Diplomarbeit

23- and 20-gauge vitrectomy in ERM surgery

In a retrospective study 23-gauge vitrectomy in epiretinal membrane surgery was comparable to 20.gauge vitrectomy regarding postoperative complications, except a higher rate of hypotony, but offered shorter surgery time and an accelerated visual recovery

eingereicht von

Gerald Seidel

Mat.Nr.: 0334519

zur Erlangung des akademischen Grades

Doktor(in) der gesamten Heilkunde

(Dr. med. univ.)

an der

Medizinischen Universität Graz

ausgeführt am

Institut / Klinik für Augenheilkunde

unter der Anleitung von

Prof. Dr. Anton Haas

Ort, Datum …….. (Unterschrift)

Eidesstattliche Erklärung

Ich erkläre ehrenwörtlich, dass ich die vorliegende Arbeit selbstständig und ohne fremde Hilfe verfasst habe, andere als die angegebenen Quellen nicht verwende habe und die den benutzten Quellen wörtlich oder inhaltlich entnommenen Stellen als solche kenntlich gemacht habe.

Graz, am ... ... *Unterschrift*

Index

23-GAUGE AND 20-GAUGE VITRECTOMY IN EPIRETINAL MEMBRANE SURGERY

Purpose: To investigate the safety profile of the 23-gauge sutureless vitrectomy system in the treatment of epiretinal membranes (ERM) compared with the standard 20-gauge vitrectomy.

Methods: A 20-gauge or a 23-gauge vitrectomy was performed in 167 and 64 eyes, respectively by the same surgeon. The incidence of intra- and postoperative complications, duration of surgery and postoperative visual acuity at day 2 were evaluated.

Results: Postoperative hypotony was found significantly, more often in the 23-gauge group compared with the 20 gauge group (9.4% [n=6] vs. 0% [n=0], $p<0.001$). With the 23-gauge system, the incidence of retinal detachment was 1.6% (n=1), of vitreous hemorrhage 0% and of endophthalmitis 1.6% (n=1). Patients with 20-gauge vitrectomy developed retinal detachments in 1.8% (n=3), vitreous hemorrhages in 1.2% (n=2) and endophthalmitis in 2.4% (n=4). The mean overall surgical time was significantly shorter in the 23-gauge group with 23.1 ± 6.5 minutes compared to 34.5 ± 9.1 in the other group ($p<0.05$). At postoperative day 2, patients with 23-gauge vitrectomy regained preoperative mean best corrected visual acuity of 20/60. Patients who had 20-gauge vitrectomy experienced a significant decrease of visual acuity from 20/80 to 20/100 ($p<0.05$).

Conclusions: Twenty-three-gauge vitrectomy in ERM surgery is a safe method with a low complication rate and is comparable to 20-gauge vitrectomy. However, the incidence of postoperative hypotony is more frequent using the 23-gauge vitrectomy.

The 23-gauge transconjunctival sutureless vitrectomy was introduced by Claus Eckhart in 2005 and provides earlier patient rehabilitation by decreased overall surgery duration.[1] It has found many advocates because of these advantages but little information is given about intra- and postoperative complications such as wound leakage, postoperative hypotony, endophthalmitis, retinal tears, retinal detachment and vitreous hemorrhage. There are several reports about the complications of 25-gauge vitrectomy and compared to standard 20-gauge vitrectomy, the incidence of postoperative hypotony and endophthalmitis was even higher.[2-7] In contrast to 25-gauge vitrectomy, the tunnel-like scleral incisions of 23-gauge vitrectomy and the use of a trocar system facilitate the self-sealing of the wound after removal of the cannulas. This may result in a lower risk of postoperative hypotony and in a lower risk of endophthalmitis. Additionally, the larger and studier instrumentarium for 23-gauge allows a better peripheral manipulation without pathologic bending and a more complete removal of the vitreous. These technical advantages should influence and minimize the complication rate.

The aim of the present study was to compare the incidence of intraoperative complications, postoperative hypotony, endophthalmitis, retinal detachment and vitreous hemorrhage between the 20-gauge and 23-gauge system in ERM surgery. We further evaluated the overall duration of surgery and the postoperative visual rehabilitation, which have been reported to be the major advantages of the 23-gauge vitrectomy.

Materials and Methods

Patients

Two-hundred and thirty-one patients with ERM were enrolled in the present retrospective, comparative, case series. The study was performed in accordance with guidelines of the local ethics committee. All patients signed an informed consent document before surgery. From January 2004 to October 2006 all consecutive patients underwent 20-gauge vitrectomy and

from November 2006 to October 2007 patients underwent 23-gauge vitrectomy performed by the same surgeon (AH) at a single site. Phacoemulsification was performed at the same time, if a significant cataract was present. Patients included in the study had to have either primary or secondary ERM. Patients were excluded from the study, if they had a history of retinal detachment surgery or vitrectomy, myopia with an axial length longer than 26mm or diabetic retinopathy. All data were obtained by a chart review including age and sex of the patients, ocular history, indication for surgery, date of surgery, surgery duration, surgery report, pre- and postoperative best corrected visual acuity (BCVA) and intraocular pressure (IOP), pre- and postoperative anterior and posterior segment findings. Patients were followed up day 1 and 2 and month 3 after surgery. For missing data regarding endophthalmitis and retinal detachment at month 3 the referring ophthalmologist was contacted.

Procedures

The pre-, peri- and postoperative regimen was the same in both groups. One day prior to surgery the patients received topically povidone-iodine 4 times a day. Before starting surgery the eyelid and the periorbital skin was scrubbed with 5% povidone-iodine solution and the eyelid draped everting lashes from the operation field. At the end of surgery peribulbar injections with cefazolin (Kefzol®) and betamethasone (Diprophos®) was given. Postoperatively patients received eye drops containing betamethasone and neomycin (Betnesol-N®) with tapered frequency for 4 weeks.

All surgical procedures were performed with the same vitrectomy unit (OS3, Oertli, Berneck; Switzerland). For 23-gauge vitrectomy we used a disposable two step cannula system (Oertli, Berneck; Switzerland and DORC, Zuidland; The Netherlands) with a pressure plate. After displacement of the conjunctiva with the pressure plate a 23-gauge stiletto blade was inserted through the conjunctiva, sclera and pars plana, at an angle between 20 and 30 degrees, 3.5mm parallel from the corneoscleral limbus. The 23-gauge cannulas were then

inserted through the tunnel-like incisions using a blunt trocar. For wound closure the cannulas were withdrawn from the scleral tunnel, and the conjunctiva was pushed laterally with a cotton tip applying pressure for a few seconds over the sclera.

For standard 20-gauge vitrectomy a conjunctival peritomy was performed and three scleral incisions were made with a 20-gauge stiletto. All incisions were sutured at the end of the procedure.

In all patients a core vitrectomy was performed and the ERM was removed using endgripping forceps (20-gauge: DORC, Zuidland; The Netherlands; 23-gauge: Synergetics, O'Fallon; USA) For visualisation of the ERM and internal limiting membrane (ILM) 0.5% indocyanine green (ICG-Pulsion®) was used, if necessary.

The overall surgical duration was defined as the time period between insertion and removal of the lid speculum. Postoperative hypotony was defined as IOP below 6 mmHg. For statistical analysis Snellen visual acuity was converted into logarithm.

Statistical Analysis

Statistical analysis was carried using SPSS version 11.0 for Windows (SPSS Inc., Chicago IL). Results were presented as mean ± standard deviation. The pattern of distribution in the variables included was compared with a theoretical normal distribution with the Kolmogorov-Smirnov test. Differences between the two groups were calculated using Wilcoxon signed-rank test. P values of 0.05 or less were considered statistically significant.

Results

Out of 231 patients with ERM which were reviewed retrospectively, 167 underwent 20-gauge vitrectomy and 64 underwent 23-gauge vitrectomy. In the 20-gauge group the mean age was

69.9±9.1 years and 60.5% (n=101) of patients were female. In the 23-gauge group 54.7% (n=35) were female, the mean age was 70.4±9.7 years.

Staining of the ERM and ILM with indocyanine green was used in 45.5% (n=76) and in 57.8% (n=37) in the 20-gauge group and the 23-gauge group, respectively. Phacoemulsification was combined with 20-gauge vitrectomy in 58.7% (n=98) and with 23-gauge in 57.8% (n=37). Epiretinal membranes were successfully removed from the fovea and no severe complications occurred intraoperatively in all patients. In two patients the 23-gauge incision had to be enlarged and closed with sutures because of an inadvertently removal of the cannula and a defect 23-gauge forceps, which had to be replaced by a 20-gauge instrument.

The most frequent complication in 23-gauge group was postoperative hypotony, which occurred in 9.4% (n=6) of the patients, which was not observed in the 20-gauge group. The IOP ranged between 0 and 5 mmHg on the first postoperative day and increased to normal values within 1 to 3 days without any intervention. A shallow choroidal effusion was observed in one patient, which resolved with increase of the IOP. None of these patients with postoperative hypotony developed signs of intraocular inflammation.

The incidence of endophthalmitis after 20-gauge vitrectomy was 2.4% (n=4) and 1.6% (n=1) after 23-gauge vitrectomy. The diagnosis of endophthalmitis was based on the presence of lid swelling, pain, hypopyon and cells and fibrin in the anterior chamber and in the vitreous. Endophthalmitis occurred on postoperative day 3 in three patients (one patient out of the 23-gauge group and two out of the 20- gauge group), and on day 6 and 10. All patients were treated with intravitreal antibiotics and steroids at presentation as well as fortified topical antibiotics. All three patients with the typical onset at day 3 underwent vitrectomy and two of them showed a positive bacterial culture. In the two patients with delayed onset (day 6 and 10) the endophthalmitis could be controlled with local steroids and without vitrectomy. No association was found between incidence of endophthalmitis and duration of surgery, simultaneous phacoemulsification or hypotony.

Retinal detachment, secondary to a peripheral retinal tear, developed in 1.8% (n=3) of the 20-gauge patients and in 1.6% (n=1) of the 23-gauge patients. The retinal tears were located at the sclerotomy site in three patients (one of them out of the 23-gauge group and two out of the 20-gauge group). In one patient the retinal tear was found in the inferior periphery. All patients could be treated successfully with vitrectomy, laser endophotocoagulation and gas or silicone oil (one patient) tamponade.

In the 20 gauge group vitreous hemorrhage occurred in 2 patients (1.2%), but in none of the 23 gauge group. No obvious origin of the bleeding could be detected and the hemorrhage resolved within 4 weeks. A possible source of hemorrhage could have been an injury of scleral or choroidal vessel after suturing the scleral incision.

The mean overall surgery duration was significantly shorter with 23.1 ± 6.5 minutes in the 23-gauge group compared to 34.5 ± 9.1 in the 20-gauge group ($p<0.05$).

To evaluate the postoperative visual rehabilitation BCVA was measured one day prior to and two days after surgery. Patients after 23-gauge vitrectomy achieved the same mean BCVA as preoperatively (20/60), whereas patients after 20-gauge vitrectomy experienced a significant decrease in visual acuity from 20/80 to 20/100 ($p<0.05$) in the same period.

Discussion

In this present study the safety profile of 23-gauge vitrectomy compared to 20-gauge vitrectomy was evaluated in patients with epiretinal membranes. We focused on four primary assessment measures in our evaluation: intraoperative complications, postoperative complications, BCVA at postoperative day 2 and surgery duration. The anatomic outcomes observed after 23-gauge vitrectomy were comparable to outcomes obtained after conventional 20-gauge vitrectomy. Successful removal of epiretinal membranes with or without staining with ICG was achieved in all patients of both groups.

There were no intraoperative complications in any of the 231 eyes. Only two eyes required conversion to conventional 20-gauge vitrectomy. No technical difficulties occurred during surgery using the 23-gauge system and all intraoperative maneuvers were feasible. In contrast, Kellner et al. reported technical problems in 37% of their case series using the 25-gauge technique like insufficient dissection of membranes with the vitreous cutter or with the endoinstruments, insufficient endoillumination or blockage of instruments in the trocar system.[8]

Surprisingly, we observed a remarkable high incidence of endophthalmitis with 2.4% in the 20-gauge group. The reported incidence of endophthalmitis using 20-gauge vitrectomy ranges from 0.018 to 1.7%, which is far below our rate.[2,9] No possible explanations were found reviewing the charts of our endophthalmitis cases regarding the pre- and intraoperative regimen. The high rate would drop to a similar range, as described in literature, if we exclude the two patients with the late onset and benign course of endophthalmitis. Most of the published work concerning transconjunctival sutureless vitrectomy and endophthalmitis has described 25-gauge systems. Several studies have confirmed the higher rate of endophthalmitis ranging from 0.23 – 0.84% using the 25-gauge method compared to the 20-gauge technique.[2,7,10] There is limited information, however, about the endophthalmitis rate in 23-gauge vitrectomy.[11-13] One presumed endophthalmitis was observed by Fine et al. In our 23-gauge series only one patient presented with endophthalmitis and he is so far the second reported case in literature. In our study the rate was lower in the 23-gauge group, but the results must be taken with care because of the limited number of patients and the retrospective nature of the study.

Interestingly, in the study of Kunimoto et al. all patients who developed endophthalmitis had a fluid filled vitreous cavity at the end of the surgery and no eye was

silicone oil, gas or air filled.[2] In our study no silicone oil, gas or air was used, which might explain some of the differences.

Some concerns exist about vitreous incarceration at the sclerotomy sites, which increases the postoperative complications like endophthalmitis and retinal detachment in sutureless vitrectomy. Unsutured sclerotomies with and without vitreous incarceration may allow the influx of bacteria. Incarcerated vitreous could also cause significant anterior vitreoretinal traction and subsequent retinal tears or detachment. The results of our study regarding the incidence of retinal detachment do not support this theory. The rate of this postoperative complication was comparable between the 20-gauge and the 23-gauge group with 1.8% and 1.6%, respectively. Most of the previous studies demonstrate no increased risk for retinal detachment using either 23-gauge or 25-gauge systems.[5,6,13-15] In contrast, Donati et al. reported an increased incidence of retinal detachments of 14% after 20-gauge surgery for epiretinal membranes.[16]

Early postoperative hypotony has been shown as a frequent occurrence after transconjunctival sutureless vitrectomy and, even if transient, may increase the potential risk for later postoperative complications. The sclerotomies are made in an oblique angle to the sclera with a stiletto blade and a slit-like incision is created in 23-gauge vitrectomy, In contrast, a round incision is made in 25-gauge vitrectomy. The 23-gauge technique should guarantee a self-sealing incision and decrease the risk of postoperative hypotony. Singh et al. evaluated 23-gauge and 25-gauge angled and straight incisions regarding leakage and histopathologic changes in rabbit eyes.[17] The results demonstrated that physiologic leakage was equivalent for 23-gauge angled and 25-gauge straight incisions, but unacceptable for 23-gauge straight sclerotomies. There is some evidence that the self-sealing performance of 23-gauge sclerotomies is better compared to 25-gauge vitrectomy with hypotony rates up to 17.11%, choroidal detachment up to 3.8% and suturing up to 7.1%.[4,18] In our study hypotony

was not associated with postoperative complications or obvious choroidal detachments, although the hypotony rate of 9.4% was the highest among published 23-gauge studies.[11,12,19] In none of our hypotony cases a suture was needed.

The popularity of transconjunctival sutureless vitrectomy has increased over the last years because of its earlier patient rehabilitation and decreased surgery duration. A reduced duration of surgery contributes not only to the surgeon's but also to the patient's comfort. Shorter duration implicates shorter light exposure to retina and therefore less possible light damage. The results of the current study confirms the significantly shorter overall surgery duration of the 23-gauge technique with 23.1 ± 6.5 minutes compared to 34.5 ± 9.1 in the 20-gauge group.

Patients who had surgery with 20-gauge system experienced a transient deterioration of mean visual acuity from 20/80 to 20/100 due to the surgical trauma at postoperative day 2. Faster visual recovery was obtained in patients who had surgery with 23-gauge vitrectomy without any decrease of vision most likely because of the less traumatic approach of this technique. Several studies comparing 25-gauge with 20-gauge vitrectomy in patients with epiretinal membranes reported similar results regarding earlier postoperative visual rehabilitation and considerably shorter surgery time using the 25-gauge system. [3,20,21]

This current study has obvious limitations because of limited number of patients and its retrospective design without standard methods of data collection. Evaluating low complications rates like endophthalmitis or retinal detachment can provide the misleading appearance of higher incidences. This might be the case in a cluster of endophthalmitis events, for example, which may have occurred in the 20-gauge group in this study. Due to the consecutive enrollment of patients also the author's initial experiences with the 23-gauge technique was included. However, a case selection bias was minimized since only patients with a well defined pathology were enrolled.

The results of this study demonstrate that in patients with epiretinal membranes 23-gauge vitrectomy is equal to 20-gauge vitrectomy regarding severe intra- and postoperative complications. Twenty-three-gauge vitrectomy combines the advantages of both, the 20-gauge and 25-gauge system and allows even vitrectomies in complex retinal pathologies. Hypotony will occur more frequently than with conventional vitrectomy techniques, but might not be an issue, since no intervention was needed in this study. The twenty-three-gauge technique however, offers earlier visual rehabilitation, improved patient comfort and shorter surgery duration.

References

1. Eckardt C. Transconjunctival sutureless 23-gauge vitrectomy. Retina 2005;25:208-11.

2. Kunimoto DY, Kaiser RS; Wills Eye Retina Service. Incidence of endophthalmitis after 20- and 25-gauge vitrectomy. Ophthalmology 2007;114:2133-7.

3. Valmaggia C. Pars plana vitrectomy with 25-gauge instruments in the treatment of idiopathic epiretinal membranes. Klin Monatsbl Augenheilkd 2007;224:292-6.

4. Acar N, Kapran Z, Unver YB, et al. Early postoperative hypotony after 25-gauge sutureless vitrectomy with straight incisions. Retina 2008;28:545-52.

5. Lommatzsch A, Heimes B, Trieschmann M, et al. Long-term results after pars plana vitrectomy with 25 gauge technique. Ophthalmologe 2008;105:445-51.

6. Patelli F, Radice P, Zumbo G, et al. 25-gauge macular surgery: results and complications. Retina 2007;27:750-4.

7. Scott IU, Flynn HW Jr, Dev S, et al. Endophthalmitis after 25-gauge and 20-gauge pars plana vitrectomy: incidence and outcomes. Retina 2008;28:138-42.

8. Kellner L, Wimpissinger B, Stolba U, et al. 25-gauge vs 20-gauge system for pars plana vitrectomy: a prospective randomised clinical trial. Br J Ophthalmol 2007;9:945-8.

9. Michels RG. Vitrectomy for macular pucker. Ophthalmology 1984;91:1384-8.

10. Chen JK, Khurana RN, Nguyen QD, Do DV. The incidence of endophthalmitis following transconjunctival sutureless 25- vs 20-gauge vitrectomy. Eye 2008 Jun 6. [Epub ahead of print].

11. Fine HF, Iranmanesh R, Iturralde D, Spaide RF. Outcomes of 77 consecutive cases of 23-gauge transconjunctival vitrectomy surgery for posterior segment disease. Ophthalmology 2007;114:1197-200.

12. Gupta OP, Ho AC, Kaiser PK, et al. Short-term Outcomes of 23-gauge Pars Plana Vitrectomy. Am J Ophthalmol 2008;146:193-7.

13. Tewari A, Shah GK, Fang A. Visual outcomes with 23-gauge transconjunctival sutureless vitrectomy. Retina 2008;28:258-62.

14. Ibarra MS, Hermel M, Prenner JL, Hassan TS. Longer-term outcomes of transconjunctival sutureless 25-gauge vitrectomy. Am J Ophthalmol 2005;139:831-6.

15. Gupta OP, Weichel ED, Regillo CD, et al. Postoperative complications associated with 25-gauge pars plana vitrectomy. Ophthalmic Surg Lasers Imaging 2007;38:270-5.

16. Donati G, Kapetanios AD, Pournaras CJ. Complications of surgery for epiretinal membranes. Graefes Arch Clin Exp Ophthalmol 1998;236:739-46.

17. Singh RP, Bando H, Brasil OF, et al. Evaluation of wound closure using different

incision techniques with 23-gauge and 25-gauge microincision vitrectomy systems. Retina 2008;28:242-8.

18. Lakhanpal RR, Humayun MS, de Juan E Jr, et al. Outcomes of 140 consecutive cases of 25-gauge transconjunctival surgery for posterior segment disease. Ophthalmology 2005;112:817-24.

19. Misra A, Ho-Yen G, Burton RL. 23-gauge sutureless vitrectomy and 20-gauge vitrectomy: a case series comparison. Eye 2008 Jun 6. [Epub ahead of print]

20. Kadonosono K, Yamakawa T, Uchio E, et al. Comparison of visual function after epiretinal membrane removal by 20-gauge and 25-gauge vitrectomy. Am J Ophthalmol 2006;142:513-5.

21. Rizzo S, Genovesi-Ebert F, Murri S, et al. 25-gauge, sutureless vitrectomy and standard 20-gauge pars plana vitrectomy in idiopathic epiretinal membrane surgery: a comparative pilot study. Graefes Arch Clin Exp Ophthalmol 2006;244:472-9.