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**‘Yellow vest’ social protests: a new era of facial injuries induced by rubber bullet from non-lethal hand-held weapons**

Rodolphe Lartizien<sup>1,2,3</sup>, Thomas Schouman<sup>1,3</sup>, Mathieu Raux<sup>1,4</sup>, Alexandre Debelmas<sup>1,3</sup>,  
Sophie Lanciaux-Lemoine<sup>1,3</sup>, Aurore Chauvin<sup>1,5</sup>, Adélaïde Toutee<sup>1,5</sup>, Valérie Touitou<sup>1,5</sup>, Jean-  
Louis Bourges<sup>6</sup>, Patrick Goudot<sup>1,3</sup>, Chloé Bertolus<sup>1,3</sup>, Jean-Philippe Foy<sup>1,3</sup>

**Affiliations:** 1- Sorbonne Université, Paris, France; 2- Université Grenoble Alpes, Grenoble, France ; 3- Department of Maxillo-Facial Surgery, 4-Department of Anesthesiology and Critical Care, 5- Department of Ophtalmology, Hôpital Pitié-Salpêtrière, Assistance Publique des Hôpitaux de Paris, Paris, France; 6-Department of Ophtalmology, Université Paris Descartes, Hôpital Cochin, Assistance Publique des Hôpitaux de Paris, Paris, France

**Corresponding author :** Dr Jean-Philippe Foy, Sorbonne Université, Department of Maxillo-Facial Surgery, Hôpital Pitié-Salpêtrière, 47-83 boulevard de l’Hôpital, 75013 Paris France ;  
Tel : 33-(0)142161448 ; email : jean-philippe.foy@aphp.fr

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**1 figure**

France has been facing violent contestation for six months with the national ‘yellow vest’ protests, resulting in about 4.000 casualties<sup>1</sup>. We managed 21 patients who presented with facial and eye injuries caused by rubber bullet from non-lethal hand-held weapons (NLHHWs). Because of a recent trend towards a steady increase in the overall number and violence of protests worldwide<sup>2</sup>, one may expect a rise in injuries caused by NLHHWs.

Facial injuries related to NLHHWs shared common characteristics, such as bone comminution and severe soft-tissue wounds, highlighting the high velocity kinetic mechanism. Notably, we observed multifocal mandibular and/or dento-alveolar fractures which could be associated with transfixing wounds of the lip, as well as comminuted zygomatic fractures and orbital walls blowout fractures which were frequently associated with severe ocular traumatism (Figure 1A-B). Most of ocular injuries were extremely severe resulting in an initial visual acuity <20/200 and an Ocular Trauma Score (OTS)  $\leq 2$  in half of the cases. We observed open-globe ruptures resulting in blindness, as well as severe closed-globe injuries such as choroidal detachment, and eyelid or lacrimal system lacerations. Intriguingly, a post-operative infection and/or a wound dehiscence were noted in four patients (19%).

Although rubber bullets from NLHHWs are designed to induce blunt injuries to incapacitate violent individuals without using firearms, they may induce death as well as severe traumas with irreversible functional consequences and long-term social implications<sup>3</sup>. Contrary to plastic bullets, rubber bullets cause more severe injuries to the head<sup>4</sup> which is particularly vulnerable to such projectiles<sup>3,5</sup>. Besides the significant severity of the facial traumatism observed during the recent events, we have learned some lessons from the challenges associated with their management and we designed a simplified algorithm to deal with such cases (Figure 1C). Each patient suffering from a midface traumatism induced by rubber-bullet from NLHHWs needs a CT scan and an early examination by a maxillofacial

surgeon and an ophthalmologist. Immediate surgery is required for open-globe injuries, injuries of the nasolacrimal system as well as orbital wall fracture with muscle entrapment, which can be easily suspected by prehospital care emergency services (ocular tonus, globe injury, light perception, pupillary reactivity, oculomotricity testing). Early surgical management of these injuries is required to improve visual prognosis and aesthetic outcomes as well as to decrease the risk of endophthalmitis, diplopia and chronic epiphora. A long-term follow-up is needed in order to correct potential sequelae.

The recent social unrest in France has shed light on a new era of facial injuries induced by NLHHWs, which need to be treated quickly and efficiently in trauma centers by an experienced multidisciplinary team. Training courses will have to be provided in order to optimize initial patient care by prehospital medical services.

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## **Legend**

### **Figure 1. Management of severe midface traumatism caused by rubber-bullet**

**NLHHWs.** (A-B) Computed tomography (CT) imaging from two patients suffering from severe midface traumatism. (A) Right comminuted zygomatic fracture on 3D reconstruction CT scan and (B) orbital walls blow-out fracture on coronal CT scan. (C) Surgical strategy algorithm for severe midface traumatism caused by NLHHWs. Open-globe injuries, muscular incarceration can be promptly detected by a quick examination (ocular tonus, globe injury, light perception, pupillary reactivity and oculomotricity testing) which can be easily performed by prehospital care emergency services.

OPH: ophthalmologists. MFS: maxillo-facial surgeon