

Original article

Hand injuries due to firework devices: A series of 58 cases

Traumatismes de la main par feu d'artifice : une série de 58 cas

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Abstract

Fireworks or firecrackers can cause serious accidents. They are classified from K1 to K4 according to the amount of powder they contain. In Alsace (France), a type-K1 firecracker is available on the free market and the K2 and K3 ones are prohibited. The aim of this study was to reveal the effects of measures taken in order to prevent repercussions related to hand injuries caused by fireworks. Patients who fell victim to firework incidents have been recorded since 2006, starting date of the prevention campaign. Records have been taken on the circumstances, the group of firecracker, the level of injury and the severity of the injury in four stages. Our series included 62 hands from 58 patients (average age: 25 years), including two women. Most of them sustained their injury during the night of New Year's Eve. The study dealt with 21 K1, and 35 K2 or K3. We registered 29 cases of grade I, 2 grades II, 21 grades III and 9 grades IV. One patient died. The numbers of consultations, K2/K3 injuries and number of surgeries increased from 2006 to 2012. Our results show that firework-related injuries to the hand are serious, pluridigital, multistage and/or bilateral. Prevention was ineffective but should be improved and strengthened, as a total ban on fireworks is a counterproductive measure.

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Keywords: Firecracker; Blast; Explosion; Amputation

Résumé

Les artifices de divertissement, pétards ou feux d'artifice, peuvent provoquer des accidents graves. Ils ont été classés de K1 à K4 en fonction de leur quantité de poudre. En Alsace, les K1 sont en vente libre, les K2 et K3 interdits. Le but de ce travail était d'étudier l'effet de la prévention sur l'incidence des lésions des mains provoquées par les artifices de divertissement. Les patients, victimes de pétards, ont été recensés à partir de 2006, date de début d'une campagne de prévention. Ont été notés les circonstances, le groupe du pétard, le niveau lésionnel, la gravité en quatre stades. Notre série comportait 62 mains chez 58 patients, âgés en moyenne de 25 ans, dont deux femmes. La plupart étaient blessés lors de la Saint-Sylvestre. Il s'agissait de 23 K1 et 35 K2 ou K3. On notait 29 grades I, 2 grades II, 21 grades III, et 9 grades IV. Un patient était décédé. Les nombres de consultations, de lésions par K2/K3 et d'opérés ont augmenté de 2006 à 2012. Nos résultats montrent que les lésions de la main par artifices de divertissement sont graves, pluridigitales, multiétagées et/ou bilatérales. La prévention a été inefficace, mais devrait être améliorée et renforcée, car l'interdiction totale des artifices de divertissement est une mesure contreproductive.

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Mots clés : Pétard ; Blast ; Explosion ; Amputation

1. Introduction

The use of fireworks during public gatherings can lead to serious accidents. We distinguish firecrackers, which are

mainly used for the noise they produce, from fireworks, rather used for the effect of light they produce.

Severe facial and hand injuries, caused by an improper use, have been reported in several countries, including Europe and overseas [1–5].

French classification of firework devices distinguishes four groups, ranked according to the amount of powder they contain, ranging from K1 to K4 in ascending order. In most European countries, K1 types are available on the free market for the

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general public, including children [6]. Worldwide, K4 firework devices can only be purchased by professionals. However, K2 and K3 types are either on the free market or they are banned to the general public, depending on local laws.

Due to the prevalence of accidents caused by fireworks in our region (Alsace, France), the prevention policy has been reinforced since 2006 [7]. The aim of this study was to reveal the effects of measures taken in order to prevent repercussions related to hand injuries caused by fireworks from 2006 to 2012.

2. Materials and methods

All the patients related to accidents caused by firework devices admitted to our unit were identified retrospectively from 2006 to 2012. Prevention policies by local authorities have been implemented since 2006 at the beginning of each month of December. They included the ban of K2/K3 sale to the general public, the broadcast of information pamphlets about the danger of firework devices, public debates in schools and health facilities, and press conferences. The on-call staff in ophthalmic as well as in hand surgery were doubled on the night of New Year's Eve 2010.

For each patient we recorded: age, gender, hand dominance and occupation or activity.

The circumstances of the injury were also recorded: festive event, time of arrival at the unit, and type of firework device causing the injury, depending on their affiliation to a group (K1 to K4) according to the national classification [6] and secondly its mode of ignition (regular firecrackers, mortars, rocket). A

Table 1

Severity of hand injuries by fireworks according to our classification.

| Grade | Injury |
|-------|------------------------------------|
| I | Skin/muscle |
| II | I + nerve |
| III | II + joint |
| IV | III + devascularization/amputation |

regular firecracker is held in the hand and lit by a fuse or a scraper; a mortar and a rocket are placed on the floor and lit by a wick. A mortar explodes on the ground while a rocket rises about thirty meters above the ground.

The characteristics of the lesions were recorded: the affected side, affected finger, level of injury according to the International Classification of the flexor tendons [8], and severity depending on the affected tissue. The severity of lesions was assessed in four stages (Table 1) based on the classification of lesions of the thumb caused by military explosives [9]. Treatment was recorded as follows: outpatient or surgical procedure in the operating room. Associated lesions (eye, maxillofacial, etc.) and critical incidents were documented.

3. Results

Our hand surgery unit receives more than 8000 cases a year. Our series included 62 hands in 58 trauma patients injured mainly during the night of 31st December to 1st January (Table 2). The average age was 25 years with extremes ranging

Table 2

Casuistry of a series of 58 patients with hand injuries by fireworks.

| (n) | Patient | | | | Condition | | | | |
|-----|------------|--------------|----------------------|---------------|----------------|---------------------|---------------|---------------|--|
| | Age (year) | Gender (M/F) | Hand dominance (R/L) | Occupation | Event (°) | Time of arrival (h) | Agent | | |
| | | | | | | | Group (K1-K4) | Type (M/FC/R) | |
| 1 | 14 | M | R | Educated | New Year's Eve | 15h41 | K2/K3 | M | |
| 2 | 19 | M | R | Educated | New Year's Eve | 01h39 | K2/K3 | M | |
| 3 | 18 | M | R | Educated | New Year's Eve | 23h42 | K2/K3 | M | |
| 4 | 20 | M | R | Unemployed | 0 | 23h06 | K1 | R | |
| 5 | 52 | M | R | Manual | Wedding | 04h14 | K2/K3 | M | |
| 6 | 48 | M | R | Manual | New Year's Eve | 21h02 | K1 | FC | |
| 7 | 15 | M | R | Educated | New Year's Eve | 23h24 | K1 | FC | |
| 8 | 28 | M | R | Manual | New Year's Eve | 00h26 | K1 | FC | |
| 9 | 15 | M | R | Educated | New Year's Eve | 00h37 | K1 | FC | |
| 10 | 20 | M | R | Unemployed | National feast | 03h00 | K2/K3 | M | |
| 11 | 23 | M | R | Manual worker | New Year's Eve | 00h46 | K2/K3 | M | |
| 12 | 24 | M | R | Unemployed | New Year's Eve | 00h54 | K1 | FC | |
| 13 | 17 | M | R | Educated | New Year's Eve | 00h50 | K2/K3 | M | |
| 14 | 16 | M | R | Educated | New Year's Eve | 01h02 | K1 | FC | |
| 15 | 22 | M | R | Manual worker | New Year's Eve | 01h12 | K3/K3 | FC | |
| 16 | 30 | M | R | Manual worker | New Year's Eve | 01h19 | K2/K3 | M | |
| 17 | 33 | M | R | Manual worker | New Year's Eve | 02h57 | K2/K3 | M | |
| 18 | 10 | M | L | Educated | New Year's Eve | 14h37 | K1 | FC | |
| 19 | 17 | M | L | Educated | New Year's Eve | 17h12 | K2/K3 | M | |
| 20 | 32 | M | R | Manual worker | New Year's Eve | 21h44 | K2/K3 | M | |
| 21 | 27 | M | R | Unemployed | New Year's Eve | 00h00 | K2/K3 | M | |

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