• Letter to the Editor •

Bilateral malignant glaucoma secondary to head percussive massage: a case report

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Received: 2025-07-23 Accepted: 2026-01-12

DOI:10.18240/ijo.2026.08.23

Citation: Gong QY, Zhu MJ, Man XF, Wang HY. Bilateral malignant glaucoma secondary to head percussive massage: a case report. *Int J Ophthalmol* 2026;19(8):1643-1646

Dear Editor,

Malignant glaucoma, characterized by extensive shallowing of the anterior chamber (AC), a severe increase in intraocular pressure (IOP), and loss of visual acuity (VA), is a rare and challenging condition within the spectrum of glaucomatous diseases that tends to have dubious treatment effects and long-term prognoses[1]. Malignant glaucoma can be divided into typical and atypical types proposed by Levene[2] in 1972. The typical type occurs following filtering surgery for glaucoma and is associated with distinct anatomical features, including microphthalmia, a shallow AC, and a small ciliary ring. The atypical type, by contrast, arises without prior filtering surgery but can be triggered by other secondary factors, such as the use of miotics, inflammation, and trauma[2-5]. However, the association between external, non-traumatic triggers, and bilateral malignant glaucoma has not been previously documented, representing a key knowledge gap in our understanding of disease etiology. Notably, it remains unclear whether any external non-traumatic triggers (those that may disrupt lens-iris diaphragm dynamics) can actually cause malignant glaucoma. Herein, we report a case of a 66-year-old female diagnosed with rare bilateral malignant glaucoma induced by external forces (a possible inducer). The aim of this report is to enhance clinical recognition of this novel etiology and provide insights for future management strategies. The study domain focuses on bilateral malignant glaucoma induced by external non-traumatic triggers, and our hypothesis posits that such triggers (those capable of disrupting lens-iris diaphragm dynamics) represent a rare yet clinically relevant cause of this condition.

CASE PRESENTATION

Ethical Approval The study was performed in accordance with the tenets of the Declaration of Helsinki and approved by the local Research Ethics Committee of Shanghai General Hospital (Approval No: CCTR-2022C15). Written informed consent was obtained from the participant before the procedures, and participant received free ophthalmic examinations.

A 66-year-old woman presented with sudden bilateral vision loss, ophthalmodynia, headache, nausea, and vomiting—symptoms that began 1wk prior. These symptoms (with severe ophthalmodynia as the most prominent feature) developed approximately 2h after she used a mini temple massage gun to alleviate a mild headache; no other traumatic events were reported. The massage gun was a commercial mini-vibration model with a speed range of 1200 r/min (Level 1) to 3200 r/min (Level 20) and a tissue penetration depth of up to 9 mm. The patient's headache had onset before the massage gun use and was deemed likely primary (non-ocular in origin). On examination, VA was no light perception (NLP) in both eyes (OU). Slit lamp examination revealed conjunctival congestion and ciliary congestion, corneal edema, an extremely shallow AC [right eye (OD): Shaffer 1; left eye (OS): Shaffer 0], pupils dilated, no light reflex, cataract (OU; Figure 1A). No

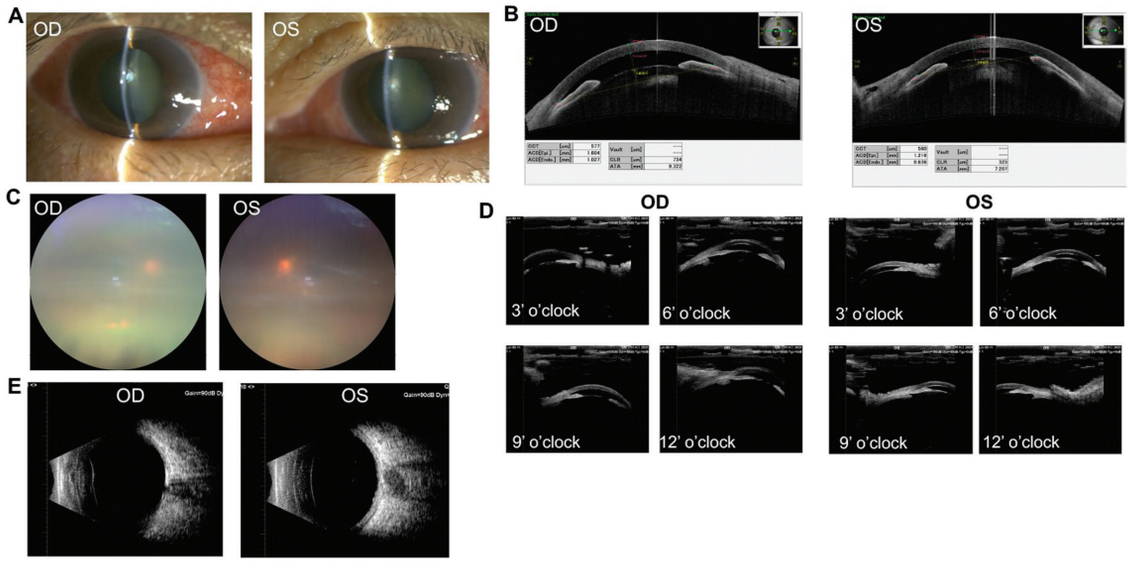

Figure 1 Ocular examination OU after the use of a massage gun A: Slit-lamp microscopic examination OU before surgery; B: Anterior segment optical coherence tomography of the right and left eyes before surgery; C: Fundus photos of the eyes after the use of the massage gun; D: UBM detection OU with nasal, inferior, temporal, and superior sides after trauma; E: B-scan ultrasonography OU showed no retinal or choroidal disease before surgery. OU: Both eyes; OD: Right eye; OS: Left eye; UBM: Ultrasound biomicroscopy.

lens tremor was observed in either eye. IOP (measured *via* Goldmann applanation tonometry) was 52.0 mm Hg in the OD and 48.9 mm Hg in the OS. Axial length was 22.17 mm (OD) and 22.11 mm (OS). Anterior segment optical coherence tomography (AS-OCT) and ultrasound biomicroscopy (UBM) showed iris-corneal endothelium attachment (Figure 1B), no zonular relaxation (Figure 1D), and a nearly absent posterior chamber. The central anterior chamber depth (ACD) was 1.03 mm OD and 0.64 mm OS. Fundus view obscured but still indicating increased cup-to-disc ratio by CLARUS™ 500 (Carl Zeiss AG, Oberkochen, Germany); B-scan ruled out posterior disease (Figure 1C and 1E). Laboratory tests showed no remarkable results. A prior diagnosis of acute primary angle closure glaucoma (APACG) with failed standard therapy prompted a re-evaluation.

The patient had no history of using vasodilators, miotic medications, or systemic medications (including topiramate); additionally, she had no prior history of glaucoma or cataract surgery, and no intraocular inflammation was detected at presentation. Laboratory tests, including complete blood count, serum electrolytes, renal/liver function, infectious and coagulation profile, were all within normal ranges. Although the patient had not undergone previous intraocular surgery, her clinical manifestations (uncontrolled high IOP, extremely shallow central and absent peripheral AC and posterior chamber, lack of pupillary block and exclusion of posterior segment disease) met the criteria for malignant glaucoma. Thus, the patient was diagnosed with bilateral malignant glaucoma. Medical therapy was conducted, including atropine gel combined with tropicamide eye drops to dilate pupils and relieve ciliary ring blockage, intravenous mannitol, as well as carteolol, brinzolamide, brimonidine tartrate to lower the IOP, and tobradex to inhibit inflammation. However, IOP initially decreased but then quickly rebounded, and the symptoms failed to improve, necessitating surgical intervention. Given the patient's bilateral vision loss, she and her family prioritized surgical intervention for the OD first. The planned procedure for the OD was phacoemulsification without intraocular lens (IOL) implantation (to facilitate the restoration of aqueous humor dynamics) combined with irido-zonulo-hyaloid-vitrectomy (IZHV) and goniosynechialysis. Surgery proceeded as follows: first, a small amount of anterior segment vitrectomy was performed to reduce posterior chamber pressure; next, phacoemulsification was conducted; finally, IZHV and goniosynechialysis were performed. Throughout the entire surgical procedure, including anterior segment vitrectomy, the phacoemulsification (both with and without viscoelastic agent) and the IZHV, no zonule loosening (*e.g.*, capsular bag decentration or capsular bag wrinkling) was observed. On the first postoperative day, VA remained NLP in OU. IOP was 19.0 mm Hg OD without medication and 48.9 mm Hg OS. Given the similar clinical context of the OS, the patient and her family agreed to a surgical strategy focused solely on IOP control for the OS. Subsequently, transscleral cyclophotocoagulation (TCP) was performed on the OS. On the first postoperative day after TCP, VA remained NLP OS, and IOP was 23.8 mm Hg OS without medication. AS-OCT revealed that the AC angle of the OD had reopened (Figure 2B), with ACD measurements of 3.19 mm (OD) and 0.76 mm (OS), both improved compared to pre-surgical values. UBM

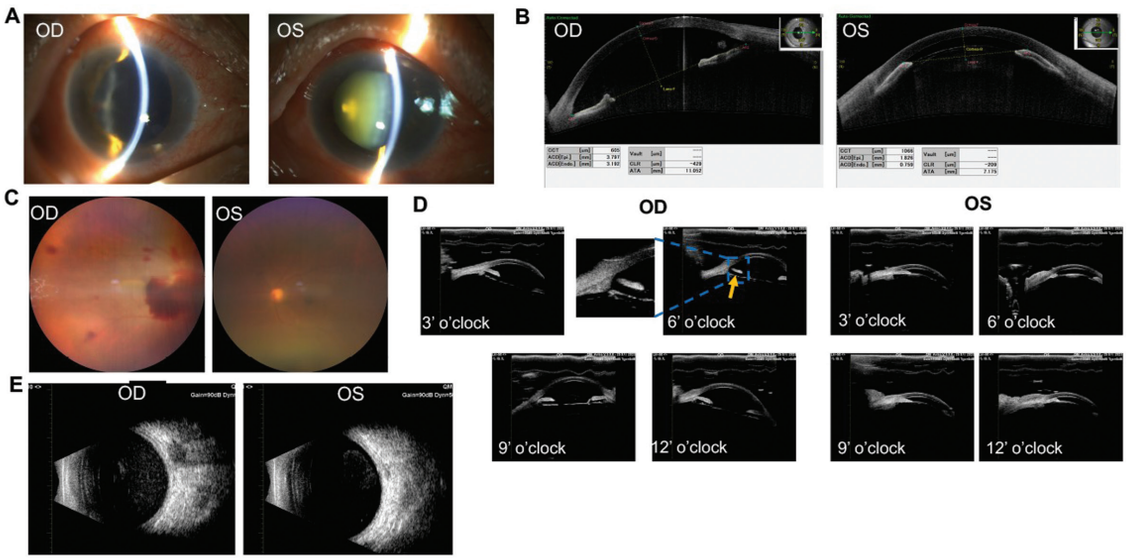

Figure 2 Ocular examinations OU after IZHV OD and TCP OS A: Slit-lamp microscope examination OD after IZHV and OS after TCP. B: Anterior segment optical coherence tomography OD showing the reopening of the anterior angle after surgery. C: Fundus photos showing the retinal manifestations of OU after surgery. D: UBM scanning OU after surgery. The scanning near 6 o'clock showed a constructed IZHV path OD. E: B-scan ultrasonography OU after surgery. OU: Both eyes; OD: Right eye; OS: Left eye; IZHV: Irizdo-zonulo-hyaloid-vitrectomy; TCP: Transscleral cyclophotocoagulation; UBM: Ultrasound biomicroscopy.

demonstrated a constructed IZHV pathway in the OD (Figure 2D). The patient was followed up for 3mo. Postoperative medications included topical tobramycin-dexamethasone eyedrops and antibiotic eyedrops (4 times daily for 3wk), as well as tropicamide (once daily for 2wk, to maintain mydriasis). VA, IOP, and ACD were monitored monthly. Notably, NLP persisted in OU from the initial examination through the entire follow-up period. During follow-up, both IOP and ACD remained within satisfactory ranges.

DISCUSSION

Since von Graefe's[3] first description in 1869, malignant glaucoma has been regarded as one of the most critical ophthalmologic emergencies. Conventional glaucoma surgery is the most common triggering factor[4]. There have also been case reports of malignant glaucoma occurring without surgical triggers, caused by conditions such as connective tissue disease, miotic use and trauma, and it may even occur spontaneously[5-7]. Although no universal diagnostic criteria for malignant glaucoma exist, clinical diagnosis should be made by excluding other causes of aqueous misdirection. In the present case, the apparent trigger for the patient's symptoms was the use of a massage gun around her temples, which was likely associated with an acute increase in IOP and sudden vision loss. Examination revealed an extremely shallow AC (OU) and disappearance of the angle around the eyes, with the exclusion of potential suprachoroidal hemorrhage and effusion. Differential diagnoses, including APACG and lens dislocation, were considered but ruled out. Normal anti-glaucoma treatments for APACG did not ameliorate the symptoms of the patient, and laser peripheral iridotomy (LPI) did not exert any effect. These findings disobeyed the manifestations and therapeutic strategies of APACG. In this case, no lens tremor was detected on examination, and UBM assessments of the distance from the lens edge to the suspensory ligaments showed no abnormalities[8]. Additionally, no lens capsule or zonule abnormalities were observed during surgery. Thus, lens dislocation was excluded in this patient.

It has been reported that patients with unilateral malignant glaucoma face a higher risk of developing the condition in the contralateral eye; however, there are no previous reports of simultaneous bilateral malignant glaucoma onset[9]. Our patient developed bilateral malignant glaucoma triggered by external force. By Mu and Fan[10], they reported a case of lens subluxation and secondary acute angle closure glaucoma (AACG) associated with 2mo of percussive massage gun use. In their case, UBM revealed that the lens had shifted from its normal position and moved anteriorly, leading to the diagnosis of lens subluxation and secondary AACG. While our patient's condition was also induced by a percussive massage gun, there were key differences: our patient's massage gun use duration was shorter, and her symptom onset was sudden, severe, and bilateral—consistent with malignant glaucoma rather than lens subluxation. Furthermore, treatments targeted at malignant glaucoma partially reduced the patient's IOP and relieved her ocular pain. These lines of evidence strongly support bilateral malignant glaucoma as the most likely diagnosis in this case. Therefore, the mechanism by which massage gun use induces intraocular pathological changes remains to be

fully elucidated. We hypothesize that high-frequency vibration of the massage gun (applied near the orbital region) triggered anterior movement of the lens-iris diaphragm and misdirection of the aqueous humor, resulting in an extremely shallow AC and disappearance of the posterior chamber.

Massage guns are growing in popularity, and have demonstrated benefits in the management of certain conditions[11]. Nevertheless, improper use of these devices can cause harm to the human body, especially when used in areas lacking buffering adipose tissue, such as the head and vertebral region. Case reports have documented complications including vertebral artery dissection and retinal detachment[12-13]; together with our case, these reports emphasize the need to raise public awareness of the importance of using such devices under correct and professional guidance.

To our knowledge, this is the first documented case of bilateral malignant glaucoma triggered by a head massage gun. It also highlights potential pitfalls in misdiagnosing malignant glaucoma as APACG and draws attention to the ocular risks associated with common consumer devices. Beyond identifying a novel trigger for bilateral malignant glaucoma, this case offers actionable value for clinical practice and public health domains, areas that have not been fully elaborated in previous literature.

In summary, this case serves as a clinical alert: clinicians should recognize “refractory APACG” as a potential red flag for malignant glaucoma. Additionally, it informs the public about the risks of using massage guns near the orbit, particularly for individuals with anatomical vulnerabilities, such as a short axial length.

ACKNOWLEDGEMENTS

We thank the participant for her involvement in the study.

Availability of Materials and Data: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Artificial Intelligence Statement Disclosure: This work was prepared without artificial intelligence.

Foundation: Supported by the National Natural Science Foundation of China (No.82101132).

Conflicts of Interest: Gong QY, None; **Zhu MJ,** None; **Man XF,** None; **Wang HY,** None.

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