

## CASE REPORT

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# A Rare Complication of Inhaler Use; Open Globe Injury and Blow Out Fracture After the Inhaler Explosion

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**ABSTRACT:** Open globe injury (OGI) is a serious ophthalmological emergency resulting in loss of vision. Most of these injuries are caused by preventable accidents. Inhalers used in as asthma medication and in some respiratory diseases could contain compressed gas. These inhalers could be exploded by high temperature and cause traumatic injuries. This is the first report of an inhaler explosion causes an OGI with blow out fracture (BOF) and it ends with evisceration. In this article, we present a 58 years old woman with OGI and BOF requiring evisceration as a result of the explosion of an inhaler with containing compressed gas used for her asthma. These inhalers should have warning signs and labels to prevent trauma caused by inhalers. The patients and their relatives should be warned that these drugs may explode and, if possible, these drugs should be replaced with non-explosive forms for preventing possible injuries.

**Keywords:** Blow out fracture; evisceration; eye trauma; inhaler explosion; open globe injury

Inhalers used in as asthma medication and in some respiratory diseases could contain compressed gas. These inhalers could explode with high temperature and cause traumatic injuries. We present an open globe injury (OGI) and blow out fracture (BOF) which is sadly ended with evisceration caused by an inhaler explosion. It is the first report of caused an eye injury with an inhaler explosion. We discuss about suggestions how to prevent these injuries based on our clinic experience.

## CASE REPORT

A 58 years old woman was admitted to our outpatient clinic with corneo-scleral rupture as a result of an inhaler exploded and impacted to her right eye. (Figure 1). She put it in fire, it exploded quickly after putting it and hit her right eye. There was no sense of light perception in the right eye. Slit-lamp biomi-

croscopy examination revealed large corneal rupture, prolapsed out of the intraocular tissues and incisions around the orbita and eyelids. In emergency, computerized tomography scans showed fragmented fractures at medial and inferior walls in the right eye, rupture and collapse of the globe, intraocular hemorrhage and right maxillary sinus hematoma (Figure 2, Figure 3).

The patient underwent surgery for open globe injury under general anesthesia. The patient's right eye was eviscerated because of the high loss of corneal (approximately 270 degree) and scleral tissue, complete disintegration of the lens, prolapse of the highly large part of retinal and choroidal tissues along with the vitreous from the rupture area. In addition, plastic foreign bodies were cleaned, eyelid with tarsal incision and cuts around the eyes were sutured (Figure 4). In the postoperative follow-up pe-

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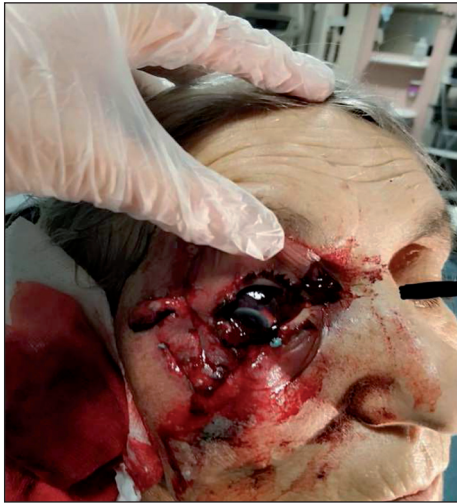


FIGURE 1: Preoperative view of the patient.

riod, soft tissue infection and orbital edema were observed. Postoperative symptoms were controlled by treatment with antibiotics and analgesics. As maxillary sinus hematoma resorbed slowly, she was discharged with a prosthetic eye plan (Figure 5).

Written informed consent was obtained from the patient and her family for publication of this case report and accompanying images.

## DISCUSSION

OGI is a major and preventable cause of monocular blindness and defined as a full thickness injury of the globe, present a severe damage of the eye and often result in poor outcome.<sup>1,2</sup> OGI accounts for about

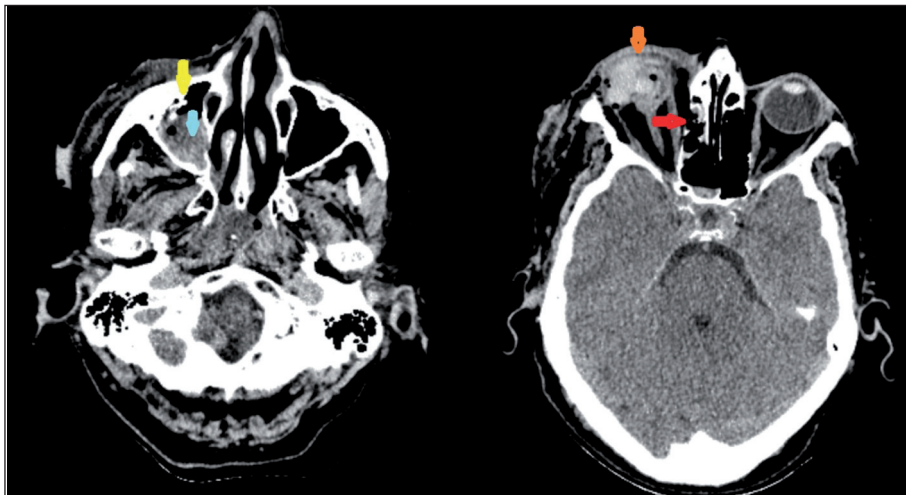


FIGURE 2: CT scans showed fragmented fractures at medial (red arrow) and inferior (yellow arrow) walls in the right eye (blow out fracture), right maxillary sinus hematoma (blue arrow) rupture and collapse of the globe and intraocular hemorrhage (orange arrow).

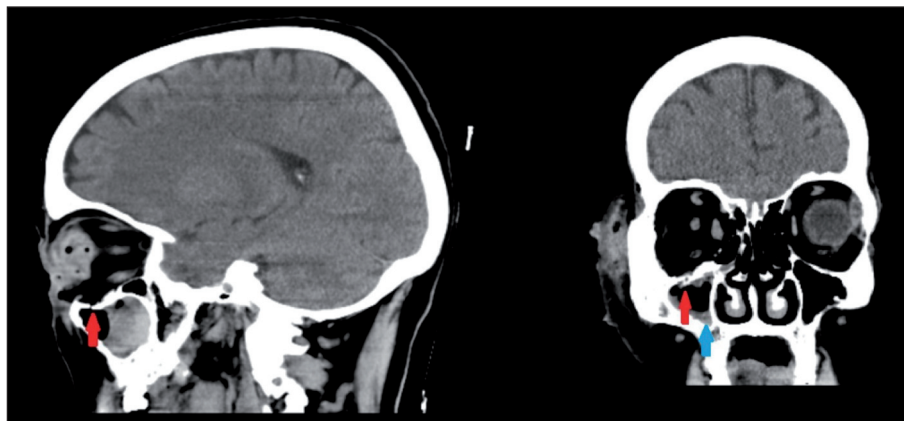


FIGURE 3: Blowout fracture at coronal and sagittal view (red arrows) and right maxillary sinus hematoma at sagittal view (blue arrow).

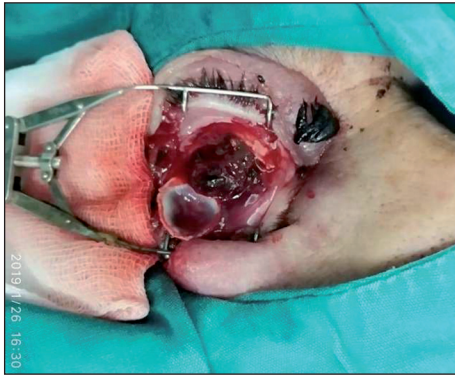


FIGURE 4: Peroperative view of the patient.



FIGURE 5: Postoperative image at 20<sup>th</sup> day.

10% of all eye diseases.<sup>3</sup> Due to the trauma, patients are operated on a wide scale, from primary corneal suturing to evisceration/enucleation. Postoperative visual acuity of patients varies according to the severity of the injury.

The visual prognosis is worse in injuries involving the cornea, sclera and adnexia.<sup>4</sup> They are more serious in the form of blast injuries.<sup>5</sup> In our patient, the inhaler, which had hit the eyeball and caused BOF and a large cornea-scleral rupture. The severity of the injury increased due to impact and heat. Retinal and choroidal prolapse occurred in this large incision. Unfortunately evisceration was required for the right eye which was highly damaged and had very low repair chance with the risk of sympathetic endophthalmitis.<sup>6</sup> The severity of impact sometimes could break the orbital bones and may cause blowout fracture as an example of our patient has experienced.<sup>7</sup> BOF are

isolated orbital floor fractures and usually seen as a result of blunt traumas such as falls, traffic accidents and sports accidents. Because of their thin structure the orbital floor and the medial orbital wall are the most common fractured sites. Blunt trauma to the eye without a pressure component toward the eye rim causes sudden increase of pressure inside the orbit and it results with fracture of the orbital bones. In addition, if the trauma directs towards the orbital rim, it can buckle the orbital walls with consequent fracturing.<sup>8</sup> Bone fractures can cause herniation of orbital contents into sinuses. These could generate some problems such as diplopia and enophthalmos. As our patient was eviscerated we did not observe these problems. Other possible complications are traumatic optic nerve transection, canalicular trauma, eyelid defects, facial burns, trauma to the facial artery and its branches and even life-threatening intracranial traumas.<sup>9</sup> Consequent observation is also required in the development of sympathetic ophthalmia after evisceration.

In previous studies, some cases have been reported as a result of the explosion of the inhaler such as thoracoabdominal penetrating trauma and facial burn.<sup>10,11</sup> According to our knowledge, this is the first case report in which an eye injury occurred due to an inhaler.

There are currently two types of inhalers used throughout the world. One of them is the metered-dose inhalers (MDI) and the other one is dry powder inhalers (DPI). MDIs consist of three major components; the canister which is produced in aluminum or stainless steel by means of deep drawing, where the formulation resides; the metering valve and a mouthpiece. The formulation itself is made up of the drug, a liquefied compressed gas propellant. DPI is a handheld device that usually uses dry powder medications in a capsule which is loaded in the device and pierced than inspiration generates turbulence that disperses the particles in the inspired air. There are many different forms of DPIs that vary among companies. MDIs are still widely used in our country. The boxes of MDI expand and explode violently when it faced with heat. The canister creates massive damage with burst of the propellant compressed gas explosion. The severity and prognosis of the injury is even worse

with the effect of temperature.<sup>12</sup> There are still no warning signs on inhalers for MDIs can explode. In prospectus of these drugs, there is explanation for exploding but usually patients do not read them. Also, if there is a sign, some of them still can ignore or miss these signs. So, if it is necessary to use MDIs, patients should warn with speaking with them. Another fact inhaler medication, which should be used in times of crisis in diseases such as asthma, are often accompanied by patients. This is a higher risk for any possible trauma to exposure. In addition occupational injuries can be observed in patients who work in high-temperature related jobs. The possibility of explosion in contact with a possible fire or heat can be observed in other injuries mentioned above, including eye injury.

In conclusion, inhalers used as asthma medication and in some respiratory diseases could contain compressed propellant gas such as MDIs. These inhalers could be exploded by high temperature and cause traumatic injuries. To prevent possible injuries, MDIs should have warning signs and labels. The pa-

tients and their relatives should be warned that these drugs may explode and, if possible, MDIs should be replaced with non-explosive forms like DPIs.

### **Informed Consent**

*Written informed consent was obtained from the patient for publication of this case report and accompanying images.*

### **Source of Finance**

*During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.*

### **Conflict of Interest**

*No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.*

### **Authorship Contributions**

*All authors contributed equally while this study preparing.*

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