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Endophthalmitis following intravitreal injections at a tertiary center: real-life data on incidence, risk factors, management strategies, and visual outcomes

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Abstract

Purpose To investigate the incidence, contributing factors, management, and long-term outcomes of endophthalmitis following intravitreal injections performed in our clinic.

Methods This retrospective study included all patients who received intravitreal bevacizumab, aflibercept, ranibizumab, or dexamethasone injections between 2019 and 2024 at four retina clinics of Ankara Bilkent City Hospital. Demographic characteristics of the patients, visual acuity, intravitreal injection etiology, comorbidities, and treatments applied were recorded. Patients who received antibiotic prophylaxis after intravitreal injections (IVI) were categorized as Group 1, while those who did not receive prophylaxis were classified as Group 2.

Results A total of 4171 patients and 21,339 intravitreal injections were evaluated. Of the participants, 47.2% were female and 52.8% were male, with a mean age of 66.3 ± 10.3 years (range: 40–98). Group 1 included 13,121 injections (61%), while Group 2 had 8,218 injections (39%). Endophthalmitis was observed in 13 patients (3.0 per 1000 patients—8.1 per 10,000 injections). Patients who developed endophthalmitis had an average of 6.1 ± 4.1 prior injections (range: 2–16), and the mean time to presentation after the last injection was 7.6 ± 3.4 days (range: 2–14). Endophthalmitis cases were distributed as 7 in Group 1 (5.3 per 10,000) and 6 in Group 2 (4.4 per 10,000). The endophthalmitis rate in Group 1 was not statistically significantly different from Group 2 ($p > 0.05$). All patients received vitreous taps and intravitreal vancomycin-ceftazidime injections at initial presentation. Eleven patients (85%) underwent a pars plana vitrectomy within 24 h. The mean follow-up period was 32 ± 20 months, and any case did not require evisceration surgery.

Conclusion Early surgical intervention in cases of endophthalmitis is the most critical approach for preserving the eye and achieving visual rehabilitation. Notably, endophthalmitis was more common in people who got intravitreal bevacizumab or dexamethasone injections, and antibiotic prophylaxis did not appear to reduce the risk of its occurrence.

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Keywords Intravitreal injection, Endophthalmitis, Bevacizumab, Ranibizumab, Aflibercept, Dexamethasone

Introduction

Intravitreal anti-vascular endothelial growth factor (anti-VEGF) agents are the first-line treatment for chorioretinal vascular diseases, including neovascular age-related macular degeneration (nAMD), diabetic macular edema (DME), myopic choroidal neovascularization, and retinal vein occlusion (RVO) [1–6]. Meanwhile, clinicians commonly use intravitreal dexamethasone for inflammatory macular edema, including uveitis, diabetic macular edema, and RVO-associated macular edema [7, 8]. Due to the chronic nature of these diseases, repeated treatments are often required, increasing the risk of complications associated with these invasive procedures.

Infectious endophthalmitis is the most serious complication, given its association with severe, irreversible vision loss and poor prognosis [9]. The incidence ranges from 0.02 to 0.2%; despite the low individual risk, the cumulative risk can rise to 1% after two years due to the frequent repetition of the procedure [1, 10]. The causative microorganisms typically originate from the own flora, such as conjunctiva or eyelid tissues of the patient [11].

The use of povidone-iodine and other precautions helps lower the risk of endophthalmitis by limiting the number of germs that can get into the vitreous during the procedure. The use of masks is also recommended to mitigate the risk of respiratory-source endophthalmitis caused by pathogens such as Streptococcus species. Other contributing factors include blepharitis, contamination of gloves, speculum, surgical drapes, and medications [12, 13].

As the annual number of intravitreal injections continues to increase worldwide, the likelihood of encountering injection-related complications such as endophthalmitis is also rising. Consequently, understanding the incidence, risk factors, and management of post-injection endophthalmitis has become increasingly important in everyday retina practice.

The present study aims to investigate real-world data from a high-volume tertiary retina center regarding the frequency of post-intravitreal injection endophthalmitis, contributing factors, treatment strategies, long-term visual outcomes, and the impact of antibiotic prophylaxis. While previous studies have reported the incidence and risk factors of endophthalmitis following intravitreal injections, many have been limited by a focus on a single agent, smaller sample sizes, or a lack of variability in clinical settings.

In contrast, our study includes multiple anti-VEGF agents as well as dexamethasone implants, reflecting the diversity of real-life clinical practice. Furthermore, the study uniquely evaluates the effect of prophylactic antibiotic use across different physicians with varying prescribing habits, allowing for a natural comparison in a non-randomized yet observationally robust setting. This variability provides valuable insights into a still-debated aspect of intravitreal injection safety and contributes meaningfully to the existing body of literature.

Method

This single-center, cross-sectional, observational study was conducted in the retina department between 2019 and 2024. Approval was obtained from the Ethics Committee of Ankara Bilkent City Hospital (Approval No: TABED 1-24-73), and the study adhered to the principles of the Declaration of Helsinki.

All patients treated and followed up in the retina department who had received intravitreal anti-VEGF agents (bevacizumab, aflibercept, ranibizumab) or intravitreal dexamethasone implants were enrolled. Patient data were retrieved from the hospital information system using the endophthalmitis diagnosis code. Parameters recorded included the agent used during injection, whether antibiotic prophylaxis was administered, the etiology of the injection, and whether bilateral injections were performed on the same day. Patients who received antibiotic prophylaxis after intravitreal injection (IVI) were classified as Group 1, while those who did not receive prophylaxis were classified as Group 2. Endophthalmitis cases were evaluated based on visual acuity, the day of presentation, intravitreal drug used, injection etiology, and treatment modality. The administration of topical antibiotics after IVI was not randomized. In this study, patients managed by physicians who routinely administered antibiotic prophylaxis in clinical practice were compared with those managed by physicians who did not.

The treatment agents included in this study were as follows: ranibizumab (0.5 mg/0.05 mL; Novartis Pharma SAS, Basel, Switzerland), bevacizumab (1.25 mg/0.05 mL; Avastin; Roche, Basel, Switzerland), aflibercept (2 mg/0.05 mL; Eylea; Bayer Pharma AG, Berlin, Germany), and Dexamethasone implant (0.7 mg; Ozurdex; Allergan SAS, Irvine, CA, USA).

Injection technique

A standard injection protocol was applied to all patients in the operating room. 0.5% topical proparacaine hydrochloride. Eyelids and lashes were cleaned with 10% povidone-iodine. A sterile wire lid speculum was placed to retract the eyelashes and 5% povidone-iodine were instilled into the conjunctival sac, and a three-minute

Table 1 The demographic characteristics of both groups

	Group 1 (*n* = 2660)	Group 2 (*n* = 1511)
Age	67.51 ± 10.4 (40–98)	66.95 ± 10.31(40–95)
Female/ male	1256 (47.2%) /1404 (52.7%)	711 (47.0%) /800 (52.9%)
DME-PDR	1418 (50.3%)	772 (51.0%)
nAMD	928 (34.8%)	534 (35.3%)
RVO	314 (11.8%)	205 (13.5%)

DME: Diabetic macular edema, PDR: Proliferative diabetic retinopathy, nAMD: neovascular age-related macular degeneration, RVO: Retinal vein occlusion

Table 2 Incidence of endophthalmitis per 10,000 injections

Incidence type	Cases (*n*)	Total (*N*)	Rate (per 10.000)	95% Confidence Interval
Overall endophthalmitis	13	21,339	8.1	2.8–9.4
Group 1	7	13,121	5.3	1.5–9.2
Group 2	6	8,218	4.4	3.0-11.6

Group 1: Cases received antibiotic prophylaxis

Group 2: Cases did not receive antibiotic prophylaxis

waiting period was observed. Injections were performed using sterile gloves, a drape, and a surgical mask in the operating room. These rooms were laminar flow operating rooms reserved only for intravitreal injections. Unless the specialist preferred a different site, we used the temporal pars plana approach. Retinal artery perfusion was assessed post-injection by checking for hand movement vision.

Aflibercept and bevacizumab were prepared and administered in vials, with bevacizumab occasionally divided among multiple patients.For same-day bilateral intravitreal bevacizumab injections, separate vials were predominantly used. However, during certain time periods, a single vial was occasionally divided and administered to 4–5 patients.Ranibizumab was primarily administered using prefilled syringes (PFS) and rarely by withdrawing from the vial. The dexamethasone intravitreal implant was preloaded in a drug-specific injector for direct administration. Group 1 (the antibiotic prophylaxis group) prescribed topical moxifloxacin drops four times daily for five days post-injection.

Statistical analysis

For statistical evaluation, data were recorded using SPSS 21.0 (IBM Corp.) and MedCalc version 12.3 (MedCalc Software bvba, Inc.). The normality of the data distribution was assessed using the Kolmogrov-Smirnov test. To compare the obtained data, Chi-square tests and paired samples t-tests were employed. Multivariate analysis was also performed to account for potential confounding factors. All evaluations were conducted with a 95% confidence interval, and *p*-value of less than 0.05 was considered statistically significant.

Results

This study evaluated 4171 patients who underwent a total of 21,339 intravitreal injections across four retina clinics at Ankara Bilkent City Hospital between 2019 and 2024. Among the patients, 47.2% ($n = 1967$) were female, and 52.8% ($n = 2204$) were male, with an mean age of 66.3 ± 10.37 years (range, 40–98). Neovascular age-related macular degeneration (nAMD, $n = 8867$), diabetic macular edema (DME) and proliferative diabetic retinopathy (PDR) ($n = 10524$), and retinal vein occlusion (RVO, $n = 1948$) were some of the diagnoses. The demographic characteristics of both groups are summarized in Table 1.

A total of 11,103 eyes received bevacizumab, 4323 received aflibercept, 3893 received ranibizumab, and 2020 received dexamethasone implants. The total number of patients who received intravitreal injections in both eyes on the same day was 3585. Antibiotic prophylaxis was administered in 13,121 injections (61%; Group 1), while 8,218 injections (39%; Group 2) did not receive prophylaxis. Endophthalmitis was observed in 13 eyes of 13 patients, corresponding to an incidence of 3.0 per 1,000 patients or 8.1 per 10,000 injections (Table 2). The average number of prior injections among these patients was 6.1 ± 4.1 (range, 2–16), and the mean age was 65.5 ± 9.9 years (range, 46–82). Of the 13 cases, six were female (46%) and seven were male (54%). Four patients had received bilateral injections on the same day, three of whom received dexamethasone implants, while one received bevacizumab. Any statistically significant difference was not found in the incidence of endophthalmitis between patients who received bilateral injections on the same day and those who received them on different days ($p = 1.0$).

The characteristics of the cases that developed endophthalmitis following intravitreal injection are summarized in Table 3.

The distribution of injection indications among patients who developed endophthalmitis was as follows: diabetic macular edema (10 cases, 77%), nAMD (1 case, 8%), proliferative diabetic retinopathy (1 case, 8%), and RVO (1 case, 8%). In terms of injected agents, six patients received bevacizumab, six received a dexamethasone implant, and one received aflibercept.

Patients presented with symptoms including red eye, ocular pain, decreased vision, and increased floaters, on average, 7.6 ± 3.4 days (range, 2–14) after intravitreal injection. Of these, seven patients presented within 6 days or less, while six patients presented after a week. Among the cases, 54% were phakic, and 46% were pseudophakic. Clinical findings included conjunctival hyperemia, ciliary injection, varying degrees of corneal edema, presence of fibrin and hypopyon in the anterior chamber, and vitreous condensation (Fig. 1).

Table 3 Characteristics of patients who developed endophthalmitis following intravitreal injection

Case	Age (years)	Gender	Eye	Underlying disease	IV Drug	Duration of symptoms (days)	Same day IVI	Antibiotic Prophylaxis	Culture Results
1	46	F	Left	DME	Bevacizumab	2	No	Yes	Negative
2	59	M	Left	DME	Dexamethasone implant	4	No	Yes	Negative
3	64	M	Left	DME	Dexamethasone implant	6	Yes	No	Negative
4	82	M	Left	DME	Dexamethasone implant	6	Yes	No	Negative
5	66	F	Right	DME	Bevacizumab	5	Yes	No	Negative
6	76	M	Right	DME	Bevacizumab	4	No	No	Negative
7	69	F	Left	DME	Dexamethasone implant	8	No	Yes	Negative
8	73	M	Right	DME	Bevacizumab	14	No	Yes	Negative
9	57	M	Left	RVO	Dexamethasone implant	6	No	No	Negative
10	56	M	Left	DME	Dexamethasone implant	5	Yes	No	Negative
11	75	F	Left	DME	Aflibercept	9	No	Yes	Negative
12	56	F	Right	PDR	Bevacizumab	11	No	Yes	Positive
13	73	F	Left	nAMD	Bevacizumab	13	No	Yes	Negative

DME: Diabetic macular edema, nAMD: Neovascular age-related macular degeneration, PDR: Proliferative diabetic retinopathy, RVO: Retinal ven occlusion

Upon clinical diagnosis of infectious endophthalmitis, all patients underwent vitreous tap and bacterial sampling, followed by intravitreal vancomycin (1 mg/0.1 ml) and ceftazidime (2 mg/0.1 ml) injections. In two cases, vitrectomy was not performed because of response to intravitreal and topical antibiotic treatments. Pars plana vitrectomy (PPV) was performed in 11 patients (85%) within 24 h. In four cases, phacoemulsification surgery was conducted simultaneously, with two cases left aphakic. Silicone tamponade was applied in 7 of the 11 cases (64%) following vitrectomy (Table 4).

In cases of endophthalmitis caused by the dexamethasone implant, the implant was removed during vitrectomy. Due to the early stage of the implant, it could not be removed with the ocutome and was extracted from the sclerotomy using forceps (Fig. 2).

Surgical images obtained during pars plana vitrectomy in a case of endophthalmitis following intravitreal injection are presented in Fig. 3.

A multivariate regression analysis was conducted to identify independent risk factors associated with endophthalmitis. None of the variables included in the analysis demonstrated a statistically significant effect ($p > 0.05$). Although bilateral injections administered on the same day showed a positive coefficient, this relationship was not statistically significant ($p = 0.18$) (Table 5).

Visual outcomes

The average best-corrected visual acuity (BCVA) before injection was 0.60 ± 0.70 (LogMAR). On the first day of endophthalmitis presentation, BCVA distribution was reported as follows: light perception in 1 patient (8%), hand motions in 5 patients (38%), BCVA 1.3 ± 0.30 (logMAR) in 5 patients (38%), and BCVA ≥ 0.30 (logMAR) in 2 patients (15%). After an average follow-up of 32 ± 20 months, any case did not require evisceration surgery. Final BCVA at the last follow-up was hand motions in 2 patients and 0.70 ± 0.7 (logMAR) (range, 1.3–0.20) in the remaining cases.

Discussion

In this retrospective study conducted at a tertiary center, endophthalmitis was observed in 13 cases (0.081%) after 21,339 intravitreal injections. Given that each intravitreal injection represents an independent risk exposure for endophthalmitis, the analysis was conducted at the injection level. In cases where patients received bilateral injections or multiple injections over time, endophthalmitis occurred following only one specific injection, while other injections remained uneventful. Our study presents real-life data from patients who received intravitreal injections under the same standard conditions at a single center, with a higher number of injections.

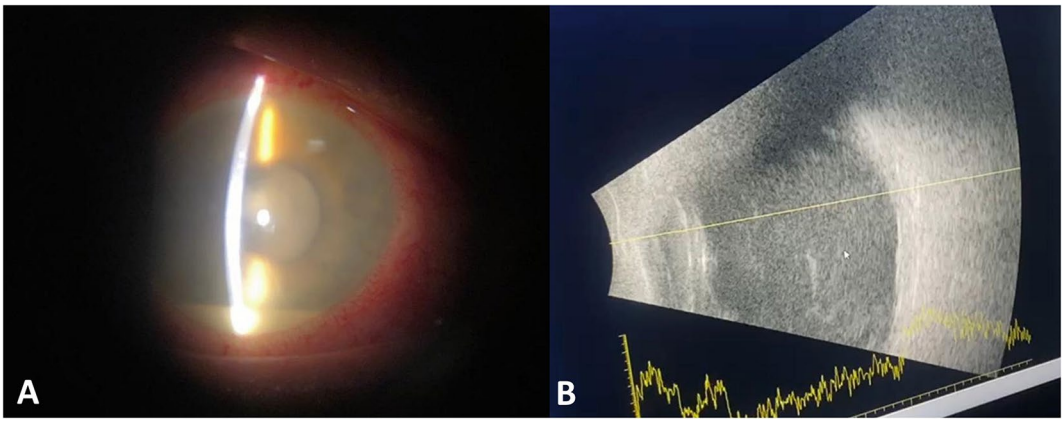

Fig. 1 Conjunctival hyperemia, ciliary injection, and hypopyon in the anterior chamber of a patient who developed endophthalmitis after a dexamethasone implant (**A**) and hyperechoic dense vitreous condensation compatible with endophthalmitis on B-scan ultrasonography (**B**)

Table 4 Visual acuity (LogMAR) before and after intravitreal injection and management

Case	VA Before IVI	VA After IVI	Management	Last Check VA
1	HM	HM	IV Vanco + zidim + PPV + Silicon	HM
2	0.3	0.3	IV Vanco + zidim + PPV + Silicon	0.3
3	0.4	HM	IVVanco + zidim + PPV + Phaco-IOL + Silicon	1.6
4	0.7	1.0	IV Vanco + zidim + PPV + Silicon	0.8
5	1.3	LP	IV Vanco + zidim + PPV + Phaco + Silicon	1.3
6	1.3	HM	IV Vanco + zidim + PPV + Silicon	0.7
7	0.4	HM	IV Vanco + zidim + PPV + Silicon	1.3
8	0.6	1.3	IV Vanco + zidim	0.6
9	1.0	1.3	IV Vanco + zidim + PPV	1.0
10	0.2	0.6	IV Vanco + zidim + PPV	0.6
11	1.3	HM	IV Vanco + zidim	0.3
12	0.2	0.2	IV Vanco + zidim + PPV	0.1
13	0.6	0.4	IV Vanco + zidim + PPV + Phaco	0.2

VA: Visual Acuity, IVI: Intravitreal injection, HM: Hand motions, LP: Light perception, IV Vanco + zidim: Intravitreal vancomycin and ceftazidime, PPV: Pars plana vitrectomy, Phaco: Phacoemulsification, IOL: Intraocular lens

Intravitreal injections are frequently used in the treatment of retinal diseases. Although they are a quick and relatively simple procedure, complications such as retinal tears, detachments, cataracts, inflammation, and endophthalmitis—potentially resulting in vision loss—can occur [9].

The reported per-prosedure incidence of endophthalmitis following intravitreal injection of anti-VEGF agents ranges from 0.02 to 0.08 [1, 14–16]. The largest study reporting the rates of endophthalmitis following anti-VEGF injections, a meta-analysis by Fileta et al., which reviewed 43 studies, identified 197 cases of endophthalmitis out of 350,535 intravitreal injections, resulting in an overall incidence rate of 0.056% [17]. Another study by Dossarps et al. reported an endophthalmitis incidence of 0.021% after 316,576 intravitreal injections [18]. Brynskov et al. did not report any case of endophthalmitis after 20,293 intravitreal injections [19], while another study found an incidence of 0.039% [20]. Overall, the incidence of endophthalmitis observed in our study is consistent with the rates reported in the literature.

Storey et al. reported that antibiotic use did not affect endophthalmitis development [21]. Similarly, Benoist et al. did not find any significant relationship between antibiotic prophylaxis and the development of

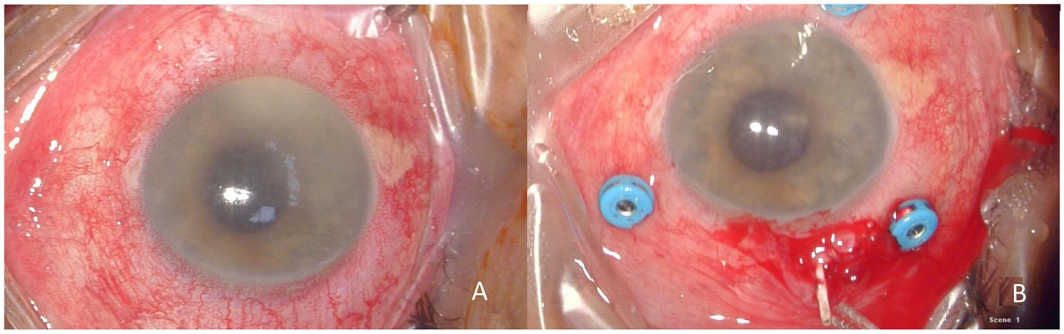

Fig. 2 Intraoperative view of a pseudophakic patient who developed endophthalmitis following a Dexamethasone implant (**A**) and removal of the Dexamethasone implant through the sclerotomy site (**B**)

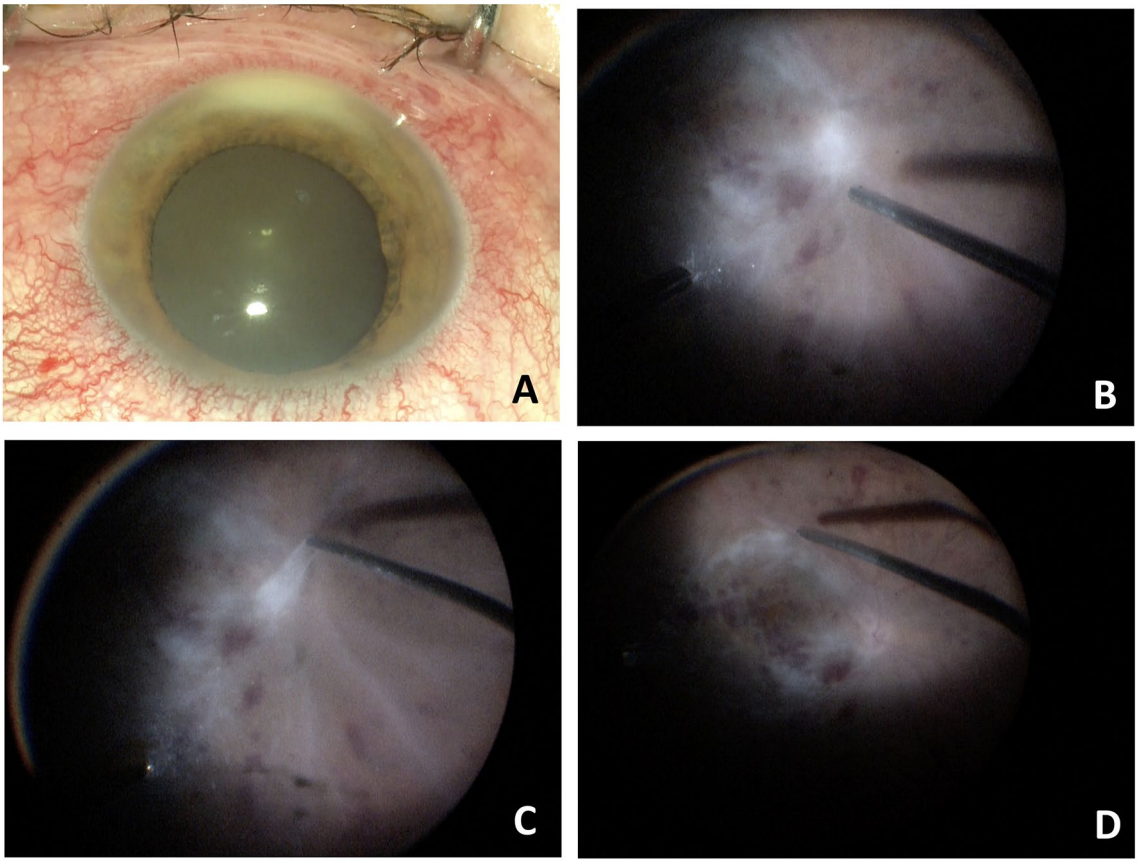

Fig. 3 Photographs during vitrectomy surgery of a case who developed endophthalmitis after intravitreal injection. Ciliary injection and hypopyon (**A**), the appearance of retinal hemorrhage and infiltrates before and after posterior hyaloid separation (**B, C**), and ghost vessels in the retinal vascular structures suggestive of occlusion (**D**)

Table 5 Multivariate analysis of risk factors associated with endophthalmitis

Variable	Coefficient	*p*-value
Same day IVI	0.00103	0.18
Right eye	-0.00053	0.37
Left eye	-0.00048	0.42
Age	$5.73*10^{-6}$	0.75
Gender	$-9.25*10^{-5}$	0.78
Group	$-8.06*10^{-5}$	0.85

IVI: Intravitreal injection

endophthalmitis after intravitreal injection [22]. Cheung et al. also did not observe any significant difference in the incidence of endophthalmitis between patients who received topical antibiotics and those who did not [23]. In line with our results, Costa et al. did not report any difference in the development of endophthalmitis between the groups that received antibiotic prophylaxis and those that did not [20]. The results of our study prove that the use of antibiotics after intravitreal injection does not have an additional contribution to the prevention of endophthalmitis.

The literature includes investigations into the risk of endophthalmitis associated with different intravitreal injection drugs. VanderBeek et al. reported a higher rate of endophthalmitis after intravitreal steroid injections compared to anti-VEGF agents [24]. Another study found that the incidence of endophthalmitis was more pronounced following bevacizumab injections [20]. However, Rayess et al. found that ranibizumab, bevacizumab, and aflibercept did not significantly alter the risk of developing endophthalmitis. In the same study, the risk of endophthalmitis after aflibercept, bevacizumab, and ranibizumab was reported as 0.035%, 0.039%, and 0.035%, respectively [25]. In our study, endophthalmitis occurred more frequently in patients who received bevacizumab and dexamethasone implant compared to those who received aflibercept. The vial form and splitting of the drug may contribute to the increased risk associated with bevacizumab. Bilateral injections on the same day may increase the risk of endophthalmitis in the dexamethasone implant scenario. Any case of endophthalmitis was not observed in patients treated with ranibizumab, likely due to the use of the pre-filled syringe (PFS) form of ranibizumab. At that time, ranibizumab was the only

PFS commercially available in Turkey. Packaging prefilled syringes in a single-use, sterile, sealed tray with a sterile cap eliminates several steps in drug preparation. The prefilled sterile drug delivery system decreases the likelihood of contamination during preparation, thereby decreasing the risk of endophthalmitis [26].

Bevacizumab is used as an off-label drug for the treatment of chorioretinal vascular diseases. It undergoes an additional compounding step in pharmacies, where it is repackaged into syringes for individual use. In anti-VEGF injections, these extra steps during drug preparation from the vial introduce the potential for contamination, thereby increasing the risk of endophthalmitis. In our clinic, we prepare bevacizumab from a vial, and at times, we even divide it among multiple patients from a single vial. We recommend using prefilled bevacizumab provided by a compounding pharmacy to reduce the risk of bevacizumab-associated endophthalmitis.

It is difficult to compare post-cataract surgery endophthalmitis with endophthalmitis following intravitreal injections, as the surgical settings and risk factors differ significantly. Cataract surgery involves larger incision sites, a longer procedural duration, and typically includes the administration of both intracameral and topical antibiotics postoperatively. Post-cataract surgery endophthalmitis is typically an acute infection caused by intraocular contamination during the procedure. The risk of this type of endophthalmitis is closely linked to surgical techniques, sterilization protocols, and the use of prophylactic antibiotics. The study conducted by Ong et al. revealed that the absolute risk of developing endophthalmitis is similar between cataract surgery (0.016%) and intravitreal injections (0.024%) [27]. In contrast, endogenous endophthalmitis arises from hematogenous spread of a systemic infection and is more frequently seen in immunocompromised individuals, diabetic patients, or those with a history of intravenous drug use. Recent studies have highlighted that systemic infections and immunosuppressive conditions significantly increase the risk of endogenous endophthalmitis. In their review, Markan et al., emphasize that both fungal and bacterial pathogens are implicated in the etiology of endogenous endophthalmitis in patients who have had COVID-19 infection and received high-dose steroid therapy. They underline the critical importance of early diagnosis and timely intervention in improving clinical outcomes in these vulnerable patients [28].

In our study, 77% of patients who developed endophthalmitis after IVI had diabetes. Both diabetes and advanced age are conditions associated with relative immunosuppression. Previous studies have reported higher rates of endophthalmitis in patients receiving corticosteroid injections. The rate of endophthalmitis following corticosteroid injections is 0.13%, compared to 0.019% after anti-VEGF agents. The immunosuppressive effects of corticosteroids, which may lower the bacterial load needed to cause infection, likely play a multifactorial role in this increased rate. Additionally, the dexamethasone implant needle could allow more bacteria to enter the larger wound tract [24, 29–30].

Although the available evidence in the literature comparing tap and injection or early vitrectomy in the management of endophthalmitis developing after intravitreal injections is insufficient to determine the optimal treatment strategy, we believe that early vitrectomy plays a crucial role in both protecting the eye and providing visual rehabilitation [31].

Patients with endophthalmitis presented to our clinic an average of 7.0 ± 3.7 days (range: 2–14 days) after their last intravitreal injection. The slightly delayed presentation is likely due to our status as a referral center for patients from distant cities, resulting in time lost during transportation. We also think that patients who received dexamethasone implants may present later due to fewer pain complaints.

Delayed presentation is a well-established risk factor for poor visual outcomes in post-intravitreal injection endophthalmitis. Several studies have demonstrated that early recognition and intervention significantly improve prognosis. In our cohort, the ~7-day average delay contrasts with findings in other series: A study by Dossarps et al. reported a median time from injection to presentation of 4 days (range: 1–26 days) in post-intravitreal injection endophthalmitis cases. The most common symptom was vision loss. The study emphasized that earlier presentation was associated with better visual outcomes [18].

These findings underscore the importance of prompt recognition and treatment of endophthalmitis to preserve visual function. Compared to these studies, longer average delay of our cohort may reflect real-world challenges in patient access to care and awareness, potentially contributing to variations in visual outcomes.

The limitations of our study include its retrospective design, which may have introduced errors due to missing data, as it was based on medical records. Additionally, it was not possible to control for confounding factors. While this design represents the main limitation of our work, the study offers real-life data on intravitreal injections performed at a high-volume tertiary center under standardized clinical conditions. All injections were administered by physicians trained in a uniform injection protocol and performed using sterile drapes, surgical masks, caps, sterile gloves, and surgical gowns. In this regard, the study closely mirrors current IVI practices and provides a valuable opportunity for retina specialists to retrospectively evaluate their clinical outcomes in real-world settings. Clinical parameters such as the severity of

blepharitis were not routinely documented in the electronic records. Furthermore, adherence to prescribed antibiotic prophylaxis (e.g., moxifloxacin) could not be confirmed. Given that all patients received moxifloxacin, the findings should be interpreted within the scope of this particular antibiotic. There was no randomization in the topical antibiotics given after IVI. However, one independent retina expert administered antibiotics to every patient after the injection, whereas the other did not.

In summary, although aseptic intravitreal injection techniques may vary regionally and globally, the use of povidone–iodine remains a critical agent for reducing bacterial colonization and the risk of endophthalmitis. Our study demonstrated that early surgical intervention in cases of endophthalmitis following intravitreal injection is crucial for preserving the eye and achieving visual rehabilitation. Additionally, same-day bilateral intravitreal anti-VEGF injections present a low rate of complications and are well tolerated by patients. The results of this study indicate that the use of antibiotics after intravitreal injection does not contribute significantly to the prevention of endophthalmitis. Given the higher rate of endophthalmitis in diabetic patients, PFS injections may be preferred in these individuals. Lastly, as the frequency of IVI procedures continues to rise, identifying effective, standardized practices that reduce the risk of endophthalmitis remains a priority.

Abbreviations

Anti-VEGF	Vascular endothelial growth factor
BCVA	Best-corrected visual acuity
DME	Diabetic macular edema
IVI	İntravitreal injection
nAMD	neovascular age-related macular degeneration
PDR	Proliferative diabetic retinopathy
PFS	Prefilled syringes
PPV	Pars plana vitrectomy
RVO	Retinal vein occlusion

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Author contributions
S.Ç, Y.Y.T, M.Ö, B.G wrote the main manuscript text and prepared Figs. 1, 2 and 3 and M.Ş, C.Ç,Ö.M.B, M.A.Y, Y.T, M.N.A, Z.Y manuscript editing and consultants to the procedure. All authors reviewed the manuscript.

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Data availability
If requested, all data generated or analyzed during this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate
The study was approved by the Ethics Committee of Ankara Bilkent City Hospital and was conducted in accordance with the declaration of Helsinki. Informed consent was obtained from all participant.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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