

Vitreous loss during cataract surgery: prevention and optimal management

PM Jacobs

Abstract

Vitreous loss during cataract surgery is associated with a poor visual outcome. Experienced surgeons and those performing a high volume of cataract operations have lower rates of vitreous loss. Risk stratification systems, which allow prediction of intraoperative complications from preoperative criteria exist, so that less experienced surgeons can avoid higher risk cases. The management of vitreous loss includes counselling patients before surgery of the potential risks and complications. When vitreous loss occurs, it is important for the surgeon to avoid actions which increase the chance of disaster for the eye. These include phacoemulsification in the presence of vitreous and attempts to recover dropped lens fragments from the posterior segment without vitrectomy. There are advantages in performing an anterior vitrectomy by the pars plana route rather than through the anterior chamber and this approach is facilitated by sutureless 23-gauge instruments. Dislocation of lens nuclear fragments into the vitreous is associated with a high incidence of retinal detachment as well as secondary glaucoma and cystoid macular oedema. Early involvement of a retinal surgeon in the management of these eyes is recommended. *Eye* (2008) 22, 1286–1289; doi:10.1038/eye.2008.22; published online 22 February 2008

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Introduction

The posterior lens capsule is an anatomical barrier, which separates the vitreous body from

the forces involved in lens fragmentation and aspiration and intraocular lens implantation. The UK national cataract surgery survey 1997–1998 found capsule rupture and vitreous loss in 4.4% of patients.¹ Other reports suggest higher and much lower rates between 8.22 and 0.45% of patients.^{2,3} Vitreous loss is associated with an increased risk of sight threatening complications, including cystoid macular oedema, retinal detachment, and endophthalmitis.^{4–7} Posterior capsule disruption may be followed by dislocation of lens fragments into the posterior segment and those eyes have an even worse prognosis.^{8,9}

Prevention

The minutiae of safe cataract surgery are outside the scope of this article and are dealt with in recent texts.^{10,11} The incidence of vitreous loss depends on the experience of the surgeon,⁶ surgical volume (number of cataract operations per surgeon in a year),^{12,13} and the complexity of cases or case mix.¹⁴ Scoring systems allow a quantitative preoperative assessment of risk for individual cases.^{15,16} Such risk stratification allows complications to be anticipated and obviated by appropriate patient preparation, type of anaesthesia, and selection of surgeon. Muhtaseb¹⁵ showed that even experienced consultants had an 8% vitreous loss rate and a 4% rate of dropped lens nucleus in eyes in the highest risk group. It seems appropriate for cataract surgery in such eyes to be undertaken only by surgeons experienced in vitrectomy and in removal of dislocated lens fragments from the posterior segment.

The importance of the capsulorrhexis in the success of a cataract operation has rightly been emphasised¹⁷ but the quality of the capsulorrhexis may be determined much earlier in the operation by factors such as patient

Department of
Ophthalmology, York
Hospital, York, UK

Correspondence:
PM Jacobs,
Department of
Ophthalmology,
York Hospital,
Wigginton Road,
York,
YO31 8HE,
UK
Tel: +44 1904 726552;
Fax: +44 1904 726343.
E-mail: Paul.Jacobs@
york.nhs.uk

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preparation, choice of anaesthesia, and the construction of the corneal wound. Difficulties may be encountered even after a perfect capsulorrhexis in high-risk eyes, for example, after vitrectomy¹⁸ when an unstable anterior chamber depth may result in fluctuations in anterior chamber depth, pupil constriction, and patient discomfort.¹⁹ Management techniques for these eyes should be understood.^{18,20}

Management: the patient

Cataract surgery is not a trivial operation but patients increasingly expect it to be so. Management of a significant intraoperative complication will be easier for the patient if informed consent has included a discussion of possible vitreous loss, dislocation of lens matter, and failure to implant an intraocular lens. This will reduce patient anxiety and help to maintain the trust between patient and surgeon during, and after, the operation. Patients want to be warned of rare complications, 93.5% would like to be informed if the risk is 1 in 50 and 62.4% if it is 1 in 1000.²¹ However, the accuracy of recall of consent information is low, particularly, with respect to serious complications, which provides a challenge in preparation of the patients for what may be complicated surgery.²²

Management: the eye

Recognition that vitreous loss has occurred will be prompted by a subtle but sudden change in the conditions within the eye. One or more of the following signs may be observed: sudden deepening of the chamber, change in the mobility of the lens nucleus, excess sideways displacement of the nucleus, sudden appearance of a red reflex, and abnormal movement of structures (for example, the pupil margin) remote from instruments in the anterior chamber caused by traction transmitted through vitreous strands.

If phacoemulsification is still in progress, this should be stopped and the probe carefully withdrawn from the eye in a way that minimises traction on the vitreous. A viscoelastic substance may be injected into the anterior chamber at this stage to reduce vitreous prolapse as the phacoemulsification probe is withdrawn and to stabilise any remaining lens fragments. It is most important that the surgeon should then pause for reflection. While an assessment of the situation takes place, time can be gainfully employed by setting up the equipment for vitrectomy and adding a sub-Tenon's anaesthetic, if appropriate. Delayed action at this stage may allow the lens nucleus or significant portions of lens material to sink posteriorly. This is a readily managed complication with a generally favourable outcome.²³ Precipitate and

aggressive attempts to retrieve lens fragments by an anterior approach are harmful.²⁴

The aims of management of vitreous loss are removal of any vitreous from the anterior chamber and surgical wound, completion of cataract removal, and safe intraocular lens implantation. It is appropriate for any, all, or none of these to be completed by the primary surgeon, depending on the surgeon's experience and the difficulties of the individual case. Vitreous should be removed with a vitreous cutter and a separate infusion, which may be conveniently provided by an anterior chamber maintainer. The use of a coaxial infusion sleeve around a vitreous cutter is not to be recommended as there is a conflict inflow between infusion and aspiration, and control of intraocular pressure is lost every time when the cutter is removed from the eye. Lack of maintenance of a stable intraocular pressure is a weakness of so called 'dry' vitrectomy techniques. To remove vitreous from the anterior chamber, the most logical site to place the cutter is through the pars plana, with either an anterior chamber or pars plana infusion.²⁵ This minimises anterior chamber manipulation, reduces the tendency for vitreous incarceration in the corneal incision, and permits the removal of vitreous well behind the posterior capsule, which is more difficult when the cutter is introduced through the anterior chamber and more risky for the integrity of the remaining capsule. Triamcinolone particles can be used to visualise vitreous strands in the anterior chamber²⁶ but their use is not essential. Sutureless 25-gauge vitrectomy has been used.^{25,27} The wider 23-gauge sutureless instruments²⁸ offer greater control and may be better in dealing with retained lens material as well as vitreous. Soft lens matter can be readily removed using the vitrector. Nuclear material may be emulsified and aspirated by reintroducing the phacoemulsification probe, after the anterior chamber has been completely cleared of vitreous, or intact nuclear fragments can be removed through an enlarged incision. Viscoelastics or a lens glide²⁹ may help to stabilise nuclear fragments in the anterior chamber before removal.

If nuclear fragments are dislocated posteriorly behind the plane of the posterior capsule, aggressive efforts to retrieve these without pars plana vitrectomy can result in giant retinal tears and retinal detachments.^{9,24} Passing an instrument through the pars plana to retrieve a sinking lens nucleus is known as posterior-assisted levitation. This technique is claimed to be safe in some small series.^{30,31} Such manoeuvres carry the same theoretical risks as aggressive anterior retrieval and, before embarking on this approach, the primary surgeon should be confident of completing the process. Failed attempts of this nature may compromise the cornea, lens capsule and retina, and complicate subsequent management.

Any cataract surgeon who is not experienced in posterior segment surgery should have discussed the management of a dropped lens nucleus with local vitreoretinal specialists, before the event occurs, with regard to the extent of primary surgery and the timing of referral. Some posterior segment surgeons advocate the insertion of an intraocular lens in the presence of nuclear fragments in the posterior segment. There are arguments against this. Leaving an eye, with a dropped lens nucleus, without an intraocular lens permits the removal of nuclear material from the posterior segment through the anterior chamber. There is a high incidence of retinal detachment at the time of nucleus removal⁹ and an unstable intraocular lens or anterior chamber lens can complicate the use of internal tamponade. Perfluorocarbon liquids may be helpful in elevating a lens nucleus for removal through the anterior chamber.³² They may also be used to support a nucleus away from the retina during posterior segment fragmentation. The timing of removal of lens matter from the posterior segment is not firmly established. Immediate pars plana vitrectomy has advantages for the patient and for the eye.³³ Secondary glaucoma is an important complication of retained lens matter and this is prevented or reversed by early vitrectomy.³⁴ However, deferment of surgery for 2–3 weeks may allow lens material to become softer and easier to remove.³⁵ Delay of more than 3 weeks is associated with a poor outcome as a result of retinal detachment, cystoid macular oedema, chronic inflammation, and glaucoma.³⁶ The incidence of retinal detachment in eyes with retained lens fragments is high,⁹ well above 10% in most series. It is essential that these eyes are referred immediately to a posterior segment specialist, who can then make the appropriate decisions about management.

Management: the surgeon

Vitreous loss during cataract surgery is a rare event. In what should be an unfamiliar situation for the surgeon, decision-making is facilitated by prior preparation. Patients have high expectations of cataract surgery and adequate discussion of serious complications and informed consent before the procedure reduces the pressure on the surgeon to solve all intraoperative problems immediately. It is the responsibility of the surgeon to ensure that the equipment necessary to deal with vitreous loss is available before commencing cataract surgery and that those assisting in the operating room are able to make these facilities available with expediency, to minimise the transmission of anxiety to the patient. Some cataract surgeons have the vitreoretinal surgical skills and experience to deal with all the immediate sequelae of vitreous loss, including dropped

lens nucleus and retinal detachment. The best cataract surgeons will have the least experience of managing vitreous loss and there should be no disgrace in discontinuing the surgery and enlisting a specialist's help at an early stage. Both primary cataract surgeons and surgeons involved in the subsequent vitreoretinal management of cases of vitreous loss should participate in clinical audit and clinical governance to ensure acceptable outcomes for patients.³⁷

Discussion

Although vitreous loss in cataract surgery is associated with sight threatening complications, including cystoid macular oedema and retinal detachment, the outcomes can be good. Ang³⁸ reported a final best-corrected visual acuity of 6/12 or better in 84.4% of eyes after posterior capsule rupture in a district general hospital setting. There was, however, an impact on the patients in terms of additional surgical procedures, additional medication, and the number and duration of follow-up reviews. Prevention of vitreous loss, whenever possible, remains important. Good practice includes preoperative identification of patients with a high risk of such a complication, so that this can influence the type of cataract surgery and choice of surgeon. Provision of adequate information before surgery about potential complications, and what these complications may mean for visual outcome, should apply to all patients.

As the number of patients requiring cataract surgery each year is large and the incidence of vitreous loss is low, it is not appropriate for every cataract surgeon to be an experienced posterior segment surgeon. A pars plana approach may be the most controlled way to carry out an anterior vitrectomy and there is no reason for anterior segment surgeons to avoid this. Sutureless vitrectomy techniques make entry and exit through the pars plana very easy in the context of a cataract operation.

When vitreous loss occurs, there is a risk that inappropriate immediate management can have a devastating outcome for the patient, particularly, in the case of posteriorly dislocated lens fragments.^{9,24} Those eyes have a high rate of retinal detachment and an experienced posterior segment surgeon should be involved at a very early stage in their management.

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