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RETINAL DISORDERS

Incidence of endophthalmitis in a large series of 23-gauge and 20-gauge transconjunctival pars plana vitrectomy

Barbara Parolini · Federica Romanelli · Guido Prigione · Grazia Pertile

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Abstract
Background To study the incidence of endophthalmitis after 23-gauge pars plana vitrectomy and to compare it with the endophthalmitis rate after 20-gauge pars plana vitrectomy performed in the same ophthalmology department.
Methods The charts of 4,021 consecutive 20-gauge or 23-gauge pars plana vitrectomies performed at a single institution, between August 1 2003 and April 1 2008, were reviewed to search for the occurrence of postoperative endophthalmitis. This is a retrospective, interventional, comparative cohort study.
Results Endophthalmitis developed in one of 3,078 eyes after 20-gauge vitrectomy (0.03%) and in none of 943 eyes after 23-gauge vitrectomy.
Conclusions We did not find an increased risk of endophthalmitis after 23-gauge sutureless vitrectomy.

Keywords Sutureless vitrectomy · Sclerotomy sites · Endophthalmitis

Introduction

Endophthalmitis is a serious ocular condition, which often results in irreversible loss of vision [1, 2]. The incidence of this complication should therefore be taken into account when a new surgical technique is introduced.

Chen first described sutureless self-sealing sclerotomies for pars plana vitrectomy in 1996 [3].

Transconjunctival sutureless 25-gauge vitrectomy was developed recently [4], and has many advantages over standard 20-gauge sclerotomies [4–9]. Sclerotomies in 25-gauge vitrectomy require no suturing because they are only 0.5 mm in diameter, while the sclerotomies in 20-gauge vitrectomy are 1.15 mm wide.However, specific complications linked to the sutureless techniques have been described, which include postoperative wound leakage, hypotony, and choroidal detachment [10, 11].

Furthermore, recent papers have reported that the incidence of endophthalmitis after 25-gauge vitrectomy is significantly higher than after a 20-gauge vitrectomy [12–14].

In 2005, Eckardt et al. [15] published a sutureless transconjunctival approach using 23-gauge trocars, which have the advantage of a larger calibre, stiffer instruments and more efficient cutters.

The 23-gauge transconjunctival sutureless pars plana vitrectomy was introduced to our Retina Service in May 2005. The indications for this type of surgery are increasing. However, in our practice, 20-gauge vitrectomy continues to be predominantly utilized in complex posterior segment surgical cases. The 23-gauge approach is versatile and not subject to the majority of the shortcomings of 25-gauge vitrectomy, while at the same time it retains many of the advantages of 25-gauge vitrectomy.

The goal of the present study was to compare the incidence of endophthalmitis after 23-gauge vitrectomy with the rate of endophthalmitis after 20-gauge vitrectomy performed in the same hospital. We also compared our data with previously published data regarding 20- and 25-gauge.

No financial relationship exists.

The authors have full control of all primary data, and they agree to allow Graefe's Archive for Clinical and Experimental Ophthalmology to review their data upon request.

B. Parolini (✉) · F. Romanelli · G. Prigione · G. Pertile
Ospedale Sacro Cuore,
Negrar-Verona 37024, Italy
e-mail: barbara.parolini@sacrocuore.it

Based on a PubMed search, to our knowledge there are no previous reports of the incidence of endophthalmitis in 23-gauge vitrectomy.

Patients and methods

A total of 4,021 consecutive pars plana vitrectomy cases performed by the Retina Service at the Sacro Cuore Hospital in Verona, Italy, between August 1 2003 and April 1 2008, were reviewed.

All of the surgeries were performed at one surgical location by three surgeons.

Vitrectomy cases were identified through a search of the Hospital's computerized database of surgical records.

As a routine preoperative eye preparation, the periorbital skin and lashes of all eyes undergoing either 20 and 23-gauge vitrectomy were scrubbed in a progressively outward circular motion using sterile gloves and sterile gauze pads, soaked in 10% povidone-iodine (Betadine, Purdue Frederick Co., Norwalk, CT, USA), before preparing the operating sterile field.

All of the patients were draped, everting and covering the lashes so that they would not contaminate the operative field.

All eyes received three preoperative ofloxacin drops, 1 hour before operation. Ofloxacin, tobramycin and dexamethasone drops were also applied at the end of the operation and as postoperative therapy four times a day. None received oral antibiotics.

As an additional preoperative manoeuvre for 23-gauge cases, the bulbar conjunctiva was left in contact with a povidone-iodine solution, which was applied with Q-tips in order to avoid any contact with the cornea. The conjunctiva was then washed with BSS before starting the operation.

Opening and closing technique for 23-gauge vitrectomy was performed as follows: the conjunctiva was moved from the sclerotomy site with forceps, both postero-anteriorly and laterally, and was then held with a pressure plate. A tunnel incision 0.72 mm wide was made in a two-step procedure, first with a stiletto blade positioned at a 20° to 30° angle to the entry site, and then by entering the sclera with the trocars. Vitrectomy was performed as completely as possible in each of the 20- and 23-gauge surgeries, with particular attention paid to removing the vitreous at the sclerotomy sites.

At the end of the procedure, the 23-gauge cannulas were removed and each sclerotomy site was massaged with a Q-tip and the tip of a forcep, immediately after removing each cannula. Possible wound leakage was checked at normal intraocular pressure (IOP). A minimal but self-limiting leakage was considered to be acceptable.

The diagnosis of endophthalmitis was based on its clinical presentation. Positive culture results were not a requisite for the diagnosis of endophthalmitis.

Results

Of the total 4,021 consecutive eyes treated with vitrectomy in our hospital, 3,078 underwent 20-gauge vitrectomy and 943 underwent 23-gauge vitrectomy. Postoperative endophthalmitis occurred in one eye (0.032% of the total 20-gauge vitrectomies).

Phacoemulsification with IOL implantation was combined with vitrectomy in 1,292 (42%) of the 20-gauge cases and in 358 (38%) of the 23-gauge cases.

In 37 of the eyes in the 23-gauge group (3.9%), sutures needed to be placed due to persistent wound leakage at the end of surgery.

In the 23-gauge group, the final tamponade used was fluid in 572 eyes (60.7%), air in 242 (25.7%), sulphur hexafluoride (SF6) gas in 119 (12.6%), and 1,000 cs silicone oil in ten eyes (1%).

Thirty-one eyes (3.3%) presented with IOP lower than 7 mmHg on the first postoperative day. However, within 10 days, the IOP values spontaneously became normal.

The one case of endophthalmitis was diagnosed 5 days after vitrectomy. The patient was a 64-year-old woman with type II diabetes, who had been operated on to treat a non-clearing vitreous haemorrhage. The initial operation was a standard 3-port pars plana vitrectomy with 20-gauge sclerotomies, which were all sutured. The final tamponade was fluid. No intra-operative complications occurred. On the first postoperative day, she presented with mild corneal oedema, IOP within normal values and normal fundus.

Discussion

According to Kunimoto and Kaiser (2007), "the rate of post surgical endophthalmitis has declined with time, and the decline would not have been possible if surgeons had not learned how to circumvent the pitfalls encountered during the evolution of the procedure" [12].

Recent studies report that the incidence of endophthalmitis after 20-gauge vitrectomy is 0.018% to 0.07% [12, 16]. This is of critical importance, because visual outcome is generally poor for patients with postvitrectomy endophthalmitis [17].

Kunimoto and Kaiser [12] found that 25-gauge sutureless vitrectomy had a 12.5-fold higher rate of endophthalmitis than did 20-gauge vitrectomy (0.23% vs 0.018%). Specifically, endophthalmitis developed in one of 434 eyes

after 25-gauge vitrectomy as compared with one of 5,500 eyes for 20-gauge vitrectomy.

A similar incidence of endophthalmitis after 25-gauge vitrectomy is reported by Chen et al. [13], and an even higher incidence is reported by Scott et al. [14].

In our study, we did not observe endophthalmitis in the sutureless vitrectomy group. We applied the same surgical strategy for 23-gauge surgery from the first operation onward, paying particular attention to the following steps:

- (1) Disinfection of the conjunctival fornix with povidone-iodine for at least 1 minute before entering with the trocars.
- (2) Displacement of the conjunctiva antero-posteriorly and laterally to mismatch the entry site into the conjunctiva and into the sclera.
- (3) Sclerotomy construction with a tunnel shape in the two-step procedure described in Patients and Methods. Kunimoto and Kaiser [12] also reported that wound closure prevention due to the type of wound formed could be critical in avoiding infection.
- (4) Complete central and peripheral vitrectomy with scleral depression, in pseudophakic and phakic eyes. Kunimoto and Kaiser [12] also discussed "how minimal vitrectomy, with higher amounts of retained vitreous at the end of the procedure, results in a potentially larger bacterial load which may be sequestered from the normal immunologic factors."
- (5) Stopping the infusion any time an instrument is extruded from the eye, until the introduction of a valve system for the cannulas (DORC). This procedure prevents the incarceration of vitreous into the sclerotomies, until complete vitrectomy is performed.
- (6) Careful closure of the wound by massage on the conjunctiva and the sclera at the sclerotomy site with a Q-tip and with forceps, immediately after removing the trocars.
- (7) Careful checking for wound leakage before removing the infusion cannula at 20 mmHg. If leaking of wound was observed, a bubble of air was injected through the infusion cannula.
- (8) Careful checking for wound leakage after removing the infusion cannula. If leaking of the wound was observed, a bubble of air was injected with a syringe and a 27-gauge needle via pars plana.

The above procedures helped to avoid early postoperative hypotony, which has been thought to be a possible risk factor for infection [12]. However, only 2% of the 23-gauge vitrectomy cases had an IOP less than 7 mmHg, and only on the first day after surgery. Kunimoto and Kaiser [12] suggested that the "less vigorous flow through the 25-gauge infusion as compared with the 20-gauge cannula might lead to a decrease in the washing effect of the infusate, which could cause more bacteria to remain in the eye". Thus, it may be significant that 23-gauge infusions imply a more powerful flow and washing effect than do 25-gauge systems.

Also according to Kunimoto and Kaiser [12], the substance filling the vitreous cavity at the end of the case could be critical, because a common feature of all the endophthalmitis cases reported in their study is that they had a fluid-filled vitreous cavity at the end of the surgery; none had a silicone oil-, gas-, or air-filled vitreous cavity. They thought it therefore "possible that an air- or gas-filled vitreous cavity allowed for superior wound integrity compared with a fluid-filled eye". In our study, the choice of final tamponade was left to the surgeon, based on the type of surgery. The majority of the eyes (59%) were left filled with fluid, while 39% received air or gas, and 1% received 1000 cs silicone oil. We believe that the choice of tamponade is not likely to be critical to preventing endophthalmitis. However given the rare incidence of this complication and the small number of eyes in our sample, this conclusion might not be validated.

In 3.9% of the 23-gauge vitrectomy cases, it was necessary to place a suture at the end of surgery. Therefore, the construction of the tunnel seems to be the key factor in ensuring a successful wound closure.

None of the eyes in our study received subconjunctival antibiotics at the end of surgery.

In their study, Kunimoto and Kaiser excluded the surgeon as a possible critical factor in inducing endophthalmitis in sutureless vitrectomy, because the same surgeons were performing both 20- and 25-gauge vitrectomy which have very different infection rates, and because the occurrence of infection did not seem to be related to the learning curve [12]. Our study supports this conclusion, because the same surgeons performed both the 23- and the 20-gauge vitrectomy, and the single case of endophthalmitis did not occur as the result of a surgery performed at the beginning of the learning curve.

The incidence of endophthalmitis after 25-gauge vitrectomy has previously been reported to be 0.23% [12]. In our study, the incidence in the 20-gauge group was 0.032%, but no endophthalmitis cases were reported as a result of the 943 23-gauge vitrectomies. However, our sample size was too limited for our results to be statistically significant. To demonstrate at least a 5%, 10% or 20% difference between the 20-gauge and the 23-gauge groups, the study would need to include at least 2,976, 2,840 or 2,604 eyes respectively which had been operated on using the 23-gauge technique.

However, our study did demonstrate a 54% difference in the incidence of endophthalmitis between the 23-gauge group and the data previously reported for 25-gauge vitrectomy [12]. Furthermore, our series was sufficient to

demonstrate that the incidence of endophthalmitis after 23-gauge was not threefold greater that the incidence occurring with the 20-gauge technique.

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