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Characterization of genital injuries secondary to foreign bodies from 2011 to 2020

Meher Pandher, Arnold Oparanozie, Amy Song, Jasmine Mahajan, Courtney Berg, Gabriel Fernandez, Chrystal Chang, Amjad Alwaal, Robert Weiss

Division of Urology, New Jersey Medical School to Newark, Newark, NJ, USA

Purpose: To identify demographic trends of foreign object genital injuries presenting to emergency departments from 2011 to 2020.

Materials and Methods: The National Electronic Injury Surveillance System database reports consumer product-related injuries in United States ED visits. The database was queried to identify 375 cases of genital injuries from 2011 to 2020. Inclusion criteria consisted of cases reporting injuries involving the urethra, penis, or scrotum. Data was reported and analyzed using linear regression.

Results: Based on 375 cases, an estimated 13,170 (95% confidence interval, 10,817–15,522) patients in the US suffered genital injuries due to foreign bodies between 2011 and 2020. These injuries involved the penis (65.9%), urethra (30.7%) and scrotum (3.5%). Of all patients, 11.8% required hospital admission after treatment of which injuries to the urethra were most common (44.0%). Most of these patients were ages 19 to 64 (66.1%). Consumer products most implicated included rings (50.7%), zippers (17.1%), and pens and pencils (10.3%). Injuries due to zippers and swimming apparel occurred significantly more frequently in patients ages 0–18 ($p<0.05$). Injuries due to kitchen gadgets occurred significantly more in patients ages ≥65 ($p<0.05$). Pens, pencils, and massage devices were items that routinely resulted in urethral injuries, often requiring hospitalization. Linear regression showed genital injuries related to foreign objects significantly increased from 2011 to 2020 ($p<0.001$).

Conclusions: Due to the nature of injury caused to genitalia by intentional and unintentional exposure to foreign bodies, educating individuals on this topic in sexual education classes is necessary for preventing future injuries.

Keywords: Emergency service, hospital; Foreign bodies; Genitalia; Wounds and injuries; Urethra

INTRODUCTION

Routine urological emergency department (ED) consults can vary from renal colic to scrotal pain [1]. Less frequent presentations that may require urology consultation include injuries pertaining to foreign body damage to genitalia. While penile and scrotal injuries secondary to vibrators, zips, and clothing have been previously studied, no study to date reports an analysis of all genital injuries related to foreign bodies presenting to the ED [2-4].

Although such injuries are relatively uncommon, they have the potential to result in significant damage and can subsequently require urologic intervention. Identifying the types of foreign body genital injuries and characterizing which require admission to the hospital can expedite the evaluation and consultation process in the ED, with the

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Corresponding Author: Meher Pandher https://orcid.org/0000-0001-6932-9355
Division of Urology, New Jersey Medical School to Newark, 185 South Orange Ave, Newark, NJ 07103, USA
TEL: +1-732-614-3432, E-mail: mp1257@njms.rutgers.edu

goal of ultimately reducing damage done to genitalia. It can also aid urologists in understanding the breadth of foreign body genital injuries and recognize which they may have to encounter most frequently. This study aims to use data from the National Electronic Injury Surveillance System (NEISS) to describe the consumer products causing foreign body damage to genitalia, the genital anatomy damaged, and to identify the foreign body genital injuries that most frequently require hospital admission.

MATERIALS AND METHODS

The NEISS database reports consumer product-related injuries in the United States and provides national estimates of product-related injuries resulting in ED visits. The database was queried to identify 375 cases of genital injuries from 2011 to 2020. Inclusion criteria consisted of cases reporting injuries involving the urethra, penis or scrotum. This removed cases involving injuries to the labia or vagina which are not relevant to urology providers. Patients who left the ED without being seen by an ED physician were excluded from the analysis. National estimates and 95th percentile confidence intervals (CIs) were generated by the NEISS database. Ages were stratified into 0–18, 19–64, or 65 and older age groups. Product codes initially identified as massage devices and jewelry were recategorized into three distinct categories–penile rings, piercings, and massage devices–based on descriptive information in the narrative column. Similarly, all products in the curated database originally coded as daywear products were found to be zip related injuries and were re-labeled as such. All other product codes were left to the classification designated by NEISS. The top nine consumer products responsible for foreign body genital injuries were identified. Disposition was classified as patients who were treated and released, treated and transferred to a different hospital, treated and admitted, held for observation, or left without being seen. Patients who left without being seen by a physician were removed from the analysis, due to the fact that their injuries were not well described. Data on age, sex, race, disposition, and object involved was reported and analyzed. Linear regression and ANOVA analyses were used to analyze trends, with a p-value of <0.05 deemed as statistically significant. Analysis was performed using SPSS statistics software version 24 (IBM Corp., Armonk, NY, USA). There was no need for approval of Institutional Review Board because a public database was used.

RESULTS

Based on 375 cases, an estimated 13,170 (95% CI, 10,817–15,522) patients in the US suffered genital injuries to the penis, scrotum, or urethra due to a foreign object during from 2011 to 2020. The majority of patients were aged 19–64 years (66.1%), with fewer patients who were 0–18 years old (27.1%) or over 65 (6.8%) (Table 1). The majority of these patients were white (45.3%) and male (97.1%). 82.3% of patients were treated and released from the ED while 11.8% were treated and admitted. 65.9% of all foreign body genital injuries involved the penis, 30.7% involved the urethra, and 3.5% involved the scrotum. Of those injuries which required hospital admission, urethral injuries were more frequent (44.0%) than scrotal (33.0%) and penile (9.0%) injuries (Fig. 1).

Items most commonly responsible for genital foreign body injuries across all ages included rings (22.7%), zippers (10.4%), pens and pencils (6.1%), swimming apparel (6.1%), piercings (3.5%), desk supplies (3.2%), kitchen gadgets (3.2%), and massage devices (3.2%) (Supplementary Table). Injuries due to zippers and swimming apparel occurred significantly more frequently in patients ages 0–18 ($p<0.05$). Injuries due to kitchen gadgets occurred significantly more in patients ages ≥65 ($p<0.05$; Table 1). Consumer products responsible primarily for foreign body genital injury in children aged 0–18 included swimming apparel (43.4%), zippers (22.6%), kitchen gadgets (11.3%), and pens and pencils (11.3%). In patients ages 19–64, consumer products most implicated included rings (50.7%), zippers (17.1%), and pens and pencils (10.3%). Consumer products responsible for most genital injury in the elderly over 65 included rings (47.1%) and kitchen gadgets (17.6%) (Table 1). Penile injuries occurred predominantly due to zippers rings (45.1%), zippers (22.3%), and swimming apparel (13.1%). Urethral injuries were commonly due to pens and pencils (46.2%), massage devices (25.6%), and kitchen gadgets (12.8%). Scrotal injuries were less frequent, but occurred most often due to rings (40.0%) (Fig. 2). The consumer products that often required hospital admission were pens and pencils, with 39% of injuries due to pencils being hospitalized, followed by massage devices (17.0%), and rings (12.0%). Swimming apparel was the most benign consumer product, as all related injuries were treated and released from the ED (Fig. 3). Pens, pencils, and massage devices were items that routinely resulted in urethral injuries, and also items that most often required hospitalization. As stated previously, urethral injuries independently also required frequent hospitalization compared to other genital anatomy. Patients ages ≥65 were admitted to the hospital significantly more often than patients of any other age ($p<0.05$; Table 1). Linear regression

Table 1. Anatomy injured, foreign object implicated, and disposition of patients of different age groups

	Age (y)			Chi-squared
	0–18	19–64	≥65	
Overall	100 (27.1)	244 (66.1)	25 (6.8)	
Anatomy injured				p=0.273
Penis	69 (69.0)	158 (64.8)	14 (56.0)	
Urethra	25 (25.0)	80 (32.8)	10 (40.0)	
Scrotum	6 (6.0)	6 (2.5)	1 (4.0)	
Foreign object implicated	53 (53.0)	146 (59.8)	17 (68.0)	p<0.05
Ring	0 (0.0)	74 (50.7)	8 (47.1)	
Zipper	12 (22.6)	25 (17.1)	2 (11.8)	
Pens and pencils	6 (11.3)	15 (10.3)	2 (11.8)	
Swimming apparel	23 (43.4)	0 (0.0)	0 (0.0)	
Piercings	1 (1.9)	11 (7.5)	1 (5.9)	
Desk supplies	4 (7.5)	8 (5.5)	0 (0.0)	
Kitchen gadgets	6 (11.3)	3 (2.1)	3 (17.6)	
Massage devices	1 (1.9)	10 (6.8)	1 (5.9)	
Disposition				p<0.05
Treated and released	79 (79.0)	191 (78.3)	15 (60.0)	
Treated and transferred	6 (6.0)	9 (3.7)	0 (0.0)	
Treated and admitted	12 (12.0)	35 (14.3)	10 (40.0)	
Held for observation	3 (3.0)	9 (3.7)	0 (0.0)	

Data are presented as number (%).

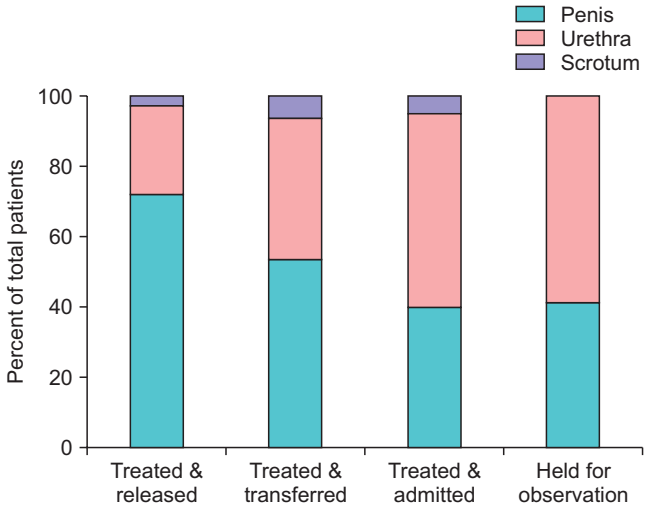

Fig. 1. Hospital disposition of different genital injuries.

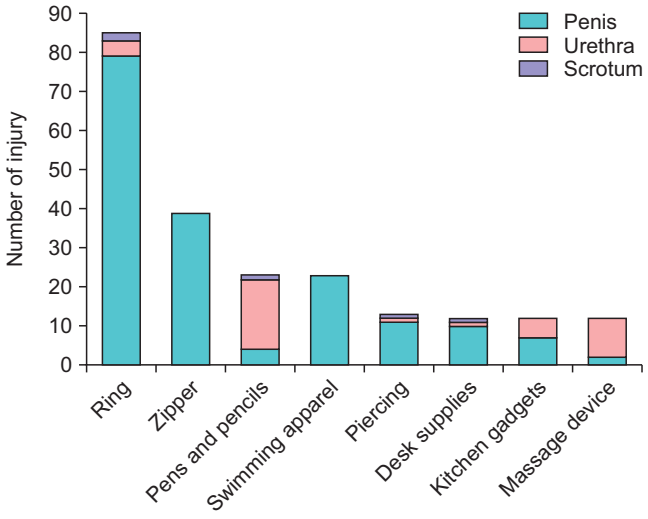

Fig. 2. Genital anatomy injured by consumer products.

indicated that the number of genital injuries related to foreign objects significantly increased from 2011 to 2020 (p<0.05).

DISCUSSION

The narrative section of the database described many of these foreign body genital injuries occurring in the setting of sexual encounters. While previous studies show that sexual activity and the number of sexual partners among adults has decreased, our data demonstrates an increase in foreign body genital injuries over the years [5]. This may be due in part to an increase in the use of sex toys and other consumer products for sexual pleasure with other contributing factors including insufficient sex education and safety precautions. As sex practices are changing over the years, and fewer people report sexual partners, so must our sex education change to include safe use of sex toys and items to enhance sexual pleasure. Consumer products should be

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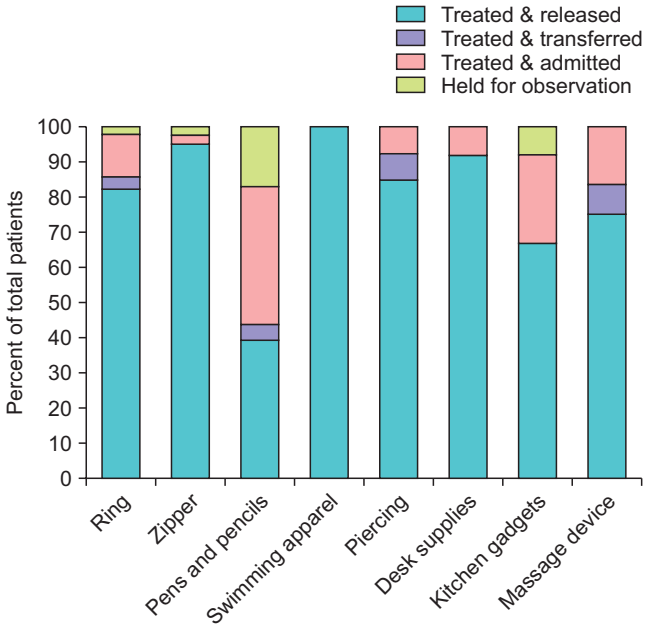

Fig. 3. Hospital disposition of genital injuries due to common consumer products.

aware of the use of their products for sexual purposes and must include safety warnings depicting health complications of such use.

Items inserted into the urethra lead to the most severe genital injuries, often requiring hospital admission or observations. Pens and pencils were the consumer item most frequently implicated in urethral injuries, followed by other common household items including kitchen gadgets, desk supplies, and massage devices. Other studies have reported urethral foreign body injuries due to plastic forks, spoons, screws, staples, wires, drill bits, sewing needles, cables, fishhooks and even a decapitated snake. Such injuries can be attributed to underlying psychiatric illnesses, skewed judgment while under the influence of drugs, as well as desire for erectile enhancement and self-stimulation [6-8]. Most urethral foreign bodies were removed manually with extrinsic pressure, while more severe cases required cystotomies, urethrotomies, endoscopic basket extraction, or laparoscopic or open surgeries (Fig. 4) [8-10]. Complications of these injuries include, but are not limited to, urinary tract infections, sepsis, Fournier's gangrene, false urethral passage, lacerations, and strictures [6]. While most foreign body genital injuries

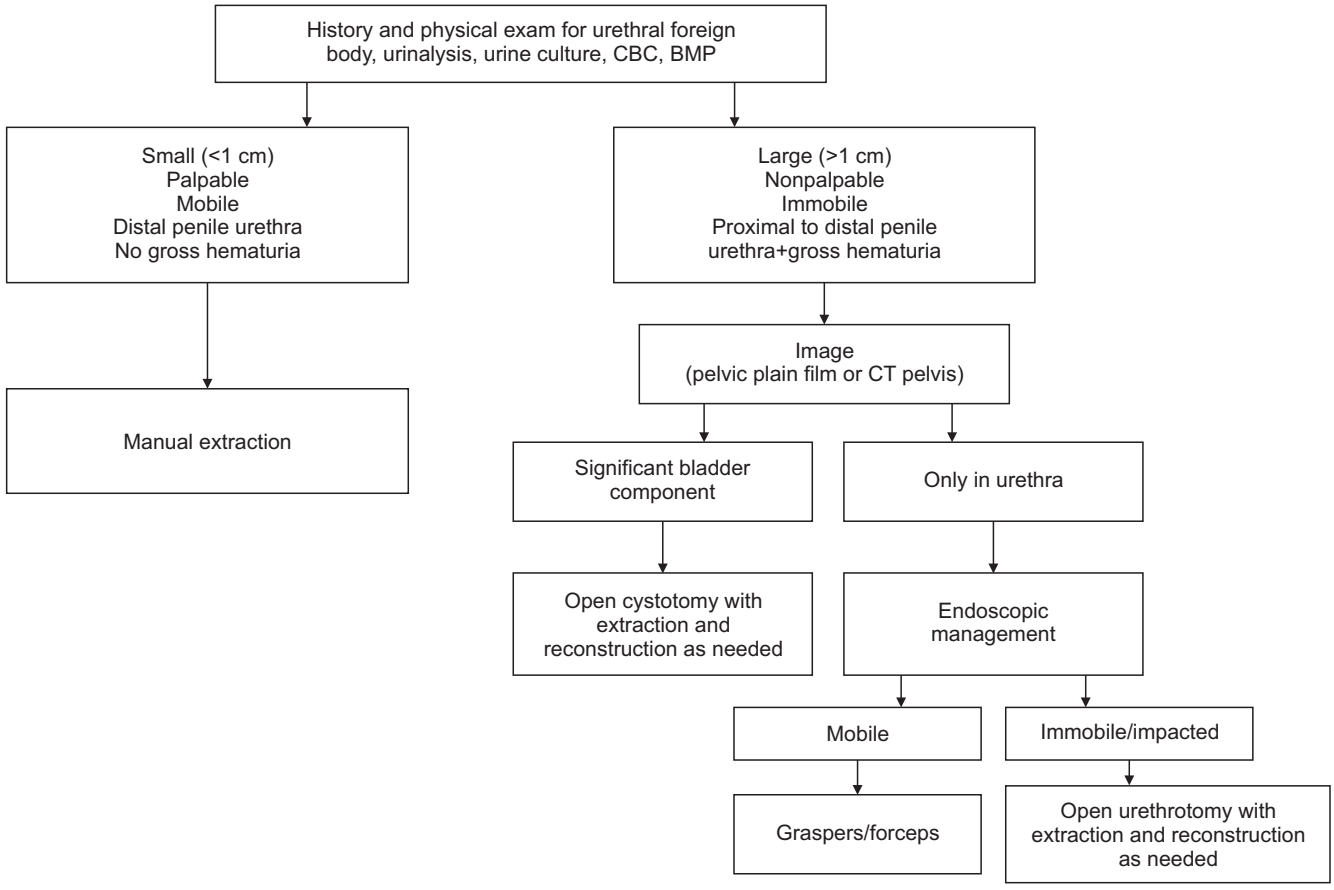

Fig. 4. Cook County Hospital algorithm for urethral foreign bodies. CBC, complete blood count; BMP, basic metabolic panel; CT, computed tomography. Adapted from Palmer et al. Urology 2016;97:257-60 [6] with permission of Elsevier.

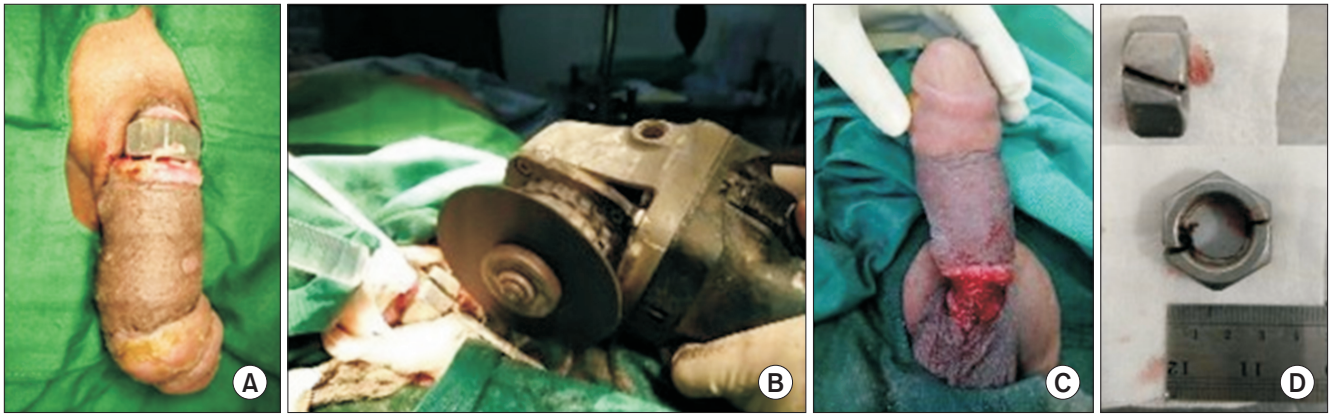

Fig. 5. (A) Penis strangulated by thick metallic ring. (B) Grinder being used to cut ring off. (C) Laceration of penile skin due to ring. (D) Metallic ring. Adapted from Noegroho et al. Int J Surg Case Rep 2021;80:105609 [14].

do not require urology consultation, urethral injuries can cause significant harm if not evaluated appropriately and identified early. While the NEISS database does not include information on interventions undergone by patients, previous research has shown that some patients with a urethral foreign body insertion require surgical intervention.

Penile rings are used to enhance sexual function by limiting blood outflow from the corpus cavernosum, effectively prolonging the erection [11]. However, penile ring entrapment is a serious medical emergency that can risk tissue loss if not managed appropriately [12]. According to our data, penile ring injuries were most common in patients ages 65 and older, presumably due to decreasing erectile function in this age group and need for assistance for prolonged erection. In this study, similar injuries occurred by penile rings and also individuals mimicking the function of penile rings by tying string, rope, plastic ties, or placing bottlenecks around the base of their penis. Prolonged constriction of the penis lasting longer than 30 minutes can result in complications such as severe ischemia and edema. Patients suffering from extended periods of constriction usually delay coming to the hospital due to embarrassment, and present with more severe levels of injury [13]. Physicians should be resourceful in removing constrictive rings, and may need to rely on tools from the maintenance department (Fig. 5) [14]. Treatment options initially include sliding the ring off using various lubricants and also include cutting the ring with tools such as stout scissors, K-wire cutters, bone cutting clamps, or industrial grade cutters. If such conservative management is unsuccessful, then surgical options such as lateral corporotomy to release edema or cystotomy with perineal urethrostomy may be used. Mechanical methods of removal are preferred over thermal or electric ones to reduce the risk of burn injuries, fistulas, or strictures [15]. Furthermore, cystoscopy may be performed to determine the extent of urethral injury, and broad spectrum antibiotics should be initiated to prevent infection [13,16]. If left untreated, penile strangulation can lead to necrosis, gangrene, auto-amputation of the penis, and death. The literature describes a case of prolonged penile strangulation, leading to penile necrosis, pyelonephritis, bronchopneumonia, and eventually, death [17]. Other cases have reported postoperative complications of penile ring removal, resulting in septic shock and death [15]. While only 12% of all ring related genital injuries presenting to the ED required hospital admission, penile ring entrapment is a rare, urological emergency that often requires urgent urologic intervention.

Genital piercings comprise about a third of body piercings, and may lead to serious injuries of the genitourinary tract [18]. Body piercings have existed for centuries and have roots in Hindu customs [19]. Popular penile piercings include "Prince Albert" piercings, in which the piercing passes from the urethra through the ventral aspect of the glans [20]. Given the location of these piercings, strenuous exercise or sexual activity can cause avulsion of such piercings and lead to urethral rupture, eventually requiring reconstructive surgery. Penile piercings can also result in superficial infection, abscess, or systemic sepsis, as the piercing serves as a nidus for bacterial growth. In the instance of abscess formation or superficial infection, antibiotics should be administered, the piercing must not be removed given risk of introducing additional bacteria, and the abscess should be drained. In severe cases of persistent infection, the jewelry should be removed and an incision and drainage procedure should be performed. Scarring following infection can result in infertility or urethral obstruction [21]. Other complications of penile piercings include paraphimosis in patients who are uncircumcised due to inability to move the foreskin

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over the genital piercing. To manage this, the prepuce can be manually returned to cover the glans with the help of nerve blocks. Furthermore, rare cases of squamous cell carcinoma arising from the piercing area have been reported in patients with concomitant HIV and hepatitis C, potentially due to the inflammation caused by the piercing [22]. Other case reports demonstrate complications such as recurrent sexually transmitted diseases, priapisms, and post-coital bleeding. Most of these complications associated with genital piercings are due to poor technique during piercing, poor after-piercing care, body changes after long-term jewelry wear, and damage from partners and intercourse [18]. Penile pearls are another ornamental foreign object that includes foreign object insertion beneath the skin of the penis. Common in Asia and used to enhance sexual pleasure, this rare practice has few complications, but there are a few reports of infection, hematoma formation, scar tissue, and erectile dysfunction. While not represented in the NEISS dataset, it is another form of foreign body genital injury. Urologists should be familiar with management of genital piercing and penile pearl related genitourinary complications. Rarely do these injuries require hospital admission, but patients must be educated about proper piercing care.

Zip injuries are the most common cause of all penile injuries [3]. Patients with zipper injuries commonly present to the ED with their prepuce or scrotal skin caught in zippers, resulting in direct tissue injury. Known risk factors for zipper injuries include age under 18 years old, being uncircumcised, and requiring assistance for dressing [4]. These injuries are treated conservatively; for example, one method of management includes applying mineral oil and then attempting to unzip [23]. Another method is by releasing zipper-entrapped penile skin by inserting a small screwdriver in between the outer and inner faceplates of the zip fastener and rotating the screwdriver until the gap between faceplates widens enough to remove the prepuce [24]. Alternatively, bone cutters may be used to break and disengage the two zipper faceplates altogether [3,25]. Zip injuries rarely result in complications or require circumcision of foreskin. These injuries tend to be more benign and rarely require admission or observation. Most can be handled by ED physicians without the involvement of anesthetics or urologists [26].

Swim apparel related genital injury commonly involves entrapment of the penis of a young child in the mesh lining of swimsuit bottoms. Swim shorts commonly have netting or mesh to serve as a layer of separation between wet fabric and skin, providing adequate scrotal support. Krishnan et al. [27] report a case of foreskin entrapment within the netting, resulting in progressive edema and pain. With application of local anesthesia, the suit was cut away with fine scissors and the edema resolved. Similarly, others have reported cases of foreskin entrapment in swimsuit linings, in which the mesh was removed easily without need for sedation [28]. In cases of prolonged skin entrapment, penile or foreskin necrosis may ensue. Such injuries may be prevented through developing mesh with smaller holes, or replacing mesh altogether with alternative airy fabrics such as nylon or polyester.

The objective of our study was to identify and characterize consumer products associated with foreign body genital injuries presenting to the ED. We found that objects that involved the urethra were more likely to require hospitalization and observation, while those involving the penis and scrotum were less harmful. Many products that are involved in foreign body genital injury can be managed conservatively, but some, including penile ring entrapment, can become serious if not reduced in a timely manner. Foreign body use to enhance sexual pleasure is a phenomenon that has spanned hundreds of years, but continued sexual positive in popular culture must encourage patients to come to the ED if something goes wrong.

1. Limitations

A potential limitation of this study is the use of retrospective data from the NEISS database. As the injuries are reported by various providers, there were inconsistencies in reporting which specific body parts were affected, which may impact the categorization of injuries. Furthermore, the database only reports cases that warranted a visit to the ED. This data likely is an underestimate of the true number of injuries caused by foreign objects, as many cases can likely be treated conservatively at home. Additionally, given the nature of these injuries, patients may not be forthcoming in reporting the involved foreign body, due to embarrassment. The NEISS database does not record what interventions are required for patients once they arrive at the ED, and further research regarding the number of foreign body genital injuries that specifically require urologic intervention and surgery will be informative.

CONCLUSIONS

When there is suspicion for urethral injuries, particularly those secondary to pens or pencils, it is imperative that urgent consults are placed to urologists without delay, due to the rates at which these injuries require hospitalizations. Delay in seeking treatment for genital injuries can potentially lead to complications including penile necrosis, ure-

thral damage, and in some extreme cases septic shock and death. Due to the nature and extent of the damage caused to genitalia by intentional exposure to foreign bodies, educating individuals on this topic in sexual education classes is necessary for preventing future injuries.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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AUTHORS' CONTRIBUTIONS

Research conception and design: Meher Pandher, Jasmine Mahajan, and Amy Song. Data aquisition: Meher Pandher, Jasmine Mahajan, Amy Song, and Arnold Oparanozie. Statistical analysis: Meher Pandher, Jasmine Mahajan, and Amy Song. Data analysis and interpretation: Meher Pandher, Jasmine Mahajan, Amy Song, and Arnold Oparanozie. Drafting of the manuscript: Meher Pandher, Jasmine Mahajan, Amy Song, and Arnold Oparanozie. Critical revision of the manuscript: all authors. Supervision: Robert Weiss and Amjad Alwaal. Approval of the final manuscript: all authors.

SUPPLEMENTARY MATERIAL

Supplementary material can be found via https://doi.org/10.4111/icu.20220316.

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