Uludağ Üniversitesi Tıp Fakültesi Dergisi
Journal of Uludağ University Medical Faculty
52, 1949329, 2026
DOI: https://doi.org/10.32708/uutfd.1949329

ORIGINAL RESEARCH

Carbonated Mineral Water Bottles: An Underrecognized Cause of Ocular Trauma*

Gamze UÇAN GÜNDÜZ, Songül SEYİS

Bursa Uludag University, School of Medicine, Department of Ophthalmology, Bursa, Türkiye.

ABSTRACT

This study evaluated the mechanisms, clinical characteristics, and outcomes of ocular injuries associated with carbonated mineral water bottles. Twenty patients presenting with bottle-related ocular trauma at a tertiary referral center were retrospectively reviewed. Demographic features, injury mechanisms, ocular findings, management strategies, and visual outcomes were analyzed. The mean age was 37.2 ± 17.4 years, and most patients were male (75%). Injuries were predominantly caused by high-velocity bottle cap impact during opening (80%), whereas the remaining cases resulted from bottle explosion after impact (20%). Bottle cap injuries were consistently associated with closed-globe trauma, while bottle explosions caused open-globe trauma in most cases. The left eye was more commonly affected (65%), particularly in bottle cap–related trauma. At presentation, 55% of eyes had a best-corrected visual acuity of ≥20/40, increasing to 65% at final follow-up. Hyphema and traumatic cataract were the most frequent anterior segment findings, whereas commotio retinae was the most common posterior segment pathology. Most patients were managed conservatively with medical treatment, while a smaller proportion required retinal laser or surgical intervention. Although visual outcomes were generally favorable, severe injuries could occur, especially following the bottle explosion. Carbonated mineral water bottle–related ocular trauma represents an under recognized yet preventable cause of eye injury, and increased public awareness together with simple safety precautions may help reduce these avoidable accidents.

Keywords: Ocular trauma. Bottle cap. Carbonated mineral water bottle. Closed globe injury. Commotio retinae.

Karbonatlı Maden Suyu Şişeleri: Göz Travmasının Fark Edilmeyen Bir Nedeni

ÖZET

Bu çalışmada soda şişeleri ile ilişkili oküler yaralanmaların mekanizmaları, klinik özellikleri ve sonuçları değerlendirilmiştir. Üçüncü basamak bir merkeze soda şişesine bağlı oküler travma nedeniyle başvuran 20 hastanın verileri retrospektif olarak incelenmiştir. Demografik özellikler, yaralanma mekanizmaları, oküler bulgular, tedavi yaklaşımları ve görsel sonuçlar değerlendirilmiştir. Hastaların ortalama yaşı 37,2 ± 17,4 yıl olup, çoğunluğunu erkek hastalar oluşturmaktaydı (%75). Oküler travma, çoğunlukla, şişe açılması sırasında şişe kapağının yüksek hızla göze çarpmasına bağlı gelişirken (%80), geri kalan olgular şişenin patlaması sonucu meydana gelmişti (%20). Şişe kapağına bağlı yaralanmaların tamamı kapalı göz yaralanması ile ilişkiliyken, şişe patlamaları genellikle açık göz yaralanmasına neden olmuştu. Kapağa bağlı yaralanmalarda sol göz daha sık etkilenmişti (%65). Başvuru sırasında gözlerin %55'inde en iyi düzeltilmiş görme keskinliği ≥20/40 iken, son kontrolde %65'e yükselmişti. Ön segmentte en sık hifema ve travmatik katarakt görülürken, arka segmentte en yaygın patoloji kommosyo retina idi. Hastaların çoğu medikal tedavi ile izlenirken, bazı hastalarda retinal lazer veya cerrahi girişim gerekti. Görsel sonuçlar genel olarak yüz güldürücü olmakla birlikte, özellikle şişe patlamasına bağlı yaralanmalarda ciddi görme kaybı gelişmişti. Soda şişelerine bağlı oküler travmalar, yeterince bilinmeyen ancak önlenebilir bir göz travması sebebidir. Toplum farkındalığının artırılması ve basit güvenlik önlemlerinin uygulanması bu önlenebilir yaralanmaların azaltılmasına katkı sağlayabilir.

Anahtar Kelimeler: Oküler travma. Şişe kapağı. Soda şişesi. Kapalı göz yaralanması. Kommosyo retina.

Date Received: 12.May.2026
Date Accepted: 13.July.2026

* Presented as a Poster Presentation at the "TOD 46. Kış Sempozyumu" (17-19 January 2025, Bursa, Türkiye).

Dr. Gamze UÇAN GÜNDÜZ
Institution and Address: Bursa Uludag University, School of Medicine, Department of Ophthalmology, Bursa, Türkiye
E-mail: gamzeug@uludag.edu.tr

AUTHORS' ORCID INFORMATION
Gamze UÇAN GÜNDÜZ: 0000-0002-5458-1686
Songül SEYİS: 0009-0001-1056-4235

Ocular trauma remains a leading and preventable cause of monoocular blindness, particularly among young adults. Although occupational injuries and traffic accidents are well-recognized causes, many eye injuries still occur during everyday activities and routine handling of common household items.

Pressurized containers, such as carbonated beverage bottles, are a known source of eye injury among ophthalmologists. The high internal pressure generated by dissolved carbon dioxide may be abruptly released during bottle opening or following minor mechanical impact, leading to projectile bottle caps or explosive glass fragmentation. These

mechanisms can cause both blunt and penetrating ocular injuries, resulting in a wide spectrum of damage ranging from superficial corneal abrasions to severe penetrating injuries and intraocular foreign bodies.

Carbonated mineral water is widely consumed in Türkiye and constitutes a common component of daily dietary habits, which may partly explain why bottle-related injuries continue to be encountered in ophthalmic practice.

Interestingly, although this type of injury is familiar to ophthalmologists, it has been rarely presented in the ophthalmic literature, with only a limited number of reports published since the 1980s[1-8]. Also, the general public is largely unaware of the potential danger of carbonated beverage bottles. Given their widespread use in everyday life and their generally harmless perception, these injuries may be both under recognized and underreported.

In this study, we describe the clinical features, injury mechanisms, and outcomes of ocular trauma related to carbonated mineral water bottles and drawing attention to an often overlooked yet everyday source of injury.

Materials and Methods

This retrospective study included patients who presented with ocular trauma related to carbonated mineral water bottles at a tertiary referral center between June 2020 and June 2025. Patients with ocular injuries caused by carbonated mineral water bottles were included in the study, while those with incomplete records or trauma unrelated to such bottles were excluded.

Demographic and clinical data were collected from medical records, including age, gender, laterality, mechanism of injury, and time of injury within the year. Mechanisms of injury were categorized as projectile bottle cap–related or glass bottle explosion following a fall. Initial ophthalmic examination findings were recorded, including best-corrected visual acuity (BCVA), anterior and posterior segment findings, the presence of intraocular foreign bodies, and eyelid laceration. In patients presenting with decreased visual acuity and a clear visual axis, optical coherence tomography (OCT) was performed when clinically indicated. In eyes with media opacity secondary to hyphema, traumatic cataract, vitreous hemorrhage, or corneoscleral injury, direct posterior segment visualization was not possible; therefore, ocular B-scan ultrasonography was used to evaluate the posterior segment. Ocular injuries were classified according to the Birmingham Eye Trauma Terminology (BETT) as open-globe and closed-globe injuries. Details of medical and surgical treatments and follow-up periods were recorded. Final BCVA was measured at the last follow-up visit.

The study adhered to the tenets of the Declaration of Helsinki and was approved by the institutional review board (approval number is 2026/202/7-13).

Results

A total of 20 eyes from 20 patients were included in the study. The mean age was 37.2 ± 17.4 years (range, 12–80 years). Fifteen patients (75%) were male and five (25%) were female.

The left eye was affected in 13 cases (65%) and the right eye in 7 cases (35%). Only 3 injuries (15%) occurred during the winter season. The mean follow-up period was 113 days (range, 2–690 days). The demographic and clinical characteristics of the patients are summarized in Table I.

Most injuries (16 eyes, 80%) occurred due to high-velocity impact of a bottle cap while opening carbonated mineral water bottles, whereas 4 injuries (20%) resulted from bottle explosion after falling, leading to ocular damage caused by glass fragments. All bottle cap injuries were blunt trauma and resulted in closed globe injuries. Among bottle cap–related injuries, the left eye was affected in 11 of 16 cases (68.8%).

In contrast, among the 4 eyes injured due to bottle explosion, 3 eyes (75%) sustained open globe injuries, including 2 corneal and 1 scleral laceration, while one eye (25%) had an isolated conjunctival laceration. Anterior segment photographs of two patients with open- and closed-globe injuries are shown in Figure 1.

Figure 1:
Anterior segment photographs of two patients. ***a:*** *Case 16 with a closed globe injury caused by a bottle cap impact. Corneal epithelial defect is visible under fluorescein staining and cobalt blue illumination.* ***b:*** *Initial presentation of Case 17 with an open globe injury following a bottle explosion. Scleral laceration with iris prolapse is observed, along with a laceration of the lower eyelid.* ***c:*** *The postoperative image of Case 17 after primary surgical repair.*

At presentation, best-corrected visual acuity (BCVA) was ≥20/40 in 11 eyes (55%), between 20/50 and 20/200 in 2 eyes (10%), between 1/200 and 19/200 in

Table I. The details of patients with ocular trauma associated with carbonated mineral water bottles.

No	Age	Sex	Eye	Mechanism of injury	OGI / CGI	Anterior segment	Posterior segment	Initial BCVA	Final BCVA	Treatment	Follow-up period
1	36	M	OS	Bottle cap	CGI	Normal	Commotio retinae, VH, choroidal rupture	0.7	1.0	Topical treatment, LF	3 months
2	54	F	OD	Bottle cap	CGI	Corneal edema, hyphema	Normal	0.7	1.0	Topical treatment	2 months
3	39	M	OD	Bottle cap	CGI	Conjunctival laceration, hyphema	Commotio retinae	1.0	1.0	Topical treatment	2 days
4	28	M	OS	Bottle cap	CGI	Hyphema	Normal	0.9	0.9	Topical treatment	2 days
5	43	M	OS	Bottle cap	CGI	Hyphema	Normal	0.8	1.0	Topical treatment	3 days
6	45	M	OS	Bottle cap	CGI	Corneal edema, cataract	Obscured	CF	0.3	Topical treatment, oral corticosteroid	3 months
7	34	M	OS	Bottle cap	CGI	Normal	Commotio retinae	0.9	0.9	Topical treatment	4 days
8	15	M	OS	Bottle cap	CGI	Corneal edema, hyphema, iridodialysis, cataract	Commotio retinae, VH	0.6	0.9	Topical treatment, lens aspiration + IOL, iridodialysis repair	23 months
9	31	M	OS	Bottle cap	CGI	Hyphema	Obscured	P+P+		Topical treatment	2 days
10	25	F	OD	Bottle cap	CGI	Hyphema, lamellar corneal laceration, cataract	Macular hole	HM		Topical treatment, intravenous corticosteroid	1 month
11	37	M	OD	Bottle cap	CGI	Microhyphema	Commotio retinae, Retinal tear, VH	1.0	1.0	Topical treatment, LF	11 months
12	38	M	OS	Bottle cap	CGI	Microhyphema, corneal epithelial defect	Commotio retinae	0.4	1.0	Topical treatment	1 month
13	12	M	OD	Bottle cap	CGI	Microhyphema	Normal	1.0	1.0	Topical treatment	2 months
14	50	M	OS	Bottle cap	CGI	Aphakic, mydriasis	Dropped IOL	CF	0.8	PPV, IOL extraction, scleral-fixated IOL	6 months
15	70	M	OS	Bottle cap	CGI	Hyphema, cataract	Obscured	CF	0.2	Phaco + IOL	6 months
16	30	M	OS	Bottle cap	CGI	Corneal epithelial defect	Normal	1.0	1.0	Topical treatment	4 days
17	31	F	OD	Explosion	OGI	Scleral laceration in zone II*	Obscured	0.05	0.4	Primary surgical repair	11 months
18	15	M	OS	Explosion	OGI	Corneal laceration	Normal	0.2	0.7	Topical treatment, bandage contact lens	4 months
19	80	F	OS	Explosion	CGI	Conjunctival laceration	Normal	0.5	0.5	Topical treatment	1 month
20	30	F	OD	Explosion	OGI	Corneal laceration, cataract	Obscured	0.05	0.15	Topical treatment, bandage contact lens	1 month

OGI: open globe injury, CGI: closed globe injury, BCVA: best corrected visual acuity, M: male, F: female, OD: oculus dexter, OS: oculus sinister, VH: vitreous hemorrhage, LF: Laser photocoagulation, IOL: intraocular lens, PPV: pars plana vitrectomy, Phaco: phacoemulsification, CF: counting fingers, HM: hand motion

5 eyes (25%), and at the level of hand motion or light projection in 2 eyes (10%). At final follow-up, BCVA was ≥20/40 in 13 eyes (65%), between 20/50 and 20/200 in 4 eyes (20%), and between 1/200 and 19/200 in 2 eyes (10%).

In addition to globe injury, eyelid lacerations were present in 4 patients (20%). The most common anterior segment findings were hyphema (55%) and traumatic cataract (25%). The most frequent posterior segment findings included commotio retinae (30%), vitreous hemorrhage (15%), and retinal tear (10%). Other anterior and posterior segment findings are presented in Table II.

Medical treatment alone was sufficient in 13 patients (65%), while 7 patients (35%) required additional laser or surgical interventions. All patients received topical corticosteroids, antibiotics, and cycloplegic agents. Systemic corticosteroids were administered in two patients.

Bandage contact lenses were applied in two patients with lamellar corneal lacerations. One patient with a scleral laceration underwent emergent primary surgical repair. Among five patients with traumatic cataract, two underwent cataract surgery; in one of these cases, iridodialysis repair was performed concurrently. The remaining three patients were managed conservatively due to non-visually significant lens opacities.

Peripheral retinal tears developed in two patients and were treated with laser photocoagulation. Vitreous hemorrhage occurred in three patients following blunt trauma and resolved spontaneously without surgical

intervention in all cases. One patient developed intraocular lens (IOL) dislocation into the vitreous cavity following trauma and underwent pars plana vitrectomy with removal of the dislocated IOL and scleral fixation of a three-piece IOL using the Yamane technique. A traumatic macular hole developed in one patient, who was lost to follow-up after one month without undergoing surgery (Figure 2).

Table II. Distribution of ocular findings in eyes with bottle-related trauma.

Ocular pathology	Frequency (%) (n=20)
Eyelids	
Laceration	4 (20%)
Anterior segment	
Hyphema	11 (55%)
Traumatic cataract	5 (25%)
Corneal edema	3 (15%)
Corneal abrasion	3 (15%)
Conjunctival laceration	2 (10%)
Corneal laceration	2 (10%)
Scleral laceration	1 (5%)
Traumatic aphakia	1 (5%)
Iridodialysis	1 (5%)
Posterior segment	
Commotio retinae	6 (30%)
Vitreous hemorrhage	3 (15%)
Retinal tear	2 (10%)
Choroidal rupture	1 (5%)
Macular hole	1 (5%)

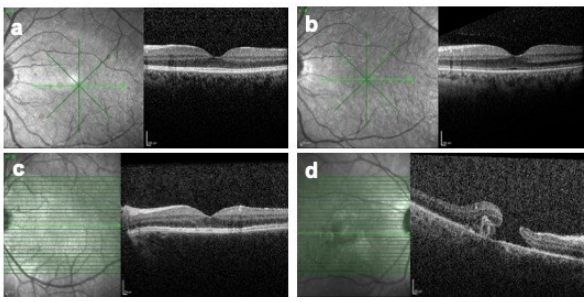

Figure 2:
Optical coherence tomography (OCT) sections of selected patients exposed to blunt trauma caused by a bottle cap. ***a:*** *In Case 12, who sustained a bottle cap injury to the left eye, subtle changes are observed on OCT. The findings are consistent with Grade 1 commotio retinae, showing hyper-reflectivity of the outer retina and loss of the thin hypo-reflective optical space.* ***b:*** *One month later, OCT of the same patient demonstrates the complete recovery of the outer retinal layers.* ***c:*** *In the left eye of Case 8, increased hyperreflectivity of the outer retinal layers is more prominently observed on OCT.* ***d:*** *In Case 10, a traumatic macular hole is observed in the right eye following blunt trauma.*

Fundus visualization was not possible in five eyes due to hyphema and/or traumatic cataract. Ocular ultrasonography demonstrated an attached retina and choroid in all of these cases.

At initial examination, macular commotio retinae was identified in five eyes and peripheral commotio retinae in one eye. Optical coherence tomography (OCT) was performed in all eyes with macular involvement. According to the classification described by Ahn et al. (2013), all cases were categorized as Grade 1 maculopathy (Figure 2). OCT findings resolved within 3–4 weeks, accompanied by improvement in visual acuity (1.0 in three eyes and 0.9 in two eyes).

Discussion and Conclusion

In this study, we presented the clinical characteristics, mechanisms, and outcomes of ocular injuries associated with carbonated mineral water bottles, highlighting an under recognized yet potentially preventable source of ocular trauma. Our findings demonstrate that bottle cap–related injuries constitute the majority of cases and are predominantly associated with blunt, closed globe injuries, whereas injuries caused by bottle explosion tend to result in more severe, open globe injury.

One of the interesting observations in our series was the predominance of left eye involvement (68.8%), particularly in bottle cap–related injuries. Similarly, in the study by Erdurman et al., the left eye was affected in 75% of the cases. [2] This finding may be explained by common behavioral patterns during bottle opening. Most individuals are right-hand dominant and tend to hold the bottle with their left hand while opening it with the right hand. As a result, the bottle is positioned closer to the left side of the body, placing the left eye at greater risk of direct impact from a rapidly released cap. Although this hypothesis has not been extensively explored in the literature, it is consistent with ergonomic positioning and may explain the asymmetric distribution of injuries observed in our cohort. However, due to the retrospective design of the study, information regarding patients' hand dominance and bottle-opening techniques was not available in the medical records. Therefore, the observed predominance of left-eye injuries could not be directly correlated with individual hand dominance. Our proposed explanation is based on the well-established predominance of right-hand dominance in the general population and should be considered a plausible hypothesis rather than a confirmed causal relationship.

Another noteworthy finding was the seasonal distribution of injuries. Only a small proportion of cases occurred during the winter months. This may be related to increased consumption of carbonated

beverages during warmer seasons. While seasonal variation in ocular trauma has been reported in other contexts, the association with beverage consumption patterns represents a more specific and behavior-driven risk factor in this setting.[9,10]

The mechanism of injury also provides important clinical insights. Bottle cap–related trauma uniformly resulted in closed globe injuries, most commonly presenting with hyphema and commotio retinae, whereas bottle explosion was associated with a higher rate of open globe injuries, including corneal and scleral lacerations. This distinction is clinically relevant, as it reflects the difference between high-velocity focal impact and multi-directional injury caused by glass fragments. Similar mechanisms have been described in studies evaluating pressurized container-related injuries, where sudden release of internal pressure can generate significant kinetic energy and lead to severe ocular damage.[10, 11]

The visual outcomes in our series were generally favorable, particularly in cases of closed-globe injury. Most patients achieved a final visual acuity of 20/40 or better, and commotio retinae cases demonstrated complete structural and functional recovery within weeks. These findings are similar with previous reports indicating that mild forms of commotio retinae, especially those classified as Grade 1 on OCT, tend to have a good prognosis.[12,13]

In contrast, more severe injuries such as open globe trauma, intraocular lens dislocation, and macular hole required surgical intervention and might have more limited visual improvement.

The generally favorable visual outcomes observed in this cohort may be partly explained by the predominance of closed-globe injuries, which accounted for the majority of cases. Compared with open-globe injuries, closed-globe trauma is typically associated with less extensive structural damage and a better visual prognosis.

Importantly, our findings also underscore the preventable nature of these injuries. Several simple precautions may significantly reduce the risk of ocular trauma associated with carbonated beverage bottles. Bottles should not be stored under extreme temperature conditions, as temperature fluctuations may increase internal pressure and should not be shaken. During opening, individuals should avoid looking directly at the bottle and instead turn their head away. Care should be taken to maintain a secure grip and avoid dropping the bottle, as impact-related explosions may lead to more severe injuries. Increasing public awareness of these basic safety measures could play a key role in reducing the incidence of such preventable injuries. The use of more durable bottle materials, avoidance of thin glass containers, and safer screw-cap designs may further decrease the bottle-related ocular injuries. More visible warning labels could also help raise awareness of these preventable accidents.

This study has several limitations. First, its retrospective design and relatively small sample size may limit the generalizability of the findings. Second, OCT could not be performed in all patients because of the clinical conditions at presentation, raising the possibility that subtle retinal abnormalities, including mild commotio retinae, may have been missed in some cases. Third, information regarding individual hand dominance was unavailable, and therefore the proposed explanation for the predominance of left-eye injuries remains speculative. Finally, follow-up duration varied considerably among patients, and some individuals were followed for only a few days after injury, which may have limited the identification of delayed posterior segment complications, such as peripheral retinal tears or retinal detachment.

In conclusion, ocular injuries related to carbonated mineral water bottles represent an under recognized but clinically relevant form of ocular trauma. While most injuries are mild and associated with good visual outcomes, more severe cases may occur, particularly following bottle explosion. Increased awareness and simple preventive measures may help reduce the burden of these avoidable injuries.

Researcher Contribution Statement:
Idea and design: G.U.G, S.S.; Data collection and processing: G.U.G, S.S; Analysis and interpretation of data: G.U.G, S.S Writing of significant parts of the article: G.U.G, S.S.
Support and Acknowledgement Statement:
We have no financial support for this study.
Conflict of Interest Statement:
The authors of the article have no conflict of interest declarations.
Ethics Committee Approval Information:
Approving Committee: Uludağ Üniversitesi Tıp Fakültesi Sağlık Araştırmaları Etik Kurulu
Approval Date: April 2026
Decision No: 2026/202/7-13

References

1. Schrader WF, Gramer E. Open globe injuries induced by glass bottles containing carbonated drinks. Graefes Arch Clin Exp Ophthalmol. 2010 Mar;248(3):313-7. doi: 10.1007/s00417-009-1145-z.
2. Erdurman FC, Ceylan OM, Hürmeriç V, Pellumbi A, Durukan AH, Sobacı G. Ocular injuries caused by metal caps of carbonated mineral water bottles. Ulus Travma Acil Cerrahi Derg. 2013 May;19(3):256-60. doi: 10.5505/tjtes.2013.36675.
3. Kuhn F, Mester V, Morris R, Dalma J. Serious eye injuries caused by bottles containing carbonated drinks. Br J Ophthalmol. 2004 Jan;88(1):69-71. doi: 10.1136/bjo.88.1.69.
4. Fonseka C. Ocular injuries from flying bottle caps. Ceylon Med J. 1993 Dec;38(4):190-1.
5. Zhu L, Lou D. Ocular injuries from pressurised bottled drinks in China. Injury. 2014 Jan;45(1):346-7. doi: 10.1016/j.injury.2013.09.039. Epub 2013 Oct 1.
6. Pedro-Egbe CN, Ejimadu CS, Nwachukwu H. Ocular injuries from exploding glass-bottled Coca-Cola® drinks in Port

Harcourt, Nigeria. Clin Ophthalmol. 2011;5:651-4. doi: 10.2147/OPTH.S19083. Epub 2011 May 19.

7. Mondino BJ, Brown SI, Grand MG. Ocular injuries from exploding beverage bottles. Arch Ophthalmol. 1978 Nov;96(11):2040-1. doi:10.1001/archopht.1978.03910060428005.
8. Al Salem M, Sheriff SM. Ocular injuries from carbonated soft drink bottle explosions. Br J Ophthalmol. 1984 Apr;68(4):281-3. doi: 10.1136/bjo.68.4.281.
9. Kuhn F, Morris R, Mester V, Witherspoon CD, Mann L, Maisiak R. Epidemiology and socioeconomics. Ophthalmol Clin North Am. 2002 Jun;15(2):145-51. doi: 10.1016/s0896-1549(02)00005-6.
10. Négrel AD, Thylefors B. The global impact of eye injuries. Ophthalmic Epidemiol. 1998 Sep;5(3):143-69. doi: 10.1076/opep.5.3.143.8364.
11. Pieramici DJ, Sternberg P Jr, Aaberg TM Sr, et al. A system for classifying mechanical injuries of the eye (globe). The Ocular Trauma Classification Group. Am J Ophthalmol. 1997 Jun;123(6):820-31. doi: 10.1016/s0002-9394(14)71132-8.
12. Mendes S, Campos A, Campos J, et al. Cutting Edge of Traumatic Maculopathy with Spectral-domain Optical Coherence Tomography - A Review. Med Hypothesis Discov Innov Ophthalmol. 2015 Summer;4(2):56-63.
13. Ahn SJ, Woo SJ, Kim KE, Jo DH, Ahn J, Park KH. Optical coherence tomography morphologic grading of macular commotio retinae and its association with anatomic and visual outcomes. Am J Ophthalmol. 2013 Nov;156(5):994-1001.e1. doi: 10.1016/j.ajo.2013.06.023. Epub 2013 Aug 20.