A 10-year Nationwide Analysis of Knife- and Cutlery-Related Ocular Injuries in U.S. Emergency Departments: 2014–2023

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ABSTRACT

OBJECTIVE: To analyze knife- and cutlery-related ocular injuries in the United States, leveraging data from the National Electronic Injury Surveillance System (NEISS).

METHODS: A database search was conducted from 2014 to 2023 on unpowered cutlery and knife-related injuries involving the eyeball. Annual national estimates of these eye injuries were assessed using simple linear regression modeling.

RESULTS: A total of 209 eye injuries were included. The average age of the patients was 27.1 years. Most injuries occurred in adults (56.2%), males (67.2%), and individuals identifying as White (49.3%). The most common injury mechanism was puncture wounds (69.2%), and most common diagnosis was corneal abrasions (31.3%). Most patients (82.4%) were treated and discharged.

CONCLUSION: Knife-related ocular injuries predominantly affect young adult males and often result in corneal abrasions, underscoring the need for preventive safety measures.

KEYWORDS: cutlery; knives; traumatic injuries; eye safety

INTRODUCTION

Traumatic ocular injuries have the potential to result in serious complications such as vision loss, infection, or permanent eye damage if not promptly treated.[1] Knife-related injuries are particularly dangerous for the eyes due to the delicate structure of ocular tissues.[2] Of particular concern with knife- and cutlery-related eye injuries is the risk of open globe injury, which can cause damage to the intraocular structures, endophthalmitis, and vision loss.[3]

While previous studies have explored the epidemiology of knife- and cutlery-related injuries during specific activities like avocado preparation or pumpkin carving, as well as knife-related injuries more broadly,[4-6] their impact on the eyes has received limited attention. Although several case reports have documented serious ocular injuries from knives and cutlery, the frequency, mechanisms, and outcomes of such injuries remain unclear.[7,8] Understanding the patterns and mechanisms of these injuries can help develop strategies to prevent such vision- threatening outcomes.

To this end, this study analyzes demographic trends, injury mechanisms, and diagnoses associated with Emergency Department (ED) visits for knife- and cutlery-related eye injuries in the United States (U.S.), using data from the National Electronic Injury Surveillance System (NEISS) from 2014 to 2023.

MATERIAL AND METHODS

The National Electronic Injury Surveillance System (NEISS) is a database maintained by the U.S. Consumer Product Safety Commission (CPSC) that collects data on injuries associated with consumer products.[9] It is a representative sample of emergency department visits across the United States, used to monitor trends in product-related injuries, including those from knives, cutlery, and other household items.[10]

The authors performed a database search from 2014 to 2023 on unpowered cutlery and knife-related injuries (Product Codes: 836, 464) involving the eyeball (Body Part Code: 77). Injuries encompassed both ocular and ocular adnexal structures, including the eyelid, orbit, and lacrimal system. Patient sex, race, age, location, season, date of injury, and disposition were recorded. Each case narrative was reviewed, and a mechanism and diagnosis of injury was identified. Mechanisms of injury included puncture (part of the eye penetrating the eye), blunt force (impact without breaking the skin), foreign body in the eye and unknown. Diagnoses included burn, corneal abrasion, foreign body lodged in the eye, laceration, open globe injury, subconjunctival hemorrhage, and other. Foreign body injuries were defined as fragments of the knife that became lodged in the eye, such as a piece of metal entering the eye while sharpening a knife Any injuries where the knife or cutlery was not the primary cause of injury were excluded.

All statistical analyses were conducted using Microsoft Excel (Version 16.6). The rates of injury were determined using the national estimates of injury computed by the NEISS weighting algorithm. Descriptive statistics were utilized to examine overall characteristics related to knives and cutlery. Simple linear regression modeling was used to determine trends in volume of the injuries. P-values less than 0.05 were considered statistically significant.

RESULTS

The query provided a total of 210 eye injuries associated with cutlery and knives. Nine cases were deemed irrelevant (e.g., rubbing eye while using a knife), leaving 201 cases for analysis. Using the NEISS algorithm, this corresponded to an estimated 7,022 eye injuries nationwide (95% CI: 5,535–8,510). Throughout the study period, the frequency of ED visits associated with cutlery and knives fluctuated, though there was no statistically significant trend ($p = 0.72$). The number of cases each year ranged from 360 cases in 2016 to 1,234 cases in 2018, showing a slightly increasing trend ($\beta = 10.7$) (**Figure 1**).

Regarding patient demographics, the majority of patients were male (67.2%) (**Table 1**). Most patients identified as White (49.3%), followed by Black or African American (10.9%), with 32.3% of patients' race not stated. In terms of age, 43.8% of injuries occurred in patients under 18 years, while 56.2% involved patients aged 18 years or older. The average age was 27.1 ± 21.4 years, with an age range from 2 to 85 years.

Injuries were most reported to occur at home (55.7%), though 40.3% of cases did not specify a location (**Table 2**). Regarding season, knife-related injuries were most prevalent during the summer months at 31.8%, followed by spring at 28.4%.

The primary mechanism of injury was puncture, responsible for 69.2% of cases, followed by foreign body injuries (27.4%) (**Table 3**). Blunt force accounted for 2.0% of injuries, and 1.5% of cases had an unknown mechanism. None of the injuries were intentional or the result of an assault.

Figure 1. Frequency of Emergency Department Visits for Knife- and Cutlery-Related Eye Injuries from 2014–2023

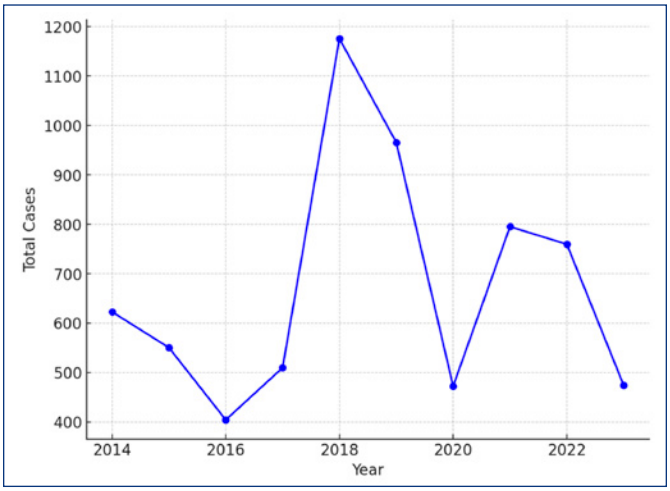

Table 1. Demographic Information

	n (%)
Sex	
Male	135 (67.2)
Female	66 (32.8)
Race	
White	99 (49.3)
Black/African American	22 (10.9)
Other	12 (6.0)
Asian	3 (1.5)
Not Stated	65 (32.3)
Age	
<18yrs	88 (43.8)
≥18 yrs	113 (56.2)

Table 2. Location and Season of Injuries

	n (%)
Location	
Home	112 (55.7)
Unknown	81 (40.3)
Sports	5 (2.5)
Public	3 (1.5)
Season	
March 1–May 31	57 (28.4)
June 1–Aug 31	64 (31.8)
Sep 1–Nov 30	44 (21.9)
Dec 1-Feb 29	36 (17.9)

Table 3. Diagnoses, Disposition, and Mechanism of Injuries

	n (%)
Mechanism	
Puncture	139 (69.2)
Foreign body	55 (27.4)
Blunt force	4 (2.0)
Unknown	3 (1.5)
Diagnosis	
Corneal abrasion	63 (31.3)
Laceration	38 (18.9)
Not specified	30 (14.9)
Foreign body	23 (11.4)
Open globe	12 (6.0)
Subconjunctival hemorrhage	12 (6.0)
Burn	7 (3.5)
Other	16 (8)
Disposition	
Released following examination and treatment	166 (82.6)
Treated and admitted	24 (11.9)
Treated and transferred	7 (3.5)
Left without being seen	2 (1.0)
Held for observation	2 (1.0)

The most common diagnosis for knife- and cutlery-related eye injuries was corneal abrasion (31.3%), followed by lacerations (18.9%) and foreign bodies (11.4%). Other diagnoses accounted for 8.0% of the injuries, which included conjunctivitis, conjunctival abrasion, cornea rust ring, contusion, corneal ulcer, and chemosis.

In terms of patient disposition, most patients (82.6%) were released after examination and treatment, while 11.9% were treated and admitted. A small percentage of patients were treated and transferred (3.5%), left without being seen (1.0%), or held for observation (1.0%).

Of the 12 cases with open globe injuries, 9 were treated and admitted (75%), while the remaining cases were released after examination and treatment (11.1%), treated and transferred (11.1%), and held for observation (11.1%). The mechanism of injury for open globe cases was primarily a puncture wound (91.7%).

DISCUSSION

To our knowledge, this is the first study to characterize eye injuries related to knives and cutlery presenting to U.S. EDs. From 2014 to 2023, there was a slight increase in the rate of these injuries, though it was not statistically significant. Most patients were male adults identifying as White. The most common injury mechanisms were puncture wounds and foreign bodies, often resulting in corneal abrasions and lacerations, with most patients treated and discharged.

Our results are generally consistent with findings from other studies in the literature. Previous research has demonstrated a predominance of male patients in ocular trauma, with lacerations being the most common diagnosis for penetrating eye injuries.[6,11] The fluctuation in ED visits may be attributed to several factors. Sampling variability, as NEISS data is based on a representative sample of EDs, could contribute to differences in reported cases. The significant drop in ED visits in 2020 likely reflects reduced healthcare utilization during the COVID-19 pandemic.[12] Other factors, such as increased access to urgent care clinics or telemedicine in certain years, may have diverted patients from EDs. Injuries were more frequent in the spring and summer months, potentially due to seasonal activities like picnics, barbecues, camping, and recreational knife use, such as fishing and hunting, which tend to increase during warmer weather.[13] These patterns highlight the need for targeted prevention strategies during high-risk periods.

Preventing knife- and cutlery-related eye injuries requires a combination of safe practices and use of protective equipment. Individuals should be educated on proper knife handling techniques, such as cutting away from the body, keeping knives pointed downward, and focusing on the task at hand to avoid distractions.[4,14] Using the appropriate tools for specific tasks and supervising children when handling knives or cutlery are also essential steps in reducing risks. Additionally, ensuring cutting surfaces are secure and non-slip can help prevent accidental slips that could lead to injuries.[5,6]

Wearing protective eyewear, such as safety goggles, is crucial during activities where debris or sharp objects may come into contact with the eyes, including carving, crafting, or outdoor tasks like fishing and camping. Improved knife designs, such as those with safety guards or rounded tips, can reduce the likelihood of accidents.[15]

This study has several limitations. First, some patient narratives were vague, making it difficult to categorize patients into specific diagnosis or mechanism groups, potentially underestimating the true incidence of injuries. Additionally, the NEISS database lacks information on patients' subsequent clinical course, including final visual acuity, admitting diagnoses, and treatments received in the ED, limiting the scope of further analysis. Furthermore, because the data were collected from a diverse range of settings, variability in how providers coded case narratives and diagnoses may have introduced inconsistencies.

CONCLUSION

Using NEISS data, this study provides an estimate of 7,022 knife- and cutlery-related eye injuries treated in EDs across the United States over the 10-year period from 2014 to 2023. These injuries predominantly affect young adults, males, and individuals identifying as White. Puncture wounds and foreign bodies were the most common mechanisms, often leading to corneal abrasions and lacerations. Open globe injuries, though less frequent, accounted for 6% of all ED visits. While most patients were treated and discharged, most open globe cases required hospital admission. These findings underscore the importance of safety interventions and promoting the use of eye protection to prevent these preventable injuries.

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