

Safety of Vitrectomy for Floaters

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- **PURPOSE:** To assess the risks of vitrectomy for the removal of primary and secondary vitreous opacities.
- **DESIGN:** Retrospective, nonrandomized, interventional case series.
- **METHODS:** We reviewed the results of 116 consecutive cases of vitrectomy for vitreous floaters. Eighty-six cases were primary and 30 cases were secondary floaters. Main outcome measures were the incidence of iatrogenic retinal breaks and postoperative rhegmatogenous retinal detachments.
- **RESULTS:** We found iatrogenic retinal breaks in 16.4% of operations. There was no statistically significant difference in risk between cases of primary and secondary floaters. Intraoperative posterior vitreous detachment induction was found to increase significantly the risk of breaks. Retinal detachment occurred in 3 cases (2.5%), all after operations for primary floaters. One case of complicated retinal detachment ended with a low visual acuity of hand movements. Cataract occurred in 50% of phakic cases. Transient postoperative hypotony was found after 5.2% of our operations, and transient postoperative high intraocular pressure was encountered in 7.8%. An intraoperative choroidal hemorrhage occurred in 1 case, which resolved spontaneously. The mean visual acuity improved from 0.20 to 0.13 logarithm of the minimal angle of resolution units.
- **CONCLUSIONS:** The risk profile of vitrectomy for floaters is comparable with that of vitrectomy for other elective indications. Retinal breaks are a common finding during surgery and treatment of these breaks is crucial for the prevention of postoperative retinal detachment. Patients considering surgery for floaters should be informed specifically about the risks involved. (*Am J Ophthalmol* 2011;151:995–998. © 2011 by Elsevier Inc. All rights reserved.)

THE AGED HUMAN VITREOUS BODY IS FAR FROM HOMOGENOUS. Vitreous opacities occur frequently, mostly because of age-related changes in the macrostructure of the vitreous body described as liquefaction (synchysis) and collapse (syneresis).¹ Less frequently, opacities can be secondary to ocular pathologic features, such as

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previous vitreous hemorrhage, uveitis, and rhegmatogenous retinal detachment (RRD). Symptoms will appear or become more prominent during the acute stage of posterior vitreous detachment (PVD), after which these symptoms usually will subside spontaneously. This is in part because of adaptation and accustomization, but also because of the natural progression of the PVD, with a forward shift of the hyaloid membrane, away from the macula.

However, a very small number of patients will experience persistent visual obscuration resulting from the vitreous floaters. Usually, visual acuity (VA) is still very good and there are no objective parameters to support the indication for surgery. Because of this lack of objective signs, the decision to treat is primarily patient driven. For this reason, vitrectomy is considered controversial by many surgeons.

A potential alternative to surgery is laser treatment. Successful neodymium:yttrium–aluminum–garnet laser photodisruption has been reported for this indication, but the procedure is not without risk. Long-term safety is unknown, and a number of patients report continued presence of smaller annoying opacities.^{2–4}

A few smaller series of vitrectomy for floaters have been published.^{2,5,6} In these studies, patient satisfaction is found to be high, but the incidence of complications varies between the studies.^{2,5} The aim of the present study was to identify complications of this procedure and to determine a risk profile in a larger series.

METHODS

THE MEDICAL RECORDS OF CONSECUTIVE PATIENTS WHO underwent vitrectomy for vitreous floaters between January 2006 and June 2010 were reviewed. All patients were operated at the Academic Medical Center Amsterdam, a tertiary academic referral center. All patients gave informed consent for the procedure. Patients often were examined on multiple visits before consideration of surgical intervention to confirm the persistence of the symptoms and to provide detailed information to each patient regarding the potential risks of the procedure. Data were retrieved from an electronic patient file containing structured operation notes and reports of all visits.

Operations were performed with the Alcon Accurus or Alcon Constellation machine (Alcon Laboratories, Fort Worth, Texas, USA) and a BIOM wide-angle viewing system (Binocular Indirect Ophthalmol Microscope; Oculus Inc, Wetzlar, Germany). For the Accurus 25-gauge

procedures, infusion pressure was set at 30 mm Hg, vacuum was set at 500 mm Hg, and cutting rate varied between 1000 and 1500 cuts/minute. For the Constellation 25-gauge procedures, infusion pressure was 25 mm Hg, vacuum was 300 mm Hg, and cutting rate varied between 2500 and 5000 cuts/minute. For all 20-gauge procedures, infusion pressure was set at 20 mm Hg and vacuum was set at 300 mm Hg, with cutting rate varying between 1000 and 2500 cuts/minute. If the posterior hyaloid was attached, a PVD always was induced. Vitreous was removed up to the vitreous base. We did not use visualization aids during the PVD induction. Shaving of the vitreous base was performed only around retinal breaks. An extensive internal search was performed in all cases using visualization with the BIOM system and scleral indentation, and the location of retinal breaks were drawn in the chart. All peripheral lesions that resembled breaks or areas of traction were treated with external cryotherapy.

Parameters retrieved were patient characteristics, preoperative and postoperative VA, preoperative phakic status, combined phacoemulsification, comorbidity, active PVD induction, intraoperative peripheral retinal breaks or traction areas, application of cryocoagulation, and tamponade type.

Statistical analysis was performed using SPSS software for Windows version 16.0 (SPSS Inc, Chicago, Illinois, USA) for chi-square test, Wilcoxon signed-rank test, Mann-Whitney *U* test, and Kruskal-Wallis analysis. For analysis, VA was converted to logarithm of the minimal angle of resolution (logMAR) values, whereby counting fingers was converted to 1.40 logMAR and hand movements was converted to 2.70 logMAR.

RESULTS

A TOTAL OF 116 EYES FROM 97 PATIENTS WERE INCLUDED. All cases had a history of persistent floaters for at least 6 months. Mean follow-up was 10.1 months (range, 3 to 57 months). Mean patient age was 58.7 years (range, 26 to 86 years). Most operations were performed under local anesthesia. General anesthesia was used only in patients who made a specific request. The posterior hyaloid was still attached in 30 (25.9%) cases. In all of these, we actively induced a full PVD. We found that the necessity of PVD induction was related significantly to patient age. Patients in whom a PVD had to be induced were on average younger than patients with a preexisting PVD (55.2 and 59.9 years, respectively; $P = .021$, Mann-Whitney *U* test).

We treated 86 eyes for primary floaters and 30 eyes that had floaters secondary to other ocular disease (10 RRD, 3 Fuchs uveitis, 3 anterior uveitis, 1 intermediate uveitis, 6 posterior uveitis, 2 retinitis pigmentosa, 5 other). There was no difference in age between these groups (mean age, 59.6 and 56.1 years, respectively; $P = .233$, Mann-Whitney *U* test). The cases secondary to RRD all had been

treated with external buckle surgery. All uveitis-related cases were quiet without medication and had no uveitis activity for at least 1 year preceding the surgery. In the primary floaters, we had to induce a PVD in 26 (30.2%) of 86 cases, and in the secondary floaters, this was necessary in 4 (13.3%) of 30 cases. This difference did not quite reach significance ($P = .069$, chi-square test).

From the total of 116 cases, we detected 1 or more iatrogenic retinal break in 19 cases (16.4%). All breaks were treated with external cryopexy and air or gas tamponade. In the remaining 97 cases without breaks, other precursors were found. In 11 cases, only retinal traction tufts were found and treated with cryocoagulation. In 3 cases, we encountered retinal breaks with signs of chronicity (surrounding subretinal pigmentation or sclerosed flaps). We considered these breaks to be preexisting and treated these with cryocoagulation and internal tamponade. In 2 cases, a retinal break was found at the preoperative examination and was treated with laser coagulation before surgery. In total, we used gas tamponade (SF₆ 20%) in 4 cases (3.4%) and air tamponade in 43 cases (37.1%). In 19 of these cases, gas tamponade (4 SF₆ and 15 air) was used for prevention of retinal detachment in eyes with iatrogenic breaks. In the remaining 24 cases of air tamponade, this tamponade was used to prevent hypotony in 25-gauge vitrectomy.

In the 29 cases that underwent 20-gauge vitrectomy, we found iatrogenic retinal breaks in 20.1%, whereas breaks were found in 25-gauge cases in 14.9%. This difference was not statistically significant ($P = .469$, chi-square test). Breaks tended to occur more frequently in the cases of primary floaters (18.6%) compared with the cases of secondary floaters (10.0%), but this difference was not statistically significant ($P = .273$, chi-square test). We did find a relation between occurrence of breaks and PVD induction. In the cases with PVD induction, retinal breaks were found in 30.5%, and in the eyes that had preexisting PVD and did not require active induction, retinal breaks were found in only 11.6% of cases. This difference was statistically significant ($P = .019$, chi-square test).

We measured the postoperative intraocular pressure (IOP) at day 1. Six eyes (5.2%) were hypotonous, defined as an IOP of 5 mm Hg or less. The hypotony resolved spontaneously within 1 week. None of the eyes had clinical signs of hypotony, like Descemet wrinkling or choroidal folds. All cases of hypotony had undergone 25-gauge vitrectomy. In 9 eyes (7.8%), the IOP was increased, defined as an IOP of 25 mm Hg or more. These were treated with topical antiglaucoma medication, and in all cases, IOP returned to normal within 3 weeks after operation. Postoperative day 1 IOP was significantly higher after 20-gauge vitrectomy (mean, 16.2 mm Hg) than after 25-gauge vitrectomy (mean, 13.3 mm Hg; $P = .011$, Mann-Whitney *U* test).

Thirty-six cases were phakic without cataract (31%), 54 cases (46.6%) were pseudophakic, and in 26 cases

(22.4%), the vitrectomy was combined with cataract extraction. In the phakic cases, cataract developed during follow-up in 18 (50%). In 9 cases, the cataract already was treated before the end of follow-up. A macular pucker developed in 2 cases, 1 in a primary floater case and 1 in a case after uveitis. A choroidal hemorrhage occurred during 1 operation. The hemorrhage developed during the vitrectomy, but remained anterior to the equator and resolved spontaneously. RRD occurred in 3 cases (2.5%), all within 3 months after surgery. All 3 cases were operations for primary floaters. Two cases were attached after 1 operation and retained good VA. In 1 case, proliferative vitreoretinopathy developed, requiring 3 retinal attachment procedures and ending with very poor visual function (VA of hand movements). In none of the 10 patients who had an RRD before the procedure did an RRD develop during follow-up. There were no cases of endophthalmitis in our series.

Overall, the mean logMAR VA improved from 0.20 to 0.13 ($P < .001$, Wilcoxon signed-rank test). Improvement was significantly greater in cases where a combined vitrectomy and phacoemulsification was performed. Mean logMAR VA change was -0.06 for the phakic eyes ($n = 36$), -0.02 for the pseudophakic eyes ($n = 54$), and -0.22 for the combined procedures ($n = 26$). This difference in improvement of VA was statistically significant ($P < .001$, Kruskal-Wallis test). Preoperative VA was on average lower in secondary cases (0.37) than in primary cases (0.15; $P < .001$, Mann-Whitney U test). We compared VA change between the primary and the secondary cases. In the 86 primary cases, the mean logMAR VA change was -0.058 , and in the 30 secondary cases, the mean logMAR VA change was -0.127 . Thus, in the secondary cases, the mean VA seemed to improve more than in the primary cases. This difference was not statistically significant ($P = .192$, Mann-Whitney U test).

DISCUSSION

DESPITE THE CONTROVERSY SURROUNDING VITRECTOMY for floaters, patients more and more demand recognition of their symptoms. Previous studies primarily have focused on outcome in terms of patient satisfaction. Using standardized questionnaires, all concluded that patient satisfaction after this procedure is high.^{5,6} Because of the small size of most of these series, not much information is available on complication rates.

One of the most feared complications of all is postoperative RRD. Because retinal breaks are a prerequisite for RRD, it follows that identification of retinal breaks at the end of surgery through meticulous internal search minimizes the rate of RRD. Our rate of iatrogenic retinal breaks is much higher than previously described.

Two small series did not encounter retinal breaks at all,^{2,5} and in another study, iatrogenic breaks occurred in only 1.3% of cases.⁶ Our rate of 16.4% falls in the same order of magnitude as those described previously for vitrectomy for other elective indications. In vitrectomy for macular disease (idiopathic macular hole and idiopathic macular pucker), the reported rate of iatrogenic breaks varies between 11% and 24% for 20-gauge procedures⁷⁻¹⁰ and between 3% and 15% for 25-gauge procedures.^{11,12} Although we found a strong positive relation with PVD induction, iatrogenic retinal breaks also were found in eyes that had an existing PVD. Intraoperative search for breaks therefore should not be confined to cases in which a PVD is induced.

Reported rates of RRD after vitrectomy for floaters vary between 0% and 6.8%.^{2,5,6} Our rate of 2.5% falls in the lower end of this spectrum and in the same order of magnitude of rates after vitrectomy for macular elective surgery. One study described a high occurrence of RRD long after vitrectomy for floaters.⁶ RRD occurred between 24 and 44 months after surgery in 5.5% of cases. A possible explanation for this late incidence of RRD is that the vitrectomy in this study was restricted to the central core only. Spontaneous PVD occurring at a later date could be the cause of late RRD. This would suggest that intraoperative induction of PVD, despite the higher risk of directly causing iatrogenic retinal breaks, would be preferable to leaving the posterior hyaloid untouched. Further study is needed to test this hypothesis. In the mean time, we cannot rule out that late RRD still may occur in some of our cases. Thus, our RRD incidence may be an underestimation because of our relatively short follow-up.

In our series, cataract occurred in 50% of phakic cases. This is in accordance with a previous study⁶ on floaterectomy, although follow-up in that study was longer. It is known that cataract will progress faster in virtually all patients older than 50 years within 2 years.^{13,14} With longer follow-up, our rate will definitely exceed our currently reported rate.

Primary floaters and floaters secondary to ocular disease are different entities. Although we encountered some differences in age, VA gain, presence of PVD, and rate of retinal breaks, none of these were statistically significant. This could be the result of the relatively small size of our series. Another potential reason for the lack of significant discrepancies is the fact that the group of secondary floaters in fact is a very diverse group with diverse pathologic features. A striking finding is that RRD occurred only in the primary cases. This same tendency was described in a previous study.⁶ Although these findings again are not statistically significant, this trend seems to suggest that surgery for secondary floaters is at least as safe as surgery for primary floaters, if not safer.

VA usually is unaffected despite reports of severe visual obscuration. Therefore, surgical removal of vitreous floaters is not expected to improve VA. In one study of 6 pseudophakic eyes, VA remained the same in 50% and

improved in the other 50% of cases.⁵ In a larger series, a slight but nonsignificant mean improvement was found, with unchanged VA in 43 of 73 of cases, improvement in 19, and worsening in 11.⁶ We did find a significant overall increase in VA, but this was the result of the relatively high proportion of combined procedures in our series, where the removal of cataract is mainly responsible for the VA gain. Earlier studies have addressed functional outcome through prospective assessment of patient satisfaction. Using standardized questionnaires, all concluded that patient satisfaction after this procedure is high, ranging from 88% to 93%.^{2,6} The apparent mismatch between VA outcome and satisfaction outcome reflects the lack of objective parameters in floater surgery.

In conclusion, vitrectomy for vitreous floaters shows a similar complication profile as vitrectomy for other elective indications. The idea that vitrectomy for floaters is simple and less dangerous than vitrectomy for other indications therefore should be banned. Despite these risks, a small selection of patients with persistent and debilitating symptoms can consent to treatment by vitrectomy. The literature on complications of vitrectomy for floaters is limited. Within these reports, variation exists in complication rates. This variation could be the result of differences in operation technique. Patients should be informed properly about the risks of this procedure, preferably based on personalized complication data.

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