Use of dental drill handpiece to remove steel nut causing penile strangulation: a case report and review of the literature

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Abstract

**Background:** Penile strangulation is an uncommon urological emergency that requires prompt intervention to avoid potentially serious sequelae including loss of the distal penis secondary to ischemia and subsequent gangrene. We present a case report of a patient who presented to the hospital with penile strangulation injury of 10-hour duration secondary to the presence of a thick hexagonal steel nut. This case is presented in accordance with Consensus Surgical Case Report guidelines.

**Case presentation:** A 24-year-old Vietnamese man presented to the emergency room with urinary retention and decreased penile sensation following a 10-hour history of penile strangulation due to the presence of a thick hexagonal steel nut that he had placed around the shaft of the penis for the purpose of sexual enhancement during masturbation. The hexagonal nut was tightly entrapping the penile shaft, resulting in edema, congestion, and swelling of the distal 5 cm of the phallus. Given the thickness of the foreign body as well as the degree of penile swelling, we were unable to remove the hexagonal nut using traditional methods of alleviating penile strangulation injuries. Following consultation with a dental colleague, a dental diamond drill handpiece was utilized to cut the foreign body without injury to the underlying penile skin. Subsequent follow-up in clinic demonstrated no significant urinary or sexual sequelae from this episode.

**Conclusion:** We report a case of penile strangulation requiring novel instrumentation and collaboration for successful treatment.

**Keywords:** Penile strangulation, Penile incarceration, Penile entrapment, Dental drill handpiece, Metallic nut, Case report

Introduction

Penile strangulation represents an uncommon urological emergency that was first reported by Gauthier in 1755 [1, 2]. Since then, cases of penile entrapment by a foreign body have been only rarely reported, and only a few case series have been published, with fewer than 100 case reports [1, 3]. Penile rings are utilized by individuals to reduce venous outflow and increase penoscrotal engorgement and may be used by individuals with erectile dysfunction or to enhance sexual gratification. Occasionally, a strangulating object encircling the penis may be associated with patients with an underlying psychosexual disorder [4]. When entrapment occurs, it necessitates urgent intervention since strangulation may cause vascular injury or necrosis, even after removal of the encircling object. Hence, penile strangulation requires prompt intervention to prevent complications [5, 6]. According to the medical literature, management of strangulation...
penile is also challenging because there is no standard guideline for various conditions, in part due to the heterogeneous nature of such case presentations. Generally, each case is managed individually according to the clinical findings and operative setting [7].

Foreign bodies for penile entrapment comprise many materials, both metallic and nonmetallic. Thin nonmetallic objects are often easy to remove. In contrast, metallic objects are challenging to remove safely. These objects causing penile strangulation in the literature are diverse, including heavy metal rings, hammerheads, metal cones, pipes, plastic bottle necks, sprockets, and plumbing cuffs [8, 9]. Metal objects represent a particularly challenging clinical conundrum as standard surgical equipment in hospital or emergency departments may not be able to cut through these objects.

Furthermore, removing a metallic object is time-consuming, especially thick metallic ones such as hexagonal nuts. Hence, the urologist should be ready and aware of the equipment required for cutting as quickly as possible to manage such medical emergencies. We report herein a case of penile strangulation with a hexagonal steel nut resolved by using an unfamiliar medical tool, viz. a dental drill machine. Our report aims to provide a simple and effective approach to the removal of metallic objects using novel instrumentation to prevent complications such as gangrene and amputation. This case is presented in accordance with Consensus Surgical Case Report (SCARE) guidelines [10].

**Case presentation**

A 24-year-old Vietnamese man with no significant psychiatric or medical history presented to the Cho Ray Hospital emergency room with penile strangulation of 10-hour duration. Prior to presentation, the patient had placed his penis through a steel hexagon nut for sexual enhancement but was not able to remove the nut after masturbation. On examination, the patient was hemodynamically stable, conscious, and oriented. The patient complained of difficulty with urination and decreased sensation to his genitalia. He was uncircumcised, and paraphimosis was present on examination. The metallic nut was located on the penile shaft approximately 5 cm from the distal penis. Physical examination demonstrated that the shaft of the penis, which was distal to the steel nut, was edematous and congested, and the patient reported decreased sensation distally to the entrapping foreign body. There were no signs of necrosis in the glans or distal penile shaft. The initial examination is demonstrated in Fig. 1. This case is typically a grade III penile injury according to the Bhat classification and low-grade injury according to the Silberstein classification (Table 1) [6, 11].

Following initial evaluation, urgent management placed an intravenous line, and the patient was given analgesics, sedatives, and antibiotics. The patient was not in urinary retention, thus we elected not to attempt to place a urinary catheter. Manual decompression and attempts using lubricant to remove the nut were unsuccessful due to the degree of penile swelling in the distal penis. It was impossible to cut the nut off using a standard bolt cutter as there was no space between the nut and the penile edematous skin. To address this, the use of a dental handpiece was considered, and a dental colleague was consulted by phone. The patient was transferred to the dental clinic in our hospital. The thick metallic nut was removed carefully utilizing a diamond drill in a dental handpiece (Fig. 2). The procedure lasted for approximately 45 minutes with continuous water irrigation to prevent thermal injury to the penis (Additional file 1: Video 1). We used mainly a handheld rotating electric drill to make progress; however, a small plastic blade was also used throughout the procedure to protect the penile skin from the abrasive drill (Fig. 3). After cutting through it at two points, the nut was dislodged from the middle of the penis without damage to the underlying penile skin. The patient was comfortable throughout the procedure. The metal nut measured 2.7 cm in inner diameter, 4.1 cm in outer diameter, and 2.2 cm in thickness; the split nut is shown in Fig. 4 following successful removal. After the nut was removed from the penis, the distal penis was flaccid, the paraphimosis was reduced, and the patient was able to spontaneously void, and the prior distal penile edema and congestion resolved spontaneously (Fig. 5).
The patient was placed on antibiotics and analgesics. Psychiatric consultation was obtained to exclude underlying mental conditions or self-injurious behavior. The patient was discharged on day 1 following an uneventful hospitalization. One-month follow-up revealed that the patient had full recovery with normal urinary and erectile function. Erection Hard Score (EHS) obtained at that time was 4/4 [12].

**Discussion**

Penile entrapment is a rare urological emergency that can result in significant complications including edema, strangulation, ischemia, gangrene, urethral fistula, and distal penile amputation, particularly when entrapment occurs for longer than 30 minutes [13]. While in our case, removing the nut was done safely in a patient presented after 10 hours of penile strangulation, evidence has shown that the stigma associated with erectile dysfunction and masturbation may contribute to the delayed presentation in most such cases [11]. In adolescents and young men, the most common reason for utilizing these foreign bodies is mainly masturbation and sexual curiosity [14]. On the other hand, middle-aged and older adults

| Grade | Penile injury grading system by Bhat et al. | Grading system by Silberstein et al. |
|-------|------------------------------------------|-------------------------------------|
| Grade 1 | Edema of distal penis. No evidence of skin ulceration or urethral injury | Low-grade injury |
| Grade 2 | Distal edema, skin, and urethral trauma, corpus spongiosum compression, and decreased penile sensation | |
| Grade 3 | Skin and urethral trauma, no distal sensation | |
| Grade 4 | Separation of corpus spongiosum, urethral fistula, corpus cavernosum compression, no distal sensation | High-grade injury |
| Grade 5 | Gangrene, necrosis, or complete amputation of distal penis | |

**Table 1** Summary of grading system for penile incarceration [6, 11]

Fig. 2 Dental drill handpiece with diamond bur

Fig. 3 Metal nut cutting with dental drill handpiece
use strangulating objects for increasing autoerotic intention and improvement of sexual performance for patients with erectile dysfunction [14, 15].

Strangulation of the penis is always an emergency and may lead to a wide range of vascular and mechanical injuries. Prompt treatment is required, as potential delayed management may lead to complications including vascular obstruction, lymphedema, loss of penile sensation, skin necrosis, urethrocutaneous fistula, urethral injury, gangrene, autoamputation of the penis, and sepsis [16]. Additionally, in such an emergency circumstance, patients are often anxious and fearful given the possibility of significant penile injury. The urologist’s challenge is to relieve the penis of strangulation as quickly as possible to prevent complications. After that, the goals of treatment are decompression and restoration of the penile vascular circulation [14].

In 1991, Bhat et al. presented a classification for penile incarceration composed of five grades (Table 1). Subsequently, Silberstein et al. simplified the grading system proposed by dividing it into two broad categories [11]. In the Silberstein classification, low-grade injuries correspond to Bhat grade I–III injuries and most of the time require no further intervention after removal of the encircling object. In contrast, high-grade injuries correspond to Bhat grade IV and V injuries and usually require surgical intervention (Table 1) [15]. In 2008, Silberstein et al. recognized higher incidence of high-grade injuries in patients presenting after 72 hours (29.1%) in comparison with patients presenting within 72 hours (0%) [11].

The choice of the method for removal of the encircling object depends on its material and size, the incarceration time, the trauma grade, and the equipment available [6, 14]. As the constricting objects involved are variable, physicians must be creative and resourceful because a given technique may be neither applicable nor available in each case. The methods and tools used to successfully remove constricting objects range from aspiration of the corpora cavernosa to the string method, use of saws, orthopedic saws, and industrial pliers [6, 7, 11, 18–21]. Additionally, depending on the entrapment degree and distal edema caused by the encircling penile object, releasing it may be challenging. While the most severe injuries are caused by non-metallic objects, they can often be easily removed by cutting the constricting object. On the other hand, it may be more challenging to remove metallic objects. A review of the literature to identify different approaches for treatment of penile strangulation caused by metallic objects is reported in Table 2. In our case, we used
Table 2  Literature review of case reports of penile strangulation caused by metallic objects removed by string technique, nonelectric cutting, and electric cutting devices

| Author               | Year published | Object | Size | Trauma grade according to Bhat et al. | Incarceration time | Treatment method                           |
|----------------------|----------------|--------|------|--------------------------------------|--------------------|---------------------------------------------|
| **String technique** |                |        |      |                                      |                    |                                             |
| Bucy et al. [26]     | 1968           | Ball bearing | 2 cm ID | 2                                     | 8 hours            | Cord, glans aspiration                       |
| Vähäsarja et al. [22]| 1993           | Loop wrench Ball bearing | 11 mm ID | UKN | 5 hours | String, glans aspiration                       |
| Noh et al. [21]      | 2004           | Metal bearing | 11 mm ID | UKN | 5 hours | String, glans aspiration                       |
| Patel et al. [27]    | 2018           | Metal ring (entrapment with both phallus and scrotum) | 6 cm ID | UKN | 24 hours | Industrial-grade steel bolt cutters Bolt cutters |
| Sarkar et al. [17]   | 2019           | Metallic plumbing pipe | 4 cm L | UKN | 6 hours | Aspiration and string method                    |
| Maregowda et al. [28]| 2020           | Two metal rings | UKN | 3 | 6 hours | String, glans aspiration                       |
| **Nonelectric cutting devices** |                |        |      |                                      |                    |                                             |
| Steiner et al. [34]  | 1978           | Metal nut | 1 cm W | 2 | 8 days | Hacksaw                                      |
| Bhat et al. [6]      | 1991           | Metal nut | 0.5 cm T | 3 | 8 days | Hammer and chisel                            |
| Patel et al. [20]    | 2006           | Two metal radiator clamps | UKN | 2 | 6 months | Orthopedic wire cutter                        |
| Shukla et al. [16]   | 2014           | Metal ring | 2 cm ID | 2 | 14 hours | Metal saw                                    |
| Sawant et al. [32]   | 2016           | Metal ring | UKN | 4 days | K-wire cutter                               |
| Noegroho et al. [1]  | 2021           | Metal ring | UKN | 1 month | Wire pliers                                 |
| **Electric cutting devices** |                |        |      |                                      |                    |                                             |
| Greenspan et al. [33]| 1982           | Steel ring | UKN | 2 | 7 hours | Dremmel moto tool with grinder                |
| Bhat et al. [6]      | 1991           | Ball bearing | 3 cm T | 3 | 5 days | Heavy drill                                  |
| Silberstein et al. [11]| 2008         | Metal ring on penis & scrotum | 6.5 cm OD | UKN | 3 days | Dremmel rotating saw                         |
| Etetafia et al. [18] | 2014           | Metal ring | 2.2 cm ID | UKN | 16 hours | Dental handpiece                             |
| Purnell et al. [23]  | 2016           | Two metal cock rings | UKN | 8 hours | Midas Rex Legend pneumatic orthopedic drill  |
| Paonam et al. [7]    | 2017           | Metal ring | UKN | 3 | 2 days | Micromotor with wheel shape bur               |
| Low et al. [31]      | 2018           | Metal ring | UKN | 2 | 12 hours | GEM ring cutter system with abrasive discs   |
| Ichaoui et al. [25]  | 2018           | Metal ring | UKN | 10 days | Angle grinder                                |
| Dawood et al. [13]   | 2019           | Metal ring | UKN | 2 | 12 hours | Diamond-tipped Midas drill                   |
a dental drill to cut off the metal nut at two sites diametrically opposite to each other for easy removal without iatrogenic injury to the penis. Although dental drills have been used to remove entrapped finger rings, using a dental handpiece as an emergency tool to relieve strangulation of the penis is rare, with only a few documented cases [7, 17].

Cutting metal produces heat as a byproduct, which may heat adjacent tissues, so care must be taken to cool the metal during this process [7]. The penis must be protected during cutting, which can often be difficult because there is usually little room between the metal and the penis. Likewise, metallic objects must be cut in two spots to avoid damage to the penile skin during removal [23]. In our case, we continuously sprinkled normal cold saline to cool both the metal nut and the penile tissue throughout the drilling procedure. We inserted a plastic tongue-shaped laminar between the strangulating nut and penile skin, which prevented penile skin and tissue injury from the force and heat. The electric dental drill represents an excellent option for removal of obstructing metallic foreign bodies as it cuts very smoothly in a short duration without significant physical exertion. Most importantly for this patient, there are no reported erectile issues after removing the strangulation in short follow-up.

Generally, the management of penile strangulation also depends on the size of the constricting object, incarceration time, injury level, available instruments, and experience of the physicians [6, 14]. If the constricting object is nonmetallic, it can be easily cut off, but thick, hardened-steel or iron nuts are difficult to remove. The lecture review reveals some points for learning:

- Dental or industrial tools can be used to achieve the desired aim of removing metallic objects, especially when there is no space between the nut and the penile edematous skin [11, 17]. In our case, a dental drill was a helpful tool to safely relieve a strangulating penile nut with as little discomfort for the patient as possible.
- More education is necessary to inform users of penile nuts on proper usage and how to prevent strangulation and its complications. After surgical intervention, patients with underlying mental conditions or self-injurious behavior should be referred to a psychiatrist for psychotherapy [4, 5, 24].

Conclusion
Penile strangulation required emergency management to preserve penile function. A dental drill handpiece may be utilized to successfully remove an encircling metal nut on the strangulated penis of a patient in an emergency.

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s13256-022-03342-6.

Additional file 1. Video 1: Strangulating penile nut removal.

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Authors' contributions
TTN: project development, data collection, manuscript writing. XTN: manuscript editing. QTC: manuscript editing. KCH: data collection. LQVD: data collection, manuscript writing. HTL: data collection. TDH: data collection, manuscript reviewing and editing. MST: project development, manuscript editing. All authors read and approved the final manuscript.

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Declarations

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Regarding patient consent statement, the distribution of this publication was discussed and agreed upon as part of the preoperative consent.

Consent for publication
Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests
The authors declare that there are no competing interests regarding the publication of this article.

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References
1. Noegroho BS, et al. Penile strangu lation injury by metallic ring: a study of 4 cases. Int J Surg Case Rep. 2021;80:105609.
2. Gautier M. Observation d’un entanglement et des testicules et de la verge, occasionné par le passage d’un briquet. J Med Chir Pharmacol. 1755;3:358.
3. Agha RA, Sohrabi C, Mathew G, Franchi T, Kerwan A, O’Neill N. The PROCESS 2020 Guideline: updating consensus preferred reporting Of CaseSeres in surgery (PROCESS) guidelines. Int J Surg. 2020;84:231–5. https://doi.org/10.1016/j.ijsu.2020.11.005.
4. Puvvada S, et al. Stepwise approach in the management of penile strangulation and penile preservation: 15-year experience in a tertiary care hospital. Arab J Urol. 2019;17(4):305–13.
5. Trivedi S, Attam A, Kerketa A, et al. Penile incarceration with metallic foreign bodies: management and review of literature. Curr Urol. 2013;7(1):45–50. https://doi.org/10.1159/000343554.
6. Bhat AL, et al. Penile strangulation. Br J Urol. 1991;68(6):618–21.
7. Paonam S, Kshetrimayum N, Rana J. Penile strangulation by iron metal ring: a novel and effective method of management. Urol Ann. 2017;9(1):74–6.
8. Agrawal M, Gine VA, Sankapal P. Two cases of penile strangulation: varied presentations and vastly different outcomes. Afr J Urol. 2020;26(1):46.
9. Perabo FG, et al. Treatment of penile strangulation caused by constricting devices. Urology. 2002;59(1):137.
10. Agha RA, Franchi T, Sohrabi C, et al. The SCARE 2020 Guideline: updating consensus surgical Case Report (SCARE) Guidelines. Int J Surg. 2020;84(October):226–30. https://doi.org/10.1016/j.ijsu.2020.10.034.
11. Silberstein J, et al. CASE REPORTS: penile constriction devices: case report, review of the literature, and recommendations for extraction. J Sex Med. 2008;5(7):1747–57.
12. Goldstein L, et al. Oral sildenafil in the treatment of erectile dysfunction. N Engl J Med. 1998;338(20):1397–404.
13. Dawood O, et al. Penile ring entrapment—a true urologic emergency: grading, approach, and management. Urol Ann. 2020;12(1):15–8.
14. Ivanovski O, Stankov O, Kuzmanoski M, et al. Penile strangulation: two case reports and review of the literature. J Sex Med. 2007;4(6):1775–80. https://doi.org/10.1111/j.1743-6109.2007.00601.x.
15. Kyomukama LA, et al. Penile ring entrapment and strangulation: a case report at Kampala International University Teaching Hospital in Western Uganda. Int J Surg Case Rep. 2021;80:104982.

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