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Case Report

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Myopic Shift Following Intravitreal Injection in a Patient with Cystoid Macular Edema: A Case Report and Review of Literature

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Abstract

Purpose: To describe the clinical presentation, diagnostic findings, and potential mechanisms of myopic shift post-intravitreal injection.

Methods: Literature on myopic shift post-intravitreal injections was reviewed via Ovid MEDLINE, EMBASE, and Cochrane Central through August 8th, 2023.

Results: A 44-year-old woman presented with sudden onset of blurred vision in the right eye, 2 days after an intravitreal aflibercept injection for CME secondary to CRVO. BCVA in the right eye was 20/50+1. There were no clinical findings to explain the refractive change. 1 month post-intravitreal injection, blurred vision resolved without treatment and BCVA returned to 20/20.

Conclusion: This case report highlights a transient myopic shift following intravitreal injection in a patient with CME secondary to CRVO that has never been previously reported. Understanding and recognizing myopic shift and its mechanisms as a potential complication following intravitreal injection will enable ophthalmologists to provide more informed patient care and optimize treatment outcomes.

Keywords

Myopic shift, Intravitreal injections, Aflibercept, Anterior lens displacement, Lens swelling

Introduction

Intravitreal injections have revolutionized the management of various retinal vascular diseases, becoming a standard therapeutic approach for conditions such as cystoid macular edema (CME) secondary to retinal vein occlusion [1]. The localized delivery of pharmacologic agents to the vitreous cavity offers targeted treatment and has significantly improved visual outcomes in patients with retinal diseases.

While intravitreal injections are generally considered safe, they are associated with potential complications, including injection site discomfort/pain, subconjunctival hemorrhage, and temporary elevation of intraocular pressure (IOP) [1]. In a retrospective cohort study, Miller, et al. found that blurred vision was the most common cause of urgent follow-up visits after receiving an intravitreal injection [2].

Transient myopic shift is a phenomenon that has been well-described in the context of blunt ocular trauma [3-9]. The decrease in distance vision is usually sudden in onset, and resolves spontaneously in a few weeks. Proposed

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mechanisms include anterior displacement of the iris-crystalline lens diaphragm, axial thickening of the natural lens, and accommodative spasm of the ciliary body [4,9].

To our knowledge, there are no reports documenting myopic shift occurring after intravitreal injection. Here, we present a unique instance of myopic shift in a 44-year-old female patient with CME secondary to central retinal vein occlusion (CRVO), following an intravitreal injection of aflibercept. The aim of this report is to describe the clinical presentation, diagnostic findings, and potential mechanisms of myopic shift post-intravitreal injection, along with a review of existing literature to contextualize this intriguing phenomenon. Despite its rarity in the available literature, we suspect the incidence of myopic shift post-intravitreal injection is higher than reported, warranting further investigation. One potential reason for this underreporting is that symptoms are often very transient with only slight blurring of the vision, which most patients already experience post-injection. However, post-injection blurry vision lasting for longer than expected may be attributed to the mechanism of myopic shift. Thus, prompt diagnostic imaging via anterior segment OCT or IOL Master is vital to capture the slight anterior lens shift in patients who present with a suspected myopic shift post-intravitreal injection. Understanding the underlying mechanisms and risk factors associated with this complication is essential for early detection, appropriate management, and patient counseling.

Methods

The chart of a patient who experienced myopic shift following intravitreal aflibercept injection for CME was retrospectively reviewed. Ovid MEDLINE, Embase, and Cochrane Central were searched from database inception through August 8th, 2023 to identify previous similar cases (Table 1).

Case Presentation

A 44-year-old female patient with a history of CME secondary to CRVO in the right eye presented on follow-up for a repeat intravitreal injection of aflibercept. She had previously received more than 20 intravitreal aflibercept injections over the past 6 years without complications. At the time of injection, best-corrected visual acuity (BCVA) was 20/20 in both eyes. The patient received an intravitreal injection of 2 mg/0.05 ml of aflibercept into the right eye. 3 days post-injection, she presented to the clinic with a 1-day history of blurred vision in the right eye. Visual acuity in the right eye had decreased to $20/50^{+1}$ with the patient's typical lenses, although she was able to pinhole to $20/25^{-2}$. IOP measured by Tono-Pen Handheld Tonometer was 13 mmHg and 16 mmHg in the right and left eye, respectively. Slit-lamp examination revealed no clinical findings to explain the acute refractive change. Optical coherence tomography (OCT) confirmed that the macula was dry and that there was no change in macular thickness at 3 days post-injection compared to the pre-injection OCT (Figure 1).

1 month post-injection, the patient returned for a follow-up visit. BCVA without a myopic correction returned to baseline 20/20 in the right eye, and the patient reported that their blurred vision had completely resolved without treatment. At a follow-up visit 4 months post-injection, the patient's vision remained stable, and IOP was within normal range in both eyes at 17 mmHg.

At both 3 days post-injection and 4 months post-injection, ZEISS IOLMaster 700 and anterior segment OCT measurements were performed. IOL calculation was used to determine axial length, anterior chamber depth (ACD), and lens thickness. Anterior chamber parameters including angle-opening distance (AOD) and trabecular-iris space area (TISA) were determined by anterior segment OCT.

3 days post-injection, the axial length of the right eye was 24.61 mm, which remained unchanged at 4 months post-injection. At 3 days post-injection, the ACD in the right eye was 3.13 mm. At 4 months post-injection, an increase in ACD to 3.26 mm correlated with the resolution of myopic shift and

Table 1: Search strategy for MEDLINE, EMBASE, and Cochrane Library.

	Ovid MEDLINE search	EMBASE search	Cochrane library search
1	(Intravitreal adj2 injection*).mp.	(Intravitreal adj2 injection*).mp.	(Intravitreal NEAR/2 injection*): ti,ab,kw
2	(intra-vitreal adj2 injection*).mp.	(intra-vitreal adj2 injection*).mp.	(intra-vitreal NEAR/2 injection*): ti,ab,kw
3	Aflibercept.mp	Aflibercept.mp	Aflibercept: ti,ab,kw
4	Eylea.mp	Eylea.mp	Eylea: ti,ab,kw
5	Exp Intravitreal Injections/	Exp intravitreal drug administration/	[mh "intravitreal injections"]
6	Myopic shift.mp	Myopic shift.mp	Myopic shift: ti,ab,kw
7	Transient myopia.mp	Transient myopia.mp	Transient myopia: ti,ab,kw
8	Temporary myopia.mp	Temporary myopia.mp	Temporary myopia: ti,ab,kw
9	Pseudo-myopia.mp	Pseudo-myopia.mp	Pseudo-myopia: ti,ab,kw
10	Pseudomyopia.mp	Pseudomyopia.mp	Pseudomyopia: ti,ab,kw
11	or/1-5	or/1-5	{or #1-#5}
12	or/6-10	or/6-10	{or #6-#10}
13	and/11-12	and/11-12	{and #11-#12}

Table 2: IOP, axial length, and anterior chamber parameters of the right eye, 3 days and 4 months post-intravitreal aflibercept injection.

	3 days post-injection	**4 months post-injection**
Intraocular pressure	13 mmHg	17 mmHg
Axial length	24.61 mm	24.61 mm
Anterior chamber depth	3.13 mm	3.26 mm
Angle-opening distance (nasal)	500 µm: 0.316 mm 700 µm: 0.384 mm	500 µm: 0.314 mm 700 µm: 0.407 mm
Trabecular-iris space area (nasal)	500 µm: 0.129 mm 700 µm: 0.219 mm	500 µm: 0.131 mm 700 µm: 0.221 mm
Lens thickness	4.31 mm	4.21 mm

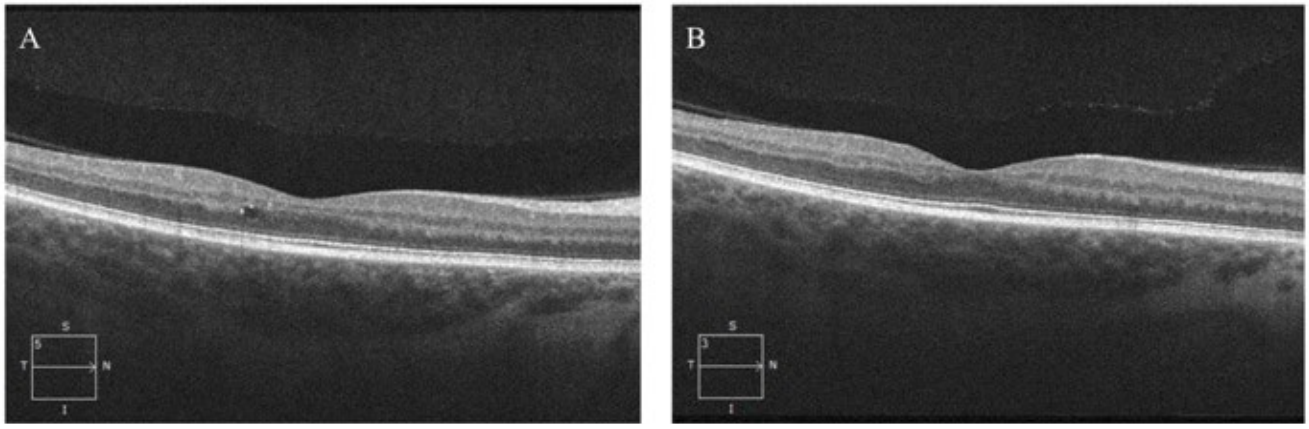

Figure 1: OCT of the right eye pre-injection (A) and 3 days post-intravitreal aflibercept injection (B) showing dry macula with no change in macular thickness post-injection.

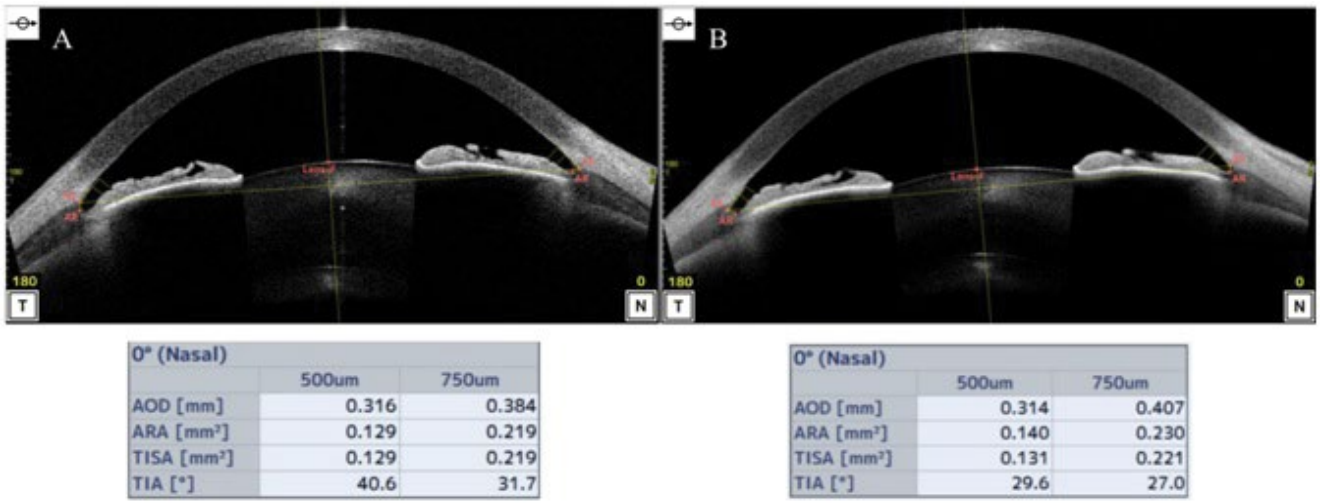

Figure 2: Anterior segment OCT and angle parameters of the right eye at 3 days post-intravitreal aflibercept injection (A) and at 4 months post-intravitreal aflibercept injection (B).

a BCVA of 20/20 (Table 2). Similarly, angle parameters in the right eye including AOD and TISA were decreased at 3 days post-injection compared to at 4 month post-injection, with the exception of AOD (500 µm) which was slightly greater at 3 days post-injection (Table 2 and Figure 2). Lens thickness in the right eye at 3 days post-injection was 0.1 mm greater compared to at 4 months post-injection, when visual acuity had returned to baseline.

Our literature search (Table 1) revealed a total of 21 studies. Following removal of duplicates, 14 full-texts were reviewed to identify previously reported cases of myopic shift following intravitreal injection. Following full-text review, we

determined that there were no relevant studies from our literature search that have reported a similar occurrence of myopic shift after intravitreal injection.

Discussion

The presented case report describes a myopic shift following intravitreal injection in a patient diagnosed with CME secondary to CRVO. This case report adds to the limited literature on this phenomenon and raises questions about potential underlying mechanisms.

In our patient, the myopic shift was apparent 3 days after the intravitreal injection, correlating with a positive therapeutic response to the anti-VEGF therapy as evidenced by the significant improvement in macular edema observed on OCT (Figure 1). The BCVA in the affected eye decreased to $20/50^{+1}$ with the patient's typical lenses, which improved to 20/20 1 month-post injection without treatment.

Various mechanisms have been proposed in the literature that may explain the myopic shift following intravitreal injection. One plausible explanation is the anterior lens displacement theory. We hypothesize that the volume-expanding agent injected into the vitreous cavity may cause a transient anterior displacement of the lens, altering its position and affecting the overall refractive power of the eye. This mechanism has been implicated in previous studies investigating post-injection changes in anterior segment morphology. Alkin, et al. reported that intravitreal injections of 0.05 mL bevacizumab or 0.1 mL bevacizumab-TA caused a significant reduction in ACD at 5 minutes and 1 hour post-injection [10]. They also noted that a greater injection volume caused more pronounced changes in angle parameters, ACD, and IOP. Similarly, Kerimoglu, et al. reported that at 5, 15, 30, and 45 minutes post-injection, a 0.1 mL intravitreal injection of triamcinolone acetonide caused a significant decrease in ACD and anterior chamber volume [11]. These anterior chamber changes were reversed with no residual clinical significance.

Anterior lens displacement has also been proposed as a mechanism for myopic shift following blunt ocular trauma. Sedaghat, et al. reported a case where an ocular nonpenetrating trauma induced a myopic shift of 7.00 D, which resolved after 15 days [9]. This was associated with a forward displacement of the iris-crystalline lens diaphragm, decrease in ACD, and increase in crystalline lens rise [9]. Chen, et al. also described a case of transient myopia induced by blunt ocular injury, where they proposed the mechanism to be an anterior lens shift leading to greater dioptric power [12].

In our presented case, vitreous hydration leading to anterior lens displacement is likely an underlying mechanism that contributed to the transient myopic shift. This is evidenced by the shallow ACD at the time of symptom onset, which subsequently increased by 0.13 mm with the restoration of visual acuity (Table 2). Decreased angle parameters were also seen at 3 days post-injection alongside the shallow ACD; both AOD and TISA measurements were greater at 4 months post-injection. However, the relatively minimal change in ACD by 0.13 mm suggests that other mechanisms may have also contributed to the myopic shift.

Importantly, one factor that may contribute to anterior lens shift post-intravitreal injection is the presence of an intact gel vitreous. The patient in our presented case had a formed vitreous and an attached posterior hyaloid membrane as seen on OCT (Figure 1). We hypothesize that in this young patient, the solid, gel-state of the formed vitreous may impose greater resistance against the injected aflibercept. Studies in animal and *in vitro* models support this hypothesis, showing faster particle distribution in liquefied vitreous [13,14].

As a result of decreased drug mobility, the intact gel vitreous may predispose the intravitreally-injected aflibercept to travel between the zonules into the Canal of Petit and the Canal of Hannover. This fluid entrapment may have led to anterior displacement of the iris-crystalline lens diaphragm, decreasing the depth of the anterior chamber and inducing a myopic shift. The direction of the bevel tip at the time of intravitreal injection may influence the propensity of the injected medication to migrate between the zonules and induce anterior lens displacement. It has been reported that there is wide variation in intravitreal injection techniques between ophthalmologists, including the angle of bevel orientation [15]. In young patients with an intact gel vitreous, it is advisable to consider an oblique injection technique at a 30-45° angle rather than a straight injection at a 90° angle to reduce the chance of the injected medication from becoming trapped between zonules and inducing anterior lens displacement (Figure 3) This technique may also reduce the risk of iatrogenic crystalline lens injury from contact of the lens by the needle tip.

In addition to anterior lens displacement, an increase in thickness of the crystalline lens may contribute to a shallowing of the anterior chamber and myopic shift. An increase in lens thickness has been observed in several cases of transient myopia after blunt ocular trauma, secondary to ciliary body edema [4,7,16]. This mechanism of lens thickening may underlie the myopic shift seen in our presented case as well, as lens thickness in our patient's affected right eye was 0.1 mm greater at 3 days post-injection compared to at 4 months post-injection (Table 2).

Moreover, stress or anxiety related to the injection procedure may induce accommodative spasm, leading to a transient myopic shift. This is plausible, as many patients experience high levels of anxiety when undergoing intravitreal injections [17,18]. Furthermore, anxiety and psychological stress-inducing events are common causes for pseudomyopia resulting from ciliary spasm [19]. This mechanism was proposed in a case of bilateral myopia following unilateral blunt trauma to the left eye [3].

Conclusion

This case report highlights the occurrence of a myopic shift following intravitreal injection in a patient with CME secondary to CRVO. The myopic shift was evident shortly after the injection and correlated with a positive therapeutic response to anti-VEGF therapy. Potential mechanisms underlying the

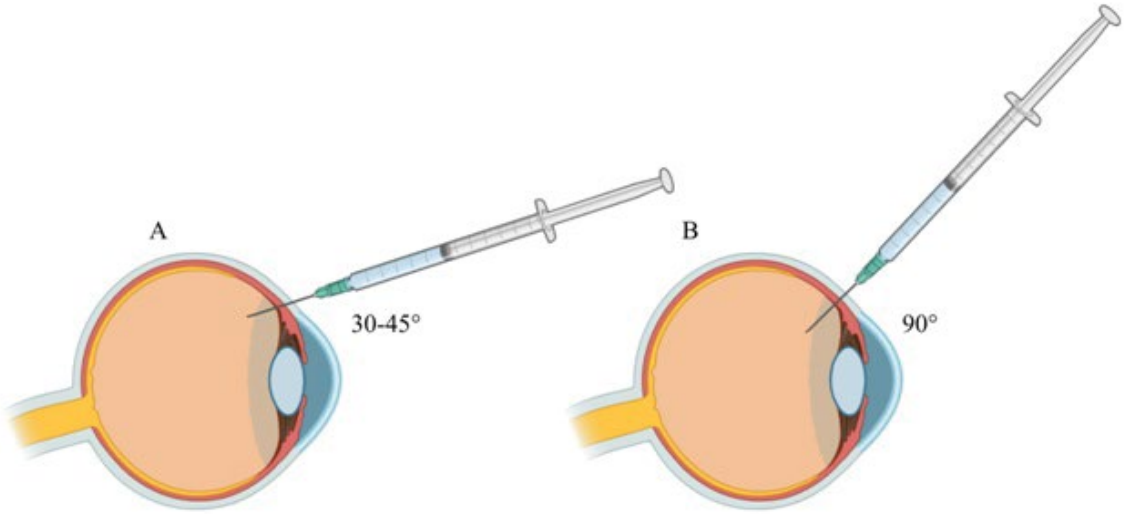

Figure 3: Intravitreal injection technique using a shallow oblique angle (A) or a perpendicular angle (B).

myopic shift in this case include hydration of the anterior vitreous leading to shift of the crystalline lens, increased lens thickness secondary to ciliary body edema, fluid entrapment in the Canal of Petit or the Canal of Hannover due to an intact gel vitreous, or accommodative spasm. We suspect that this complication is prevalent post-injection, but underreported due to its rapid spontaneous resolution. Thus, we emphasize the importance of prompt diagnostic imaging for patients who present post-injection with a suspected myopic shift. Attention to bevel tip direction during intravitreal injections should also be considered, particularly in young patients with a formed gel vitreous.

Additional research, including prospective studies and larger case series, is required to better understand the pathophysiology and epidemiology of this complication and develop evidence-based management strategies. Understanding and recognizing myopic shift as a potential complication following intravitreal injection will enable ophthalmologists to provide more informed patient care, optimize treatment outcomes, and improve patient satisfaction.

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