Implications of and treatment options for retinal detachment

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The retina is a complex structure that turns light falling onto it via a chemical reaction into nerve impulses, which then travel to the brain for interpretation into images. If the retina is damaged or moved from its correct location, a person’s ability to interpret the world is compromised with all the physical, social and psychological effects this implies. Nurses have a key role in the recognition of signs and symptoms of retinal compromise as well as the care and treatment of patients who undergo therapy for retinal detachment, so that the best possible vision is achieved for each patient.

Retinal detachment can have a devastating effect on vision, and early referral to an ophthalmologist is crucial for patients experiencing symptoms if they are to retain good vision.

This article discusses the causes, presentation and treatment of retinal detachment. It is important for nurses to understand the condition so that they can give high-quality, timely information to patients and others who may ask for their advice.

**The retina and vision**

The retina is the innermost of the three ‘coatings’ of the eyeball (the outer two layers being the choroid and the cornea and sclera). It is the layer that enables us to see, although it does not form images itself. The integrity of the retina is crucial and any defect in it has the potential to affect vision. Box 1 lists some of the anatomical markers around the retina.

The retina consists of 10 layers, although these can be divided into two main layers:

- **The retinal pigment epithelium (RPE)** is the outer layer, which lies against the choroid;
- **The neurosensory or neural retina.**

Between the neural retina and the RPE is a space known as the sub-retinal space. The neural retina is firmly attached only at its extreme and the margins of the optic nerve. Without a firm attachment to the underlying RPE there is a potential for these two layers to become separated (Fig 1, p47).

Retinal detachment is more common in men, people with myopia (short-sight) and older people (Newell, 1996). Some people have a predisposition to breaks or tears in the retina due to retinal degenerative change.

**Retinal structure and function**

In order to recognise the effects of retinal detachment on vision, it is necessary to understand the function of the retina. The neural retina collects the light falling on it from outside the eye that has passed through the cornea, pupil and vitreous gel, then through the neural layers of the retina to hit a layer of photoreceptor cells.

A series of chemical changes in the cells transform the light into electrical signals that pass along the optic nerves to the visual cortex within the occipital lobe of the brain. The visual cortex interprets what we see. The retina has two types of photoreceptor cell, rods and cones, which have different functions: rods detect contrast and motion while cones detect light of different colours and fine detail (Box 2, p46). The other parts of the neural retina are concerned with amplifying the electrical signals and, through a series of nerve cells, transmitting them to the visual cortex for interpretation.

**Types of retinal detachment**

Retinal detachment is the separation of the retinal pigment epithelium from the neural retina. It will inevitably, if not immediately, affect vision. There are three classifications of retinal detachment: rhegmatogenous, traction and exudative.

**Rhegmatogenous retinal detachment**

This is the most common form of detachment and occurs secondarily to the formation of holes, tears or breaks in the retina, which are commonly caused by vitreous traction. The vitreous humour of the eye, which fills the posterior segment of the globe, consists of collagen fibrils and hyaluronic acid molecules within an aqueous gel. Its volume reduces with increasing age (this happens earlier in individuals who are short-sighted) and as the vitreous humour shrinks, it may detach from the face of the retina. This is known as posterior vitreous detachment (PVD), and it does not normally cause problems. However, small adhesions can occur between the retina and vitreous, which may pull holes in the retina as the vitreous moves away from it.

Another common cause of retinal breaks is degeneration of the retina. Lattice degeneration is present in approximately seven per cent of the population and in about 40 per cent of eyes with a retinal detachment.

People with myopia make up only 10 per cent of the population but have 42 per cent of all retinal detachments due to increased incidence of lattice degeneration in this group and a high frequency of posterior vitreous detachment at a younger age (Taylor et al, 1995). In 8

**REFERENCES**


The absence of retinal holes, therefore, is a key indication of traction on the retina, and a possible retinal detachment. The occurrence of flashing lights, therefore, may be an indication of traction on the retina, and a possible retinal hole.

Any break in the retina will allow fluid to pass from the vitreous cavity into the sub-retinal space, separating the neural retina from the retinal pigment epithelium and causing a retinal detachment. Treatment depends on the clinical features of the detachment but may be primarily by scleral buckle, vitrectomy or retinopexy (see section on treatments, p46–47).

The timing of surgery is important – if the macular area is not affected, or has only recently become involved, surgery is likely to be undertaken as a matter of urgency in order to preserve macular function. If the macular area has been detached for some time, there is less chance of recovering macular function and surgery may be slightly delayed (Ross and Kozy, 1998).

Traction detachments are usually caused by traction bands of fibrovascular tissue that have arisen from fibrosis of inflammatory exudates and haemorrhages within the vitreous cavity. These traction bands contract, pulling the neural retina away from the retinal pigment epithelium. Fibrovascular tissue is most commonly the result of:

- Proliferative diabetic retinopathy;
- Retinal vascular disorders;
- A late complication of penetrating trauma (Pavan-Langston, 2002). Treatment is almost always by vitrectomy.

Exudative detachments are due to the leakage of fluid from the layers underneath the retina rather than from fluid entering the sub-retinal space through a hole in the retina. The absence of retinal holes, therefore, is a key feature of this type of detachment, which is caused by inflammatory conditions and by retinal or choroidal tumours. Treatment depends on identifying the underlying cause of the detachment and treating that.

Symptoms of retinal detachment

As the vitreous humour separates from the retina and moves within the eye, the patient may see ‘floaters’. These appear as spots, curly lines or rings and may be dark or clear. They move with the eye and may be especially troublesome when looking at a pale surface or the sky. Flashing lights may also be seen – these are caused by the retina being stimulated by the vitreous humour pulling on it, which the brain interprets as a flashing light. The occurrence of flashing lights, therefore, may be an indication of traction on the retina, and a possible retinal hole.

If a break in the retina occurs, a retinal blood vessel may be damaged resulting in blood flowing into the vitreous humour (vitreous haemorrhage).

A small amount of blood may be seen as a shower of spots and larger amounts of blood can cause darker patches in the field of vision. A retinal detachment may appear as a patch of vision missing or as something moving around in the periphery of vision, which may be seen out of the corner of the eye but is not there when the head is turned. Some patients also describe being able to see a spider’s web or stray hairs over their vision.

Flashes of light, new floaters in vision, showers of floaters, cobwebs, hairs or ‘curtains’ coming down over the vision may all indicate vitreous traction on the retina and the development of holes and detachment. People developing these symptoms need an urgent retinal examination to rule out any problem that requires immediate treatment.

Floaters on their own are common and unlikely to cause any problem. New floaters, especially if there are lots of them and they are associated with flashing lights, need assessment by an ophthalmic professional (usually approximately one per cent of patients, retinal detachment is a late complication of cataract surgery due to movement of the vitreous.

Blunt trauma may also result in detachment, which may occur at the time of the injury or months later (Newell, 1996). Penetrating trauma may damage the retina directly or cause tears and lead to detachment at a later date.

The posterior pole is a 5–6mm diameter zone of retina situated between the superior and inferior temporal arteries.

The macula lutea or macula is a 1.5mm diameter area within the posterior pole about 3mm lateral to the optic disc.

The fovea centralis or fovea is a central, 0.35mm depression in the macula with slightly thickened margins. The retina here consists purely of cone receptors and has no blood supply, relying on the choroid below it for nutritional support.

The optic disc is seen as a pale zone, medial to the macula. There are no normal retinal layers or photoreceptors at the optic disc, which is also known as the blind spot. Axons from the sensory retina pierce the sclera here to exit the globe and enter the optic nerve. The central retinal artery enters the eye here, passing over the rim of the optic disc and then radiating out to supply the retina. The central retinal vein leaves the globe at the optic disc.

The peripheral retina is the rest of the retina, outside the posterior pole.

The ora serrata is the scalloped edge of the sensory retina. It is a transition zone where the neural retina is continuous with cells of the pars plana. The ora serrata lies behind the ciliary body.

KeywORDS ■ Surgery ■ Retinal detachment ■ Ophthalmology

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Retinal holes caused by atrophic changes are common and may not lead to a detached retina. However, ophthalmologists often recommend treating any hole or break to rule out the possibility of subsequent detachment. Treatment of retinal holes is by cryotherapy or, more often, by laser photocoagulation. Both aim to achieve adhesions between the retina and the choroid.

Cryotherapy and photocoagulation
Cryotherapy is applied to the sclera over the break and achieves adhesion by inducing inflammation. In photo-coagulation, a laser directed through the pupil applies burns to the retina around the break in order to effectively ‘heat seal’ the hole (Newell, 1996; Adams and Charteris, 2002). Both procedures are likely to take place as outpatient or day surgery procedures, usually using topical or local anaesthetic.

Box 2. Functions of rods and cones

- Rods are contained within the periphery of the retina and are predominantly responsible for vision at low light levels. They detect contrast and motion, and produce images consisting of black, white and greys. The rods are stimulated to work in dim lighting and are why we tend to see images only in shades of black and grey at night.

- Cones are adapted to higher levels of light and are responsible for colour images and fine vision. There are three types of cone, sensitive to red, green and blue light. Cones are most dense at the fovea, a small depression in the centre of the retina, and are responsible for central vision. Damage to central vision can disrupt many daily living activities.

Retinal detachment repair
The aim of retinal detachment repair is to achieve apposition of the neural retina and the retinal pigment epithelium. Simplistically, this is achieved either by moving the retinal pigment epithelium towards the retina by indenting the sclera from the outside of the eye, or moving the retina towards the retinal pigment epithelium by pushing it from the inside of the globe.

Posturing before surgery
Positioning before and after surgery is often known as ‘posturing’. Where there is a diagnosed rhegmatogenous retinal detachment, patients who are waiting for surgery may be encouraged to adopt a particular position while resting or sleeping. Once the retina has begun to detach, it may continue to ‘peel off’ the retinal pigment epithelium and extend further, and careful positioning may retard this process.

For example, if the detachment is in the superior part of the retina, gravity will help the retina to continue to move away from the retinal pigment epithelium. Patients are therefore encouraged to lie flat on their backs as this may help to negate the effects of gravity on the retina. If the detachment is inferior, gravity will actually help to prevent extension and patients are likely to be encouraged to sit upright. This is most important if the macula is not yet affected by the detachment.

Types of surgery
Scleral buckle
This procedure has been in use for more than 30 years and until around 20 years ago it was the only one available (Sorenson, 2004). It involves finding all retinal breaks and treating them with cryotherapy through the sclera. Any fluid underneath the retina is drained to ensure it is apposed to the retinal pigment epithelium.

To allow time for an inflammatory response to develop between the choroid and the retina, the globe is indented over the position of the holes using a scleral buckle (a band of silicone, sponge, rubber or plastic), sutured to the sclera. Any traction on the retina is released as the retina is pushed towards the vitreous cavity (Pavan-Langston, 2002).

Complications include postoperative squint due to the bulk of the explant or direct trauma to a muscle and astigmatism due to the change in shape of the globe and corneal shape change. Infection or exposure of the explant may be a late complication.

References


Vitrectomy
This is more correctly termed trans pars plana vitrectomy (TPPV) and is also known as pars plana vitrectomy (PPV). The aim is to remove vitreous opacities and fibrovascular tissue, relieve traction and create a space for internal tamponade. Three small incisions are made in the eye at the pars plana. A light pipe and infusion cannula are placed through two of the incisions or ports and a cutting tool through the third. Vitreous is removed with the cutter and then a variety of micro-instruments such as scissors, forceps and lasers are used to remove traction bands and haemorrhage and ensure the retina is in the correct place. Gas, heavy liquids or silicone oil is then injected into the vitreous cavity to act as a tamponade to keep the retina in place.

The most commonly used gas in this case is air (Nofal, 2003) but sulphur hexafluoride (SF$_6$) and perfluoropropane (C$_3$F$_8$) are also used. Air is absorbed after two or three days, SF$_6$ after about 10 days and C$_3$F$_8$ after about 28 days. The length of time depends on the volume and concentration of gas in the eye. Postoperative posturing is necessary to ensure gas tamponades remain in the correct place. Gas, heavy liquids or silicone oil is then injected into the vitreous cavity to act as a tamponade to keep the retina in place.

Patients with gas bubbles in the eye should not fly until the gas has been absorbed. This is because increased altitude causes the gas bubble to increase in volume and thus raise the internal pressure of the eye.

Pneumatic retinopexy
This relatively new technique for the repair of specific types of rhegmatogenous detachment involves injecting a gas into the vitreous. The gas expands in the eye, pushing the retina back onto the retinal pigment epithelium. Gases include SF$_6$ and C$_3$F$_8$. If the break in the retina can be covered by the bubble, the sub-retinal fluid will be reabsorbed in a few days.

The retinal break is treated either with cryotherapy before the bubble is injected or with a laser after the retina has flattened. Precise head positioning or posturing will be needed for a week to 10 days so that the bubble of gas stays in place against the retinal break.

Local or regional anaesthesia is often used in retinal surgery, which enables much faster rehabilitation and discharge, and procedures may be undertaken on a day surgery basis.

Cases that are expected to be particularly long or complex are performed under general anaesthetic.

Posturgical posturing
Posturing is a major commitment by the patient and can cause physical and psychological problems (Harker et al, 2002; Ciulla et al, 1996). It involves the patient keeping her or his head in a very specific position for days or even weeks. Posturing regimens vary, but are likely to involve positioning for 50 minutes out of every hour. Some surgeons allow breaks for hygiene needs and mealtimes, but others prefer these to be undertaken within the 10-minute hourly break.

There is general acceptance that posturing is required, but little evidence to suggest which regimen works best. Patients need an enormous amount of support during initial posturing in the hospital setting, and preoperative preparation is essential to aid understanding and compliance. They will also need support at home and the presence of a ‘carer’ is essential, and may include the involvement of social service provision or community nursing services, who must all be made aware of the patient’s very specific needs.

Conclusion
The speed at which an eye symptom becomes a serious eye condition requiring rapid treatment may be difficult for the patient to come to terms with, as may the possibility of secondary surgical procedures some time later.

Preoperative visual acuity and the duration of retinal detachment are important factors associated with the return of central vision after surgery. If the macula remains attached there is an 82–87 per cent chance of retaining good vision postoperatively. If the macula is detached preoperatively, there is only a 20–37 per cent chance of regaining predetachment vision (Nofal, 2003).

People who have had retinal detachments, therefore, may have to come to terms with less than perfect vision or a less than optimal result, and nurses can and should be sources of information and support.

This may be a role for ophthalmic nurses in specialist settings, but it is important that all nurses understand the basic mechanisms of vision, possible presenting symptoms of retinal detachment and the principles of treatment, so that patients can access accurate and helpful advice from any nurse with whom they come into contact.