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KITE STRING INJURY: OUR EXPERIENCE AT A TERIARY CARE CENTER

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Abstract

Background: *Kite flying is a popular sport in many cultures around the world. In India, Makar Sankranti or Uttarayan is celebrated on 14th January. This festival is dedicated to the 'Sun God', 'Surya' in Hindu religion. 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. Injuries related to kite flying commonly range from mild injuries to severe disability and death; and may manifest with varied clinical presentations with chemical, metallic strings. Kite flying is very common in India and we feel that trauma caused by the kite thread is grossly underreported.* ***Observations and Results:*** *In our study, there were total 40 cases reported during the period of 2 months, December and January. 39(97.5%) of cases were reported during 13th to 15th January and 1(2.5%) case in December 2018. 35(87.5%) were male patients and 5(12.5%) female patients. 4(10%) patients were below 12 years and the rest were above 12 years. Protective measures wise, 26(65%) patients did not use any protective device out of these 10(38.5%) had severe injuries. While 5(12.5%) of them used either muffler or dupatta around their neck, 2(50%) patients had severe injury. 6(15%) patients used helmets and 3(7.5%) patients used wire frame in front of the vehicle; none of them had severe injuries. 12(30%) of the 40 patients had severe injuries involving neck muscles, major vessels and upper airway compromise, sclera, conjunctiva, eyelid, out of which 3(7.5%) patients required tracheostomy as a lifesaving procedure of which one succumbed to death. Out of 40 patients, 1(2.5%) patient succumbed to injuries and 39(97.5%) survived.* ***Conclusion:*** *A seemingly harmless game of kite flying can cause grievous harm even death not only to the flyers but also to innocent others. This study highlights that protection such as helmet, muffler, dupatta around the neck can reduce the grievousness of injury over head and neck but not give complete protection from innocent looking kite threads. Awareness programmes regarding the safety measures to protect oneself from grievous injuries can be conducted using pictorial depictions, minimal usage of two wheelers during those peak hours of kite flying can reduce the incidence of casualties caused by killer manja. Banning of Chinese threads and glass coatings on the threads by government can also reduce injuries.*

Keywords: *Kite string, head and neck injuries.*

INTRODUCTION

Kite flying is a popular sport in many cultures around the world. In India, Makar Sankranti or Uttrayan is celebrated on 14thJanuary. This festival is dedicated to the Sun God, 'Surya' in Hindu religion [1]. 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 [2].

Kite string also called as Manjha in India is based on pure cotton thread coated with a mixture of rice gluten, tea gums and similar natural ingredients and an abrasive: finely powdered glass, aluminium oxide or zirconia alumina [3]. In recent years, synthetic line has been coated with a variety of abrasives and strong glue they are also called as the Chinese strings, also there have been report of metallic line being used. These strings are tied to kites which are made of light paper and bamboo sticks which are glued together. All these strings with sharp cutting properties have increased the incidence of deep neck wounds and facial wounds.

Injuries related to kite flying commonly range from mild injuries to severe disability and death; and may manifest with varied clinical presentations with chemical, metallic strings [2]. Various types of accidents occur due to kite flying like injuries to fingers and hands, fall from heights during kite flying, lacerated injuries to the head and neck regions and stray string injuries to motorcycles and bicycles riders [4,5].

Kite flying is very common in India and we feel that trauma caused by the kite thread is grossly underreported.

The neck is commonly divided into three distinct zones, which facilitates initial assessment and management based on the limitations associated with surgical exploration and haemorrhage control unique to each zone [6].

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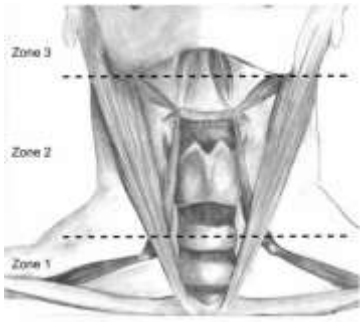

a. Zone I

Zone I, the most caudal anatomic zone, is defined inferiorly by the clavicle/sternal notch and superiorly by the horizontal plane passing through the cricoid cartilage. Structures within this zone include the:

- Proximal common carotid arteries.
- Vertebral and subclavian arteries.
- Subclavian, inominate, and jugular veins.
- Trachea.
- Recurrent laryngeal and vagus nerves.
- Oesophagus.
- Thoracic duct.

Vascular injury management is challenging in Zone I, and mortality is high. Due to the sternum, surgical access to Zone I may require sternotomy or thoracotomy to control haemorrhage.

b. Zone II

Zone II, the middle anatomic zone, is between the horizontal plane passing through the cricoid cartilage and the horizontal plane passing through the angle of the mandible. Vertically or horizontally oriented
neck exploration incisions provide straightforward surgical access to this zone, which contains the:

- Carotid arteries.
- Jugular and vertebral veins, pharynx, and larynx.
- Proximal trachea.
- Recurrent laryngeal and vagal nerves.
- Spinal cord.

c. Zone III

Zone III, the most cephalad anatomic zone, lies between the horizontal plane passing through the angle of the mandible and the skull base.

Anatomic structures within Zone III include the:

- Extracranial carotid and vertebral arteries.
- Jugular veins.
- Spinal cord.
- Cranial nerves
- Sympathetic trunk.

The aim of this study is to highlight the magnitude of the injuries caused by kite thread and to create awareness regarding the grievousness of this issue.

METHODOLOGY

A prospective cross-sectional study was conducted comprising of patients who were directly injured due to kite string over face and neck region, presented to the emergency department at L.G Hospital, Ahmedabad during the months of December 2018 and January 2019. Informed consent was taken and proforma was filled including biodata, history and detailed description of the injuries. Patients were treated on day care basis or were admitted and were taken in the operation theatre and were managed according to the severity of their injuries. Injuries involving regions other than head and neck were managed with respective departments.

INCLUSION CRITERIA

- Subjects who were directly injured with kite string over face and neck region in the period of December 2018 to January 2019 and presented to emergency department at L.G hospital.

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- Subjects who gave consent to participate in the study.

EXCLUSION CRITERIA

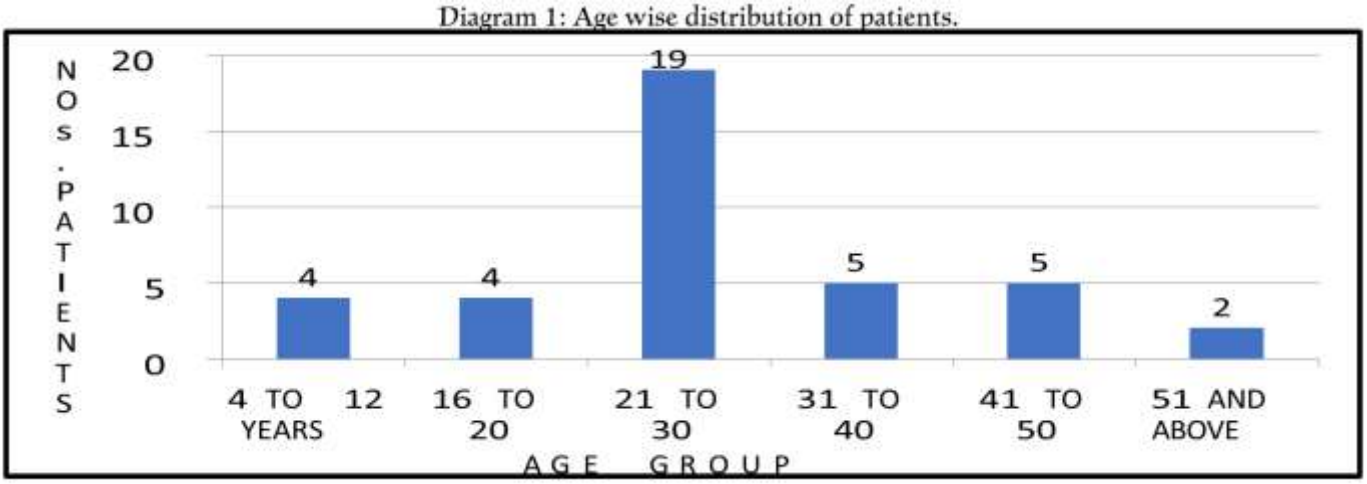
- Subjects who did not give consent to participate in the study.
- Subjects who were not directly injured due to kite string or involving injuries other than face and neck region.

OBSERVATION AND RESULT

There were total 40 cases reported during the period of 2 months, December and January, 39 (97.5%) of which were reported during 13th to 15th January and 1(2.5%) case in December 2018. Majority of the patients were male and male to female ratio was 7:1, 35 (87.5%) were male patients and only 5 (12.5%) were female. This can be explained as in our culture in many families, males are sole bread earners.

Patients aged 21 to 30 years formed the bulk of population; age distribution is depicted in Diagram 1. This age group uses two-wheeler more, hence more prone to such injuries.

Diagram 1: Age wise distribution of patients.



Looking into the vehicles used by these patients the picture which emerges is as follows; out of 40 patients, 31(77.5%) used the Motor bike, while 6(15%) were on gearless 2-wheeler like Activa, Scooty and Scooter, 1(2.5%) on bicycle and 2(5%) were pedestrians.

Relation of speed and severity of injury is depicted in Table 1. Considering the speed range, vehicles above 50 Km/h contributed for 9 (22.5%) patients, between 30 and 50 Km/h, 7 (12.5%) patients, and below 30 Km/h there were 24(60%) patients depicted in (Diagram 2). It is inferred that severity of injury is directly proportional to the speed of the vehicles. Most of the patients presented to the emergency department between morning to early evening which were the peak hours for kite flying.

Table 1. Relation of speed and severity of injury.

Speed of vehicle	Severe Injury	Mild-Moderate Injury	Total
≥50Km/h	5	4	9
30Km/h-49Km/h	4	3	7
<30Km/h	3	21	24

Table 2. Relation of severity of injuries with protective measures according to the speed.

≥50Km/h	Total	No protective measure used	Dupatta/muffler around neck	Wire frame in front of vehicle	Helmet
severe injuries	5	5	0	0	0
mild-moderate injuries	4	1	0	0	3

30Km/h-49Km/h	Total	No protective measure used	Dupatta/muffler around neck	Wire frame in front of vehicle	Helmet

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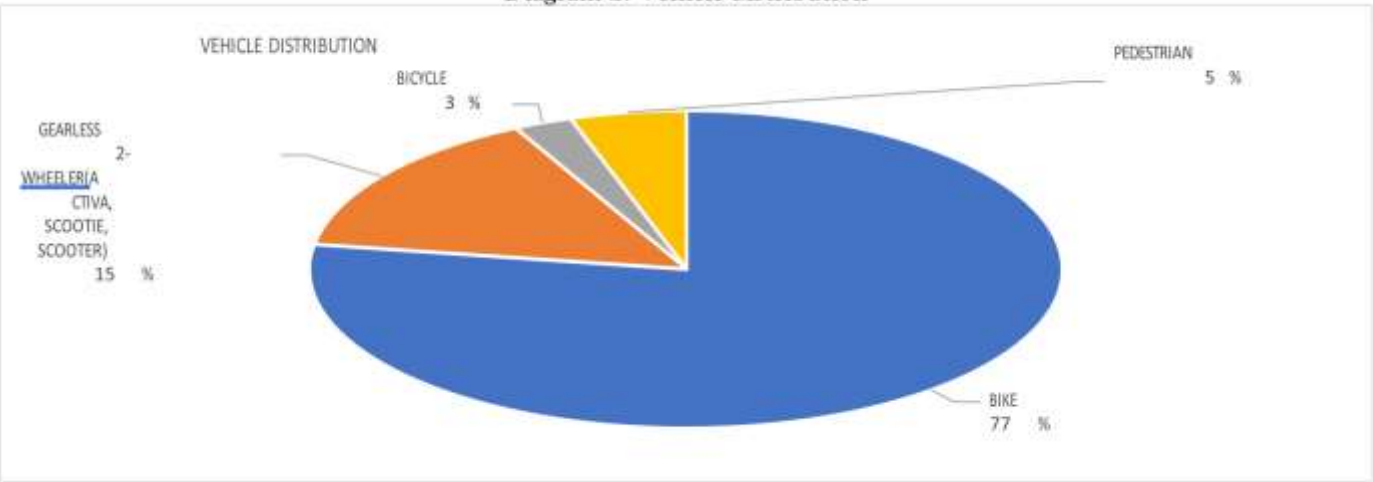
severe injuries	4	3	1	0	0
mild-moderate injuries	3	0		2	1

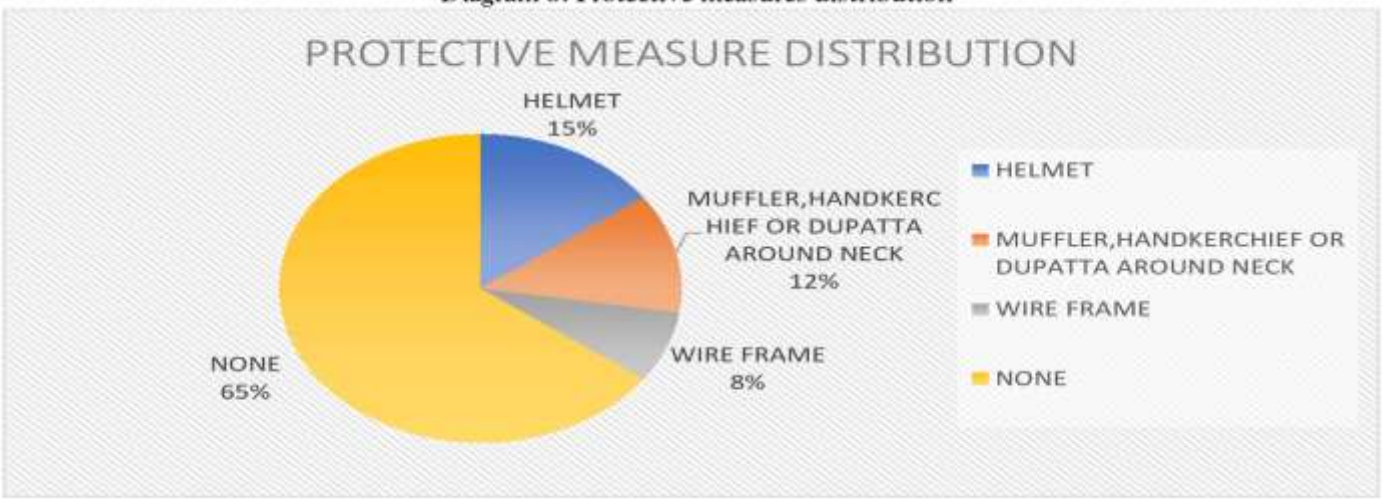
<30Km/h	Total	No protective measure used	Dupatta/muffler around neck	Wire frame in front of vehicle	Helmet
severe injuries	4	3	1	0	0
mild-moderate injuries	20	14	3	1	2

Diagram 2: Vehicle distribution



4 (10%) of the patients met with the injury over flyover, rest of them on the plane surface. Out of the 4 patients 1 met with severe injuries .35 (87.5%) patients came to the emergency department within 30 minutes of the casualty. Protective measures wise, 26(65%) patients did not use any protective device out of these 10(38.5%) had severe injuries. While 5(12.5%) of them used either muffler or dupatta around their neck, 2(50%) had severe injury. 6(15%) patients used helmets and 3(7.5%) used wire frame in front of the vehicle none of them had severe injury. Protective measure distribution depicted in diagram 3.

Diagram 3: Protective measures distribution



Out of 12(30%) patients with severe injuries 10(83.3%) patients did not use any protective measures where 2(16.6%) patients used muffler around the neck. 28(70%) patients had mild to moderate injuries out of which 12(42.8%) patients used protective measures such as dupatta or muffler around neck or wire frame or helmet, whereas 16(57.2%) patients

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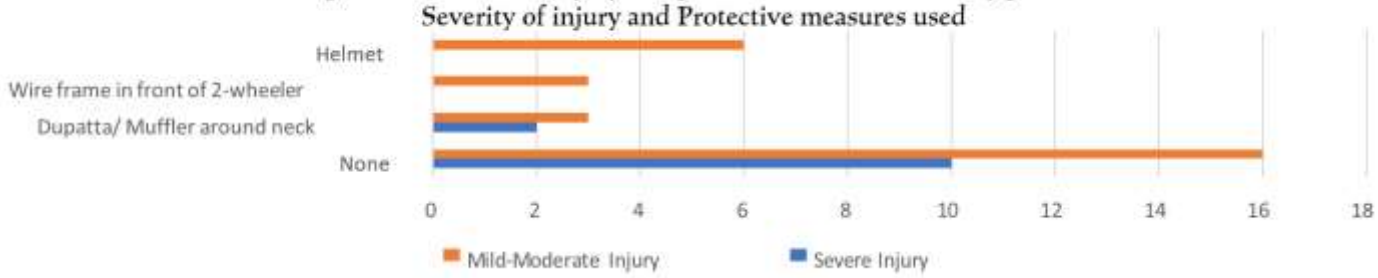
did not use any protective measures. Depicted in Diagram 4. So, it can be concluded that protective measures do help to reduce the severity of injury. And usage of multiple protective devices at the same time can increase the safety.

Diagram 4: Relation of injury and protective measures used by patients.



12(30%) patients of the 40 patients had severe injuries involving neck muscles, major vessels and upper airway compromise, sclera, conjunctiva, eyelid out of which 3(7.5%) patients required tracheostomy as a lifesaving procedure, of which one succumbed to death in other two patients decannulation was done after 2 weeks as patient stabilised.

Table 3: Major structures injured in patients.

Injured major structure		No. of patients
Air way exposed	Thyrohyoid membrane	1
	Thyroid cartilage	1
	Cricothyroid membrane	1
	Cricoid cartilage	0
	Trachea injured	1
Major blood vessels	Bilateral carotid arteries and IJV	1*
	Anterior jugular vein	1
Neck muscles	Platysma muscle	3
	Strap muscles	3
	Sternocleidomastoid muscle	2
Face		15
Eyes	Sclera, conjunctiva, lids	1
Thyroid gland injured		2
Parotid salivary gland injured	Parotid gland partial thickness injury	3

*patient succumbed to death due to severe bleeding

Carotid colour doppler and ultrasonography of neck were carried out in 6(15%) post-operative patients based on the depth and severity of face and neck injuries.

2(5%) out the 40 patients with injuries over face and neck were referred to ophthalmology department and 2 were referred to orthopaedic department for injuries involving respective regions.

Out of 40 patients, 1 (2.5%) succumbed to injuries and 39 (97.5%) survived.

Out of 40 patients 15(37.5%) had facial injuries, and 25(62.5%) had injuries involving neck region, according to zone, patients were categorised as 19 patients belong to zone II, 4 patients in zone I, 2 patients in zone III.

DISCUSSION

Kite flying is a popular leisure activity throughout the world. Certain regions like Gujarat and Rajasthan in India glorify the Sun God by have kiting festivals in the month of January (Makar Sankranti) or places like Peshawar in Pakistan celebrate the coming of spring (Basant), these being the more well-known of the organized kiting competitions [12]. The "Manja" or thread attached to the kite is the major cause of direct kite injuries its edges being sharpened by ground glass. The loose thread may get entangled to the neck of a high-speed motorist and cause serious cut throat like injuries [12].

A study of paediatric age group in Northern India found that males, 5-10 years of age were most susceptible, where as another study from Western India showed that males, 16-45 years were most frequently affected [9,10]. Another study from Rajasthan showed that males in age group of 16-25 years were most commonly affected [11]. In this study males in the age group of 21-30 years are most commonly affected. Male predominance is seen in all the studies as in our culture

in many families, are sole bread earners. In all studies including our study young population was found to me affected maximally.

While reviewing the literature, we couldn't find any study analysing the speed range of the vehicle and severity. Patients travelling with speed of 50km/h and more made maximum bulk of patients with severe injuries, and none of them with any protective measure. Patients who were travelling with less than or equal to 30Km/h speed presented with less severe injuries. Thus, concluding that speed is proportionate to the severity of injuries. Also, we observed that using protective measures reduces the severity of injuries. 4 patients met with kite thread injury over flyover out of which one had severe injuries and succumbed to death.

The stray kite drags the string across the neck of the motorcycle, bicycles riders and pedestrians causing serious and fatal injuries. Injuries sustained by the two-wheeler rider are severe as compared to pedestrians as the severity of the injury depends on both the speed of vehicle and moving kite string [12]. Not only the speed of vehicle or type of vehicle but factors such as use of protective measures, time of the day, windy weather and the location of injury be it plane surface or flyover are responsible for severity of injury.

Injury sustained by two-wheeler rider or pedestrian predominantly involve neck followed by angle of mouth with extension to cheek, in a cross-sectional retrospective study by Mehmood et al. in 2010 [13], 139 patients who sustained kite flying injury were studied. 91% of the patients were males and 63% of them belonged to the age group of 10-39years. 55% patients suffered injuries directly due to kite string with 28.78% patients having simple cuts on finger while 11% had neck injuries. Similar observations were found in our study with maximum patients with injuries involving neck followed by face.

In another case series of 13 patients suffering from cervical injuries due to kite string in Brazil by Ventura et al. [14], the mean average time spent by the pre-hospital team transporting patients to the hospital and assisting victims at the scene was 29 ± 12 minutes; however, the total time varied from 5 to 60 minutes.12 patients had Zone II injury while only one patient had Zone III injury. Moreover, platysma breech was present in all patients but only one patient had threatened airway and hence, was intubated due to associated neurological deficit.

The study revealed the most common non –fatal injuries as jugular vein injury (6 out of 13 patients), Laryngeal Injuries (6 out of 13 patients) and tracheal injury (1 out of 13 patients). Carotid injury occurred in only one patient who eventually died. All wounds were explored and venous injuries were managed using ligatures while respiratory tract injuries were primarily repaired. Tracheostomy was done in three patients of which one patient succumbed to death and other two patients were decannulated in fifteen days.

In our study average time taken by the patient to reach hospital was 30 minutes. Nineteen patients belonged to zone II, four patients in zone I, two patients in zone III. Platysma and strap muscles were injured in three patients, sternocleidomastoid was injured in two patients. Airway was exposed in 3 patients with lacerated thyrohyoid membrane in one patient, cricothyroid membrane laceration one patient and trachea injured in one patient and partial thickness laceration of thyroid cartilage in one patient, hence, tracheostomy was performed as lifesaving procedure in three patients of which one succumbed to death and decannulation was done within fifteen days in two patients. Out of the severe injuries most severe were with lacerated bilateral carotid arteries and internal jugular veins, where the patient succumbed to death.

Image 2: Lacerated wound involving angle of mouth exposing parotid tissue.

Image 3: Closure of the wound in Image 1

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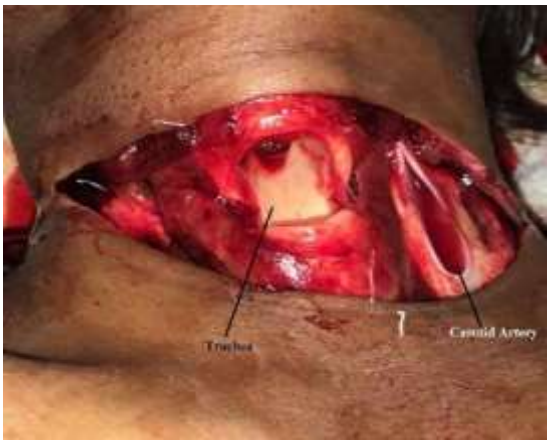

Image 4: Severe injury over neck with open airway and carotid artery laceration

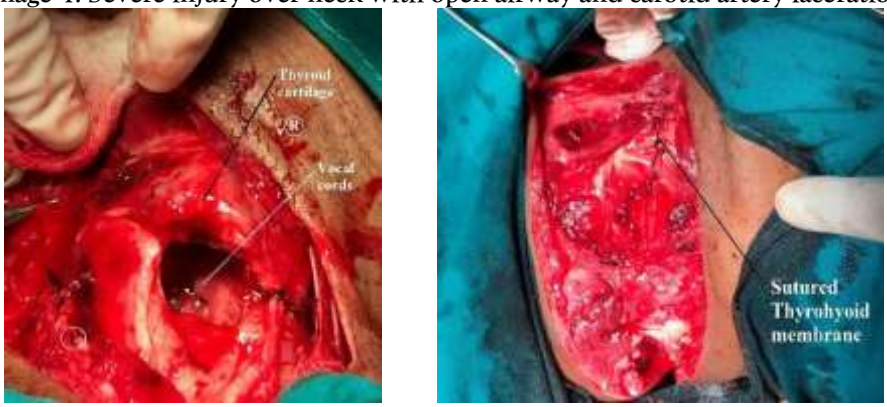

Image 5: Severe injury over neck with open airway (thyrohyoid membrane open) and vocal cords visualised from the open airway and sutured.

Image 6: Severe injury over neck with exposed airway (cricothyroid membrane injured) and tracheostomy tube

Singh V et al. [2] also published a case report of $4^{1/2}$ year old boy who sustained kite string injury over face involving lower labial mucosa and angle of mouth extending up to neck. There was no facial paresis and the wound was debrided and primarily closed layer wise. In our study similar injuries were observed in four patients with exposed parotid gland tissue in three patients two of which were minor, none of which developed facial paresis.

In another case report by Tumram et al, cervical injury sustained by manja was primarily repaired with tracheostomy but the patient developed extensive mediastinal and subcutaneous emphysema due to laryngeal injury in post-operative period which eventually proved fatal [15]. In our study three patient needed tracheostomy of which one succumbed to death due to blood loss as a result of severe injury involving major blood vessels of neck, other two patient survived and was decannulated without any complication within fifteen days.

CONCLUSION

A seemingly harmless game of kite flying can cause grievous harm even death not only to the flyers but also to innocent others [11]. This study highlights that protection such as helmet, wire frame on the two-wheeler, muffler, dupatta around the neck can reduce the grievousness of injury over head and neck but not give complete protection from innocent looking

kite threads. Usage of multiple protective devices at same time can increase the safety. Awareness programmes regarding the safety measures to protect oneself from grievous injuries can be conducted using pictorial depictions, posters, minimal usage of two wheelers or at least awareness about speed control during those peak hours of kite flying can reduce the incidence of casualties caused by killer manja. Open spaces could be allotted for kite flying, far from roads. Banning of Chinese threads and glass and chemical coatings on the threads that increase the grievousness of injuries by the government can also reduce injuries. Medical facilities for immediate care and transport should be made available during such events. Kite festival should be fun for all rather than causing irreplaceable loss to few. Kite flying injuries can be reduced by application of above-mentioned simple safety regulations and possibly stronger legislation by the government to ban chemical and glass coating on the thread.

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