of detachment, apart from those due to netsheen, the tension was raised in only 6 cases— in four of these irido-cyclitis was present, in the other two, the cause of glaucoma was not excited." In irido-cyclitis, the tension in the vast majority of cases is raised. In the very early stages, however, it may be diminished. In cases involving especially the ciliary region, even with a large natural detachment, the tension may be normal.

Retinal detachment combined with increased tension as a rule, however, denotes new growth but the presence of normal tension or even diminished tension does not exclude the possibility of a tumour.

Let me quote again from Frischs: "As the intracocular pressure later on steadily increases the detachment of the retina assumes a characteristic appearance. The retinal protrusions are pushed against the posterior..."
surface of the lens and against each other by the increased pressure in the sub-retinal space; they flatten themselves upon each other and often include only a narrow Y-shaped furrow between them. Here are it is true, serous detachments which also show this appearance. These are those rare cases in which serous detachment is associated with increase of tension. Such cases are not distinguishable from tumour of the choroid and might in analogy with pseudo-glioma be called pseudo-sarcoma. To make the right diagnosis in such cases we may call in the aid of transillumination and puncture. For this purpose Sach's or Wundemann’s transilluminator may be used. With one of these 2 appliances, it is possible to carry the source of light past the eyeball and so far into the orbit that it gets to lie on the posterior half of the sclera and so transilluminates the eyeball from behind forward. The pupil then glows with a red light; but if any portion of the interior of the eye is occupied by a dark pigmented tumour, the pupil remains dark when the
attempt is made to transilluminate from this side. The operation of puncture is made with a fine needle which is plunged deep in through the sclera at the spot where the tumour is thought to be. If the needle enters a tumour, it is not freely movable as would be the case if its point lay in the vitreous or in subretinal fluid. If in spite of these diagnostic aids, we are still in doubt, enucleation of the eye, which would be blind anyhow, is immediately indicated.”

It will be seen that considerable care is necessary before a definite diagnosis can be made and in spite of all diagnostic aids, it is sometimes impossible to arrive at a definite conclusion.

2. **Secondary Carcinoma**

Here other evidences of the disease will be present and the condition is more of interest than of any practical importance, so far as diagnosis is concerned.

3. **Glioma Euphrytum**

It is this particular form of glioma, which is also the much more frequent, which gives
rise to detachment and hence to difficulty in diagnosis. Usually there is not much difficulty however as these cases almost always occur in early life, either intrauterine or during the first three or four years; occasional cases have been reported up to thirteen years. Several members of a family have been known to be affected. Adiopathic cases of detachment hardly ever occur at that early age and confusion is not likely to arise. The appearances presented are very like those presented by a sarcoma of the choroid, especially in the glaucomatous stage at that a separate description is hardly necessary. The only important difference is the colour of the detached retina in such cases; the tumour growth shows more or less through it so that it presents a white or pinkish lustrous look — the so-called Cmaurotic bâti eye appearance.

Given a lustrous white or pinkish white tumour, occurring in a young child, where there have been no perceptible inflammatory symptoms and where the intraocular tension is increased, we have little hesitation in
Pseudo-glioma

This term, a bad one, is used to denote a subacute or chronic suppurative chorioiditis; it is usually found in children. Very often this condition is associated with middle ear disease, may be with lenticular meningitis or with an acute specific fever. The interest from our point of view is that with the contraction that results from organization, a complete detachment of the retina may occur. The history is therefore very important, and as the inflammatory symptoms may be very slight or wanting, the detachment may be the first sign. Usually a complete detachment occurs with it, the retina ultimately lying behind the lens. So far as the detachment is concerned there is little to be done so far as treatment is concerned, but the difficulty in diagnosis is to know whether the condition is a glioma or a pseudo-glioma. The most important distinction mark lies in the tension of the eye. This in genuine glioma is normal in the beginning and afterwards is increased.
In pseudo-glioma, on the contrary, diminution of tension soon sets in, which is followed by the shrinking of the eye. The subsequent course renders the true state of the case perfectly clear; but at the above stage "in doubtful cases we perform enucleation." Julien says with reference to this "The clinical features of this condition are such that a diagnosis from glioma is usually not difficult. The reflex from the surface of the inflammatory exudation, which is, as a rule, usually flush with the back of the lens, is not brilliant or glistening, it is yellowish white in colour, whereas glioma is white or crimson white, and the tension is generally reduced. Another important difference is the appearance of the iris; in glioma the whole of this is tucked forwards towards the cornea, but in those forms of choroiditis, the contraction of the inflammatory products in the vitreous causes retraction of the ciliary edge of the iris, so that the latter presents the appearance of a truncated cone with its narrow edge projecting forwards. Other points such
as evidences of old iritis, a history of fits or convulsions with retraction of the head, or presence of otitis media, assist in the diagnosis. The presence of a pseudo glioma in a child's eye accompanied with increase of tension demands early enucleation.

5. Tuberculous Sarcoma.

This condition is probably always secondary to tuberculous disease elsewhere and this can often be found. In the early stages a retinal detachment may be the only sign. This is usually less defined than the detachment due to choroidal sarcoma. Usually the coats forming the globe rapidly give way with the formation of a staphyloma and subsequent panophthalmitis. The growth is always unilateral. The important point here is to look for other symptoms of tuberculous disease. In early cases showing only detached retina, it must be watched; one must try especially to make certain that it is not a malignant growth. From sarcoma it may be distinguished by the flatness of the swelling when compared with its superficial extent, by its more...
or less distinctly modular form, and by
the evident inflammatory changes in the
surrounding choroid.

6. Gummatus Injuries

Gumma of the choroid is rare. It may
exist in conjunction with gumma of the
iris or ciliary body. The diagnosis
is necessarily difficult, inasmuch as the
vitreous is hazy and the fundus and detach-
ment hence difficult to see. It rests
mainly on the presence of other syphilitic
lesions, on the history and on the effect
of antisyphilitic treatment.

**Prognosis**

To read over the various articles on prognosis
in cases of detachment of the retina is
in the various text books, magazines etc. is
a most dreary, sad, and disappointing task.
Practically all authors speak in terms of
hopelessness. The following are a few
extracts from various authors:

"Unfortunately it is only in the rarest
cases that these good results are lasting. As
a rule after some time the separation devel
"(29) Prognosis is unfavourable. The detachment tends to enlarge and to become total. Even after improvement, relapses are the rule and complete blindness is the usual end."

"(29) The prognosis of every case is bad, spontaneous cure being extremely rare and the cures by any one or by any combination of the above methods of treatment being few and far between; and when the retina does return to its place, there is still danger of a recurrence of the detachment. Moreover, both eyes are often affected one after the other."

"(29) The prognosis is generally unfavourable, even in the best cases, where the disease remains stationary, the vision is always defective and we are never certain that the affection may not extend to the rest of the retina. A few cases of spontaneous recovery are on record and some good
has been affected by treatment. It must be borne in mind that where one eye only is affected in myopia, the second eye is generally in danger of a similar attack.

Such are a few of the extracts on prognosis and they are certainly rather unfavourable.

Ernest Thomson gives an admirable review of the prognosis in the ophthalmoscope lecture for June 1910. It is so extensive that I cannot hope to give even a summary of it under this head here. To begin with he points out the great difficulty in arriving at any conclusion regarding the condition for "since really success in prognosis depends largely on intimate knowledge of the conditions present, or at any rate likely to be present, and since such intimate knowledge is here often lacking, it is clear that prognosis in detachment of the retina is more a matter of guess work than in many other conditions."

He deals with the prognosis of detachment occurring in general diseases as the influence of various conditions and circumstances on the prognosis including myopia, traction, etc.
the age of the patient &c., 3) spontaneous cure as a factor in prognosis & 4) statistics of cure by operation.

What general conclusions can we come to in regard to prognosis? The following seem to me almost all we are justified in saying:

If the detachment is very extensive, if the vitreous is full of opacities, if there is high myopia or much choroiditis, the prognosis is bad. If, on the other hand, the detachment is small, if the vitreous is clear, and there is neither high myopia nor much choroiditis, the prognosis is much better. A recent detachment is more likely to be cured than an old one; but an old one is more likely to remain stationary than a recent one. A known cause of a purely temporary nature, such as a blow, or the albumenuria of pregnancy, is a favourable element in prognosis. If cyclitis often causes detachment, and if the cyclitis can be cured, the detachment may become stationary, at any rate for a number of years.

Finally, it may be mentioned that Ernest Thompson in concluding his
article already mentioned gives 10% as the average percentage of cures by operative measures. This average is reached by taking the average of the percentage cures of many ophthalmologists. This is at least slightly more hopeful than the views set forth in the extract given at the beginning of this head. And it seems to me that there is some reason for a more optimistic outlook in the future. The figures of more recent times seem to warrant this. Deutschmann's percentage of cures - 26.1% - especially give us hope for a more optimistic outlook.

**Treatment**

During the past 50 years, the procedures suggested, advocated and practiced have been many and varied and almost every method can lay claim to cases reported as cured. "In a multitude of counsellors there is wisdom," but unfortunately, in medicine, in a multitude of methods of treatment, there is usually something unsatisfactory; and so it is here. No superiority can
be fixed upon any one procedure and it is usually difficult to arrive at a definite conclusion as to the effect of any one procedure for it is a well known fact that spontaneous cures do occur and that a large number of cases improve very considerably with complete rest in bed and bandaging of the eyes. Almost all other methods of treatment embrace complete rest in bed and bandaging of the eyes and so it can be easily seen how difficult it is to arrive at conclusions which are at all convincing. One must remember also that at the present time, detachment of the retina must still be treated on more or less empirical lines; as has already been stated, detachment of the retina is not a definite pathological entity and until the pathogenesis is worked out completely, informing us of the underlying diseased conditions, in each case, we can only apply the proper rational treatment to each individual case.

Before launching out into the different forms of treatment, however, it will be
well to consider a few preliminaries. In the first place, what constitutes a case? This is rather a difficult thing to define for it is well known that a complete reattachment may occur and yet vision may remain greatly impaired or hardly improved at all; owing to other accompanying conditions, e.g. the disease causing the detachment may also cause some pathological changes in the other parts of the retina or optic nerve; opacity of the media, a usual early accompaniment of the condition may remain. These may interfere very materially with the patient's vision and therefore it is well to recognize that a reattachment may not be of much value to the patient, i.e. the two things do not necessarily go hand in hand.

But again a complete anatomical reattachment is not absolutely essential to a restoration of the patient's useful vision. Provided the detachment is greatly reduced, the central vision may be completely restored and the lateral cloud may disappear; the
scotoma in the field of vision may then be of so small a size as to be unappreciable to the patient. Such a case might be included among the list of cures. A complete reattachment with complete restoration of vision is an ideal state of affairs which is hardly ever reached and most people will be satisfied with anything which closely approaches this ideal.

To constitute a cure too, how long does one expect a reattachment to remain? Unfortunately a secondary detachment is a very common occurrence. When everything appears to be going well and the hopes of the patient and surgeon are at their highest, these hopes will be suddenly shattered by a complete return to the former condition — may be too worse condition than before. At the same time a ray of hope and comfort can be got from the fact that a number of brilliant results have been obtained after persistent treatment and repeated operations in these cases of relapse. Nevertheless, if an attachment can be procured for a year or so, most surgeons will be satisfied that a cure
has been affected. As Wood has it: "That
a patient with detached retina may be refer-
ed to as cured, the reattachment should
be complete, or so nearly complete that
he does not complain of symptoms, and
the retina has retained its position for at
least a year.

Here perhaps it would be advisable
to refer to the cases of Spontaneous Reattachment.
It is a well known fact that this happy
occurrence does take place and several
cases have been reported by Deutschnam
Hirschberg and other reliable observers.
And, indeed, there is little doubt that a
considerable percentage of the cases treated
by various medical and minor surgical
means and to which is attributed the
cure of the condition, can be placed
in this category. One must always take
this into consideration when discussing the
merits of any particular form of treatment.
And now let us proceed first to the
general methods of treatment, in contra-
distinction to the more active surgical
measures.
Rest. Of all the general methods used, rest in bed is probably the most important of all. Patients ought to lie in the prone position for weeks at a time. This may be varied after a little while by careful removal of the patient to a lounge or on the daily. A great point in the successful treatment of the condition is to get the patient's hearty cooperation; explain to him the condition, procure his confidence and let him understand thoroughly the reason for the absolute rest so that he may be patient and still. Restless, unhealthy patients do not give themselves a good chance. The patient should studiously refrain from any considerable exertion, and must avoid straining at stool (for this purpose the action of the bowels must be carefully regulated as mentioned later). Sneezing, hawking, laughing and all coughing.

General Health. It is very important as is emphasized by Maitland Ramsay that the patient's general well being should receive proper attention. He should be suitably dieted — usually a light diet while the
patient is in bed. Above all the emunctories should be kept in good condition, care being taken to insure regular and efficient action of the bowels, kidneys and skin.

"It is when physical condition and environment are considered with the most minute attention for the neglect of any detail, no matter how trivial, may make all the difference between success and failure." There also may be mentioned the importance of the patient's general health during convalescence. To quote from Ramsay again, "It is very desirable that the patient should as soon as possible after he is able to be out of bed, be sent to the country for a few weeks in order that the general health may be brought up to the highest possible standard. Occasionally it happens that considerable improvement occurs during the period of convalescence. The patient must always be warned to avoid carefully all acts which tend to cause straining or congestion of the head or face and to pay particular attention to the bowels so as to secure regular action — constipation.
seems to play a most important part in bringing about a relapse."

**Bandaging of the Eyes.** This is very commonly employed by many authorities and it is probably wise as it tends to keep the eyes quiet and the slight amount of pressure applied is probably useful, seeing the tension in these cases is usually low.

**Diaphoresis.** This is also often employed as an adjunct to other treatment. Formerly it was more in vogue that it is now but even yet some authorities have considerable faith in it. Various means may be employed for the production of the diaphoresis—sodium salicylate, electric and other baths. Pilocarpine is much used in doses of $\frac{1}{4}$ to $\frac{1}{3}$ gr. Mortland Ramsey, if he has got little result from his subconjunctival injections after 10 days or a fortnight's trial, gives a subcutaneous injection of $\frac{1}{10}$ to $\frac{1}{4}$ grain of Pilocarpine, alternately with the subconjunctival injection and he says that "after the first free diaphoresis, distinct improvement occasionally takes place."
Of other drugs besides those mentioned, iodide of potassium and mercury are among the only ones which find favor, especially the former. It is presumed that it acts by stimulating the tissues to absorb as it causes absorption of diseased products in other diseases, especially syphilis. It is also said to have a specific effect on the vitreous changes, choroidal disease, and other accompaniments of the disease. There is no reason why it should not be tried if there is any reason to suppose it does. The dose should be half a grain at first and gradually increased to 20 or 50 grains three a day.

The few other measures employed need only be mentioned—the artificial (moustache) beak, blisters to the temple, atrapin, tincture of glasse, a darkened room.

And now let us take into consideration the more active surgical measures employed. It would be a useless and unprofitable task to enumerate all the many methods which have been adopted for the purpose of remediating
this condition and therefore I will con-
fin[e myself rather to the methods which
at present find a certain measure of favour
in the hands of experienced ophthalmologists.

Of these probably scleral puncture
(sclerochoroidal puncture or posterior
sclerotony) has been longest in vogue
and was the first rational operation
performed for the relief of this condition.
Apparently it was first advocated and
practised by James Ware in 1805 and
his own words are: "The operation was
attended neither with difficulty nor danger.
It consisted simply in the introduction
of a common spear-pointed couching
needle through the tunica scleratica, a
little further back than the part where
it is usually introduced for the purpose
of depressing a cataract. As soon as
the instrument entered the eye, a yellow
coloured fluid immediately escaped, suf-
ficient in quantity to wet a common
handkerchief quite through. The needle
was continued in the eye about a minute,
in order to give the fluid a more ready
way to come out; and as soon as it was withdrawn the discharge ceased. The tension of the eye was considerably diminished by the operation. A compress dipped in a saturated lactin was bound on it, and the patient put to bed.

At the present day this operation still appears to hold its own and in looking through the literature, one is struck by the fact that a large proportion of ophthalmologists appear to practice this method in preference to other procedures, although other treatment usually accompanies it.

Each operator has his own slight modifications of this operation but the essential part is to tap the post-retinal sac and allow sent to the sub-retinal fluid. Usually the point of a broad knife needle or a narrow suction knife is used. This is passed through the bulbar wall (conjunctiva, sclera and choroid) in a position corresponding to the underly ing post-retinal fluid. Usually it is possible to reach it between
two of the recti muscles. It is passed in
just sufficiently far to tap the post-reti-
nal fluid and the retina itself is not
wounded. On withdrawing the instrument
it is wise to turn the knife at right
angles so as to allow the fluid a better
means of escape. Some operators, e.g.
Wack, modify it so: "He makes a
small incision behind and parallel to
the equator and through it passes a
sickle-shaped knife into the eye. On
withdrawing the blade it makes a
decided incision of the intraocular
membranes and so increases the area
of the cicatricial adhesion and sub-
sequent adhesion of the wounded tissue.
Instead of the needle or cataract knife,
the cautery may be used, for one puncture
to allow vent to the fluid; (for multiple
cautery puncture see later.)

One of the great advantages of this
method of treatment is that it is pract-
ically free from danger and the puncture
can be repeated again and again
at intervals of a few days to a week.
Indeed, patience and perseverance on the part of both surgeon and patient are desirable. The wound closes immediately and there is no further escape of fluid. The tension falls considerably at once and it is advisable to instil atropine and put on a pressure bandage over both eyes. The patient should be kept very quiet in the prone position in bed for a considerable time afterwards—10 days being the very shortest time and indeed it is much safer to keep him in bed for a much longer time, 20 or 4 weeks being very desirable.

It seems to me that it would be of value in those cases to have an assistant to use the (electric) ophthalmoscope while the operator is making the scleral flap, so as to ensure that the front retinal scar is being tapped. H. W. Wooton describes a case where this was used with advantage. By the use of the ophthalmoscope it was found that the first flap made 10 mm. from the limbus was made too far forward through the sclera and
did not tap the post-retinal fluid. The knife was seen in the vitreous. The second puncture was successful — about 12-13 mm. behind the limbus and the assistant noticed when Dr. Wooton turned the knife to allow the escape of the post-retinal fluid. That the detachment subsided.

Many cures are reported as the result of this treatment. (37) H. B. Swanley for instance records a case where a detachment which had persisted for 11 months was ultimately cured by repeated punctures of the sclera, combined with rest in bed and bandaging. (38) Greenwood also reports a case which improved decidedly by this method. (39) Webster also gives an account of several cases treated by this means, where one case was permanently cured and 10 others improved. (40) Baddley and Pollock describe a case of cure after 10 years standing. A single operation was sufficient in one eye but had to be done 7 times in the other.

In looking over the discussions on the
subject at the meetings of various societies, it soon becomes apparent that operators speak more highly of this method than any other. It is very often used too in conjunction with other methods of treatment e.g. that land Drumey in his report on 50 cases treated by subconjunctival injection makes evident that he used scleral puncture in a considerable number of the cases. It is therefore very difficult to arrive at a conclusion as to how far scleral puncture is responsible for the reported cures. It is also very difficult to say how many cases are really cured. Ernest Thomson, after a very careful study of the statistics regarding the cures by scleral puncture says "I suggest that 10% is about the maximum which these figures represent."

**Scleral Puncture with Incision of the Detached Retina.** Von Graefe was the first to recommend and practice this method and it met with fair success in his hands. It is only a further step from the last operation, an incision being made...
in the retina with a thrust of the knife, after the sclera has been punctured with the knife or cautery. The following description of a case so treated by Leslie Paton may serve as a description of cases so treated though such a description as he employed is not always done a vertical incision about \( \frac{1}{2} \) cm. in length was made about 5 mm. behind the insertion of the ext. rectus. The upper and lower borders of the muscle were cleared and a tenotomy hook incised under the tenon and used to rotate the eye and fix it. Then above the muscle with a cautery a trough was made through the sclera behind the equator. About half a drachm of fluid escaped when the puncture was completed. Some more fluid was drawn off with a lacrimal syringe and then a Graphe knife was plunged through the retina presenting in the puncture and pulled slowly out. A similar puncture was then made below the muscle. Only a small quantity of fluid escaped from
this fracture." He goes on to say later: "Ontesting 3 days after operation, the field was fully repaired. He now, 9 months later, has a full field of vision with V 3/5. His retina shows the 2 radiating scars of operation."

Griesen of Philadelphia uses this method and has a special way of making his incision so that he gets a T-shaped wound in the retina. His description is as follows: The technique I employ requires the use of the von Graefe curved knife. I make the scleral fracture about 6 mm. from the limbus midway between the recti muscles, with the back of the knife towards the cornea, and penetrate just deep enough to enter the space between the retina and the sclera. I then rotate the knife sufficiently to allow the subretinal fluid to escape. When this has drained out I rotate the knife blade back to the line of primary incision, and with a quick thrust pass the knife through the retina. Having gone through the retina, I again rotate the
Knife at right angles and while draw-
ing the knife out of the wound turn the
edge of the blade back against the retina,
so that the incision in the retina is made
longer than the incision in the sclera. In
this way I secure a double incision in the
shape of a T, which gaps sufficiently
to permit the subsequent accumulation
of subretinal fluid to escape and to
allow the weight of the vitreous to press
the retina against the sclera and to keep
it approximated till union occurs."

Ellis also reports 2 cases treated
by this method and had good results in
both cases. The treatment here is of
nourse more or less empirical, but it seems
to be recognized that unless there are
previous rents in the retina (and those
often are) a simple scleral puncture
is not of so much value and it is
better to add to the puncture of the sclera
an incision in the retina. "Letting out
the post-retinal fluid, particularly if there
are rents in the retina itself, may assist
in bringing about a cure. If there is no
rent or opening in the retina, you will easily see how impossible is a reposition of the separated membrane, because there could be no free flow of fluid through the membrane.

Methods used with the idea of bringing about inflammatory adhesion between the choroid and detached retina.

Of these there are several methods, the one meeting with most approval in the hands of experienced ophthalmologists being multiple Galvanocaucuty Puncture.

I have already mentioned that the galvanocautery may be used for the purpose of puncturing the eyeball to allow of the exit of the post-retinal fluid. Here, however, the sclera denuded of conjunctiva, is punctured in various places, 5 or a dozen or more so that at each point touched, an inflammatory reaction may be set up causing adhesions to form between the retina and choroid. That such adhesions do occur has been proved by Wernicke and others. The method is as follows: An incision is made through the conjunctiva over the underlying vitreous detachment
and the sclera exposed. Then the point of
the galvano-cautery is used to make 50 to
100 or more punctures burning its way
through the sclera. The cautery point is
then immediately withdrawn and the con-
junction is stitched over with silk or
catgut and the eye bandaged. The
stitches may be removed after 2 days.
Some operators puncture the sclera with
the knife first and introduce the cautery
into the previously made openings. Others
introduce the cold cautery point into the
wounds and afterwards turn on the current
until cauteryization is complete. In place
of the electro-cautery Dr. uses the actual
cautery in the form of Guersant's Needle,
that instrument being provided with a "stop"
which prevents too deep a perforation of
the sclera. The punctures right through the
conjunction. A strong objection to this, how-
ever seems to be the cicatricial contraction
which occurs in the ocular conjunction
and the adhesions which result between
it and the sclerotic

If no serious reaction sets in, it is repeated
as often as is necessary to bring about a
recovery and the exenteration (and the same
exenteration) may be repeated as soon as the
eye is free from irritation.

Some authors, e.g. Ewing, think
that the improvement brought about in these
cases is due, not so much to the in-
flammatory adhesions forming between the
retina and choroid, as to the formation
of scar tissue in the sclerotic as the
result of the burns, and so reducing the
size of the eyeball itself, the result therefore
being the same as after Müller's operation.

Several cases are reported as cured by
this method also. Wemicko especially is strongly
in favour of this method and thinks it is
the method above all, which will best secure
extensive adhesions of the retina to the choroid.

Dor also has used it in many cases along
with other treatment.

J. A. Lea has reported a case in the British
Medical Journal, and it is of sufficient
interest to warrant a summary here:

The separation was associated with 8 D
of the eye opened and simple means had failed
to produce improvement. Scleral puncture was then tried and replacement followed but detachment again occurred in 4 days. Again scleral puncture was tried along with galbinor cautery application to the sclera. The separation now remained in position for 8 days but again became detached. Once more the sclerotic was punctured and the "galbinor" cautery applied more vigorously. After the 3rd application of the cautery there was no relapse and 20 months later, the Vision was 6/60.

Weinrich's statistics give a percentage of cures of 15.3 per cent by this method.

Iodine Injections

Injections of iodine into the subretinal space also for the purpose of producing a plaque-like choroid retinitis anticipating that the resulting inflammation would unite the 2 coats and thus obliterate the offending space, have also been tried by various men. Reports of cures abounded, but in the hands of many, the method proved disastrous, great reaction often being set up and in one case this was followed by meningitis.
and death, so that now this method is practically given up.

Electrolysis is another method used with the same intention of producing a plastic choroid retinitis. This is not used so much as formerly however. The electrolysis needle is first passed through the sclera just sufficiently far to reach the subretinal space. This allows a partial escape of the serous exudate. Then a 5 to 5½ milliamperé current is passed for one minute and the needle withdrawn. A few days afterwards the use of the electrolysis, some operators inject subconjunctivally a solution of 1 in 1500 or 1 in 2000 Bichloride of Mercury with the idea of maintaining the electrolysis. The patient is kept in bed for several weeks and the eyes are kept bandaged. The process may be repeated as often as is necessary.

(7) Illaraval in 1907 reported 10 cases of its use in which I was cured and the remainder much benefitted. Others report less favourably on it and in some cases the condition is made worse.
Iridectomy. Another method of treatment advocated by some, though it is difficult to know with what rational purpose in view is Iridectomy. It is unnecessary to enter into a description of this operation here. No rational grounds can be put forward for its use and yet G. C. Gougeri and others have used it and reported cases of cure. Here probably the cases are those of spontaneous cure, the iridectomy getting the credit of the cure. Many times too the method has proved rather disastrous and is now less used than formerly.

Subconjunctival Injections.

Now we come to a method which was used first extensively by de Wecker in 1887 and still finds considerable favour, especially as a supplementary measure, though occasionally alone, from many experienced operators.

De Wecker injected first without much effect, simple physiological salt solution into the ciliary capsule but later added small proportions of gelatin (3%) to increase the local irritation and consequent diaphoresis of the intraocular fluids. He found the
effect on the detachment more marked than
before and noticed that the disease was
distinctly improved. Diamond prefers a
mixture of 1% sodium chloride and 4% cane
sugar in distilled water. Of this, 4 or 5
cc. were injected into Tenon's capsule on the
first, second and fifth days of the treatment.
He has found a series of ten such injections
to be effective in detached retina.

Dr. at the Ninth International Ophthalmological
Congress reported the results of treat-
ment of 21 patients. Of these 14 were cured
or much improved, several of them having
no relapse after 10 years. This method
included chiefly injections into Tenon's
capsule of 20 to 30 per cent. solutions of
sulfates but he usually employed other
measures along with this, including the
Hauteloup leech to the temple, thermo-
cytotherapy puncture of the sclera at the site
of detachment, a compressive bandage and
rest in bed.

Marple of New York
reports 3 cases where no distinct permanent
benefit accrued from sub-conjunctival injec-
tions. He used at first 5% solution of sod-
sum chloride and gradually increased the strength to 25%. The stronger solutions proved extremely painful. Of the 2 methods, injection into Tenon's capsule and injection subconjunctivally, the former appears to be much more painful and according to most observers, it has no advantage over the more superficial injections.

On the use of subconjunctival injections in the treatment of this disease, and the effects of the treatment in 50 cases, Mallard and Ramsey gives a very full and detailed account in a paper read to the Ophthalmological Society of the United Kingdom and published in the Transactions of that Society and in "The Ophthalmoscope." A short epitome of his methods, solutions, effect of treatment will be given here and will serve as an outline of the method as used by others.

He has selected and tabulated all the cases of detachment of the retina treated by him in the Glasgow Ophthalmic Institution for a period of 4 years ending at Oct. 31st 1905. He lays special stress to begin with on the importance of attending
to the patient's general health, both during treatment and convalescence. This I have already mentioned in the preliminary post treatment. This method is as follows:—The patient is kept in bed, for most of the time on his back, and both eyes are closed with a pressure bandage. Should the site and character of the detachment be deemed favourable, the subretinal fluid is always evacuated by seleral puncture.

On the 2nd or 3rd day, the 1st injection is made, 5 to 20 minims of 1 in 2000 bismuthide of mercury with 8 per cent. chloride of sodium being the solution ordinarily used. Every effort is made to insure asepsis. The solution is injected as nearly as possible over the site of the detachment, well backwards and avoiding Tenon's capsule. The ocular conjunctiva rises in a bleb but this soon disappears and is replaced by a diffuse oedema.

The severe pain which almost invariably follows can be mitigated by the use of chemically pure sodium chloride and
by the addition to the solution, immediately before use of a few drops of a 1% cocaine or 2% ephedrine solution. Hot fomentations immediately afterwards also help to alleviate it.

On the day following the injection there is marked increase in the intracocular tension and the media are seen to be distinctly hazy, but the loss of transparency is generally of brief duration and as a rule within 48 hours of the 1st injection the patient declares that his sight is cleared. In from 4 to 6 days, the conjunctival oedema has for the most part disappeared and the eye is ready for another injection. The average number given is from 4 to 6.

He states that when the above treatment has met with no decided improvement after 10 days to a fortnight, a sub-cutaneous injection of from 1/8 to 1/4 grain of Belladonna should be alternated with the sub-conjunctival injections and after the first free diaphoresis, distinct improvement occasionally takes place.

A marked chemosis is essential to the success of the treatment, the improvement
vision seemed to go on pari passu with the degree of reaction following the injections. When the reaction is absent or almost ill-marked, he therefore increases the strength of the fluid. In his earlier cases he used Dor's fluid.  

\[ \text{Sodii Chlorid.} \quad \text{grammes 5} \]  
\[ \text{Sodii Carb.} \quad \text{g. 0.40} \]  
\[ \text{Sodii Sulphat.} \quad \text{g. 0.40} \]  
\[ \text{Sodii Phosph.} \quad \text{g. 0.10} \]  
\[ \text{Potass. Sulphat.} \quad \text{g. 0.40} \]  
\[ \text{aq. Distillat ad grammes 10.} \]

This, though efficacious, was found to be very painful and a 1 to 2% of added to the ordinary solution of bromide of mercury and sodium chloride was found to have a much more powerful effect, causing greater oedema and fewer painful effects.

The average duration of the whole treatment is about a month, but the longer a patient remains in bed, the less likely is relapse to take place. If after the above treatment with 2 or 3 weeks in the recumbent position, there are no signs of improvement, Ramsay considers the case
as certainly incurable.

He lays stress on the general health being brought up to the highest possible standard and particular attention should be paid to the condition of the bowels to prevent any straining.

As to the modus operandi of the saline injections, opinions differ. Some say the process is osmotic but for obvious reasons, this explanation cannot be accepted in every case. It is more likely that the injected fluid acts merely as a counter-irritant, and this is borne out at least by the researches of Karl Wessely. According to this author, the injection is followed by dilatation of the blood vessels of the ciliary area and the aqueous comes to contain a large amount of albumen, such results being due to the injection acting upon the vasodilator mechanism of the eye as a powerful conjunctival stimulant.

He proceeds later to give an analysis of the 50 cases treated. If we accept the cure as being reattachment for at least a year then RAMENSKY's percentage
of cures was 14%—quite a favourable figure. "In 10% of cases, Ramsay holds that a good result may be expected by this mixed treatment.

Many continental operators have also used this treatment and reported on it but the methods of treatment are practically the same as that detailed above, while the strengths of the solutions vary a little. Their statistics vary but the mean of their percentages is about 10%.

Deutschmann's Operations

Bisection, with and without the Intravitreous Injection of Sterile Animal Vitreous

Deutschmann of Hamburg is the chief advocate of these operations. He first published his classic description of them in the year 1895 and still claims results better than those attained by any other form of treatment. He is opposed to waiting till other methods of treatment have been tried but advises the more effective employment of immediate surgical intervention. The simpler bi-
section method he regards as especially valuable in the more acute or recent cases; the combined procedure, i.e. the injection of sterile animal vitreous along with the bisection, he reserves for the more advanced and less hopeful forms of the disease. Deutschmann asserts that bisection reduces the tension on the retina, which in his experience can be so marked that it is impossible to reattach it without making one or several incisions through the vitreous bands. He evacuates the subretinal and preretinal fluids and tries to produce small inflammatory adhesions between the choroid and retina. With the injection of animal vitreous into the posterior chamber he produces a mechanical pressure on the detached retina against the choroid, and a welding of both membranes on an inflammatory basis, with simultaneous refilling of the eyeball. Relapses may occur with either or both methods, but under these circumstances he repeats the operation in an attempt to regain what has been lost.
Bisection of the Vitreous and Retina.

Deutschmann never employs this operation in cases where the detachment is along the equator; when one has to deal with such he deems it advisable to wait, without treating the patient till the subretinal fluid has gravitated downwards.

After thorough disinfection and cocainization, a two-edged linear knife, about the width of a medium sized Graefe knife, is entered at a tangent to the globe, through conjunctiva and sclera well back of the ciliary region, passed quickly forward, and then downwards and backward, sweeping toward a counter puncture at the other extremity of the ocular diameter, so as to cut in two as much as possible of the vitreous chamber without wounding any of the surgically unimportant structures. The knife is then drawn out as quickly as it was introduced, being turned a little on its axis in order to allow the subretinal fluid as well as some of the preretinal fluid to escape. This maneuver may be repeated as often as 20 times or more, with
sufficiently long intervals between successive operations to permit the eye to recover from the reaction, which, however, is generally small or nil. Of course this interval must be a longer one if the larger retinal vessels have been wounded, or any other unforeseen accident should occur.

A celluloid shield should then be applied to both eyes, or if a bandage is used, it should be a loose one for the first 24 hours. After the first day, only the eye operated on is covered, and it must be kept under the influence of atropine during the whole period. The patient should be kept in bed 7 or 8 days after each operation and results watched with the ophthalmoscope.

As a rule when these directions are strictly followed under careful asepsis, the operation is without danger to the eye.

**Combined Retinectomy and Intravitreous Injection of Animal Vitreous.**

Deutschmann reserves this operation for those cases in which vision has sunk very low or in which other means of restoring sight have failed. He says that
while one must not expect too much from it yet by its use he has been able to save a small percentage of eyes in desperate cases. He also claims that, carried out under full cocaineization and with strict aseptic precautions, it does not endanger either the eye operated on or the fellow eye.

The instrument employed by Deutschmann (glass syringe) allows only an advance of its piston. This arrangement is provided so that no deleterious suction can be practised on the contents of the eye should the finger by chance be removed from the piston end. As nozzle for the syringe, one may employ a platinum iridium cannula or a double edged half-cannula.

He now employs ready-to-use sterilized vitreous body of absolutely fresh calf’s eye, hermetically sealed in glass tubes. Two kinds of calves vitreous are supplied by Mielch, Chemist, Hamburg. No 1 is made by the filtration of freshly boiled vitreous body (sterilized at 401 °C 2 sec) afterwards resterilized by boiling...
in hermetically sealed glass tubes. No gas has a stronger action and is composed of fresh vitreous body inspissated at 40°C, in vacuo, and the residue is taken up with physiological salt solution — sterilized by boiling — so that the component parts of normal but concentrated vitreous body are contained in it.

The technique of this intravitreous operation as given by the author is as follows: "To bring the retina once more as close as possible to the choroid by means of the pressure of the injected animal vitreous, it is, of course, necessary to get rid of the subretinal fluid. If one uses the point of the ordinary platinum iridium cannula then the procedure is as follows; the syringe, filled with the animal vitreous, is best introduced in the region of the ora serrata, somewhat outward and downward. It is given to the assistant to hold while the operator, with the double edged linear knife makes the usual bisection downward. After the completion of this manoeuvre, he, with the syringe, injects into the eye
very slowly some of the contents of the
barrel. It is generally sufficient to push
forward the piston from 1.5 to 2 divisions,
according to the consistency of the eye.
Then the syringe point is withdrawn
and the puncture closed with toothed forceps
for some minutes, that none of the fluid in-
jected may escape from the eye. To use the
syringe with the canula knife, omit the
manual bisection and insert the knife point
of the syringe, filled with animal vitreous
in exactly the same way as is directed in
the bisection operation with the double edged
knife. One can introduce the canula knife
up to the point of the counter puncture
but in all cases avoid moving the point
from side to side.

On the introduction of the syringe, the
subretinal fluid flows out. Then one imme-
diately presses the syringe piston forward, thus
making the injection. The point of entrance
is in this case also held together with forceps
after the removal of the syringe.

After the operation, both eyes are slightly
bandaged for twenty-four hours, then one
eye only

Further measures depend on the reaction shown by the eye. This reaction, again, is independent on the concentration of the animal vitreous used. "I must state here, to spare my colleagues every unpleasant experience, that they must begin with the weaker preparation, and since the operation can with perfect safety be repeated several times, gradually go on to stronger ones." The ocular tension is generally reduced after these operations. For the 1st injection, we should dilute vitreous preparation N 1 with equal parts of sterilized physiologic salt solution; for the second use the solution pure and so on.

Inflammatory symptoms, such as may appear at various periods up to the eighth day after the operations, can as a rule, be easily controlled by atropin and hot applications. If increase of tension sets in, one should at first wait quietly; only when the pain becomes very severe and perception of light is somewhat worse under the influence of the heightened tension should one interfere and do another simple injection.
Under ordinary conditions, however, it should always be borne in mind that after every injection the vitreous body will become more or less cloudy. This transparency gradually clears up completely. Even if it assumes a yellowish abscess-like appearance, it becomes clear and normally transparent again in the course of a few months. It is only now and then necessary to assist absorption by hot applications or by an occasional salt injection.

(55)
Deutschmann's latest statistics report 68 cases treated by the use of animal vitreous; in all cases, there were repeated injections. 3 patients were cured, 46 improved, in 38 cases there was no improvement, and one case was still under treatment.

(56)
His statistics of all his cases treated by both methods is as follows: Out of 267 cases the results are

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cured</td>
<td>70</td>
<td>26.1%</td>
</tr>
<tr>
<td>Improved</td>
<td>94</td>
<td>35.2%</td>
</tr>
<tr>
<td>Failed</td>
<td>101</td>
<td>38.7%</td>
</tr>
</tbody>
</table>

But 42 of these cases were hopeless from the first. If these be neglected, we have
Cured 31.1 per cent
Improved 41.3 per cent
Failed 27.6 per cent.

There is no doubt as to what Deutschmann means by cure—"a complete reattachment of the retina in anatomical sense. Only those patients who have been cured for 2 years are included."

Few other ophthalmologists seem to have given this a fair trial. Thomson states in "Ophthalmoscope" June 1910 that Tubergen and Wernicke have both tried it but the results have not been encouraging. Casey Wood has tried it in 10 cases and cured one and improved the central vision in two, but with incomplete attachment of the retina. In the others there was little or no improvement.

Dr. Oscar Dodd, of Chicago thinks he gets better results from Deutschmann's Operation than from simple reattachment and has secured a complete reattachment in one case.

There are, no doubt, some risks connected with the operation such as the presence of a large retinal vessel or the tightening
up of a previously existing intraocular in-
flammation." A great number of ophthal-
mologists think that the simpler methods
are safer and give as good results. But
on the other hand the percentage of cures
given by Deutschmann far surpass those
of any other operator.

Müller's Operation.

Leopold Müller is the originator of this
operation and apparently the only one who
has performed it. He was led to perform it
because of his belief that many cases of
detachment are due to disproportion
between the shrunken and shrinking
vitreous humour and the coats of the eye.
He proposes rather a formidable but, he
claims successful remedy for this condi-
tion viz.: a resection of a portion of the
scleral wall, so as to reduce the size of
the eyeball. Seeing it is impossible to
obtain asepsis of the conjunctiva, Müller
operates on the globe behind the equator.
The first stage in this operation is Kroneis'
resection of the outer orbital wall. Thi
havimg been performed, the temporal aspect of the eyeball is thoroughly exposed. The external rectus is then divided, the cut ends being secured by fine sutures, so that later they may be reunited. The operator then carefully and slowly excuses with a sharp scalpel a biconvex piece of sclera 20 mm. long (with its length parallel to the equator) and 8–10 mm. wide, in such a manner that its anterior edge lies 1–2 mm. behind the insertion of the external rectus. Its posterior margin should correspond to the equator. The edges of the scleral wound are now brought together by 5 small stitches.

In the performance of this operation care must be taken not to injure the choroid, but just before tying the scleral sutures, the subretinal sac is tapped with a narrow knife and some of the fluid allowed to escape. The cut ends of the rectus externus are then carefully approximated and the long plates skin to skin adjusted. When the wound is closed the whole eyeball is smaller than before.
Muller reports 3 cases in which he had done the operation after which the separated membranes resumed and held their position for 10, 11 and 15 months respectively.

No other operator seemed to have tried this operation. It is certainly rather a formidable proceeding and is analogous in many ways to Estlander's Operation for bilateral Empyema. It seems quite possible that, in the cases of enlarged globe due to extreme myopia, it might prove very valuable. It requires further experience to prove this.

**Unitled Treatment.**

In the vast majority of cases, some form of united treatment is used, i.e. a combination of several of the methods of treatment above mentioned e.g. rest, atropinisation, Huentelope Leech, excisional puncture & subconjunctival injections are often all taken advantage of in the treatment of 1 case. In such a condition as this where there is no specific treat-
ment, it is probably wise to use such combined or mixed treatment.

Now let me proceed to give the notes on the cases treated at the Hull Royal Infirmary during the last 6 months while I was resident there.

Case 1. Mary Bratello, age 5

12 Napoleon Avenue, Kent Street.

Admitted to Simpson Ward on Dec 4th, 1910 under the care of Dr. W. Legge Roe, Senior Ophthalmic Surgeon.

History. Very little history to be obtained.

Patient had squint since a baby. Mother states that about 11 weeks before admission, she noticed that the girl's eye was turning (gradually) black. The girl had complained occasionally of some pain in the eye but did not complain of not seeing. She does not remember having any blow.

Has had slight discharge from her left ear for some months.

No history of convulsions.

Patient was taken to the dispensary
4 weeks ago where Mr. Roe saw her.
He states that the eye was then in the
same condition as it is now except that
the tension is rather more marked now.
At that time he thought it was a new
growth, probably sarcoma but treated
her with Hydrag. 2% Neorine q.s.
thrice a day. No improvement resulted.

Objective Examination.

Some episcleral injection

Cornea hazy & stony looking.
Pupil dilated & fixed.
Anterior chamber very shallow.
Tension + 2.

With oblique illumination, there is
a curious looking greyish structure
lying behind the lens; this is
obscured to some extent by the hazy
of the cornea.

Wishing further to be made out by
ophthalmoscope; greyish mass attached
detached retina

Refraction of Right Eye shows a hyper-
metropia of +5 D.

Diagnosis: ? Sarcoma of c?rroid
Dec 6th 1910  EH by Anaesthesia

Left Eye enucleated.

13th 1910  healed by 1st intention

Jany 3rd 1911  discharged.


is as follows: - "There is no evidence of any new growth in this eye. As a specimen it is spoiled by being turned inside out, and the only important lesion we can make out is complete detachment of the retina. This is rolled up into a ball and was found to be separated from the choroid."

Case II  Ethel Rose, aged 8 years

10 Studley Terr. Courtney St.

Admitted to Simpson Ward on Dec 19th
tq. 10 under the care of Dr. A. Legge Rose.

History. About the 19th of September
Mrs. Rose noticed that Ethel had developed a squint in the left eye. 14 days later she had a sudden attack of pain in her left temple. This was followed by more severe attacks. About
10 days after 1st attack of pain, the left eye became inflamed and the patient noticed that the sight was gradually "getting worse", with attacks of pain more frequent and severe. She was seen by Mr. Roe at the Dispensary on Nov. 14th 1910 & was treated by him there till admission.

She has always been a healthy child and no history is forthcoming of a knock or blow in or near the eye.

Had Scarlet Fever some years ago. Mr. Roe states that the condition has not altered in any way since he first saw it. During that time—saw Nov. 14th 1910, she has had Hydroc.

Became gr. 1/4 twice a day, with no improvement resulting.

Patient is completely blind in left eye; perception of light is doubtful.

Objective Examination

Marked subconjunctival injection

Cornea very atamy & membrane very slightly sensitive

Pupil dilated and fixed—no posterior synechia.
Anterior chamber practically abolished.
Tension +2 at least.

On looking at the eye, there can be seen lying forward in the eye, just behind the lens, a sexual grey mass.
This is confirmed by oblique illumination and by direct ophthalmoscopy. No details of fundus to be seen. This mass is evidently a completely detached retina.

Examination of the other eye shows a normal fundus with some hypermetropic astigmatism the correction for which is +2.5 D sph. + 2.5 D cyl. Ax Vert.

Diagnosis: Choroidal Tumor, probably Sarcoma.

Dec 20th, 1910. 64 lbs. Ether Anesthesia.

R. Eye Enucleated. Eye was enlarged and socket small so that the palpebral fissure required to be slit at the outer angle to allow dislocation of eyeball.


Jan 12, 1911. Discharged.

Laboratory Report from The Clinical Research Association Limited 39, 12, 10.

"There is no evidence of a new growth"
in this eye. It presents complete detachment of the retina with great vascularity and some hemorrhage into the choroid. The retina itself is swollen and oedema of the lens is softened, opaque and cuts very easily. There is no evidence of tubercle or acute inflammation.

Case III.

Joseph Santon, aged 37 years.
Labourer,
10 Linden Grove, Temple Street.
Admitted to Elsie Ward on December 2nd, 1910 under charge of W. A. Legge Ros.
On Nov. 18th while patient was working a darkness came suddenly over his left eye and he has been able to see very little since as the sight of his left eye has been poor for some time.
Patient was seen at out-patient department 3 days ago and recommended for admission.
On admission, patient can manage to find his way about fairly comfortably in a well lighted room but in a subdued light seems perfectly blind.
Vision is 6/60 in both eyes and he cannot count fingers at a four distance. The field of vision cannot be satisfactorily made out.

By direct inspection and oblique illumination, nothing abnormal can be made out.

By direct ophthalmoscopic examination, the left eye presents a marked detachment of the retina downwards and forwards, and extending to about 1½ times the diameter of the disc from the edge of the disc. It does not appear to be mobile. The detachment is best seen with a +8 lens at the highest part. It gradually slopes away above and below. There is difficulty in seeing the part clearly, however, owing to opaque opacities in the vitreous.

No rent can be seen in the retina.

Tension is slightly lower than normal. There is moderate ciliary opacities present. -8.0 Examination of the other eye shows fairly well marked opacities in the lens prevents a proper view of the fundus. As far as can
He made out, there is no detachment here but there are a few patches of choroiditis.

Myopia of -4.0 present.

Diagnosis: Detachment of the Retina associated with myopia.

Treatment: Complete rest in bed with pressure bandage applied to both eyes. Prone position.

Dec 7: Pt. Jordan gr. v. ten in bed.
Dec 7: Pt. Jordan gr. v. ten in bed.

Progress:

Dec 20th: Witnessed much clearer and detachment slightly shallower. Slight improvement in vision.

Dec 29th: Media still clearing; best still.

Jan 13th: Media very clean now and fundus clearly seen. Detachment is much less in extent & distinctly shallower. Pressure bandage may be discontinued.

Jan 20th: Patient allowed up for a few hours.

Feb 4th: Discharged - to attend as out patient.

March 15th: With -7 spherical
lens for Right Eye and — 8 spherical lens
in left eye patient's vision is
R 60, L 54.

He can read the newspaper unfortunately
tell the time on his watch and do the
work of a timekeeper. Below is his
present field of vision.

The detachment is hardly visible now.
The patient is greatly pleased with
the result it has little or no disability.
Case IV. Frank Edmonds, aged 53 years
Formerly Butler

Guildford Union
Admitted to Black Wood, March 6th, 1911, with美术
About 5 weeks ago, patient noticed while
swearing a word that his left eye became
suddenly dim. He had no symptoms
previously to this, he had no pain.
The sight has gradually got dimmer,
but for the last 5 weeks or so, the condition
has remained more or less stationary.
3 years ago, patient had "a stroke;"
apparently a right sided hemiplegia,
for which he still suffers slight disability,
especially in his right arm.

Seen at Outpatient Department a week
ago and recommended for admission.

On admission:

Vision R. E. 6/6 R. E. 6/60

Cannot tell time on watch with left
eye, and cannot count fingers
at 1 foot distance.

The field of vision is a small consider
as is seen by accompany nip chart
as the central vision is affected
somewhat, however, the field of vision
would not be taken very accurately.

Centre each chart with "pointer" at Zero before commencing to use the Automatic Registration.

PERIMETER CHARTS.

The eccentric continuous red line indicates the average normal Field of Indirect Vision, the small red circle the position of the blind spot.

Designed for use with Prof. McHardy's Registering Perimeter. JOHN WEGGS & SON, LTD., 287 Oxford Street, London, and 72 Bridge Street, Manchester

By direct inspection and oblique illumination, with any abnormal can be made out.

On throwing side light into the left eye from the plane mirror, only the reflex from the inner half of the fundus is got.

On direct ophthalmoscopic examination, there is a marked detachment of the
retina on the outer side, almost to halve the extent of the fundus. The detachment is most marked in the central part, shading off above and below. It presents a very pretty tessellated appearance, like water silk, most noticeable in the centre.

The detached retina is not mobile. It is best seen with a +8 lens. No rent is visible in the retina.

The media are quite clear.

Tension is normal or slightly minus. There is a slight degree of simple hypermetropia, about +3 D.

On transillumination with a modified Sack's lamp, no difference can be made out with the lamp placed over different parts of the eye.

**Right Eye.** Fundus is normal and eye is practically emmetropic.

**Diagnosis.** Idiopathic Detachment of Retina, possibly due to haemorrhage, as patient has anterior sclerosis.

**Treatment.** Complete rest in bed in prone position.

By Dr. Jodidi ge x her in die.
Progress.

March 24th: Marked improvement; patient to lie in bed still.

March 30th: Detachment is much less and presents a more addicted appearance. He sees objects more distinctly than he did a week ago.

April 3rd: Detachment still remains and as V is still 2/6, operation was advised.

April 4th: Anesthesia and cocaine

Patient was made to look upwards and downwards as far as possible; the conjunctiva was secured as low down in the fornix as possible and slid up towards the cornea. Then an incision was made through the conjunctiva close to the forceps, parallel with the corneal margin; then, with a Graefe's blade, a knife, an incision was made through the sclerotic, downwards and outwards, between the inferior rectus and external rectus muscles, well back of the ciliary region. The knife
was then turned slightly and about 20-30 veins of clear strawcoloured fluid escaped - no vitreous.
The galvano cautery was then inserted just through the sclera for a moment. The
conjunctiva was slid back into position again and the wound thus made a valve
like one. The eyes were then both bound up.

April 11th. There is a marked improvement
in the detachment at the site of operation; there is now no detachment
below and out of there it seems to be replaced. There still remains some
detachment, however, above.
The operation will be repeated in his
case up and out. (see conclusion)
The patient says that his sight is much
better but he is still unable to see the
time on his watch.

Case V
William Carter, aged 49 years.
Blacksmith
3 Sheldon Square, Gibson Street
Admitted to Elsecar Ward on March 15th.
1911 under charge of Drs. A. Logge Roe.

History. About Christmas time, patient says that he was struck by a hook on the right temple. Since then he has had darting rights and black streaks floating in front of his eye (right). Sees these with his eyes closed. For the last 2 or 3 weeks, his eye has been watering a little and he has had pain across that eye. During that time also, he has gradually (not suddenly) become blind. 2 or 3 weeks ago, he saw quite well without.

was seen at out patient department 2 days ago and recommended for admission on admission. Patient can see quite well with his left eye, so that he can find his way about with ease. Vision is R \( \frac{6}{60} \), L \( \frac{6}{12} \), and he can count fingers with his right eye at 4' distance.

The field of vision is a very small one compared with the apparent extent of the detachment. The accompanying chart shows this.
The pupil is moderately dilated and reacts slightly and sluggishly, but reacts well on throwing light into the left eye.

A thorough test is to be made on direct inspection or oblique illumination.

Direct ophthalmoscopic examination

There is a detachment of the retina in the lower and inner half, almost to...
half the extent of the fundus and it extends near to the margin of the disc. It is very lobular in character, being divided into 3 mounds with 2 "valleys" between, the lowest one being the highest. It is best seen with a +12 lens. The main vessels lie in these "valleys" and then spread themselves over the detached retina. The detachment is very transparent, a certain amount of the red reflex being got through it. It is also particularly mobile. No rent can be seen in it.

There is about 1 D of simple hypermetropia. Tension is normal.

Transillumination gives the same bright reflect, no matter to what part of the eye the lamp is applied.

Left Eye. About -8 D of hypermetropia. Fundus appears perfectly normal and media are quite clear. 1/18

Diagnosis. Detachment of Retina.

Treatment and Progress.

Complete rest in bed in prone position

By Dr. Joseph got for mi die
March 21st. Slight improvement; detachment rather shallow.

March 25th. Still improving. Patient sees better, especially objects passing by the left side.

March 30th. The detachment is still mobile, not so lobular in character and presents a distinctly striated appearance.

April 3rd. The detachment is now more marked below, but otherwise still has the same appearance. Attempt to OPERATE.

April 4th. Operation. Exactly the same operation was done as described in the last case, only the incision was made downwards and onwards, between the inferior and internal recti muscles. By and some 20 minims of clear straw-coloured fluid escaped. Both eyes were bandaged up with a pressure bandage and the patient kept rigidly in bed in the prone position.

April 11th. Now the lowest "mound" which was opposite the site of incision is gone and the next to it is much
diminished. He also states that his vision is "much better", though he still cannot tell the time on his watch. The operation will be reperformed in the course of a few days. (see conclusion)

Conclusions regarding Cases.
Cases I and II are so exactly similar that they may be considered together.
To begin with, it is a most curious coincidence that 2 so unusual and similar cases of detachment of the retina should be admitted to the same hospital within a fortnight of each other. The interest centres itself around the pathology and diagnosis. What were the conditions due to?
There had been no previous acute illnesses, at least immediately preceding, the slight chronic cataracts needed in Case I being the only condition abnormal. There were no signs of any inflammatory condition at the time & no signs of any
former inflammatory mischief, such as posterior synechia. There was only the completely detached retina with matched glaucoma in both cases. So far as we could make out therefore it was not a pseudo-glauca. Because of the increased tension and the fact that the condition occurred in children it did not appear to suggest an ordinary idiopathic detachment. New growths of the choroid seemed to be left and the diagnosis seemed to point to that. Mercury had no effect and a syphilitic tumour was not therefore likely. Besides there was nothing in the history or in other signs to suggest syphilis. It was not like the condition either which we keep in sch meral or conditores where there is usually much more inflammation. We seemed to be narrowed down to glauca or sarcoca and of these sarcoca was thought the more likely for the detachment did not have the plum-col white character of that disease.
It was therefore thought that sarcoma of the choroid was the most likely cause of the condition; enucleation was therefore performed. The laboratory reports in both cases came therefore as somewhat of a surprise and we are still as much at a loss to account for the condition. Mr. Rose felt quite certain that some kind of growth would be found accounting for the condition and even yet thinks there "may have been a flat sarcoma at the posterior and thus escape observation unless carefully done." If this is not so these apparently the conditions are the extremely rare ones of detached retina with glaucoma. What the cause of the detachment was, it seems to be impossible to say.

At any rate I think it will be agreed that early enucleation was the only proper treatment in both cases.

Regarding case III, it seems to have been an ordinary case of Retinal
Detachment, due to, or at least associated with Myopia. This case
brings out very clearly the good effects which may result from simple rest
and bandaging of the eyes. This was done for 6 weeks, and while the attach-
ment is not quite, but almost, complete,
and the field of vision is not completely
restored, still the vision is so far
improved that the condition now
causes the patient no symptoms and
he is able to follow his employment
satisfactorily. This, I think, may be
designated quite a satisfactory
result.

Regarding Cases IV and V, their
pathology does not seem at all clear
and there seems to be nothing to point
to the cause of the condition. It was
thought that Case IV might be due to a
haemorrhage from a seareded vessel but
only serum was drawn off. In Case
V, it is very doubtful how far the
blow received months before was respon-
sible for the condition and I am afraid
they must both be included in the list of the great unknowns — I dispel other cases.

Regarding the last three cases, I am aware that it is quite impossible to draw conclusions from them as in 2 of them, they are still under treatment and in the other, too short a time has elapsed to prove anything. But as I expect to go to Canada in the course of a few months, I know that it will be quite impossible for me to follow the cases and so I am sending this thesis at this time.

So far as the last 2 cases are concerned, the treatment, so far as it has gone, has been very encouraging and matters seem to point to a satisfactory result.

**General Conclusions**

So far as pathology and diagnosis are concerned, I must leave these as they already stand. I think that little more can be added and that scientific research is required.
Before a clear view of the pathological conditions can be stated
wars regarding Treatment.

1. To begin with, it seems to me that
that there is some reason for looking more
hopefully on this disease than in in former
times. Looking over the literature of
some 30 or 40 years ago, and comparing
it with the present day literature on
the subject, one is struck by the more
optimistic character of it. Formerly,
practically every case was considered
hopeless, "complete blindness being the
rule." Now a-days however, we have
it pointed out that a certain percentage
of cases can be cured both by operative
and non-operative methods. This is
indeed an advance and I have come
to the conclusion that at least 10% of
cases can be cured. This, in itself
is some ray of comfort to the patient.

2. It is well to remember that a
certain proportion of patients recover
without any treatment at all. Shorten-
eous cures are known to occur and
indeed many cases attributed to the use
of certain treatment, are cases of this kind.
3. Always keep in mind the possibility
and likelihood of relapse. This should
always be mentioned to the patient (as men
tioned) to try and prevent
such a calamity. At the same time
it must be remembered that cures are
often effected after several relapses.
No patient should be regarded as
cured till after a year's replacement.
Redetachments after this time are unusual.
4. Given a patient with Detached Retina,
put him in possession of the facts as
clearly as possible. If it is of long
standing and associated with high
myopia tell the patient that no treat-
ment will improve it. If the detae-
ment is recent & of an idiopathic
nature & even with myopia, tell him that
the condition is curable in a small
percentage of cases — probably about 10%.
Tell him that you would certainly
advise treatment but that the treatment
will be long and probably a little
irksome, requiring a recumbent position
and the eyes bandaged for some weeks. Also
that some operative treatment will probably
be necessary. Indeed, I think these
lines on which we ought to deal with
such a patient.

6. The form of treatment employed must
be varied accordingly to the requirements
of each individual case. It must
usually be of a mixed nature.
To begin with it is advisable, I think
to try the effect of simple non-operative
treatment, including complete rest in
bed, atropin instillation, iodides or
salicylates internally, perhaps
occasionally and along with these way
be used subconjunctival injections.

6. Failing any improvement in the
course of 2 or 3 weeks, what operative
procedure or procedures are we to try?
If the detachment is in the lower
part of the retina, I think it would
be advisable, in the hands of experi-
enced ophthalmologists, to perform his
simple dissection at once, as this operation
seems to hold out better prospects than any other. If this, for any reason, can not be done, from the position of the detachment or, then I would strongly advocate scleral puncture over the detached portion of the retina, with application of the gelatin sponge as described in Cases IV and V or with multiple puncture of the detached sclera.

7. Repetition of these or other operations will be necessary—the time elapsing between the operations varying with each individual case, and with the improvement which has taken place.

8. In unpromising cases, Deitschmann's combined bi-section of the vitreous and the injection of sterile animal vitreous may be used. Blindness operation however seems to hold out a promising though formidable operation. But too few cases have been operated on by this method to arrive at any conclusion.

9. Alone all, patience and perseverance on the part of both patient
and surgeon are essential.

Yardfaulk Place,
Edinburgh
April 28/11

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