Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

AMERICAN ACADEMY OF OPHTHALMOLOGY®

The Influence of Universal Face Mask Use on Endophthalmitis Risk after Intravitreal Anti–Vascular Endothelial Growth Factor Injections

*Writing committee for the Post-Injection Endophthalmitis Study Group**
Samir N. Patel, MD,[1] Peter H. Tang, MD, PhD,[2] Philip P. Storey, MD, MPH,[3] Jeremy D. Wolfe, MD,[4] Jordana Fein, MD,[5] Sumit P. Shah, MD,[6] Eric Chen, MD,[7] Ashkan Abbey, MD,[8] Philip J. Ferrone, MD,[9] Chirag P. Shah, MD,[10] Michelle C. Liang, MD,[11] Maxwell S. Stem, MD,[12] M. Ali Khan, MD,[1] Yoshihiro Yonekawa, MD,[1] Sunir J. Garg, MD[1]

Purpose: Routine use of face masks for patients and physicians during intravitreal anti–vascular endothelial growth factor (VEGF) injections has increased with the emergence of the coronavirus disease 2019 pandemic. This study evaluates the impact of universal face mask use on rates and outcomes of post-injection endophthalmitis (PIE).

Design: Retrospective, multicenter, comparative cohort study.

Participants: Eyes receiving intravitreal anti-VEGF injections from October 1, 2019, to July 31, 2020, at 12 centers.

Methods: Cases were divided into a "no face mask" group if no face masks were worn by the physician or patient during intravitreal injections or a "universal face mask" group if face masks were worn by the physician, ancillary staff, and patient during intravitreal injections.

Main Outcome Measures: Rate of endophthalmitis, microbial spectrum, and visual acuity (VA).

Results: Of 505 968 intravitreal injections administered in 110 547 eyes, 85 of 294 514 (0.0289%; 1 in 3464 injections) cases of presumed endophthalmitis occurred in the "no face mask" group, and 45 of 211 454 (0.0213%; 1 in 4699) cases occurred in the "universal face mask" group (odds ratio [OR], 0.74; 95% confidence interval [CI], 0.51–1.18; $P = 0.097$). In the "no face mask" group, there were 27 cases (0.0092%; 1 in 10 908 injections) of culture-positive endophthalmitis compared with 9 cases (0.004%; 1 in 23 494) in the "universal face mask" group (OR, 0.46; 95% CI, 0.22–0.99; $P = 0.041$). Three cases of oral flora–associated endophthalmitis occurred in the "no face mask" group (0.001%; 1 in 98 171 injections) compared with 1 (0.0005%; 1 in 211 454) in the "universal face mask" group ($P = 0.645$). Patients presented a mean (range) 4.9 (1–30) days after the causative injection, and mean logarithm of the minimum angle of resolution (logMAR) VA at endophthalmitis presentation was 2.04 (~20/2200) for "no face mask" group compared with 1.65 (~20/900) for the "universal face mask" group ($P = 0.022$), although no difference was observed 3 months after treatment ($P = 0.764$).

Conclusions: In a large, multicenter, retrospective study, physician and patient face mask use during intravitreal anti-VEGF injections did not alter the risk of presumed acute-onset bacterial endophthalmitis, but there was a reduced rate of culture-positive endophthalmitis. Three months after presentation, there was no difference in VA between the groups. *Ophthalmology 2021;128:1620-1626 © 2021 by the American Academy of Ophthalmology*

Supplemental material available at www.aaojournal.org.

Although intravitreal anti–vascular endothelial growth factor (VEGF) injections are used for the treatment of many retinal diseases, acute-onset bacterial endophthalmitis remains a potentially devastating complication.[1] Numerous studies have evaluated potential risk factors associated with post-injection endophthalmitis (PIE).[2-6] Universal face mask precautions to lower the transmission of the coronavirus through respiratory droplets have been established for the safety of patients, ancillary staff, and physicians.[7,8] It is hypothesized that face mask use may not only lower the spread of the coronavirus but also alter the risk of PIE.[7,8]

Prior studies involving simulated intravitreal injections suggest that face mask use by physicians may reduce bacterial dispersion associated with speech.[9,10] In contrast, one study of 483 622 intravitreal injections found that physician face mask use did not influence the overall risk of PIE compared with a "no talking" policy, although it may

https://doi.org/10.1016/j.ophtha.2021.05.010
ISSN 0161-6420/21

reduce oral flora–associated endophthalmitis.[11] It is unknown how patient face mask use or a combination of physician, ancillary staff, and patient face mask use alters PIE risk. Recently, experimental investigations have suggested that patient face mask use during intravitreal injections may direct bacterial dispersion and expiratory airflow toward the eye, which could potentially increase the risk of PIE.[12-14] Despite these findings, it is unclear if these changes in face mask protocols alters the clinical risk of PIE. This lack of data is particularly relevant given the routine use of face mask for patients and ophthalmologists during intravitreal injections.[15] The purpose of this study is to evaluate the rates and outcomes of PIE with a universal face mask policy compared with no face mask use by physicians, ancillary staff, and patients.

Methods

This retrospective, multicenter, comparative cohort study received approval from the Institutional Review Board at Wills Eye Hospital. Data were collected in accordance with Health Insurance Portability and Accountability Act of 1996 guidelines, and the study conformed to the tenets of the Declaration of Helsinki.

Data Collection

Across all participating centers, patients who developed endophthalmitis after anti-VEGF injections were identified through billing and clinical records. The total number of intravitreal injections, type of anti-VEGF injection used, gender, and age were obtained from each center. De-identified endophthalmitis data included date of causative injection; face mask use; date of endophthalmitis treatment; best available visual acuity (VA) based on the better of pinhole testing or habitual correction before causative injection, at the time of tap and antibiotic injection or vitrectomy, at 3 months postprocedure, and at last follow-up; and microbial culture results. Face mask policies for each participating center including dates of physician face mask use, patient face mask use, and taping of face masks were obtained.

Inclusion and Exclusion Criteria

All patients diagnosed with presumed PIE after an intravitreal injection of bevacizumab, ranibizumab, or aflibercept were included in this study. Patients who underwent treatment with intravitreal brolucizumab or intravitreal steroids (triamcinolone or dexamethasone intravitreal implant) were excluded. Dates of inclusion were October 1, 2019, to July 31, 2020. Cases of endophthalmitis were defined by the decision of the treating physician to inject intravitreal antibiotics, either during a tap and inject procedure or during pars plana vitrectomy. Culture-positive endophthalmitis was defined as any patient with bacterial growth on culture from a vitreous or anterior chamber tap. Endophthalmitis was categorized as culture-negative based on negative final culture results.

Intravitreal Injection Protocol

Across all 12 clinical sites, all injections were performed in office-based settings, and all eyes were initially prepped with a topical anesthetic and topical povidone-iodine based on the routine of the injecting physician. Each physician determined use of subconjunctival lidocaine, viscous lidocaine hydrochloride ophthalmic gel, manual lid retraction or use of a bladed lid speculum, conjunctival displacement before injection, and location of injection site. Injection techniques and protocols were similar during the study period.

Face Mask Classification

For the "universal face mask" group, physicians and ancillary staff wore a face mask of the wearer's preference when administering an intravitreal injection. In addition, the patient wore a face mask of the patient's preference when receiving an intravitreal injection. For a subset of patients, adhesive tape was used to secure the entire top portion of the patient's face mask. The date of "universal face mask" policy was determined by the individual clinical sites, though all centers incorporated a universal face mask policy between March and May 2020.

For the "no face mask" group, physicians and patients did not wear a face mask when administering an intravitreal injection.

Endophthalmitis Treatment Protocol

Any patient who presented with presumed infectious endophthalmitis immediately underwent treatment at the discretion of the treating physician. In general, patients underwent either a pars plana vitreous tap with aspiration or anterior chamber paracentesis with injection of intravitreal antibiotics or immediate pars plana vitrectomy with vitreous culture and intravitreal antibiotics. Antibiotic treatments included intravitreal vancomycin (1 mg/0.1 ml) and intravitreal ceftazidime (2 mg/0.1 ml or 2.5 mg/0.1 ml). In cases in which a patient had a suspected penicillin allergy, intravitreal amikacin (400 μg/0.1 ml) was substituted for ceftazidime at the discretion of the treating physician. A subset of patients underwent vitreous or anterior chamber tap but did not have microbiologic specimens sent for processing if they were treated at a satellite office without immediate access to a microbiologic facility.

Statistical Analysis

The primary outcome for this study was the rate of presumed acute-onset bacterial endophthalmitis after intravitreal injection in the "universal face mask" group compared with the "no face mask" group. The secondary outcomes included rate of culture-positive endophthalmitis, rate of oral-flora endophthalmitis, VA, and microbial spectrum of culture-positive cases. Snellen VA was converted to logarithm of the minimum angle of resolution (logMAR) equivalent for the purpose of statistical analysis as established by prior studies.[16,17] Univariate relationships between the groups were evaluated without adjustment for other covariates using Pearson's chi-square test or Fisher exact test for categorical variables and 2-sample t test, Mann–Whitney U test, or analysis of variance with a Tukey's honest significant difference post hoc test for continuous variables. Statistical significance was considered to be a 2-sided P value < 0.05. All data were analyzed using statistical software (IBM SPSS 25 Statistics).

Results

During the study period, a total of 505 968 intravitreal anti-VEGF injections (120 532 bevacizumab, 187 539 ranibizumab, and 197 897 aflibercept) in 110 547 eyes were performed. Overall, 130 cases of presumed endophthalmitis after intravitreal injection were identified (0.026%; 1 in 3892 injections), and cultures were available in 116 of 130 (89.2%) of these cases.

Across all 12 centers, universal policies for physician, ancillary staff, and patient face mask use were instituted between March 18, 2020, and May 19, 2020. At 3 of 12 centers, policies to secure the entire top portion of the patient's face mask with adhesive tape

before an intravitreal injection were instituted between May 1, 2020, and June 14, 2020.

Endophthalmitis Incidence

In the "no face mask" group, presumed endophthalmitis occurred in 85 of 294 514 injections (0.0289%; 1 in 3464 injections) in 56 692 eyes, of which 27 were culture-positive (0.0092%; 1 in 10 908 injections) (Table 1). The most common causative organism was *Staphylococcus epidermidis,* which occurred in 11 cases. There were 3 cases of oral flora−associated endophthalmitis (0.0010%; 1 in 98 171 injections), and causative organisms included 2 cases of *Enterococcus* faecalis and 1 case of *Streptococcus mitis*.

In the "universal face mask" group, presumed endophthalmitis occurred in 45 of 211 454 injections (0.0213%; 1 in 4699 injections) in 53 855 eyes, of which 9 were culture-positive (0.0040%; 1 in 23 494 injections) (Table 1). Causative organisms included 3 cases of *S. epidermis*, 3 cases of coagulase-negative *Staphylococcus*, 1 case of *Staphylococcus* lugdenensis, and 1 case of *Pseudomonas*. There was 1 case of oral flora−associated endophthalmitis (0.00050%; 1 in 211 454 injections), which was *Enterococcus* faecalis.

In the "universal face mask" group, 18 602 of 211 454 (9%) injections were administered under a policy in which tape was used to secure the top portion of the patient's face mask. With this protocol, presumed endophthalmitis occurred in 4 cases (0.021%; 1 in 4650 injections), of which 1 case was culture-positive (0.005%; 1 in 18 602 injections). No cases of oral flora−associated endophthalmitis occurred in this subgroup.

When comparing the "universal face mask" group and "no face mask" group, there was no difference in the primary outcome of risk of presumed endophthalmitis between the 2 groups (odds ratio [OR], 0.74; 95% confidence interval [CI], 0.51−1.18; $P = 0.097$). However, there was a decreased risk in the secondary outcome of culture-positive endophthalmitis between the 2 groups (OR, 0.46; 95% CI, 0.22−0.99; $P = 0.041$). Furthermore, there was no difference in risk of oral flora−associated endophthalmitis between the 2 groups (OR, 0.46; 95% CI, 0.05−4.46; $P = 0.645$).

Baseline Endophthalmitis Presentation

Patients with presumed endophthalmitis presented a mean (standard deviation [SD]) of 4.9 (4.8) days after intravitreal anti-VEGF injection (range, 1−30 days). Patients in the "universal face mask" group presented a mean (SD) of 5.2 (5.7) days after injection compared with a mean (SD) of 4.7 (4.2) days in the "no face mask" group ($P = 0.566$). The median (range) number of injections until endophthalmitis developed was 23 injections (range, 1−116). In the no face mask group, eyes received a mean (SD) 29.73 (26) injections before endophthalmitis diagnosis compared with 29.78 (28) injections for the face mask group ($P = 0.99$). An intravitreal tap with intravitreal antibiotic injection was performed in 125 of 130 (96%), and 5 of 130 (4%) cases underwent immediate pars plana vitrectomy.

Patients were followed for an average of 6.2 months (range, 6 days to 12.0 months) after endophthalmitis treatment, and mean (SD) follow-up for patients in the "no face mask" group was 8.3 (2.9) months compared with 2.70 (1.3) months for the "universal face mask" group ($P < 0.001$).

Of the 116 endophthalmitis cases sent for culture, 78 of 85 (92%) were from the "no face mask" group, and 38 of 45 (84%) were from the "universal face mask" group ($P = 0.239$). Forty-three of 78 (55%) microbiologic specimens in the "no face mask" group were anterior chamber aspirates compared with 23 of 38 (61%) from the "universal face mask" group ($P = 0.58$). In the "universal face mask" group, 9 of 38 (24%) cases were culture-positive compared with 27 of 78 (35%) endophthalmitis cases in the "no face mask" group ($P = 0.379$). Endophthalmitis cases in the "universal face mask" group were oral flora associated in 1 of 38 (3%) cases compared with 3 of 78 (4%) cases for the "no face mask" group ($P > 0.99$).

Endophthalmitis Risk by Drug Type

Of the 294 514 injections in the "no face mask" group, 67 482 (23%) were bevacizumab, 119 278 (40%) were aflibercept, and 107 754 (37%) were ranibizumab. Of the 211 454 injections in the "universal face mask" group, 53 050 (25%) were bevacizumab, 78 619 (37%) were aflibercept, and 79 785 (38%) were ranibizumab. Overall, endophthalmitis cases occurred after intravitreal injection of ranibizumab in 36 of 187 539 (0.02%; 1 in 5209 injections) injections, aflibercept in 68 of 197 897 (0.03%; 1 in 2910 injections) injections, and bevacizumab in 26 of 120 532 (0.02%; 1 in 4635 injections) injections ($P = 0.03$). There was no difference in endophthalmitis risk between the "universal face mask" group and "no face mask" group based on drug type (Table 2).

Visual Outcomes

Overall mean (SD) VA at the causative injection was logMAR 0.6 (0.65) (~20/80) with no significant difference between the "universal face mask" group (logMAR 0.53; ~20/70) and the "no face mask" group (logMAR 0.64; ~20/90, $P = 0.346$) (Table 3).

Mean (SD) VA at endophthalmitis presentation for presumed endophthalmitis cases was logMAR 1.65 (0.95) (~20/900) in the "universal face mask" group compared with logMAR 2.04 (0.77) (~20/2200) in the "no face mask" group ($P = 0.022$). At 3 months follow-up, mean VA was logMAR 1.01 (~20/200) for the "universal face mask" group versus logMAR 1.07 (~20/240) for the "no face mask" group ($P = 0.764$). At last follow-up, mean VA was logMAR 1.02 (~20/210) for the "universal face mask" group versus logMAR 1.10 (~20/240) for the "no face mask" group ($P = 0.650$).

Mean (SD) VA at endophthalmitis presentation for culture-positive endophthalmitis cases was logMAR 1.43 (1.21) (~20/600) in the "universal face mask" group compared with logMAR 1.90 (0.83) (~20/1600) in the "no face mask" group ($P = 0.204$). At 3 months follow-up, mean (SD) VA for culture-positive endophthalmitis cases was logMAR 1.09 (1.0) (~20/250) in the "universal face mask" group compared with logMAR 0.87 (0.79) (~20/150) in the "no face mask" group ($P = 0.544$).

Discussion

This study evaluated the influence of a universal face masking policy (physician, ancillary staff, and patient face mask use) on the rates and outcomes of endophthalmitis after intravitreal anti-VEGF injections. As a result of the coronavirus disease 2019 pandemic, there has been interest in understanding whether face mask use alters the risk of PIE as universal precautions have been established for both patients and healthcare personnel.[7,8] In our study involving 12 institutions across the United States, we evaluated 505 968 intravitreal anti-VEGF injections with confirmation of endophthalmitis diagnosis and clinical course. The difference in presumed endophthalmitis rates between injections administered with a universal face masking policy compared with no face mask policy was not statistically

Table 1. Rates of Endophthalmitis after Intravitreal Anti-Vascular Endothelial Growth Factor Injection in the "No Face Mask" Group Compared with "Universal Face Mask" Group

	Injections Administered with No Face Mask N = 294 514	Injections Administered with Universal Face Masking N = 211 454	Odds Ratio (95% CI)	*P* Value
Presumed endophthalmitis, N (%)	85 (0.0289%) 1 in 3464 injections	45 (0.0213%) 1 in 4699 injections	0.74 (0.51–1.18)	0.097
Culture-positive endophthalmitis, N (%)	27 (0.0092%) 1 in 10 908 injections	9 (0.0040%) 1 in 23 494 injections	0.46 (0.22–0.99)	**0.041**
Oral flora–associated endophthalmitis, N (%)	3 (0.0010%) 1 in 98 171 injections	1 (0.0005%) 1 in 211 454 injections	0.46 (0.048–4.46)	0.645

CI = confidence interval; N = number.
Boldface indicates statistical significance.

significant. However, injections administered with a universal face mask policy were associated with significantly lower rates of culture-positive endophthalmitis.

Prior studies have suggested that physician face mask use may reduce bacterial dispersion associated with speech in simulated scenarios;[9,10] however, no differences were observed in a recent clinical study.[11] With regard to patient face mask use, previous studies have suggested that patient face mask use during intravitreal injections may direct air, and subsequently bacteria, toward the treatment eye.[12,13] These findings may suggest that, under certain scenarios, patient face mask use may paradoxically increase the risk for PIE. However, it is unknown if these alterations in expiratory airflow and possibly bacterial dispersion around an intravitreal injection site alter the risk of PIE in a clinical setting. In this study, we found that, at a minimum, there was no increased risk of PIE with a universal face mask policy that included physician, staff, and patient face mask use.

A particular concern for increased expiratory airflow directed toward the eye with patient face mask use is the increased risk for oral flora–associated endophthalmitis. Indeed, prior studies have suggested that securing the superior portion of a patient's face mask with tape may reduce bacterial dispersion or air particles toward the eye.[13,14] At 3 of 12 centers involved in our study, adhesive tape was used to secure the entire top portion of the patient's face mask such that 18 602 of 211 454 (9%) of injections in the "universal face mask" group were administered with this policy. Our findings suggest no difference in endophthalmitis risk with this additional measure. However, no cases of oral flora endophthalmitis were observed in this subgroup. Given the devastating visual prognosis of oral flora–associated endophthalmitis, taping the superior portion of a patient's face mask may still be a clinically relevant prophylaxis measure; however, our study was underpowered to specifically address this question.

Economic considerations for universal face masking also should be considered. If presumed endophthalmitis risk is reduced from 0.0289% in the "no face mask" group to 0.0213% in the "universal face mask" group, then approximately 13 158 patients would need to be treated with a universal face mask policy to avoid 1 additional case of endophthalmitis and prevent a visual decline from 20/70 at

Table 2. Rates of Endophthalmitis after Intravitreal Anti-Vascular Endothelial Growth Factor Injection in the "No Face Mask" Group Compared with "Universal Face Mask" Group Based on Medication Type

Medication Type		Injections Administered with No Face Mask N = 294 514	Injections Administered with Universal Face Masking N = 211 454	Odds Ratio (95% CI)	*P* Value
Bevacizumab (N = 120 532)	Presumed endophthalmitis, N (%)	18 (0.027%) 1 in 3749 injections	8 (0.015%) 1 in 6631 injections	0.57 (0.25–1.30)	0.174
Ranibizumab (N = 187 539)	Presumed endophthalmitis, N (%)	23 (0.021%) 1 in 4685 injections	13 (0.016%) 1 in 6137 injections	0.76 (0.39–1.51)	0.435
Aflibercept (N = 197 897)	Presumed endophthalmitis, N (%)	44 (0.037%) 1 in 2711 injections	24 (0.031%) 1 in 3276 injections	0.83 (0.50–1.36)	0.828

CI = confidence interval; N = number.

Table 3. Visual Acuity Outcomes for Endophthalmitis after Intravitreal Anti-Vascular Endothelial Group Factor Injection in the "Universal Face Mask" Group versus "No Face Mask" Group

	Universal Face Mask Group (N = 45)	"No Face Mask" group (N = 85)	P Value
Mean (SD) logMAR VA at causative injection	0.53 (0.52)	0.64 (0.70)	0.346
Mean (SD) logMAR VA at endophthalmitis presentation	1.65 (0.95)	2.04 (0.77)	**0.022**
Average lines of Snellen VA lost at endophthalmitis presentation from causative injection	11.2	13.9	0.117
Mean (SD) logMAR VA at 3 mos	1.01 (0.80)	1.07 (0.90)	0.764
Mean (SD) logMAR VA at last follow-up	1.02 (0.81)	1.10 (1.0)	0.650

logMAR = logarithm of the minimum angle of resolution; N = number; SD = standard deviation; VA = visual acuity.
Boldface indicates statistical significance.

causative injection to 20/200 at 3 months after treatment. Furthermore, with regard to potential vision benefit for endophthalmitis cases, visual outcomes after endophthalmitis were similar in the "universal face mask" group compared with the "no face mask" group. Although VA at the time of the causative injection was similar between the 2 groups, eyes in the "no face mask" group were more likely to present with worse VA at the time of endophthalmitis presentation. This may be driven by the increased number of culture-positive endophthalmitis cases, which had worse outcomes; however, visual outcomes at 3 months after treatment were similar between the 2 groups.

Overall endophthalmitis risk was higher with intravitreal aflibercept compared with intravitreal ranibizumab or intravitreal bevacizumab. Prior studies have reported an increased risk of sterile intraocular inflammation after intravitreal aflibercept injection, although no clustered spikes were reported during the study period.[18,19] The authors' standard practice is to have a low threshold to administer intravitreal antibiotics whenever the treating physicians believe that a case could represent infectious endophthalmitis. However, any patient only treated with topical steroids without additional interventions was excluded from this study. Furthermore, during the study period, there was a transition to aflibercept prefilled syringes from medication vials, which could alter the risk of infection. Indeed, prior studies have suggested that prefilled syringe use may decrease endophthalmitis risk by reducing handling of the medication in preparation for treatment.[5,20]

Study Limitations

Limitations of this study are inherent in its retrospective nature and include inconsistent data entry, potential missing data, heterogeneity of injection preferences among physicians, and inconsistency in laboratory testing. Although we report a multicenter study of PIE with over 500 000 intravitreal injections, our findings may still be limited by sample size, particularly when evaluating the role of taping the top of face masks as well as changes to the rate of oral flora–associated endophthalmitis. The low incidence of oral flora–associated endophthalmitis necessitates a study with over 2.2 million injections to be sufficiently powered, and the inability to confirm microbiologic flora limits the use of large-scale insurance claims databases or clinical registries.

Another limitation is the lack of a standardized protocol for intravitreal injections across institutions with physicians individually determining injection protocols, including the potential use of viscous lidocaine gel, which may alter the risk of endophthalmitis.[21] However, there was no change to the unique protocols of each clinical site during the study period with the exception of the face mask policy. Furthermore, there was no standardization among the different institutions with regard to the type of face mask worn by patients and physicians. It is possible that the risk of PIE may be altered by different types of face masks (surgical, cloth, N95). Another limitation is that this study did not adjust for intercorrelation of multiple injections from the same eye or same patient. It is possible that intercorrelation of multiple injections administered in the same eye may alter the incidence of endophthalmitis.

Last, it is possible that other factors could have contributed to the decreased risk of endophthalmitis observed in our study. For example, with coronavirus restrictions, it is possible that additional infectious control precautions such as room sterilization, air filtration, and more strict observance to sterile technique, in addition to universal face masking, may have influenced the risk of endophthalmitis. Although these limitations are inherent in retrospective studies, our findings reflect actual clinical experiences and represent the environment in which many physicians currently operate.

Although some studies suggest that patient face mask use may direct oropharyngeal air flow toward the treatment eye, leading to an increased risk of PIE, our large, multicenter, retrospective study suggests that universal face mask use during intravitreal injections does not increase the risk of developing presumed endophthalmitis and is associated with a lower rate of culture-positive endophthalmitis. Continued policies for future universal face masking may be driven by other factors such as respiratory droplet precautions or economic considerations in the postpandemic environment rather than as a potential prophylaxis measure for endophthalmitis. Our study findings are limited by sample size for this uncommon condition, and additional studies are warranted to assess the potential role of face mask use and the risk of oral flora–associated endophthalmitis.

Footnotes and Disclosures

Originally received: January 12, 2021.
Final revision: May 3, 2021.
Accepted: May 11, 2021.
Available online: May 18, 2021. Manuscript no. D-21-00083.

[1] Wills Eye Hospital, Philadelphia, Pennsylvania.

[2] VitreoRetinal Surgery, P.L.L.C., Minneapolis, Minnesota.

[3] Austin Retina Associates, Austin, Texas.

[4] Associated Retinal Consultants, Royal Oak, Michigan.

[5] Retina Group of Washington, Chevy Chase, Maryland.

[6] NJ Retina, New Brunswick, New Jersey.

[7] Retina Consultants of Texas, Houston, Texas.

[8] Texas Retina Associates, Dallas, Texas.

[9] Vitreoretinal Consultants of New York, Great Neck, New York.

[10] Ophthalmic Consultants of Boston, Boston, Massachusetts.

[11] New England Eye Center, Boston, Massachusetts.

[12] Pennsylvania Retina Specialists, PC, Camp Hill, Pennsylvania.

*Members of the Post-Injection Endophthalmitis Study Group:

VitreoRetinal Surgery, P.L.L.C., (Minneapolis, MN): Peter H. Tang, MD.

Associated Retinal Consultants (Royal Oak, MI): Matthew G.J. Trese, DO; Jeremy D. Wolfe, MD.

Austin Retina Associates (Austin, TX): Philip P. Storey, MD, MPH; Nitya Rao, BS.

Retina Group of Washington (Chevy Chase, MD): Jordana Fein, MD; Mariam Mathai, MD; Priya S. Vakharia, MD.

Georgetown University School of Medicine (Washington, DC): Brice Hwang, MD.

Retina Consultants of Texas (Houston, TX): Eric Chen, MD; Ankoor R. Shah, MD.

Texas Retina Associates (Dallas, TX): Ashkan Abbey, MD; Patrick D. Williams, MD.

NJ Retina (New Brunswick, NJ): Sumit P. Shah, MD; Jonathan L. Prenner, MD; Matthew Henderson, BS.

Vitreoretinal Consultants of New York (Great Neck, NY): Philip J. Ferrone, MD; Jessica Lee, MD.

Northwell Department of Ophthalmology (Great Neck, NY): Minh Trinh, MD.

Ophthalmic Consultants of Boston (Boston, MA): Chirag P. Shah, MD; Jacob Duker, MD.

New England Eye Center (Boston, MA): Michelle C. Liang, MD; Jacob Duker, MD.

Wills Eye Hospital (Philadelphia, PA): Samir N. Patel, MD; M. Ali Khan, MD; Yoshihiro Yonekawa, MD; Sunir J. Garg, MD; John Hinkle, MD; Rebecca R. Soares, MD; Richard S. Kaiser, MD; Allen C. Ho, MD; Ajay E. Kuriyan, MD; Jason Hsu, MD; Allen Chiang, MD; Michael N. Cohen, MD; James P. Dunn, MD; Mitchell S. Fineman, MD; David H. Fischer, MD; Omesh P. Gupta, MD; Michael A. Klufas, MD; Sonia Mehta, MD; Carl H. Park, MD; Carl D. Regillo, MD; Arunan Sivalingam, MD; Marc J. Spirn, MD; James F. Vander, MD; David Xu, MD; Qiang Zhang, PhD.

Disclosure(s):
All authors have completed and submitted the ICMJE disclosures form.

The author(s) have made the following disclosure(s): S.J.G.: Consultant − Allergan, Apellis, Bausch & Lomb, Boehringer Ingelheim, Johnson & Johnson, Kanaph, Merck Manuals; Research grants − American Academy of Ophthalmology, Apellis, Boehringer Ingelheim, NGM Bio, Regeneron.

Y.Y.: Consultant − Alcon, Allergan, Genentech.

P.J.F.: Consultant − Genentech; Stockholder − ArcticDx.

M.C.L.: Consultant − Gyroscope Therapeutics; Ad boards − Allergan, Novartis.

Funding/Support: J. Arch McNamara Research Fund (Philadelphia, PA).

Portions of the manuscript were submitted for presentation to the American Academy of Ophthalmology Annual Meeting, November 12−15, 2021; submitted for presentation to The Retina Society Annual Meeting, September 29 to October 2, 2021; presented at the 44th Virtual Annual Macula Society Meeting, February 6−7, 2021; and were accepted for presentation at Virtual Association for Research in Vision and Ophthalmology Annual Meeting, May 1−7, 2021.

HUMAN SUBJECTS: Human subjects were included in this study. The human ethics committees at Wills Eye Hospital approved the study. All research adhered to the tenets of the Declaration of Helsinki.

No animal subjects were used in this study.

Author Contributions:

Conception and design: Patel, Tang, Storey, Wolfe, Fein, Shah, Abbey, Ferrone, Shah, Liang, Stem, Khan, Yonekawa, Garg

Data collection: Patel, Tang, Storey, Wolfe, Fein, Shah, Abbey, Ferrone, Shah, Liang, Stem, Khan, Yonekawa, Garg

Analysis and interpretation: Patel, Tang, Storey, Wolfe, Fein, Shah, Abbey, Ferrone, Shah, Liang, Stem, Khan, Yonekawa, Garg

Obtained funding: Study was performed as part of the authors' regular employment duties. No additional funding was provided.

Overall responsibility: Patel, Tang, Storey, Wolfe, Fein, Shah, Abbey, Ferrone, Shah, Liang, Stem, Khan, Yonekawa, Garg

Abbreviations and Acronyms:
CI = confidence interval; **logMAR** = logarithm of the minimum angle of resolution; **OR** = odds ratio; **PIE** = post-injection endophthalmitis; **SD** = standard deviation; **VA** = visual acuity; **VEGF** = vascular endothelial growth factor.

Keywords:
Antibiotics, Endophthalmitis, Intravitreal injection, Prefilled syringes, Prophylaxis, face mask.

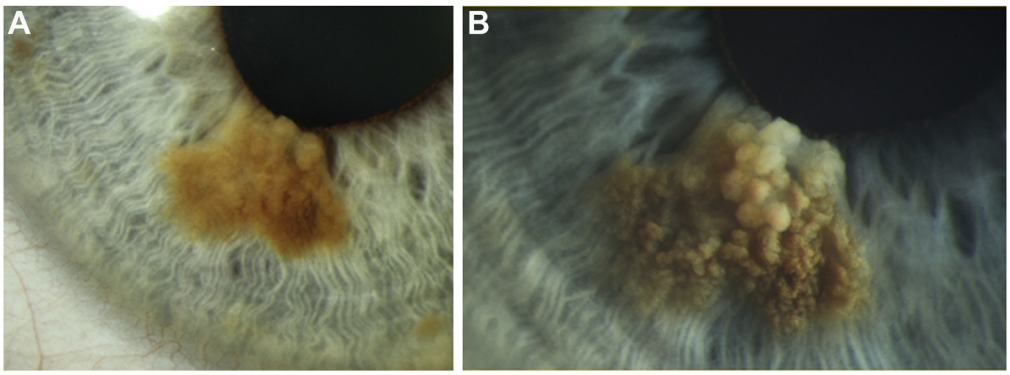
Correspondence:
Sunir J. Garg, MD, Wills Eye Hospital, Mid Atlantic Retina, Thomas Jefferson University, 840 Walnut Street, Suite 1020, Philadelphia, PA 19107. E-mail: sgarg@midatlanticretina.com.

References

1. Soliman MK, Gini G, Kuhn F, et al. International practice patterns for the management of acute postsurgical and postintravitreal injection endophthalmitis: European vitreo-retinal society endophthalmitis study report 1. *Ophthalmol Retina*. 2019;3:461−467.
2. Uhr JH, Hsu J. Endophthalmitis following intravitreal injections performed in the office versus operating room setting. *Curr Ophthalmol Rep*. 2019;7:128−135.
3. Shah CP, Garg SJ, Vander JF, et al. Outcomes and risk factors associated with endophthalmitis after intravitreal injection of anti-vascular endothelial growth factor agents. *Ophthalmology*. 2011;118:2028−2034.
4. Storey P, Dollin M, Pitcher J, et al. The role of topical antibiotic prophylaxis to prevent endophthalmitis after intravitreal injection. *Ophthalmology*. 2014;121:283−289.

5. Storey PP, Tauqeer Z, Yonekawa Y, et al. The impact of prefilled syringes on endophthalmitis following intravitreal injection of ranibizumab. *Am J Ophthalmol*. 2019;199:200–208.
6. Garg SJ, Dollin M, Hsu J, et al. Effect of a strict 'no-talking' policy during intravitreal injection on post-injection endophthalmitis. *Ophthalmic Surg Lasers Imaging Retina*. 2015;46:1028–1034.
7. Klompas M, Morris CA, Sinclair J, et al. Universal masking in hospitals in the covid-19 era. *N Engl J Med*. 2020;382:e63.
8. Anfinrud P, Stadnytskyi V, Bax CE, Bax A. Visualizing speech-generated oral fluid droplets with laser light scattering. *N Engl J Med*. 2020;382:2061–2063.
9. Wen JC, McCannel CA, Mochon AB, Garner OB. Bacterial dispersal associated with speech in the setting of intravitreous injections. *Arch Ophthalmol*. 2011;129:1551–1554.
10. Doshi RR, Leng T, Fung AE. Reducing oral flora contamination of intravitreal injections with face mask or silence. *Retina*. 2012;32:473–476.
11. Patel SN, Hsu J, Sivalingam MD, et al. The impact of physician face mask use on endophthalmitis after intravitreal anti-vascular endothelial growth factor injections. *Am J Ophthalmol*. 2020;222:194–201.
12. Hadayer A, Zahavi A, Livny E, et al. Patients wearing face masks during intravitreal injections may be at a higher risk of endophthalmitis. *Retina*. 2020;40:1651–1656.
13. Patel SN, Mahmoudzadeh R, Salabati M, et al. Bacterial dispersion associated with various patient face mask designs during simulated intravitreal injections. *Am J Ophthalmol*. 2020;223:178–183.
14. Schultheis WG, Sharpe JE, Zhang Q, et al. Effect of taping face masks on quantitative particle counts near the eye: implications for intravitreal injections in the COVID-19 era. *Am J Ophthalmol*. 2021;225:166–171.
15. Olivia Li JP, Shantha J, Wong TY, et al. Preparedness among ophthalmologists: During and beyond the covid-19 pandemic. *Ophthalmology*. 2020;127:569–572.
16. Scott IU, Schein OD, West S, et al. Functional status and quality of life measurement among ophthalmic patients. *Arch Ophthalmol*. 1994;112:329–335.
17. Gregori NZ, Feuer W, Rosenfeld PJ. Novel method for analyzing Snellen visual acuity measurements. *Retina*. 2010;30:1046–1050.
18. Greenberg JP, Belin P, Butler J, et al. Aflibercept-related sterile intraocular inflammation outcomes. *Ophthalmol Retina*. 2019;3:753–759.
19. Hahn P, Chung MM, Flynn Jr HW, et al. Postmarketing analysis of aflibercept-related sterile intraocular inflammation. *JAMA Ophthalmol*. 2015;133:421–426.
20. Baudin F, Benzenine E, Mariet A-S, et al. Association of acute endophthalmitis with intravitreal injections of corticosteroids or anti–vascular growth factor agents in a nationwide study in France. *JAMA Ophthalmol*. 2018;136:1352–1358.
21. Stem MS, Rao P, Lee IJ, et al. Predictors of endophthalmitis after intravitreal injection: a multivariable analysis based on injection protocol and povidone iodine strength. *Ophthalmology Retina*. 2019;3:3–7.

Pictures & Perspectives



Documented Growth of Presumed Iris Tapioca Nevus to Tapioca Melanoma

A 49-year-old White woman presented with a left iris lesion which had been present for more than 10 years (Fig **A**). Its discrete tapioca appearance mandated observation as a presumed slightly suspicious nevus. After 2 years, growth was documented, making the presumptive diagnosis of circumscribed tapioca iris melanoma (Fig **B**). Intraocular pressure and gonioscopy remained normal, and there was no visible seeding on the iris surface. The tumor was treated with ruthenium plaque brachytherapy. Tapioca iris melanoma is rare and has a nodular amelanotic surface. Seeding is frequent because of poor adhesion of tumor cells, and therefore biopsy should be avoided (Magnified version of Fig **A**-**B** is available online at www.aaojournal.org).

Stéphanie Lemaître, MD, PhD[1,2]
Gordon Hay, BSc (Hons), MBBS[1]
Mandeep S. Sagoo, MB, PhD[1,2,3]

[1]Ocular Oncology Service, Moorfields Eye Hospital, London, United Kingdom; [2]Retinoblastoma Service, Royal London Hospital, London, United Kingdom; [3]NIHR Biomedical Research Centre for Ophthalmology at Moorfields Eye Hospital and University College London Institute of Ophthalmology, London, United Kingdom