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AS-OCT Detection of Posterior Gas Bubble Dislocation After DSAEK Preventing Malignant Glaucoma

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Abstract

Descemet stripping automated endothelial keratoplasty (DSAEK) is a well-established surgical technique for the treatment of endothelial dysfunction, in which intracameral gas tamponade plays a critical role in graft adherence. We report a case of a patient with pseudophakic bullous keratopathy who underwent an uncomplicated DSAEK procedure using a 25% sulfur hexafluoride (SF₆) gas–air mixture. On the first postoperative day, slit-lamp examination suggested an appropriate anterior chamber configuration and satisfactory graft attachment. However, detailed anterior segment optical coherence tomography (AS-OCT) revealed subtle posterior migration of the gas bubble beneath the iris plane. This clinically occult finding raised concern for altered anterior segment anatomy and a potential risk of malignant glaucoma. Prompt surgical re-intervention was undertaken on postoperative day one, involving decompression of the misdirected gas bubble and reinjection of a centrally positioned tamponade. This resulted in restoration of normal anterior chamber configuration and stable graft adherence. Best-corrected visual acuity (BCVA) improved from 0.1 Snellen (1.0 logMAR) preoperatively to 0.7 Snellen (0.15 logMAR) at 2 weeks following surgery. This case highlights the value of AS-OCT in detecting clinically unapparent postoperative complications after DSAEK, enabling timely intervention and prevention of potentially sight-threatening conditions.

Keywords: DSAEK; anterior segment OCT; endothelial keratoplasty; bullous keratopathy; gas tamponade; SF₆; malignant glaucoma; postoperative complications; slit-lamp examination

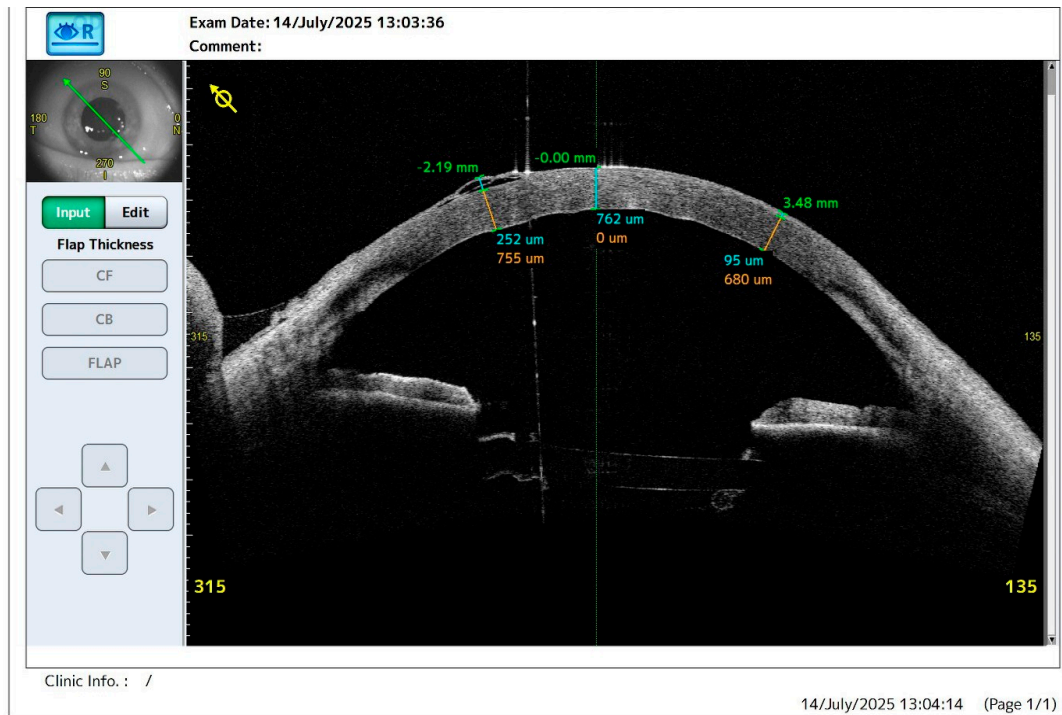


Figure 1. Preoperative anterior segment optical coherence tomography (AS-OCT) demonstrating advanced bullous keratopathy with marked stromal edema and epithelial detachment. Multiple subepithelial bullae are visible, corresponding to recurrent epithelial blistering responsible for significant ocular pain. The patient, a 67-year-old female with a history of cataract surgery, reported progressive visual deterioration and increasing discomfort despite intensive treatment with hyperosmotic eye drops and ointments. Preoperative best-corrected visual acuity (BCVA) was 0.1 Snellen (1.0 logMAR), and intraocular pressure (IOP) measured 18 mmHg. Due to persistent symptoms, lack of therapeutic response, and declining visual function, the patient was qualified for Descemet stripping automated endothelial keratoplasty (DSAEK). Bullous keratopathy remains a common indication for endothelial keratoplasty, particularly in pseudophakic patients, where progressive stromal edema and epithelial bullae significantly impair vision and quality of life [1]. Endothelial keratoplasty techniques such as DSAEK provide effective anatomical and functional restoration in such cases.

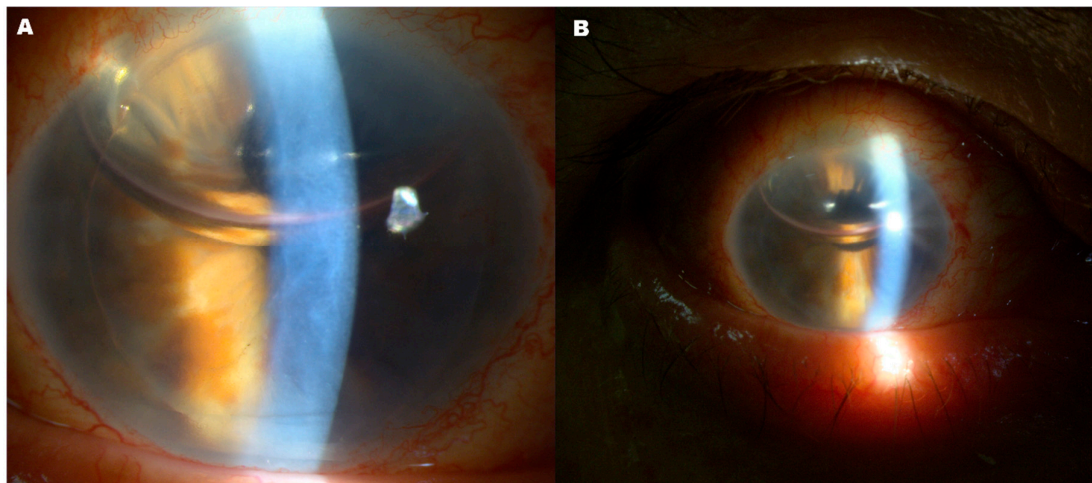


Figure 2. Early postoperative slit-lamp imaging with clinically unapparent gas misdirection. (A,B) Slit-lamp photographs obtained 6 hours after DSAEK demonstrate a large intracameral gas bubble occupying the anterior chamber, with typical superior positioning due to gravitational forces. The graft appears well apposed, and the anterior chamber configuration seems clinically appropriate at this stage. Importantly, despite the apparently

normal postoperative appearance, no signs of posterior gas migration behind the iris are visible on slit-lamp examination. This highlights the limitation of clinical assessment alone, as partial displacement of the gas bubble into the posterior chamber cannot be detected without adjunctive imaging. Intracameral gas tamponade is essential for graft adherence after DSAEK; however, its behavior within the anterior segment is influenced by multiple factors, including patient positioning and anterior chamber anatomy [2]. Slit-lamp examination alone may be insufficient to detect subtle or posteriorly located gas misdirection, which can lead to underestimation of early postoperative complications [3].



Figure 3. AS-OCT detection of clinically occult posterior gas migration after DSAEK. (A) Multiplanar AS-OCT assessment on postoperative day one, including vertical, horizontal, and rotational scans. Posterior displacement of the gas bubble beneath the iris is detectable only in the vertical scan (arrow), while horizontal and rotational sections do not clearly demonstrate the abnormality, indicating its localized and orientation-dependent nature. Notably, this finding was not apparent on slit-lamp examination (Figure 2). (B) Magnified vertical AS-OCT

image highlighting posterior migration of the gas bubble beneath the iris plane (**arrow**), associated with anterior displacement of the iris–lens diaphragm and early shallowing of the anterior chamber. The arrows indicate the exact location of gas misdirection. Based on the AS-OCT findings, prompt surgical re-intervention was performed with decompression of the misdirected gas bubble and reinjection of a centrally positioned tamponade, effectively eliminating the risk of malignant glaucoma. These findings illustrate that posterior gas migration after DSAEK may remain clinically occult and dependent on scan orientation, emphasizing the importance of comprehensive, multiplanar AS-OCT imaging to detect subtle abnormalities that may predispose to malignant glaucoma. Posterior migration of air or gas behind the iris has been described as a mechanism leading to secondary angle closure and malignant glaucoma after endothelial keratoplasty [4]. Early detection is critical, as altered aqueous dynamics and anterior displacement of the iris–lens diaphragm may result in rapid intraocular pressure elevation and graft compromise [5,6]. This case highlights the role of AS-OCT as a sensitive diagnostic tool enabling timely intervention and prevention of such complications.

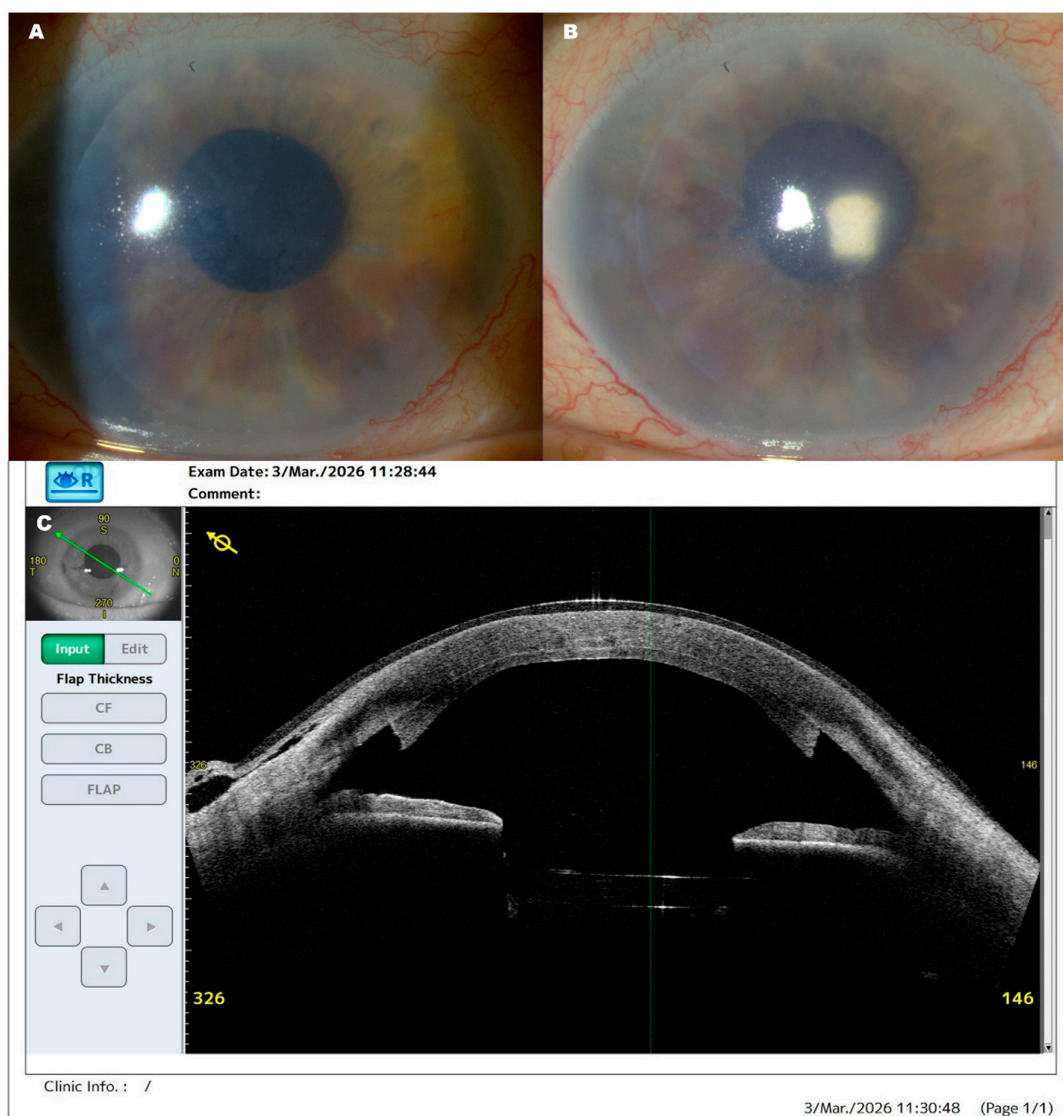


Figure 4. Postoperative outcome at 2 weeks after DSAEK. (A,B) Slit-lamp photographs obtained 14 days after surgery demonstrate a well-centered and fully attached endothelial graft with marked improvement in corneal clarity. The optical zone shows progressive transparency with regression of stromal edema. No signs of graft detachment, interface opacities, or immunologic rejection are observed. The anterior chamber remains well formed, without evidence of shallowing or abnormal iris configuration. Best-corrected visual acuity (BCVA) at

this stage was 0.7 Snellen (0.15 logMAR). (C) AS-OCT confirms complete graft adherence with a regular interface and absence of interface fluid. No residual or misdirected gas bubble is present. The anterior chamber depth is normal, and the iris–lens diaphragm is in a physiological position, confirming stable postoperative anatomy and resolution of the previously detected complication. Timely recognition and management of postoperative complications are essential for maintaining graft survival and visual outcomes after endothelial keratoplasty [1,5]. Restoration of normal anterior segment anatomy following appropriate intervention is associated with favorable prognosis and reduced risk of secondary glaucoma [3,6].

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Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

AS-OCT	Anterior Segment Optical Coherence Tomography
BCVA	Best-corrected Visual Acuity
DSAEK	Descemet stripping automated endothelial
IOP	Intraocular pressure

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