



Original Article

# Outcomes of 23-gauge transconjunctival sutureless vitrectomy for acute postoperative endophthalmitis

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## Abstract

**Background:** To report our 3-year experience of 23-gauge transconjunctival sutureless vitrectomy (TSV) for acute postoperative endophthalmitis at a tertiary referral center in southern Taiwan.

**Methods:** This retrospective chart review study included 19 patients with acute postoperative endophthalmitis who underwent 23-gauge TSV from January 2011 to January 2015 at Kaohsiung Veterans General Hospital, Taiwan. Bacterial and fungal cultures from aqueous samples, vitreous samples, or both were performed.

**Results:** Nineteen patients (12 male; 7 female) were included. The mean age was  $72.4 \pm 8.29$  years. Acute postoperative endophthalmitis was noted in 18 patients after cataract surgery and in 1 patient after 23-gauge vitrectomy for a rhegmatogenous retinal detachment. Upon presentation, visual acuity was less than hand movement for 80% of the patients. Chief complaints included blurred vision (19 patients, 100%), followed by pain (10 patients, 52.6%) and red eye (4 patients, 21%). All patients were administered an intravitreal injection (IVI) of antibiotics and 23-gauge TSV, and the average number of IVIs was  $2.68 \pm 1.73$  (1–9 IVIs). The interval between their initial eye symptoms and vitrectomy was  $4.11 \pm 4.73$  days (0–2 days), and the interval between diagnosis with endophthalmitis and a vitrectomy was  $1.11 \pm 1.52$  days (0–6 days). The final visual acuity was no light perception for 1 patient (5.3%), between 6/60 and 6/12 for 8 patients (42.1%), and 6/12 or better for 9 patients (47.4%). No retinal detachment or hypotony was noted postoperatively in any case.

**Conclusion:** 23-gauge vitrectomy is safe and effective for the management of acute postoperative endophthalmitis. Early diagnosis and treatment with 23-gauge vitrectomy may provide a good visual outcome.

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**Keywords:** 23-Gauge vitrectomy; Postoperative endophthalmitis; Transconjunctival sutureless vitrectomy

## 1. Introduction

Postoperative endophthalmitis is a rare but sight-threatening complication. The incidence has ranged from 0.07% to 0.11% after cataract surgery and 0.054%–0.23% after microincisional vitrectomy surgery (MIVS).<sup>1–4</sup> Even

with prompt intervention, the visual prognosis is poor. In the Endophthalmitis Vitrectomy Study (EVS), the final visual acuity was less than 20/40 for 47% of the cases, less than 20/100 for 26% of the cases, and eventually no light perception for 5% of the cases.<sup>5</sup> As for the management of acute postoperative endophthalmitis, early diagnosis and timely treatment is crucial and may preserve visual function. According to the results of the EVS, vitrectomy was most beneficial for those patients who presented with a visual acuity of light perception, equivocal to those presented with a visual acuity of hand motions or better, and was also indicated for those with clinical aggravation after initial intervention.<sup>5</sup> In recent years,

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23-gauge sutureless vitrectomy has rapidly been accepted in vitreoretinal surgery with satisfactory postoperative results for various diseases. The advantages include a shorter surgical time, minimal conjunctival damage, earlier postoperative recovery, and less patient discomfort, as compared with conventional 20-gauge pars plana vitrectomy.<sup>6,7</sup> Regarding the use of 23-gauge transconjunctival sutureless vitrectomy (TSV) to treat acute postoperative endophthalmitis, there was only 1 retrospective study that involved 4 cases and 1 prospective study that involved 10 cases.<sup>8,9</sup> The present investigation reviewed 19 patients with acute postoperative endophthalmitis who underwent 23-gauge TSV and examined the safety and effectiveness of 23-gauge TSV for the treatment of acute postoperative endophthalmitis.

## 2. Methods

The current study involved a retrospective chart review approved by the Institutional Review Board of Kaohsiung Veterans General Hospital. This study enrolled patients who were diagnosed with acute postoperative endophthalmitis and underwent 23-gauge TSV that was performed by 1 retinal specialist (Tsung-Tien Wu) from January 2011 to December 2013 at Kaohsiung Veterans General Hospital, Taiwan. The diagnosis was made according to clinical symptoms and signs that were observed within 6 weeks after a prior operation, including blurred vision, ocular pain, conjunctival injection, and prominent anterior and posterior segment inflammation. Demographic features, baseline examination data, comorbidity, and past surgical history were recorded.

Upon confirmation of the diagnosis, an immediate vitreous tap (0.2–0.3 mL via a 26-gauge needle) or aqueous tap (0.1 mL via a 30-gauge needle through a clear cornea) was performed for culture. The vitreous and aqueous specimens were divided and injected on blood agar, chocolate agar, and Sabouraud's dextrose agar for bacterial and fungal cultures. After vitreous/aqueous tap, an intravitreal injection (IVI) of vancomycin (1 mg/0.1 mL) and ceftazidime (2.25 mg/0.1 mL) was performed. Whether an IVI of dexamethasone (0.32 mg/0.08 mL) was administered simultaneously depended on the severity of anterior and posterior segment inflammation and the pathogens suspected. Patients who presented with prominent corneal edema or ring infiltration, fibrin exudation or hypopyon in the anterior chamber, and vitreous opacity that obscured a second-order retinal vessel wound referred as more severe inflammation and been administered IVI of dexamethasone if they had no contraindications. Topical antibiotics including fortified cefazolin (5%) and gentamycin (1.5%) eye drops with 1% prednisolone acetate (Pred-Forte<sup>®</sup> ophthalmic suspension, Allergan) were prescribed at the same time. Patients presenting with a visual acuity of light perception, a fulminant infection, or inflammation underwent immediate 23-gauge TSV prior to IVI.

Re-evaluation was performed 6–8 h later, and a physician would decide whether observation, repeat IVI, or 23-gauge TSV would be performed if the visual acuity, symptoms, and signs had worsened. Patients experiencing clinical

improvement after IVI only were excluded, and those with a follow-up time of <3 months were also excluded. Patients who underwent immediate 23-gauge TSV or those who did not show any clinical improvement after IVI and then underwent 23-gauge TSV were included.

The operation was performed under general anesthesia or with retrobulbar anesthesia. Aseptic procedure was performed with 5% povidone-iodine solution. An Alcon Constellation<sup>®</sup> Vision System with 23-gauge Ultravit<sup>®</sup> High Speed Vitrectomy Probes and a xenon illuminator fiber were used. The trocar was set up using conjunctiva displacement and a tunnelization technique. If there was a suspicious concomitant choroidal/retinal detachment or severe vitreous opacity, a 6-mm-length trocar was applied for the sclerotomy of infusion. Vitrectomy was performed with hand-held wide-angle viewing lenses (Landers Wide Field Vitrectomy Lens) and a stereoscopic diagonal inverter (SDI) without a vitrectomy lens ring to prevent excessive conjunctival injury and bleeding. A core and peripheral vitrectomy was performed as completely as possible, if visible. At the end of surgery, a scleral indentation was performed to check for any iatrogenic tears. An IVI of antibiotics including vancomycin and ceftazidime with/without dexamethasone was administered to all cases after trocar removal. Gentamycin ointment was applied with eye patching. The vitreous specimens were sent for another culture. During postoperative follow-up, adjuvant IVI of antibiotics with/without dexamethasone was performed if any infection or inflammation persisted. The postoperative follow-up results were recorded, including best-corrected visual acuity, intraocular pressure (IOP), anterior segment examinations, and fundus examinations. Hypotony was defined as an IOP of <5 mmHg.<sup>10</sup>

## 3. Results

A total of 24 patients were reviewed, while 3 patients were excluded because they demonstrated clinical improvement after IVI only; another 2 patients were excluded because of incomplete data and follow-up. Finally, 19 patients were included in our study. The average follow-up time was  $5.73 \pm 3.91$  months. Acute postoperative endophthalmitis was noted in 18 of them after cataract surgery and in 1 patient after 23-gauge TSV. The clinical data are summarized in [Tables 1 and 2](#). The initial visual acuity was light perception for 4 patients, hand motion for 4 patients, counting fingers for 7 patients, and better than counting fingers for 4 patients. The chief complaints included blurred vision (19 patients, 100%), followed by pain (10 patients, 52.6%) and red eye (4 patients, 21%). All patients had various severity of vitritis with vitreous opacity. One patient (case no. 9) had a concomitant choroidal detachment, and 4 patients had secondary glaucoma upon presentation.

Fourteen patients were administered an IVI of antibiotics before the 23-gauge TSV, while the 5 other patients underwent 23-gauge TSV immediately after their diagnosis was confirmed. The average number of IVIs was  $2.68 \pm 1.73$  (1–9 IVIs). The interval between the initial ocular symptoms and vitrectomy was  $4.11 \pm 4.73$  days (0–22 days), and the interval

Table 1  
Demographic data.

Patient no.	Age	Sex	S/S to VT (days)	Initial surgery	Comorbidities	Number of pre-VT IVIs	Number of post-VT boost IVIs	Post-OP Day 1 IOP (mmHg)
1	72	M	3	Cata	—	1	0	18
2	75	F	1	Cata	DM	1	0	12
3	69	M	3	Cata	—	1	0	15
4	76	M	3	Cata	—	1	0	24
5	65	F	6	Cata	DM	1	2	13
					2 <sup>nd</sup> glaucoma			
6	73	F	2	Cata	2 <sup>nd</sup> glaucoma	0	0	11
7	79	F	4	Cata	2 <sup>nd</sup> glaucoma	1	1	13
8	65	M	1	Cata	—	0	3	23
9*	86	F	4	Cata	Choroidal detachment	1	1	20
10	54	M	4	Cata	DM	1	0	9
					Retained lens material in AC			
11	80	M	0	Cata	—	0	0	13
12	65	M	4	Cata	DM	1	0	19
13	67	M	6	Cata	—	1	1	21
14	80	M	2	Cata	2 <sup>nd</sup> glaucoma	1	7	12
15	79	M	4	Cata	—	1	0	13
16	64	M	1	23-G VT	—	0	1	11
17	74	F	22	Cata	—	1	0	11
18	86	M	7	Cata	—	0	2	13
19	61	F	1	Cata	—	1	0	20

AC = anterior chamber; DM = diabetes mellitus; S/S = symptoms/signs; VT = vitrectomy; \*S/p evisceration 1 week later due to progressed to panophthalmitis.

Table 2  
Best-corrected visual acuity and culture results.

Patient no.	Pre-OP VA	Post-OP VA	Follow-up times (months)	Origin of patients	Culture results
1	CF	6/15	3	Referral	<i>Staphylococcus epidermidis</i> (vitreous)
2	6/30	6/6	14	Referral	No growth
3	CF	6/30	3	Referral	No growth
4	HM	6/8.6	12	Referral	No growth
5	LP	6/30	3	Referral	Coagulase negative <i>Staphylococcus</i> (vitreous)
6	CF	6/20	13	Referral	No growth
7	LP	6/20	3	Our hospital	<i>Staphylococcus epidermidis</i> (aqueous)
8	LP	6/10	3	Referral	<i>Pseudomonas aeruginosa</i> (vitreous)
9*	LP	NLP	3	Referral	<i>Citrobacter koseri</i> (vitreous)
10	CF	6/15	5	Our hospital	<i>Staphylococcus epidermidis</i> (vitreous)
11	CF	6/8.6	10	Referral	No growth
12	HM	6/8.6	6	Referral	No growth
13	HM	6/60	3	Our hospital	No growth
14	CF	4/60	10	Referral	<i>Pseudomonas aeruginosa</i> (vitreous and aqueous)
15	6/60	6/30	4	Referral	No growth
16	HM	6/12	5	Our hospital	No growth
17	CF	6/60	3	Referral	No growth
18	6/60	6/30	3	Referral	No growth
19	2/60	6/8.6	3	Our hospital	Gram-Positive Bacillus (vitreous)

CF = counting fingers; HM = hand movement; LP = light perception; NLP = no light perception; \*S/p evisceration 1 week later due to progressed to panophthalmitis.

between the diagnosis of endophthalmitis and vitrectomy was  $1.11 \pm 1.52$  days (0–6 days). No intraoperative complications were noted in any patient. No sclerotomy suture was required at the end of surgery for any patient, and no hypotony was noted on the day after the operation.

The positive culture rate was 42.1% (8 patients); among them, 50% (4 patients) had gram-positive cocci and 50% (4 patients) had gram-negative bacilli (Table 2). All patients had improved visual outcomes after the operation, except for 1

patient who underwent an evisceration 1 week after the 23-gauge TSV because of progressive panophthalmitis.

#### 4. Discussion

The EVS, published in 1995, was a prospective, randomized, and multicenter clinical trial that evaluated the roles of pars plana vitrectomy and systemic antibiotics for the management of acute-onset endophthalmitis following cataract

surgery or secondary intraocular lens implantation in 420 patients.<sup>5,11</sup> Between the immediate vitrectomy and IVI-only subgroups, there was a 3-fold increase in the frequency of achieving 20/40 or better, nearly a 2-fold chance of achieving 20/100 visual acuity or better, and a 50% decrease in the frequency of severe visual loss (defined as visual acuity worse than 5/200) in those who presented with an initial vision of light perception only and who underwent an immediate vitrectomy. The results indicated that patients with only light perception as their initial presenting visual acuity obtained the most visual benefit from an immediate pars plana vitrectomy. The EVS provided level 1 evidence-based data to establish guidelines in the 20-gauge era. Visual acuity outcomes involving 20-gauge vitrectomy in the EVS were as follows: 53.7% achieved 20/40 or better, and 82.1% achieved 20/200 or better. In a study by Altan et al., in the 20-gauge vitrectomy subgroup, 24.1% achieved a visual acuity of 20/40 or better, while 65.5% achieved a visual acuity of 20/100 or better.<sup>12</sup> In our study, 47.37% achieved a visual acuity of 6/12 or better, and 89.47% achieved a visual acuity of 6/60 or better. Only 1 patient had a poor visual outcome because of an uncontrollable infection, and this patient eventually underwent an evisceration. Further, this particular patient presented with a visual acuity of light perception with almost complete choroidal detachment, and the patient had *Citrobacter koseri* in both aqueous and vitreous culture specimens. This retrospective study suggests that 23-gauge TSV is as effective as 20-gauge vitrectomy for the management of acute postoperative endophthalmitis.

Shorter operative times were another advantage of 23-gauge TSV, because of a higher cutting rate and lack of suture use. In patients with endophthalmitis, the eyes were severely inflamed, the conjunctiva was injected, and the conjunctival/episcleral vessels were engorged. In the 20-gauge era, excessive bleeding was inevitable when performing a peritomy or anchoring the lens ring; additional time was necessary to reach hemostasis, especially in eyes with endophthalmitis. With a 23-gauge TSV trocar system, a peritomy was not required. Moreover, our study used a hand-held wide-angle viewing lenses without a vitrectomy lens ring. Without anchoring sutures for the lens ring and peritomy, less unnecessary bleeding and conjunctival injury would be anticipated. The integrity of the conjunctiva could decrease the possibility of postoperative conjunctival leakage or hypotony.

Postoperative hypotony is an important issue in 23-gauge TSV. The incidence ranged from 0 to 14% postoperatively.<sup>9,10,12</sup> In this study, no sclerotomy orifice sutures were required, and no postoperative hypotony was noted. Conjunctival displacement and a tunnelization technique were used as a standard trocar set-up, allowing the conjunctiva and Tenon's capsule to be repositioned and to cover the sclerotomy orifices after trocar removal. Furthermore, the peripheral cortical vitreous may also occlude the sclerotomy orifices after removal of the trocars. The better integrity of the conjunctiva observed in this study may also prevent hypotony.

Retinal/choroidal detachment is one of the most difficult sight-threatening complications in endophthalmitis, regardless

of whether it is concomitant, intraoperative, or postoperative. In the EVS, the incidence of postoperative retinal detachment was 7.8% in the subgroup that underwent a 20-gauge vitrectomy.<sup>5</sup> In a study by Altan et al., 13.8% of the subgroup that underwent 20-gauge vitrectomy developed a postoperative retinal detachment, while no retinal detachment developed in the subgroup that underwent 25-gauge vitrectomy.<sup>12</sup> In a study by Almanjoui et al., the incidence of postoperative retinal detachment was 10% after a 23-gauge TSV.<sup>9</sup> No postoperative retinal detachment developed in this study during follow-up. Comparing the results with those studies, the incidence of retinal detachment after 23-gauge or 25-gauge vitrectomy seemed lower than that of 20-gauge vitrectomy. Iatrogenic tears during vitrectomy may result from ocurome tractional force or instrument insertion/extraction. High-speed cutting and an MIVS trocar system may theoretically reduce tractional force during manipulation. However, a longer follow-up time or additional prospective study may be required for evidence-based conclusions.

In patients with a concomitant retinal/choroidal detachment or severe vitreous opacity, malalignment of the infusion into the subretinal space could occur, resulting in an iatrogenic retinal/choroidal detachment. An extended-length 6-mm trocar was routinely employed to ensure exact insertion of the infusion into the vitreous cavity when setting up the infusion for such patients. An extended-length 6-mm trocar may cause lenticular injury in phakic patients, but it was safe in the present study because all patients were pseudophakic. A higher cutting rate, lower vitreous traction involved with the 23-gauge system, and shorter operative time may account for the lower incidence of retinal detachment in the present study. In addition, careful scleral indentation at the end of surgery may also prevent iatrogenic intraoperative tears and causative retinal detachments.

Eight out of 19 (42.1%) eyes had positive microorganism culture results in our study. The EVS reported a 69.4% positive culture rate, and Altan et al. reported a 62.1% positive culture rate in the 20-gauge subgroup and 58.3% in the 25-gauge subgroup. The positive culture rate was lower than in previous studies.<sup>5,12</sup> However, a different positive culture rate was noted in patients who underwent causative cataract/vitrectomy surgeries at our hospital (60%) and those who were referred from other hospitals/clinics (35.7%). The lower positive culture rate in patients referred from other hospitals/clinics may result from the administration of prescription antibiotics before their referral. Gram-positive cocci were the most commonly isolated bacteria in our study and previous studies.<sup>5,12</sup>

The present study had some limitations. First, it was a retrospective study. Although the postoperative results in this study were satisfactory, a randomized controlled study is needed to compare these results with those of 20-gauge vitrectomy. Second, this study did not strictly follow the EVS suggestions. An IVI of antibiotics was performed before 23-gauge TSV in 14 patients, and 5 patients underwent 23-gauge TSV immediately on the day their diagnosis was confirmed. Most patients had improvement in visual acuity,

and nearly 50% of the patients in this study had a visual acuity of 20/40 or better. The EVS established guidelines that have been followed for more than 10 years. In the 20-gauge era, pars plana vitrectomy required longer hospital stays and greater expense than did IVI antibiotics. The incidence of retinal detachment was slightly higher in the IVI group than the vitrectomy group (9.0% vs. 7.8%, respectively), but the difference was not statistically significant. Nevertheless, 23-gauge TSV provided a shorter operative time and convalescence period, which may shorten the hospital stay and prevent additional procedures. Given the compatible effectiveness and fewer postoperative complications than 20-gauge pars plan vitrectomy, the EVS guideline should be modified in the MIVS era. This study also had selection bias. Only patients who required 23-gauge TSV were included, while patients were excluded if they were administered IVI antibiotics only and subsequently improved. Patients requiring 23-gauge TSV had relatively more severe infection/inflammation and had lower visual potential.

In conclusion, 23-gauge TSV is safe and effective for the management of acute postoperative endophthalmitis. The visual acuity prognosis was comparable with that achieved with traditional 20-gauge vitrectomy. Surgical trauma to the conjunctiva and intraoperative bleeding were minimized. The operative time and convalescence period were shortened. Using a conjunctiva displacement tunnelization technique with an extended-length 6-mm trocar for the infusion set-up and a hand-held wide-angle viewing lenses without a vitrectomy lens ring during the operation may reduce the possibility of postoperative hypotony and incidence of retinal detachment. Nevertheless, a randomized prospective study is required for a direct comparison between 20-gauge and 23-gauge TSV to reach a more definitive conclusion.

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