CASE REPORT

Glass-coated kites and cervical injuries: a serious threat to children and adults

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INTRODUCTION

Kite flying is a popular game for children and adults all over the world. In India, Pakistan, and Bangladesh, people celebrate the arrival of spring by holding a kite festival. These kite festivals include a game of kite fighting, in which participants attempt to use their kite to cut the string of a rival kite. An abrasive material is often placed on the string of the kite to increase its ability to cut other kite strings.[1,2] Typically, the thread is coated with a combination of ground glass and a water-soluble paper glue called manja. In Brazil, kite strings prepared in this manner are known as cerol, and the game is popular in regions with strong winds.[3]

Kites are associated with various types of injuries, including accidents that occur during the preparation of the threads, electrical injuries from high tension currents, falls that occur during the game, or injuries caused to bystanders during kite flying, especially those riding motorcycles or bicycles.[4–6] The severity of the latter type of injury depends on both the speed of the vehicle and the kite, which is directly related to the wind speed. In Brazil, the use of motorcycles has significantly increased in the last few years, and riders are especially vulnerable to injuries caused by manja.[7] Emergency departments have occasionally even reported patients with fatal neck injuries due to kites.

The purpose of the present study was to identify and analyze the type and severity of cervical injuries and the management of patients with penetrating neck wounds due to manja.

METHODS

Between January of 2001 and December of 2008, thirteen patients suffered cervical injuries due to glass-coated kites and were admitted to the following seven hospitals in the metropolitan area of Campinas, Brazil: Hospital das Clinicas da UNICAMP, Hospital e Maternidade (under Dr. Celso Pierro), Santa Casa de Limeira, Santa Casa de Mogi-Guaçu, Hospital Augusto Oliveira Camargo-Indaiatuba, Hospital Municipal de Paulínia, and Hospital Municipal de Hortolândia. The medical histories of the patients were reviewed retrospectively, and the victims who died at the scene were excluded from the present study.

Initial treatment by the pre-hospital team at the scene of the accident included airway establishment by intubation, hemorrhage control by direct pressure or packing, and fluid resuscitation. Uniform management practices were employed by the seven emergency departments (ED), and advanced trauma life support (ATLS®) protocol was applied. The oral pharynx was carefully examined, and any internal wounds or blood were noted. Respiratory distress, hoarseness, subcutaneous emphysema, and associated injuries were also evaluated. When necessary, laryngoscopy, bronchoscopy, and esophagoscopy were conducted in the operating room. The neck was divided into three zones: I, below the cricoid cartilage; II, between the angle of the mandible and the bottom of the cricoid cartilage; and III, above the angle of the mandible.[8,9]

The demographics of the patient (gender and age), mechanism of injury, time spent at the scene and in transit to the hospital, vital signs upon admission, time interval between the initial injury and required operation, injuries to organs, type of surgical procedure required by the patient, presence of post-operative complications, length of stay (LOS, measured in days), and mortality were recorded. Trauma was quantitatively assessed by determining the revised trauma score (RTS) and the injury severity score (ISS). Institutional ethics committee approval was obtained from the State University of Campinas. The data were entered according to a standard protocol and were analyzed using the Epi-Info 6.04 software.

RESULTS

In total, thirteen patients (twelve men and one woman) were evaluated in the present study. The mean age of the patients was 30 years old (range: 7–50 years), and all of the injuries were caused by kite strings coated with manja. Eleven of the victims were riding a motorcycle, one victim was riding a bicycle (the only child in the present study), and one was riding a horse.

The mean average time spent by the pre-hospital team transporting patients to the hospital and assisting victims at the scene was 29 $\pm$ 12 minutes; however, the total time varied from 5 to 60 minutes. In one case, the patient was transferred to a second hospital after one hour in the ED. Except for two patients who made their own way to the hospital, the patients were transported to the emergency department by the pre-hospital team.

In four of the patients, deep neck wounds that exposed the larynx of the trachea were observed. One patient presented an associated neurological deficit (a Glasgow Coma Score of 5) and was transported with a definitive

Figure 1 - The victim was riding a motorcycle and suffered a cervical penetrating trauma.

airway that was inserted at the scene. One victim was transported within five minutes of injury and arrived at the hospital in cardiorespiratory arrest due to a complete transection of the neck vessels and trachea. As a result, this patient died before surgical treatment could be performed. The other twelve patients were hemodynamically stable upon admission, and the mean RTS of these patients was 7.55 $\pm$ 0.98. Except for the patient who was intubated upon admission, evidence of respiratory distress was not observed.

Twelve patients had injuries in zone II, and one patient had an injury in zone III. In all of the cases, penetrating neck injuries were immediately explored because the wounds were deep and had transected the platysma (Figure 1). All of the injuries were diagnosed during the first operative exploration. In five of the patients, the surgical team used the cervical wound to access the injury. The injured structures and their respective treatments are described in Table 1. The most common non-fatal lesions were of the jugular veins (in six patients), larynx (six patients), and trachea (one patient). Venous injuries were treated with ligatures, and all seven of the respiratory tract injuries were sutured. A tracheostomy was placed in four patients (57.2% of the patients with respiratory tract injuries). Laryngeal surgical treatment included repair of the mucosal tears, a reduction in the displaced fractures, and suturing of the cartilage fragments without endolaryngeal molding, which was associated with tracheostomy in three patients. In all of the cases, the tracheostomy was removed after four weeks.

The mean ISS of the patients was 8.5 $\pm$ 6.1. Peri- or post-operative complications did not occur in the patients who underwent operations, and the mean average LOS was three days. The follow-up period ranged from four months to two years. The recovery of the patients was satisfactory, and only one patient with laryngeal injury had temporary hoarseness, which was monitored by a phonoaudiologist.

DISCUSSION

Penetrating neck wounds are often dramatic and require immediate action. When the laceration transects the platysma, it is unclear whether patients without obvious vascular or visceral cervical injuries should undergo wound exploration or whether they should be carefully observed until occult injuries become obvious.[9] Contact between manja and human skin can lacerate the skin and the deep fascia of the neck and injure internal cervical structures, such as the carotid arteries, jugular veins, larynx, and trachea. The severity of cervical injury in our cohort appeared to be related to the speed at which the manja and the victim came into contact. A positive correlation between the severity and depth of the injury and the speed of the motorcyclist or rider at impact was observed. Unfortunately, a helmet only protects the face from injuries, but the neck remains exposed.

The construction of a definitive airway prior to transport was only necessary in one patient. Most of the patients were stabilized at the ED. With the exception of the patient who died shortly after arrival in the ED, all of the patients in the present study required surgery for obvious clinical indications. Operative exploration revealed visceral or vascular injuries in all but one patient. Seven patients presented laryngotracheal trauma, and four presented complex injuries that required suturing and a temporary tracheostomy. When a patient has severe injuries, ED protocol dictates avoiding complications of subsequent laryngeal edemas.[8] The only carotid injury occurred in the patient who died, and all of the venous injuries were treated with a ligature. Post-operative complications were not observed, and the mortality rate was 7.7% (one patient).

Table 1 - Injured structures, operative treatments, ISS, and LOS.

N	Injured structures	Treatment	ISS	LOS
1	Larynx	Sutures + tracheostomy	9	4
2	Anterior jugular vein	Venous ligature	4	3
3	Larynx	Sutures	9	2
4	Larynx, internal and external jugular vein	Sutures + venous ligatures	9	3
5	Larynx and external jugular vein	Sutures + tracheostomy + venous ligature	9	4
6	Trachea	Sutures + tracheostomy	16	3
7	Internal and external jugular vein	Venous ligatures	4	3
8	Larynx, anterior and external jugular vein	Sutures + venous ligature	9	3
9	Larynx and anterior jugular vein	Sutures + tracheostomy + venous ligature	9	4
10	Thyroid gland	Sutures	4	3
11	Muscles only	Sutures	4	2
12	Superior thyroid artery	Ligature	4	2
13	Trachea, common carotid arteries, and internal and external jugular veins	Death on arrival	25	0

N, patient number; ISS, injury severity score; LOS, length of stay (days).

Kite flying is a high-risk activity. For example, numerous electrical injuries related to kite flying have been reported, and fatal injuries have occurred.[1,4–6] Neto *et al.*[3] reported two patients who sustained neck injuries due to a kite string in 1998 in Belo Horizonte, Brazil. Within a 2-month period, 49 patients with manja-related injuries were admitted to the hospital in Brazil.

Injuries related to kite flying are preventable. Precautions include choosing a safe location (such as an open beach or field with a diameter of at least 100 meters) and keeping a safe distance from telephone lines, electricity cables, trees, roads, cars, people and animals. Participants should not touch the kite string during flight, allow anyone to walk in between the control handle and the kite, or fly a kite in strong winds. Moreover, participants should wear gloves while flying a kite. The severity of injury does not depend on the thickness of the kite string or on the size of the kite. The use of glass and glue increases the potential cutting surface of the string, turning a simple game into a deadly activity.

Recently, regional laws that prohibit the preparation and sale of manja have been approved. In the last few months, the implementation of Sao Paulo State law 12,192 has reduced the number of injuries related to kite flying in the metropolitan area of Campinas.

In conclusion, the results of the present study indicated that potentially lethal injuries to the vascular system and visceral injuries to the neck can occur due to kite flying. This atypical mechanism of injury must be examined to develop preventive measures and to prepare emergency physicians and trauma surgeons for the appropriate management of patients.

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REFERENCES

1. Tiwari VK, Sharma D. Kite-flying: a unique but dangerous mode of electrical injury in children. Burns. 1999;25:537–9, doi: 10.1016/S0305-4179(99)00015-7.
2. Wankhede AG, Sariya DR. ''Manja'' - A dangerous thread. J Forensic Leg Med. 2008; 15:189–92, doi: 10.1016/j.jflm.2007.07.002.
3. Neto JB, Ferreira GC, Filho AL, Fontes MO, Bomfim F, Abrantes WL. Kiting Injuries: Report of Two Cases and Discussion. J Trauma. 2000; 48:310–1, doi: 10.1097/00005373-200002000-00019.
4. Kyriacou DN, Zigman A, Sapien R, Stanitsas A. Eleven-year-old male with high-voltage electrical injury and premature ventricular contractions. J Emerg Med. 1996;14:591–7, doi: 10.1016/S0736-4679(96)00132-1.
5. Meza-Ortiz F, Rojas-Solís MB, Noriega-Zapata PA. Quemaduras eléctricas en niños. Reporte de tres casos relacionados con papalotes. Revisión de la literatura. Gac Med Mex. 2000;136:373–7.
6. Wankhede AG, Sariya DR. An electrocution by metal kite line. Forensic Sci Int. 2006;163:141–3, doi: 10.1016/j.forsciint.2005.09.011.
7. Souza MFM, Malta DC, Conceição GMS, Silva MMA, Gazal-Carvalho C, Morais Neto OL. Análise descritiva e de tendência de acidentes de transporte terrestre para políticas sociais no Brasil. Epidemiol Serv Saúde. 2007;16:33–44.
8. Fraga GP, Mantovani M, Hirano ES, Crespo NA, Horovitz APNC. Laryngeal trauma. Rev Col Bras Cir. 2004;31:380–5.
9. Rathlev NK, Medzon R, Bracken ME. Evaluation and management of neck trauma. Emerg Med Clin North Am. 2007;25:679–94, doi: 10.1016/j.emc.2007.06.006.