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### Authors

Bagga, Herman S  
Tasian, Gregory E  
McGeady, James  
[et al.](#)

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## Zip-related genital injury

**Herman S. Bagga, Gregory E. Tasian<sup>\*</sup>, James McGeady, Sarah D. Blaschko, Charles E. McCulloch<sup>†</sup>, Jack W. McAninch, and Benjamin N. Breyer**

Department of Urology, University of California, San Francisco, San Francisco, CA <sup>\*</sup>Division of Urology, Children's Hospital of Philadelphia, Philadelphia, PA and <sup>†</sup>Department of Epidemiology and Biostatistics, University of California, San Francisco, San Francisco, CA, USA

### Abstract

- To describe the epidemiology of genital injuries caused by trouser zips and to educate both consumers and the caregivers of patients who sustain such injuries.
- The National Electronic Injury Surveillance System, a dataset validated to provide a probability sample of patients who present to emergency departments (EDs) in the USA with injuries, was analysed to characterize zip-related genital injuries occurring between 2002 and 2010.
- A total of 523 cases were analysed to obtain national estimates.
- Between 2002 and 2010, an estimated 17 616 patients presented to US EDs with trouser zip injuries to the genitals.
- The penis was almost always the only genital organ involved.
- Zip injuries represented nearly one-fifth of all penile injuries.
- Amongst adults, zips were the most frequent cause of penile injuries.
- Annual zip-related genital injury incidence remained stable over the study period.
- Zip-related genital injuries affect both paediatric and adult cohorts.
- Practitioners should be familiar with various zip-detachment strategies for these populations.

### Keywords

genitourinary system; injuries; trauma; consumer product safety; clothing; penis

### Introduction

Although first conceived in the mid-1800s by Whitcomb Judson, an engineer named Gideon Sundback is credited with the development of the modern zip in 1913. On garments, the device was first marketed as a fastener for children's clothes because of its ease of use. The

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Correspondence: Benjamin N. Breyer, Department of Urology, 400 Parnassus Avenue, Suite A-610, Box 0738, San Francisco, CA 94143-0738, USA. bbreyer@urology.ucsf.edu.

#### Conflict of Interest

None declared.

device gained popularity for use on trousers, where it has since become nearly ubiquitous as a mechanism of closure [1].

Owing to their location, trouser zips are thought to account for a significant proportion of penile injuries, particularly of the prepuce. This has been particularly noted in children, where it has been reported to be a common cause of paediatric penile injuries [2,3]. This has prompted reports of multiple techniques for the release of entrapped tissue within the zip teeth and slider [3–11].

Current reports of zip-related genital injury are based on small case series, focusing nearly exclusively on the paediatric population [2,3,12]. The incidence of zip-related injury remains unknown, particularly within the adult male population. We describe the epidemiology of acute zip-related genital injuries using a nationally representative sample of individuals who presented to emergency departments (EDs) in the USA. By describing the at-risk population, we hope to increase prevention and preparedness for treatment.

## Materials and Methods

We used data from the National Electronic Injury Surveillance System (NEISS) dataset. The NEISS is a stratified national probability sample of patients who sustain injuries and present to US EDs. Data are prospectively collected from ~100 representative US hospitals. Operated by the US Consumer Products Safety Commission (CPSC), the dataset is validated to produce national estimates of patients who present to US EDs with an injury. Data on patient age, type of injury, locale where injury occurred, body part affected, disposition from the ED, and product(s) involved are abstracted from the ED records by professional NEISS coders. In addition, a brief narrative description of each injury (e.g. mechanism, associated conditions, injury sustained) is recorded. Secondary and tertiary level review and quality control occurs after the data are sent to the CPSC [13].

The NEISS database was queried to identify all subjects who sustained genital injuries from 2002 to 2010. The narrative descriptions were reviewed by three of the authors (H.S.B., G.E.T. and P.B.F.) and the specific genital organs involved were identified. Data were inspected to identify products associated with genital injury, and all cases of injury related to the use of a trouser zip were identified.

All analyses were performed with adjustments for sample weighting and the stratified survey design [14]. All data are reported as national estimates along with 95% CIs, unless specified as actual case numbers. Linear regression was used to determine the changes in annual incidence rate. Analyses were performed using Stata 12 (Stata Corp., College Station, TX, USA). The study was exempt from institutional review board approval.

## Results

Based on 2695 actual cases, an estimated 81 448 individuals (95% CI 66 555–96 341) presented to US EDs with penile injuries from 2002 to 2010. Two thirds of all penile injuries occurred in the paediatric population (0–18 years). Based on 523 actual cases, 17 616 patients (95% CI 10 477–24 755) sustained zip injuries to the penis, making this aetiology responsible for 21.6% of all penile injuries presenting to US EDs. The annual incidence of penile zip-related injury was stable across the study period (Fig. 1). The age distribution (mean age: 22 years; median [SD] age: 18 [16.45] years) of penile injuries was positively skewed (Table 1).

Within the adult population, 29.8% of all penile injuries in patients presenting to an ED were sustained whilst using a trouser zip, resulting in 8189 adult ED presentations (95% CI 6138–

10 240). This made zip injury to the penis the single most common aetiology of adult penile injury prompting presentation to an ED.

In the paediatric age group, 16.6% of all penile injuries were sustained whilst using a zip, resulting in 8954 ED presentations (95% CI 5879–12 029). The mechanism was the second most common cause of penile injury within this age group. The highest proportion of paediatric penile injury was attributable to crush injuries by toilet seats (17.5% of penile injury).

Over 98% of patients who presented with zip-related injuries to the penis were evaluated and treated in the ED, without the need for inpatient admission. During the study period, two actual cases were noted to require operative intervention to detach the zip. There were 11 actual cases of concomitant penile cellulitis or abscesses, with almost all of these patients noted to have a delayed presentation, with zip injury occurring at least 2 days previously. The majority of these patients were also managed as outpatients. National estimates regarding the rates of operative intervention and infectious complications surrounding zip-related penile injury could not be reliably calculated owing to the rarity of these events.

Zip injuries rarely involved any other genital organ than the penis. The next most common organ involved was the scrotum, which was involved in <1% of all zip injuries. Zip injuries in females were exceedingly rare, with five actual cases reported during the 9-year study period. Four of the five injuries were to the labia during zip closure. The other injury was the result of a zip element acting as a foreign body within the vagina. The scarcity of injuries of the female genitalia made generating national estimates unreliable.

## Discussion

The location of a trouser zip makes the adjacent penis vulnerable to injury by the device. Indeed, we found that injury caused by skin entrapment by a zip is a common source of penile injury that prompts presentation to US EDs. These injuries occur within both the paediatric and adult populations and, with proper understanding of detachment strategies, can generally be managed in the ED without the need for inpatient admission.

As suggested in previously published small case series, zip-related injury occurs predominantly in the uncircumcised penis [2,3]. After the American Academy of Pediatrics adopted a neutral position on neonatal circumcision in 1999, circumcision rates fell from a peak incidence of 63% in 1999 to 54% in 2009 [10]. We found a stable annual incidence of zip-related injury over the 9-year study period since 2002, suggesting that these decreasing rates did not translate into an increased risk of injury.

There are few reports on the epidemiology of zip injury. Yip et al. [2] described their experience with 32 patients who sustained preputial injuries over 3 years. In their study, they noted zip injury as the most common aetiology of prepuce injury in children, but found this mechanism of injury rare in adults. El-Bahnasawy and El-Sherbiny [12] reported their experience with penile trauma, noting only 2% of admitted paediatric penile injuries were zip-related. In the most comprehensive analysis to date, Wyatt and Scobie [3] described their 7-year experience with zip injuries in boys aged <14 years presenting to their ED. They noted 30 presentations during this period, all of which were managed in the ED with various release techniques. All patients were noted to be uncircumcised. Interestingly, they found that most children were reported to be wearing underpants during the time of injury, although the type of underwear was not described. Our previous reports have noted zip injuries to the penis as contributors to genitourinary injury in patients presenting to US EDs [15,16]. The present study is the first to report the prevalence of zip-related genital injury in detail, using an appropriately weighted sample. We confirmed that zip injuries are a

common form of penile injury within the paediatric population. Furthermore, we noted that penile injuries in adults are also commonly attributable to zips, and have a similar incidence to injuries in children.

Management strategies reported in the literature for such injuries are variable. For skin that has become entrapped between the locked teeth of a zip, cutting the cloth between interlocked dentition is generally adequate [3,10]. When skin is caught within the buckle of the fastener itself, however, removal can be more challenging. A reasonable initial approach is to attempt unzipping with or without a lubricant such as mineral oil [11]. If this fails, owing to pain, oedema or complicated entanglement, multiple other strategies have been advocated. Cutting the median bar of the zip with bone or wire cutters to separate the two faceplates and release entrapped skin is one known method [5,6,9]. Others have noted that complete separation of the faceplates can be difficult and have therefore proposed limited separation of these elements to relieve entrapment. Techniques have included wedging a screwdriver between the faceplates [10] or promoting separation with torque forces by squeezing the top faceplate with pliers [8]. The teeth of the zip mechanism can also be removed one at a time to release the skin [2,7]. Finally, in refractory cases, circumcision or elliptical incision of penile skin is another option for removing a zip [2,4].

The goal of our study was to influence prevention and preparedness for treatment of such injuries by raising awareness of their epidemiology. Given that previous reports have suggested that most injuries occur unintentionally during zip fastening [3], an important element of prevention is probably simply more attentive use of the zip by the operator; however, parents may consider the use of trousers with an elastic strap or Velcro-fly fasteners until they are confident of their child's manual dexterity and attentiveness during zip fastening. Other mechanisms of prevention for males of all ages may include form-fitting underwear to keep the phallus packed away from the zip or the use of button-fly fasteners. When injury does occur, however, practitioners should be familiar with various zip-detachment strategies to treat patients of all ages, from children to adults.

Despite the comprehensive nature, reliability, and generalizability of the NEISS, there are limitations of the dataset and thus our study. Although NEISS captures the majority of acute genitourinary injuries in the USA, it does miss some presumably low acuity presentations that may result in visits to primary care providers and urgent care facilities. This may result in an underestimate of zip injuries within our report. A further limitation is the fact that there were missing data. It was not documented if patients were circumcised, were wearing underwear at the time of injury, or what types of zips or trousers were used. These data are important to further stratify risks of injury.

In conclusion, trouser zip injuries account for a large proportion of penile injuries in patients presenting to US EDs in both the paediatric and adult cohorts. Practitioners should be familiar with various zip-detachment strategies for both of these populations.

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## Abbreviations

**ED** emergency department

<b>NEISS</b>	National Electronic Injury Surveillance System
<b>CPSC</b>	Consumer Products Safety Commission

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**Fig. 1.** Estimated number of penile injuries caused by zips resulting in ED presentations, by year. The rate of zip-related penile injuries remained steady over the study period. Error bars represent 95% CIs.

**Table 1**

Proportion of zip-related penile injuries by age range.

Zip-related penile injuries	Actual no. of cases	National estimate	95% CI	Estimated annual incidence	95% CI	% of all penile zip-related injuries
Paediatric	291	9 054	4 898–13 210	1006	544–1468	51.4
0–1 year	0	0	0–0	0	0–0	0.0
2–3 years	25	582	194–971	65	49–108	3.3
4–7 years	72	2 063	1 233–2 893	229	137–321	11.7
8–11 years	84	2 546	1 637–3 454	283	182–384	14.5
12–15 years	65	2 132	874–3 389	237	97–377	12.1
16–18 years	45	1 731	960–2 503	192	107–278	9.8
Adult	232	8 562	5 579–11 545	951	620–1283	48.6
19–28 years	88	3 211	2 185–4 237	357	243–471	18.2
29–45 years	86	3 235	2 150–4 320	359	239–480	18.4
46–65 years	48	1 785	1 180–2 390	198	131–266	10.1
66+ years	10	331	64–598	37	7–66	1.9
Total	523	17 616	10 477–24 755	1957	1164–2751	100