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Research Article

The Role of Vitrectomy in the Treatment of Endophthalmitis After Cataract Surgery

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Abstract

Background: Vitrectomy is important for the diagnosis and treatment of post cataract-surgery endophthalmitis, a still devastating complication.

Patients and Methods: Data of 50 patients who underwent pars plana vitrectomy for post cataract-surgery endophthalmitis were evaluated retrospectively. The median follow-up period was 9 months. The surgical techniques used were VIT (three-port pars plana vitrectomy to eradicate the inflamed vitreous, install antibiotics, and take specimens for stain and culture) and TAP (taking specimens from the vitreous and injecting antibiotics through one-port sclerotomy).

Results: From 50 patients who were treated for post cataract-surgery endophthalmitis, 37 (74%) patients underwent VIT and 13 (26%) underwent TAP.

The causative organisms could be isolated in 37 patients (74%). Gram-positive organisms represented 89.6% of isolates (54.5% were gram-positive, coagulase-negative micrococci, which were the most common isolates), whereas gram-negative organisms were only 11.4% of isolates. All gram-positive isolates were sensitive to vancomycin and all tested gram-negative isolates were sensitive to both ciprofloxacin and ceftazidime. Twenty percent of the patients needed additional procedures (16.2% in VIT group vs. 30.8% in TAP). The frequency of retinal detachment following the treatment of post cataract-surgery endophthalmitis was 8% (5.4% in VIT group vs. 15.4% in TAP group. There was a positive correlation between initial and final visual acuity (rspearman = 0.49652).

Conclusion: Vitrectomy was efficient in improving the visual acuity. The initial visual acuity is a predicting factor of the visual outcome. More invasive initial procedure (VIT) may result in less necessity of additional procedures.

Keywords: *Post cataract-surgery; endophthalmitis; VIT; TAP; visual acuity*

Introduction

Postoperative endophthalmitis is a serious complication following cataract surgery. Recent estimates range from 0.07% to 0.13% [1-4]. In acute cases, signs and symptoms may include decreased visual acuity, pain, hypopyon, corneal infiltration, fibrinous anterior chamber response, vitreous inflammation, retinal periphlebitis, and/or mid-peripheral retinal hemorrhages [5,6]. In chronic infectious postoperative endophthalmitis, patients may present with any of the signs or symptoms characteristic of acute infectious postoperative endophthalmitis. However, they typically present with a persistend low-grade uveitis that may respond to corticosteroids initially. Mutton-fat precipitates may be present on the IOL as well as on the corneal endothelium. However, white plaques (may be seen in both bacterial and fungal infections), located on the posterior capsule, on the IOL, and/or associated with retained lens particles suggest the diagnosis [7,8]. The most important diagnostic goal is to identify the causative organism. Biopsy from aqueous and vitreous is available.

Patients and Methods

Patients: Data of 50 consecutive patients who were treated by pars plana vitrectomy for postoperative endophthalmitis at the University Eye Hospital in Ulm, Germany, between September 1995 and February 2003 were evaluated retrospectively.

Classification of endophthalmitis: Bacterial endophthalmitis that occurred within 6 weeks after the cataract surgery was considered as acute endophthalmitis and infections that occurred after 6 weeks as chronic endophthalmitis [2,9].

Classification of visual acuity: Visual acuity was assessed before the vitrectomy procedure, at demission from the hospital and in various intervals afterwards. The patients were divideded into four groups according to visual acuity: 1) ≥ 20/40, 2) ≥ 20/100, 3) ≥ 5/200, and 4) < 5/200.

Medical treatment: All the patients were treated with the combination of cefotaxime (3 x 2g) or ceftazidime (3 x 2g) with vancomycin (2 x 1g) or amikacin (2 x 500 mg) intravenously, and vancomycin (1.0 mg in 0.1 ml) and amikacin (0.4 mg in 0.1 ml) were injected intravitreally.

Surgical techniques: The patients were subjected to either VIT- or TAP- techniques. In VIT-technique, a three-port pars plana Vitrectomy was used to eradicate the inflamed vitreous, install antibiotics, repair the affected retina, and take specimens for stain and culture. On the other hand, in TAP-technique, specimens were taken from the vitreous (tube of the vitrectomy probe) and antibiotics were injected through one-port sclerotomy. Additional procedures within one week of the initial procedures were considered as early, and thereafter as late [10].

Culture methods: The intraocular specimens were natively transported in an insulin syringe or in port-a-cul tubes for microbiologic examination. To detect the offending organisms, samples were plated at 37°C on blood-, chocolate- and Schadler-agar or inoculated in thioglycolate- and heart-brain-glucose broth. Culture media were incubated at appropriate conditions for a period of seven days and controlled at days one, two, three and seven [11].

Gram and Giemsa stains of intraocular fluids were performed. Susceptibilities of isolates were determined by agar diffusion test or microbroth dilution method.

Classification of the causative microorganisms: Culture results were classified as follows:

a. Growth of organisms in the family micrococcaceae, considered normal inhabitants of lid flora was phrased" gram-positive, coagulase-negative micrococci".
b. Growth of gram-positive organisms considered more virulent than those in group (1) were phrased" other gram-positive organisms".
c. Growth of gram-negative organisms.

Statistic methods: Wilcoxon Two-Sample Test was used to compare the final visual acuity in the two technique-groups (VIT and TAP). The relation between the final visual acuity and the visual acuity at the initial presentation was calculated with Spearman Correlation Coefficients. The frequency of culture-positive cases in both types of vitrectomy (VIT and TAP) was tested by Fisher's Exact Test.

Results

Patients: The median age of the patients was 75.5 years (Minimum: 56 years, Maximum: 90 years), 64% of patients were women and 36% were men. More left eyes were affected than right eyes, 56% and 44%, respectively.

Time of diagnosis: In 43 patients (86%), bacterial endophthalmitis was acute and in 7 patients (14%), bacterial endophthalmitis was chronic.

Symptoms and signs: Blurred vision, pain, and red eye were documented in 62%, 48%, and 14% of patients, respectively. Thirty patients (60%) were accompanied with hypopyon, and only 3 (6%) with corneal infiltration.

Follow-up: Follow-up period of the final visual acuity ranged from 2 weeks to 40 months, with a median follow-up period of 9 months.

Operative data: Thirty-seven patients (74%) underwent VIT -technique and 13 patients (26%) were subjected to TAP-technique. Antibiotic injection (Amikacin: 0.4mg in 0.1ml + Vancomycin: 1mg in 0.1ml) was used in all the operations either through the irrigation solution in the VIT group or through the one sclerotomy in the TAP group.

Systemic diseases: There was a history of diabetes mellitus in 13 patients (26%), systemic hypertension in 22 patients (44%), and glaucoma in 7 patients (14%).

Microbiology: The total culture-positive cases were 37 from 50 patients (74%), whereas cases with no growth were 13 (26%). Fourty-four causative organisms were isolated from 37 patients. The gram-positive, coagulase-negative micrococci representing 54.5% of all isolates. Other gram-positive bacteria and gram-negative bacteria were isolated in 34.1% and 11.4%, respectively.

Other gram-positive micrococci contained: Staphylococcus aureus (6.8%), Streptococcus species (6.8%), Enterococcus species (11.4%), and Propionibacterium acnes (9.1%). The gram-negative bacteria contained: Pseudomonas aeruginosa (4.5%), Ochrobactrum anthropi (4.5%), and Chryseomonas luteola (2.3%).

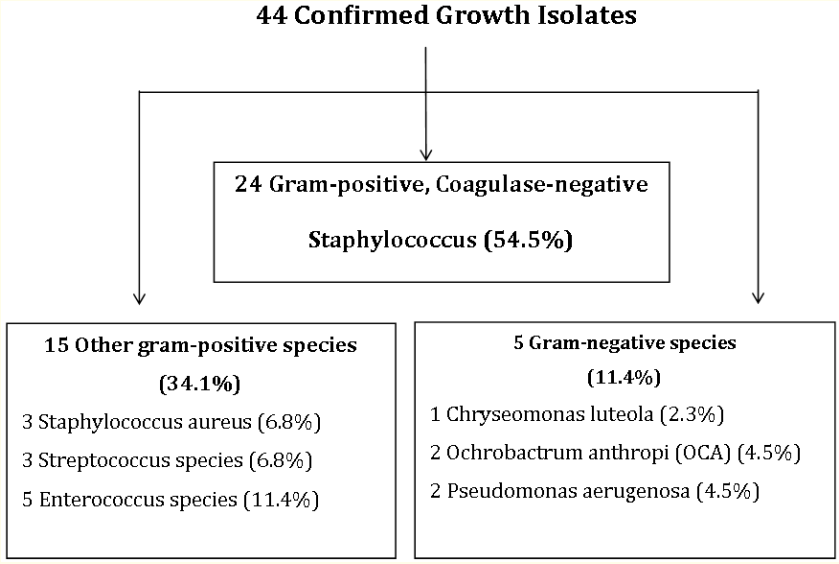

Figure 1: *Distribution of confirmed growth isolates on bacterial groups.*

Although culture-positivity in VIT-group was slightly higher than in TAP-group (75.7% vs. 69.2%), the difference was not statistically significant (rFischer = 0.7193).

The frequency of vitreous culture-positive cases with negative aqueous culture was (43.75%), whereas aqueous culture-positive cases with negative vitreous culture was (31.25%).

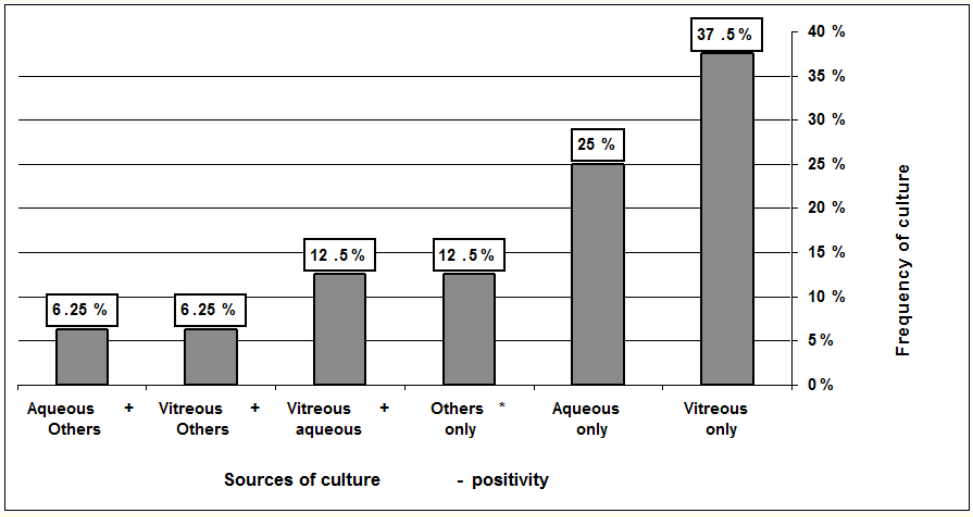

Figure 2: *Frequency of culture-positivity with respect to different sources.*
** = IOL, lenscapsules, or vitrectomy cassette.*

Susceptibility: All gram-positive isolates were tested for susceptibility to vancomycin and all (100%) were sensitive and all gram-negative organisms were resistant to vancomycin. Also, all gram-negative and gram-positive isolates (100%) that were tested for susceptibility to ceftazidime and ciprofloxacin were sensetive to these antibiotics. On the other hand, only 25% of gram-negative isolates were sensitive to cefotaxime, whereas 88.88% of gram-positive isolates were sensitive to it.

Frequency of additional procedures: Twenty percent of all patients needed additional procedures. In acute cases, 21% had additional procedures (7% early and 14% late), whereas only one case (14.3%) needed additional procedure in chronic cases (late). Reoperations in patients who were assigned to initial TAP were 30.8%, whereas in patients assigned to initial VIT were 16.2%.

One from the three early additional procedures in patients with acute endophthalmitis was because of retinal detachment and was treated by an initial VIT and an additional VIT. Whereas the two other cases were because of worsening ocular inflammation or infection, and one case was treated by an initial VIT and an additional TAP, and the other case was treated by initial and additional TAPs. Three from 6 patients with acute endophthalmitis underwent late additional procedures because of retinal detachment complication. One of them was treated by VIT as an initial procedure, and the two others were treated by TAP as an initial procedure, but the additional procedures were VIT in the three cases. The other 3 patients with acute endophthalmitis underwent late additional procedures because of worsening ocular inflammation. One of them was treated by TAP as an initial procedure, and the two others were treated by VIT as an initial procedure, but the additional procedures were VIT in the three cases. The one patient with chronic endophthalmitis who underwent VIT as an initial procedure had a worsening inflammation complication, and underwent VIT as an additional procedure afterwards.

The frequency of reoperations in relation to the microorganisms in all patients was as follows: Gram-positive coagulase-negative micrococci (20.8%), gram-negative (20%), no growth (7.7%), and other gram-positive micrococci (6.6%). Only in acute cases, the frequency of early additional procedures was as follows: No growth (0%), gram-positive coagulase-negative micrococci (4.3%), other gram-positive micrococci (9%), and gram-negative (25%). The 4 patients who needed additional procedures because of retinal detachments were 2 from patients who underwent VIT as an initial procedure, i.e.5.4% of the 37 cases, and 2 from patients who underwent TAP as an initial procedure, i.e.15.4% of 13 cases.

Visual Acuity (VA)

One patient (2%) had an initial visual acuity of ≥ 20/40, 4 patients (8%) had an initial visual acuity of ≥ 20/100, three patients (6%) had an initial visual acuity of ≥ 5/200, and the most patients (42 from 50 patients = 84%) had a visual acuity of < 5/200 at the initial presentation. Only 20% of patients had visual acuity of < 5/200 after vitrectomy, compared to 84% at the initial presentation. Also, patients who had visual acuity of ≥ 20/40 were 32% in comparison to 2% at the initial presentation (Table 1), and there was a positive correlation between initial and final visual acuity (rSpearman = 0.49652).

	Initial VA		Final VA	
	n	%	n	%
≥ 20/40	1	2	16	32
≥ 20/100	4	8	7	14
≥ 5/200	3	6	17	34
< 5/200	42	84	10	20

Table 1: *Total comparison between initial and final visual acuity in all patients.*
n = Number of patients for each visual acuity group

Because most of patients (84%) presented the worst initial visual acuity of < 5/200, they were studied in respect to the two types of vitrectomy. We noticed that 50% of patients who treatet by VIT-technique as an initial procedure achieved final visual acuity of ≥ 20/100 in comparison to only 20% of patients treatet by TAP-technique and achieved the same final visual acuity (Figure 3). However, there was no statistically significant difference in final visual acuity between the two treatment groups (rWilcoxon = 0.6813).

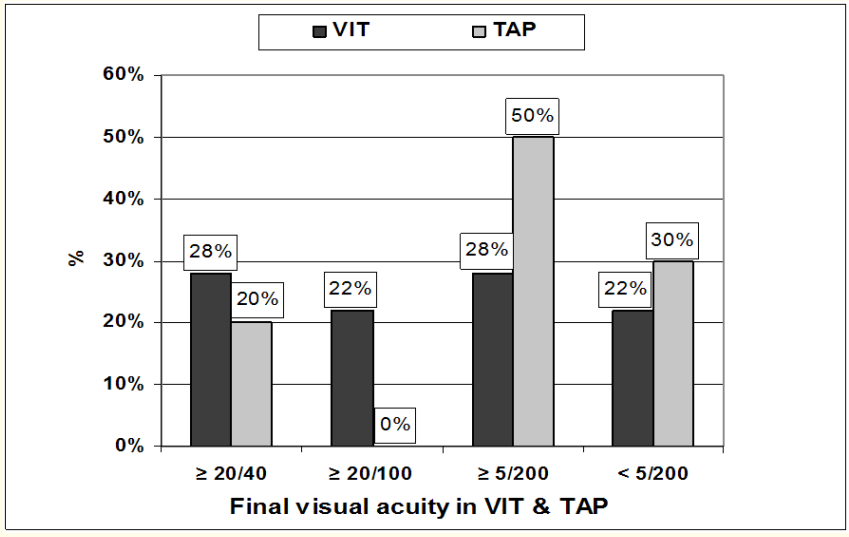

Figure 3: *Final visual acuity for patients with initial visual acuity < 5/200 in TAP- and VIT- techniques.*

The microorganisms isolated from patients that achieved final visual acuity of ≥ 20/40 were in order of frequency as follows: 66.6% of gram-negative organisms, 44.4% of other gram-positive organisms, 27.7% of gram-positive, coagulase-negative micrococci, and 23% of no growth cases. Twenty percent of patients who underwent additional procedures had a final visual acuity worse than 5/200 compared to 17.5% of patients who did not, whereas 30 % of patients scheduled for reoperations achieved ≥ 20/40 final visual acuity compared to 32.5% who did not.

Three from 4 patients with complication of retinal detachment achieved a final visual acuity of ≥ 5/200 and one patient achieved a final visual acuity of < 5/200.

Discussion

Microbiology and susceptibility: The overall culture positivity rate was 74%, whereas the culture positivity rate in the Endophthalmitis Vitrectomy Study (EVS) was 69.3% [12,2]. Gram-positive, coagulase-negative micrococci predominated in our study (54.5%). Based on the EVS, gram-positive, coagulase-negative micrococci were also the most frequent group of isolates, representing 69.9% of isolates [2]. Other gram-positive organisms represented 34.1%, and gram-negative organisms represented 11.4% from 44 isolates in 50 patients. Compared to the EVS, other gram-positive bacteria were isolated in 24.2% of the isolates with confirmed growth and gram-negative bacteria in 5.9% [2] (Table 2).

	Culture Positivity	Frequency of the Causative Microorganisms		
		Gram Positive, Coagulase Negative	Other Gram Positive	Gram Negative
Ulm	74%	54.5%	34.1%	11.4%
EVS	69.3%	69.9%	24.2%	5.9%

Table 2: *Our microbiological results in comparison to EVS.*

In our study, 100% of tested gram-positive isolates were sensitive to vancomycin and 100% of tested gram-negative isolates were sensitive to both ceftazidime and ciprofloxacin. This result supports our method in the medical treatment. Our results were comparable to that of the EVS: All gram-positive isolates tested in that study were susceptible to vancomycin. 89% of gram-negative isolates were susceptible to both amikacin and ceftazidime and 11% were resistant to both [2]. This confirms the efficacy of the combination of vancomycin and ceftazidime in the treatment of bacterial post cataract-surgery endophthalmitis.

The culture-positive cases in patients who underwent VIT as an initial management (75.6%) were slightly more than in patients who underwent TAP (69.2%). The culture positivity rate with respect to the VIT- and TAP-techniques in EVS was 72% and 65, 8%, respectively [13]. This means that there was no difference between the two techniques in isolating the causative bacteria. In our study, the frequency of vitreous culture-positive cases with negative aqueous culture (43.75%) was higher than those of aqueous culture-positive cases with negative vitreous culture (31.25%). The EVS reported also higher culture positivity from vitreous (54.9 %) than from aqueous (22.5%) [12]. these imply the importance of vitreous as a source for obtaining the offending organisms.

Additional procedures

There was a correlation between the virulence of microorganisms and the frequency of early additional procedures in acute cases in our study. This result corresponds with the EVS, which enrolled only acute cases. They concluded that the rate of early additional surgery procedures in patients with either no or equivocal growth was only 5%, and in patients with gram-positive, coagulase-negative micrococci isolated from their initial procedure it was 3.6% which was lower than for patients with gram-negative (31%) or other gram-positive growth (29%). In our study, patients assigned to TAP-technique were somewhat more likely to have additional procedures (30.8%) in comparison to patients who underwent VIT-technique (16.2%). This result corresponds with the results of EVS, in which the additional procedures were needed in 39% of patients with TAP-technique compared with 32% for patients with VIT-technique [10].

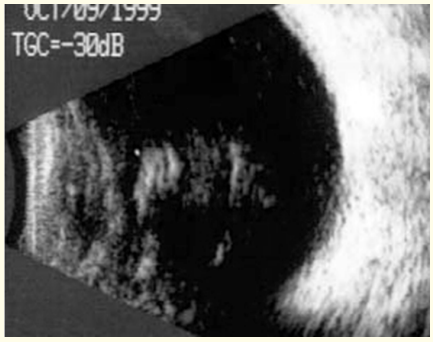

Figure 4: *Vitreous inflammation (Arrows) in a 77-year-old woman with acute postcataract-surgery endophthalmitis. The culture was positive for Staphylococcus aureus.*

The frequency of retinal detachment following vitrectomy was 8% in our study and the incidence of retinal detachment was higher after TAP-technique (15.4%) than after VIT-technique (5.4%) as an initial procedure. Although the incidence of retinal detachment in EVS was also 8.3% after treatment of endophthalmitis, there was no statistically significant difference in frequency based on whether initial management was vitrectomy or tap-biopsy, 7.8% and 9% respectively [14]. These data show that patients who underwent the eradication of the inflamed vitreous (VIT-technique) had about one half the need for additional procedures and almost third the risk for consequent retinal detachment.

Visual acuity

The initial visual acuity in our study correlated positively with the final visual acuity. This result is comparable to the result of EVS, in which the visual outcome following appropriate surgical management was related to different factors; most important is the level of visual function at the time of initial presentation [15].

Overall, there was a notable improvement of visual acuity in our study, with only 20% of patients still having the worst visual acuity < 5/200 after vitrectomy, compared to 84% at the initial presentation. Also, patients who had the best visual acuity of ≥ 20/40 increased obviously from only 2% at the initial presentation to 32% after vitrectomy. Patients enclosed in the EVS reached better final visual acuity: More than half of patients achieved ≥ 20/40 vision, and only 11% of patients had final visual acuity < 5/200 [12]. One possible reason maybe that the EVS had different inclusion and exclusion criteria e.g. cornea and the anterior chamber of the involved eye had to be clear enough to allow visualization of the iris; and to perform pars plana vitrectomy. Cases with initial visual acuity of < 5/200 that achieved final visual acuity of ≥ 20/100 were 50% in VIT-group and 20% in TAP-group. The proportion of severe final visual loss (5/200 or worse acuity) in the EVS was halved from 15% in the TAP-group to 8% in the VIT-group [12].

This supports the priority of VIT-technique in treating patients with the worst initial visual acuity. What was not expected in our study is that patients affected with more virulent microorganisms were not accompanied with worse final visual acuity. That is because 66.6% of gram-negative and 44.4% of other gram-positive microorganisms were isolated from patients who achieved the best final visual acuity of ≥ 20/40, whereas only 27.7% of gram-positive, coagulase-negative microorganisms and 23% of no growth cases accompanied patients who had this final visual acuity. This result is in contrast to the results of EVS, in which the gram-positive, coagulase negative micrococci and no growth group had the best final visual acuity, obtaining visual acuity of ≥ 20/40 in 62% and 55% of eyes, respectively, whereas gram-negative and other gram-positive species micrococci obtained a final visual acuity of ≥ 20/40 in 44% and 29%, respectively [13]. This might be due to the low number of patients in our study (we had only 5 gram-negative from 44 isolates).

There was no obvious difference between patients with or without additional procedures in achieving a final visual acuity. These findings do not support what was reported in EVS, which concluded that patients who underwent additional procedures achieved poorer visual acuity at final follow-up than patients who didn't [10].

None of patients with complication of retinal detachment achieved a final visual acuity of ≥ 20/40 or ≥ 20/100, whereas 34.8% of the patients without retinal detachment achieved visual acuity ≥ 20/40. Similarly, in the EVS, only 27% of patients complicated with retinal detachment achieved 20/40 final visual acuity compared with 55% of patients who did not develop detachment. This means that retinal detachment results in a poor visual outcome.

Conclusion

Culture positivity (74%) and the predominance of gram-positive, coagulase-negative micrococci (54.5%) were comparable to EVS. The combination of vancomycin and ceftazidime was efficient in the treatment of bacterial post cataract-surgery endophthalmitis. Vitreous was more fruitful than aqueous in isolating the offending microorganisms.

Vitrectomy was efficient in improving the visual acuity and VIT-techniqe should be the first choice in treating patients with the worst initial visual acuity.

The positive correlation between initial and final visual acuity makes the initial visual acuity a predicting factor for visual outcome and suggests the urgent treatment.

Treatment procedures have to be chosen individually, but more invasive initial procedures (VIT) may result in less necessity of additional procedures and reduce the complication with retinal detachment which is a risk factor for poor visual outcome.

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