



HAL
open science

Enhanced internal search for iatrogenic retinal breaks in 20-gauge macular surgery

H. Stevie Tan, Sarit y Lesnik Oberstein, Marco Mura, Marc de Smet

► To cite this version:

H. Stevie Tan, Sarit y Lesnik Oberstein, Marco Mura, Marc de Smet. Enhanced internal search for iatrogenic retinal breaks in 20-gauge macular surgery. *British Journal of Ophthalmology*, 2010, 94 (11), pp.1490. 10.1136/bjo.2009.172791 . hal-00557349

HAL Id: hal-00557349

<https://hal.science/hal-00557349>

Submitted on 19 Jan 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Enhanced internal search for iatrogenic retinal breaks in 20-gauge macular surgery

H. Stevie Tan ¹, Sarit Y. Lesnik Oberstein¹, Marco Mura ¹, Marc D. de Smet ^{1,2}

¹ Department of Ophthalmology, Academic Medical Center, University of Amsterdam, The Netherlands

² Retina and ocular inflammation unit, Center for Specialized Ophthalmology, Montchoisi Clinic, Lausanne, Switzerland

Running head: Enhanced search for retinal breaks in 20-gauge macular surgery

Key words: retinal detachment – retinal breaks – complications – vitrectomy

Word count: 2.005

Corresponding author / Reprint adress:

dr. H. Stevie Tan

Academic Medical Center

University of Amsterdam

Amsterdam

The Netherlands

E-mail: h.tan@amc.uva.nl

Abstract

Purpose: To evaluate the incidence and characteristics of iatrogenic retinal breaks in 20-gauge macular surgery with an intensified search strategy.

Design: Retrospective, non-comparative interventional case series.

Participants: 218 consecutive operations in 209 patients who underwent 20-gauge vitrectomy for idiopathic macular pucker or idiopathic macular hole.

Methods: Retrospective review of patient records undergoing 20-gauge vitrectomy with intensified peripheral search for retinal defects.

Main outcome measures: Incidence of breaks related to the sclerotomies, the incidence of breaks occurring elsewhere, the incidence of lesions suspicious for traction, the location of identified breaks and intraoperative induction of posterior vitreous detachment.

Results: Retinal breaks occurred in 24.3% of operations. In 17.4% breaks were related to the sclerotomies and in 9.6% of breaks were found elsewhere. In 6.4% of eyes, only lesions suspicious for traction were detected. Retinal detachment occurred in 1.8% of cases. The occurrence of breaks was significantly related to induction of PVD.

Conclusions: With intensified intraoperative search, a much higher incidence of retinal breaks was found than previously reported in the literature. Despite the high incidence of breaks, the incidence of postoperative rhegmatogenous retinal detachment was low. These findings support the rationale that intensive intraoperative search for iatrogenic breaks is crucial for the prevention of postoperative retinal detachments in macular surgery.

Introduction

The treatment of idiopathic macular hole (IMH) and idiopathic macular pucker (IMP) by way of a vitrectomy is now a routine procedure. Rhegmatogenous retinal detachment (RRD) is one of the most potentially serious postoperative complications. The incidence of RRD after vitrectomy has been reported to be between 1 and 16%. [1-3]

Retinal breaks are a necessary causative element in retinal detachment formation. The appearance of iatrogenic retinal breaks is a well known intraoperative complication of vitreous surgery. The insertion of instruments causes traction on the adjacent vitreous base, resulting in tearing of the retina along the border of the vitreous base. Another source of breaks is incarceration of vitreous in the sclerotomy site during withdrawal of instruments. Furthermore, the induction of a posterior vitreous detachment (PVD) has recently been identified as an important causative factor in the development of iatrogenic retinal breaks. [3,4]

Large variations exist on reported incidence of breaks. Reported frequencies range from 0 to 15.8%. [4-7] Some variation may be explained by choice of instrumentation, for instance 20 versus 25G, but other important factors may be the implementation of a consistent search strategy for intra-operative breaks and the effectiveness of the chosen method..

To minimize the incidence of retinal breaks, prophylactic measures have been proposed. Scleral buckling, [8] 360° laser [9] or circular cryoretinopexy [10] were deemed appropriate prophylactic measures but these are in fact quite invasive and impose risks of their own. Therefore, specifically targeting retinal breaks seems a more efficient strategy to minimize the occurrence of RRD. The purpose of the

present study is to describe the results of a strategy aimed at enhancing the detection yield of iatrogenic breaks with an intensified intraoperative search strategy.

Methods

Medical records of consecutive patients that underwent 20-gauge vitrectomy between January 1 2006 and June 31 2008 for either idiopathic macular pucker (IMP) or idiopathic macular hole (IMH), with a minimal follow-up of 12 weeks were reviewed. Eyes that had previous vitreoretinal surgery were excluded. All patients were operated at the Academic Medical Center, Amsterdam, a tertiary academic referral center. The operations were performed by three surgeons (HST, SYLO, MM).

All operations were performed with the Alcon Accurus (Accurus[®] 600 DS, Alcon Laboratories, Fort Worth, Texas, USA) and BIOM wide angle viewing system (Binocular Indirect Ophthalmol Microscope; Oculus, Inc, Germany). Infusion pressure was set at 30 mmHg during vitrectomy and PVD induction, cutting rate varied between 800 and 1500 cuts/minute and aspiration pressure was set at 200-300 mmHg. Core vitrectomy was performed and if not already present, a PVD was induced. PVD induction was performed either with the vitrectomy probe in the cutter-off mode or with an active Charles needle using maximum aspiration of 600 mmHg. In most cases, direct visualization of the posterior vitreous membrane and thus assessment of the presence of PVD was adequate. In case of doubt, Indocyanine green (ICG) was injected into the vitreous to stain the vitreous to facilitate identification of the posterior vitreous membrane. After inducing a PVD, removal of vitreous was carried to the periphery. Additional care was taken to remove vitreous adjacent to the sclerotomies. Indocyanine green and in a few cases Membrane Blue (DORC, Zuidland, the Netherlands) were used for staining of the inner limiting membrane (ILM) to facilitate membrane and ILM removal. ILM was removed in all cases with Eckhardt forceps (DORC, The Netherlands) and a flat-surface contact lens.

Enhanced 360° internal search was performed at the end of surgery using visualization with the BIOM system, a diverging light source and scleral indentation. During the search, the unused sclerotomy was always plugged to prevent vitreous incarceration caused by the extensive indentation. The search was sometimes facilitated by decreasing the infusion pressure to allow easier manipulation of the eye during indentation. All peripheral lesions that resembled breaks or areas of traction received external cryo application. Breaks were labeled as follows: if during cryo application the lesion did not show interruption of the whitened neuroretinal layer, it was designated as "suspicious"; if a definite interruption was seen it was called a definite break. We distinguished three types of definite breaks: 1. breaks located between 1 and 3 o'clock, and between 9 and 11 o'clock (sclerotomy related breaks), 2. breaks that were located away from any of the sclerotomies (breaks elsewhere) and 3. breaks that were believed to have been present before surgery as characterized by signs of chronicity such as sclerosed flaps or subretinal pigment deposition around the break (pre-existent breaks).

Parameters retrieved were patient characteristics, preoperative phakic status, combined phacoemulsification, indication of surgery, performance of active PVD induction, detection of peripheral retinal breaks or traction area's, application of cryo and tamponade type. Preoperative refraction was not always available for pseudophakic eyes and was therefore not included in our analysis.

Statistical analysis was performed using SPSS software for Windows version 16.0 (SPSS Inc, Chicago, Illinois, USA) for Pearson chi-square, Fischer exact and Mann-Whitney analysis.

Results

Two hundred and eighteen eyes from 209 patients met the study inclusion criteria. There were 116 right eyes and 102 left eyes. There were 129 females and 89 males. Mean follow up was 12.4 months (range 5-18 months). Mean age was 69.3 years (range 34-87 yr). Fifty one cases were pseudophakic, 72 were phakic, and in 95 cases vitrectomy was combined with phacoemulsification of a cataractous lens and implantation of an intraocular lens. 74.3% of operations were performed under local anesthesia. PVD was not yet present in 56.9% of eyes and was thus actively induced intraoperatively. Mean operation time was 63.1 minutes (range 29-111 minutes). A comparison of ocular and patient characteristics between IMP and IMH cases is presented in table 1.

Table 1. Comparison of ocular and patient characteristics
between IMH and IMP cases

	IMH	IMP	P-value
Mean age (y)	n=90 69.3	n=128 69.3	
Gender			
Male	24 (26.7%)	65 (50.8%)	
Female	66 (73.3%)	63 (49.2%)	
Lens status:			
No. of pseudophakic eyes	15 (16.7%)	36 (28.1%)	
No. of phakic eyes	36 (40.0%)	36 (28.1%)	
No. of combined phaco	39 (43.3%)	56 (43.8%)	0.073 ¹
PVDi	60 (66.7%)	64 (50.0%)	0.014 ¹
Gas tamponade	90 (100.0%)	30 (23.4%)	
Breaks	23 (25.5%)	30 (23.4%)	0.720 ¹
Sclerotomy related	15 (16.7%)	23 (18.0%)	0.803 ¹
Elsewhere	11 (12.2%)	9 (7.0%)	0.191 ¹
RRDi	0 (0%)	4 (3.1%)	

IMH = Idiopathic macular hole

IMP = Idiopathic macular pucker

PVDi = Induction of a posterior vitreous detachment

RRDi = Rhegmatogenous retinal detachment

¹ Pearson chi-square

Definite breaks were encountered in 53 (24.3%) of 218 eyes. Thirty eight eyes (17,4%) had sclerotomy related breaks, 21 eyes (9.6%) breaks elsewhere and 6 eyes (2.8%) had both types. Pre-existent breaks were found in 2 eyes (0.9%). In 14 eyes (6.4%) only suspicious lesions were encountered. These lesions were typically found at the posterior edge of the vitreous base. There was no statistically significant difference in break incidence between surgeons (chi-square $P=0.122$). A comparison of ocular and patient characteristics of eyes with and without breaks is shown in table 2.

Pre-existent breaks and suspicious lesions were excluded from further analysis. Breaks tended to occur more often in operations combining phacoemulsification (28.4%) than non-combined procedures (21.1%), but this trend did not reach statistical significance (chi-square $P=0.214$).

In cases without iatrogenic breaks, PVD was not yet present and had to be induced in 52.7%. In eyes with breaks, PVD had to be induced in 69.8% of eyes. This difference was statistically significant (chi-square $P=0.029$).

The rate of RRD in our series was 1.8% (4/218). These detachments occurred in IMP cases. Two eyes were pseudophakic, two were phakic of which one underwent a combined procedure with phacoemulsification of cataract. In 1 of 4 cases a PVD was actively induced during the operation. In 3 of the 4 cases, one or more breaks were encountered during the IMP procedure. Cryocoagulation was applied to the breaks but no postoperative tamponade agent was used. In these three cases, the RRD occurred at 1, 2 and 8 weeks respectively post operatively. In all three cases, no other breaks were encountered during the RRD operations. In the one case in which no breaks was encountered during the IMP procedure, the RRD occurred after 6 months.

Table 2: Comparison of ocular and patient characteristics between cases with and cases without breaks

	no breaks n=165	breaks n=53	p-value
Mean age	68.0	69.7	P=0.114 ²
Lens status:			
No. of pseudophakic eyes	42 (25.5%)	9 (17.0%)	
No. of phakic eyes	55 (33.3%)	17 (32.1%)	
No. of combined phaco	68 (41.2%)	27 (50.9%)	P=0.345 ¹
No. of eyes in which			
RRD developed	1 (25.0%)	3 (75.0%)	
PVDi	87 (52.7%)	37 (69.8%)	P=0.029 ¹

PVDi = Induction of a posterior vitreous detachment

RRD = Rhegmatogenous retinal detachment

¹ Pearson chi-square

² Mann-Whitney

We further analyzed the relation between use of a tamponading agent and the occurrence of RRD in the cases where iatrogenic breaks were encountered. A tamponading agent was used in 48 cases. No tamponading agent was used in 5 cases. Only one RRD was encountered in the tamponading group (2.1%), whereas RRD occurred in 3 cases of the non-tamponade group (60.0%). This difference was significant (Fisher exact test $P < 0.01$).

Discussion

Our results show that with an enhanced search strategy, a high incidence of iatrogenic retinal breaks are found in elective macular vitrectomy surgery. The reported incidence of retinal breaks varies considerably among earlier studies. The incidence in 20G vitrectomy was found to be between 0% - 7.2%.[6,7] In 25-gauge vitrectomy incidences were reported of 0%-3.1%.[11,12] In a direct comparison study, incidence in 25-gauge vitrectomy was 3.1% against 6.4% for 20-gauge surgery,[6] suggesting a lower risk in 25-gauge surgery. In our own series in 25G vitrectomy, the incidence of iatrogenic breaks was also found to be lower than in 20G vitrectomy as described in the current paper (15.8% versus 23.8%).

We believe that our extensive search technique is responsible for our success in identifying such a high number of iatrogenic breaks. Some of the earlier reports used indirect searching methods with or without indentation, and in some it is not clear if the periphery was searched over the full 360°. Our technique involves a thorough and full 360° internal search with the BIOM at the end of each procedure. Our "diagnostic" use of cryocoagulation is a sensitive means for identifying suspicious breaks. Optimal lighting conditions with diverging light beams, as can be achieved with the BIOM ensure optimal image resolution of sometimes tiny breaks.

A striking finding in this study is the relatively high incidence of sclerotomy related breaks. In a recent study on iatrogenic break incidence in 25G vitrectomy [4], the incidence of breaks elsewhere was about equal to our current findings for 20G surgery (11.9% in 25G versus 9.6% in 20G). The incidence of sclerotomy related breaks in 25G surgery, however, was much lower than that for 20G surgery (5.1% in 25G versus 17.0% in 20G). This seems to suggest that the 20G technique carries a greater risk of sclerotomy related breaks than 25G vitrectomy. In theory, the 25G

system does have inherent properties that could account for such a difference. Using smaller gauge instruments might decrease trauma in and near the vitreous base adjacent to the sclerotomies. Furthermore, the use of trocars might protect the vitreous base from excessive traction to the adjacent retina. The fact that the incidence of breaks elsewhere does not seem to differ much between 20 and 25G surgery is in line with the concept that the intraoperative induction of a PVD is the primary determining factor in the development of these mainly inferior breaks. Further studies focusing on differences between break incidence and characteristics in 20 and 25G surgery would be needed to further substantiate these arguments.

An important causative factor for the development of iatrogenic breaks is the insertion and retraction of instruments. Minimizing the number of instrument swaps could decrease the incidence of sclerotomy related breaks. In previous studies, induction of PVD during vitrectomy was found to be another important causative factor for the occurrence of breaks.[4,5] This is again corroborated by our current findings.

We have no consistent data on the amount of breaks that was present preoperatively. The peripheral retina was examined at the slitlamp in most cases; indirect examination with indentation to identify breaks preoperatively was not performed on a routine basis. The presence of a high number of pre-existing breaks may be another possible explanation for the high number of breaks which we identified. Previous studies focusing on break incidence did not specify the preoperative examination technique. Only one study described the finding of pre-existent breaks [6] but incidence of preoperatively found breaks is not mentioned either.

Despite the high incidence of breaks, the incidence of RRD is low. This is in keeping with the rationale that maximizing treatment of iatrogenic breaks could minimize the occurrence of RRD. One case of RRD occurred 6 months after the vitrectomy. After this long interval, a causal relation between the RRD and the vitrectomy becomes somewhat uncertain. In this case, no retinal break was encountered intraoperatively. In the three other cases of postoperative RRD, the causative break had already been noted and treated during the initial operation. However, these breaks were considered too small to cause any problems and thus no gas tamponade was applied.

Our study shows that iatrogenic retinal breaks occur with appreciable frequency during vitrectomy surgery. Our findings underscore the importance of systematic intraoperative examination of the full retinal periphery at the end of each vitrectomy as the key to safe vitrectomy surgery.

Acknowledgements, Competing interests, Funding

The authors have no financial interests related to this article.

Financial support: none

Competing Interest: None declared.

Copyright licence statement

“I, H. S. Tan, the Corresponding Author, have the right to grant on behalf of all authors and do grant on behalf of all authors, an exclusive licence (or non-exclusive for government employees) on a worldwide basis to the BMJ Publishing Group Ltd, and its Licensees to permit this article (if accepted) to be published in the British Journal of Ophthalmology and any other BMJPGGL products and to exploit all subsidiary rights, as set out in our licence.”

H.S. Tan

References

1. Guillaubay A, Malvitte L, Lafontaine PO. Incidence of retinal detachment after macular surgery: a retrospective study of 634 cases. *Br J Ophthalmol.* 2007;91:1327-1330.
2. Wimpissinger B, Binder S. Entry-site-related retinal detachment after pars plana vitrectomy. *Acta Ophthalmol Scand.* 2007;85:782-785 .
3. Tabandeh H, Chandhry N, Smiddy WE. Retinal detachment after macular hole surgery. *Retina.* 1999;19:281-286.
4. Tan HS, Mura M, de Smet MD. Iatrogenic retinal breaks in 25-gauge macular surgery. *Am J Ophthalmol.* 2009;148:427-30.
5. Chung SE, Kim KH, Kang SW. Retinal breaks associated with the induction of posterior vitreous detachment. *Am J Ophthalmol.* 2009;147:1012-1016.
6. Scartozzi R, Bessa AS, Gupta OP, Regillo CD. Intraoperative sclerotomy-related retinal breaks for macular surgery, 20- vs 25-gauge vitrectomy systems. *Am J Ophthalmol.* 2007;143:155-156.
7. Moore JK, Kitchens JW, Smiddy WE, Mavrofrides, Gregorio G. Retinal breaks observed during pars plana vitrectomy. *Am J Ophthalmol.* 2007;144:32-36.

8. Chang TS, McGill E, Hay DA et al. Prophylactic scleral buckle for prevention of retinal detachment following vitrectomy for macular hole. *Br J Ophthalmol.* 1999;83:944-948.
9. Koh HJ, Cheng L, Kosobucki B, Freeman WR: Prophylactic intraoperative 360 degree laser retinopexy for prevention of retinal detachment. *Retina.* 2007, 27:744-749.
10. Hager A, Ehrich S and Wiegand W. Vitreoretinal secondary procedures following elective macular surgery. *Ophthalmologe.* 2004;101:39-44.
11. Patelli F, Radice P, Zumbo G, Frisone G, Fasolino G. 25-gauge macular surgery: results and complications. *Retina.* 2007;27:750-754.
12. Faia LJ, McCannel CA, Pulido JS, Hatfield RM, Hatfield ME, McNulty VEW. Outcomes following 25-gauge vitrectomies. *Eye.* 2008;22:1024-1028.