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Air Bag Associated Posterior Segment Ocular Trauma

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Abstract

Introduction: a significant number of ocular injuries has been reported associated to air bag deployment. Here we report a clinical case of a blunt air bag associated ocular trauma. The ocular presentation, clinical course, management and visual outcome of this patient is then described. **Case Report: a** 40-years old male was injured by its truck air bag deploying after an accident. He reported ocular damages subsequently the blunt trauma, in particular a macular parafoveal preretinal exudation on the right eye. The patient underwent a clinical evaluation for a medical or surgical approach to treat retinal damage. Instrumental OCT and angiography study were performed. **Discussion**: air bag-associated ocular trauma is induced by impact with the inflating air bag and severe ocular injuries might occur in occupants with unfastened seat belt. The localization of ocular injuries is variable. They are generally caused by 3 mechanism combined or not: blunt trauma, abrasion and chemical damage. The clinical case we described suffered probably from a traumatic maculopathy with a clinical commotio retinae. This type of air bag related injury is quite infrequent (0.8-5.3%) and present a slow but good visual recovery. **Conclusion**: new technologies will require the possibility of air bag disconnection and different gradient of inflation based on the crash forces and seats occupant characteristics, representing a first steps to a better consumer protection.
Key words: air bag, ocular blunt trauma, commotion retinae.

Introduction

Air bag are inflatable devices that are designed to decrease mortality and morbidity resulting from motor vehicle accidents. Deployment of an air bag in a car with a properly belted occupant decreases the mortality rate of motor vehicle crashes by 50% when compared on the cases of unbelted drivers[1-2].
A significant number of ocular injuries has been reported associated to air bag deployment. The severity of air bag injuries ranged from mild to severe and the location from the anterior to the posterior segment. Reported injuries include corneal abrasion, eyelid bruise, periorbital contusion and fracture, subconjunctival haemorrhage, chemical keratitis, hyphema, lens dislocation, cataract, iridodyalisis and angle recession, corneal endothelial cell loss, vitreous and subretinal haemorrhage, choroidal rupture, retinal detachment, and eyeball rupture[3-9]. Here we report a clinical case of a blunt air bag associated ocular trauma. The ocular presentation, clinical course, management and visual outcome of this patient is then described.

Case Report

A 40-years old male, sitting in the driver's seat not wearing seat belt when strucks with his truck at a 50 mph speed. The air bag deployed and he reported subsequent ocular damages.
The ophthalmologic examination on emergency room showed a best corrected visual acuity of 0.4 in the right eye and 0.8 in the left eye. The intraocular pressure was 10 mmHg in the right eye and 16 in the left.
We described a periocular bruising and subconjunctival haemorrhage on both eyes. Slit lamp examination of the right eye revealed 2+ cells and a 3mm hyphema in the anterior chamber; the cornea presented a low subendothelial edema and the iris with a normal appearance. The fundus oculi examination on the right eye showed a preretinal macular exudation and not other pathologic lesions on the periphery. The left eye fundus oculi examination did not reveal any significant pathologic lesion.
OCT examination showed on the right eye a preretinal iperreflective area on macula region, an underlying normal retinal thickness and a preserved foveal depression. On the left eye the examination doesn't show any pathological finding. **(Figure 1)**

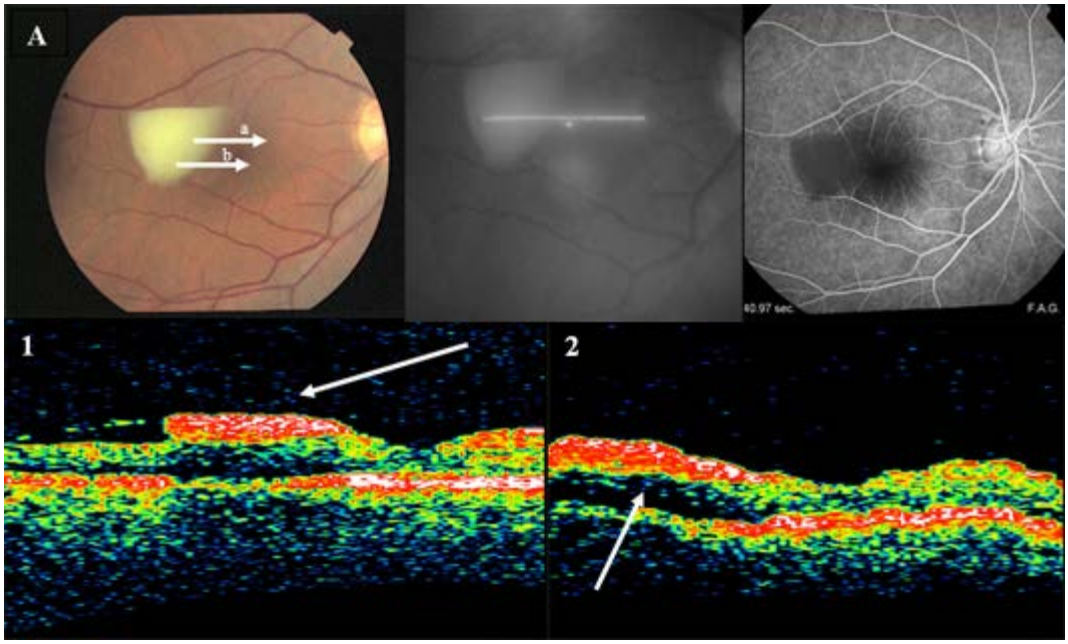

Figure 1: Funduscopic colour photography of right eye posterior pole (A); OCT study over the pathologic lesion: hypereflective preretinal area is markedly visible on the different scans: Scan 1 shows a dense epiretinal exudate just near the fovea (arrow), Scan 2 show a shadow effect on the deeper retinal layers due to the density of the pathologic lesion (arrow).

The angiographic examination confirmed the presence of a preretinal exudation of 1DA extension. No pin point of dye leakage or intraretinal edema were detected. On the left eye the examination didn't show any pathologic element.
We evaluated if a medical or surgical approach could be correct but we preferred to wait and to observe the evolution of the clinical feature.
Three months later periocular bruising and the anterior hyphema was completely resolved in both eyes. The preretinal exudation was partially reabsorbed with an slow restoration of the visual function.
On the left eye we observed a complete anatomical and functional restoration.

Discussion

The air bag is a rubber-lined nylon bag folded into the steering column and the dash board. Sensors located within the vehicle are triggered when a frontal crash occurs at 12mph or more. Air bag deployment occurs in three steps: detection, inflation and deflation. The combustion of sodium azide (detection) within the bag provides nitrogen gas to fill the 50 liter volume of the air bag in 0.05 seconds. The bag is then propelled toward the occupant at a speed of 100 to 200 mph (inflation) so that the occupant will strike the bag once it is fully expanded, and not while is actively inflating. The gases are vented to partially deflate the bag to soften the occupant'landing 100 msec after impact. **(Figure 2)**

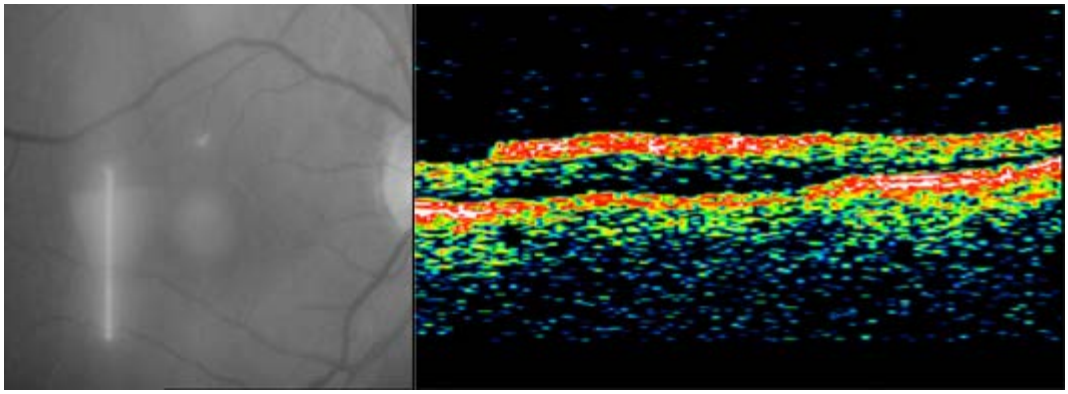

Figure 2: Funduscopic colour photography of right eye posterior pole (A); OCT study over the pathologic lesion: hypereflective preretinal area is markedly visible on the different scans: Scan 1 shows a dense epiretinal exudate just near the fovea.

Air bag-associated ocular trauma is induced by impact with the inflating air bag and severe ocular injuries might occur in occupants with unfastened seat belt. Reports of severe injury most often occur in people of short stature who sit relatively close to the steering wheel.
The localization of ocular injuries is variable. They are generally caused by 3 mechanism combined or not: blunt trauma, abrasion and chemical damage. Periorbital contusion and hyphema are the most common finding secondary to blunt trauma, usually self limited with good vision recovery. **(Figure 3)**

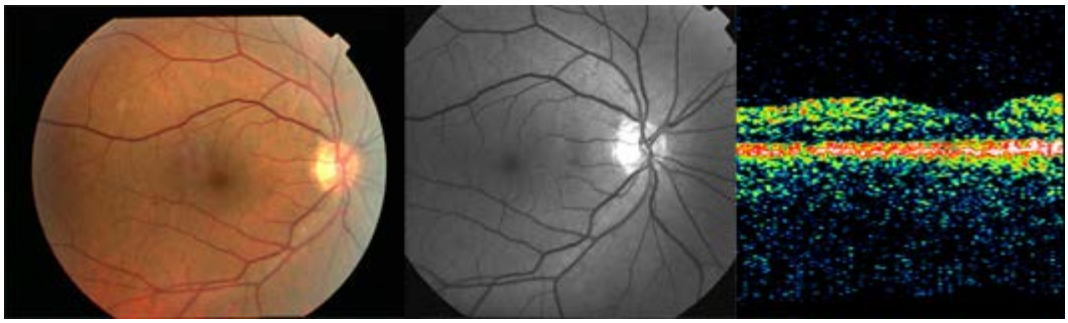

Figure 3: Funduscopic colour photography of right eye posterior pole (A); OCT study over the pathologic lesion: hypereflective preretinal area is markedly visible on the different scans: Scan 1.

Corneal abrasion and chemical keratitis due to the venting of particulate alkali material correlate with the reported chemical burns of the face and hands. The posterior segment ocular injuries could have devastating vision sequelae in the presence of choroidal rupture or retinal detachment. Therefore, patients should be informed and physicians are aware that careful follow up is essential. The clinical case we described suffered probably from a traumatic maculopathy with a clinical commotio retinae. This type of air bag related injury is quite infrequent (0.8-5.3%) and present a slow but good visual recovery. We evaluated to wait in order to appreciate if a self restoration could be possible.

On literature we analyzed correlated risk factors if associated with air bag injury: eyeglasses could be protective or harmful (these data remain a matter of dispute), contact lenses casuistry is so shrink. The patient height analysis, seldom reported, not demonstrate a significant correlation. Crash speed and the fasten seat belt correlate with the level of injury and the patient traumatic involvement. Air bag injuries are infrequently bilateral, occurring in 12.5% of the total injuries.
Analyzing injures occurring from accidents involving airbag deployment, Kuhn and associates found that half were attributable to the air bag itself. “Is that a bomb in our dashboard?” entitled a past magazine about the consequences of the air bag driver protection. Nowadays modifications of air bag has been made to allow the bag to fill more radially rather than anterior-posteriorly. Smart air bag have the characteristics of variable inflation strength depending on the geometry of the crash and the position and weight of the vehicle occupant.

Figure 4: Air bag inflation outline.

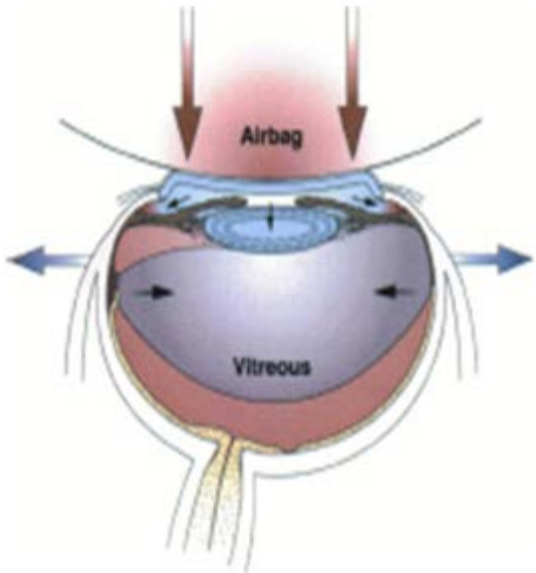

Figure 5: Diagram of the air -bag forces on the blunt trauma.

Conclusion

On the recent VII International Symposium on Ocular Trauma (ISOT) some steps has been made toward the creation of a international register of air bag associated ocular trauma, to set out a correct and systematic data collection and vehicle industry awareness. The possibility of air bag disconnection and different gradient of inflation based on the crash forces and seats occupant characteristics will represent

the first steps to a consumer protection.

As Kenney said on a cited article[10], “Air bag is a friend or a foe?”, we conclude a friend, must be a friend.

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