



Open Achilles tendon laceration in Bhutanese population- Retrospective study at tertiary health care center of Bhutan

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ABSTRACT

Introduction: There is a wealth of literature on closed Achilles tendon injuries but open-lacerations are rarely reported. We aimed to assess the frequency of open Achilles tendon laceration in Bhutanese patients with a particular emphasis on age and sex distribution, mechanism of injury, and management provided to these patients. **Methods:** Retrospective study was conducted at department of orthopedic surgery, Jigme Dorji Wangchuck National Referral Hospital (JDWRH), Thimphu. All patients treated at JDWRH for open-laceration of Achilles tendon between January 2018 to December 2020 were included. Data were analyzed for means and frequencies using SPSS software. **Results:** Of the 48 cases involved, 36 (75%) cases were male and 12 (25%) cases were female. The most affected age groups were between 21-60 years (70.8%). Majority of the cases inflicted injury following slip in the squat-toilet (85.4%). Thirty-eight (79.2%) cases had a complete-laceration of the tendon and the remaining cases (20.8 %) had a partial-laceration. All patients underwent operative-irrigation, debridement and primary-repair. Complications occurred in 9 patients (18.8%), including seven early wound infection and two late infections. **Conclusions:** Open Achilles tendon laceration is not an uncommon entity in a developing country like Bhutan where the squat toilet is still being used regularly. Changing the toilet designs to commode-type and installing proper lighting in toilet would significantly reduce the incidence of open injury. Although management can be challenging due to irregular nature of the wound and inherent contamination present, a good outcome can be achieved with early-irrigation, debridement, surgical repair and the administration of intravenous antibiotics.

Keywords: Achilles tendon; Laceration; Surgical management.

INTRODUCTION

The Achilles tendon is the primary plantar flexor of the ankle, formed by the merging of the tendinous portion of gastrocnemius and soleus muscles. It is one of the largest and strongest tendons in the human body¹⁻². However, it is frequently injured owing to its superficial location, with an annual reported incidence of 18-37 cases per 100,000 people³⁻⁴. Achilles tendon injury (ATI) can result either from closed rupture or open laceration. ATI predominantly occurs in healthy active individuals in the third to fourth decades of life⁴⁻⁵. Although closed rupture of the tendon accounts for the majority of the ATI worldwide, open lacerations are relatively uncommon with only a few reported cases^{2,4,6-9}.

ATI can be due to sports, sharp household items, penetrating injuries, and road traffic accidents². Closed ruptures are typically the result of a sports-related injury and are common

in the Western population^{2,9}. Open lacerations are due to direct cuts from sharp objects, road traffic accidents (RTA), or slipping in the bathroom^{7,9}. The open type of laceration is commonly encountered in South East Asia, where people use the squatting lavatory pan toilet². Laceration of the Achilles tendon by the edge of the toilet seat of a commode has also been reported⁷. The management of open Achilles tendon rupture is still controversial¹⁰⁻¹². However, operative management is the treatment of choice⁸. A simple, non-complicated open Achilles tendon laceration can be managed with primary repair and immobilization⁸.

The baseline data on open Achilles tendon laceration in Bhutanese population is not yet established. The main aim of this study was to determine the frequency of open Achilles tendon lacerations in Bhutanese patients with a particular emphasis on age and sex distribution, mechanism and type of lacerations, and the management provided to these patients.

METHODS

This retrospective study was conducted in Jigme Dorji Wangchuck National Referral Hospital (JDWRH), Thimphu, Bhutan, which functions as the national referral Hospital and a tertiary care center in the country. Bhutan has a three-tiered health

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care system (primary, secondary and tertiary level). Bhutanese patients seek treatment at all levels of the health care system with or without a referral. The country has four centers with a facility for orthopedic surgery. All the cases of ATI (irrespective of the cause) in these four centers are usually managed by orthopedic surgeons. The majority of the cases, including patients referred from other district and general hospitals (without orthopedic surgeons), are managed at JDWNRH.

Records of all the patients who sustained open Achilles tendon laceration from January 2018 to December 2020 were retrieved from the hospital medical record section and the surgical logbook maintained at the department of orthopedic surgery. Cases with closed injuries were excluded. The variables included demographics, type and laterality of injury, mechanism of injury, management provided to each patient, and complications. The data were analyzed for means and frequencies using SPSS version 25 (IBM, Armonk, NY, USA). Ethical clearance was granted by the Research Ethics Board of Health vide letter No. REBH/Approval/2021/022.

RESULTS

Clinical profile of patients with open Achilles tendon laceration

The total number of cases involved in this study was 48. Patient age ranged from 9 to 63 years and the mean age was 29.42 years. Seventy-five percent ($n = 36$) of the cases were male and only 25% were female ($n = 12$). Adult patients in the age group of 21-60 years were the most affected, comprising 70.8% of the cases involved, followed by those of ≤ 20 years (25.0%). Most of the patients with open Achilles tendon lacerations were students, consisting of 35.4 % (17/48) of the cases, followed by laborers (14.6 %). Laterality was essentially equivalent (52.1% right, 47.9% left). The demographic characteristics of patients with open Achilles tendon laceration are summarized in Table 1.

Mode and pattern of injury

Forty-one cases (85.4%) had sustained the injury following an accidental slip of their foot into a squat toilet (Figure 1).

Two patients had a history of slip in the drain and sustained the cut from the edge of the drain. Three patients had a history of accidental cuts of the tendon with a knife. One laborer accidentally cut the tendon with a spade and another laborer sustained the injury by an electric chain saw. About 79.2% of the patients had complete laceration (Figure 2a) of the tendon and 20.8% had partial laceration (Figure 2b).

Though a majority of the injuries were limited to the Achilles tendon, a few cases were complicated with the involvement of other structures. Two patients had involvement of the posterior tibial nerve, one patient had involvement of the peroneus brevis tendon and another patient had associated bone avulsion along with complete laceration of the Achilles tendon. The mechanism and type of injuries are summarized in Table 2.

Table 1. Clinical profile of the patients with open Achilles tendon laceration at the tertiary care center, Bhutan from January 2018 to December 2020 (n=48)

Variables	Number of cases	Percentage
Age in years (mean±SD)	29.42±14.12	
≤ 20	12	25.0%
21-60	34	70.8%
>60	2	4.2%
Sex		
Male	36	75.0%
Female	12	25.0%
Occupation		
Farmer	3	6.3%
Student	17	35.4%
Government servant	3	6.3%
Clergy	4	8.3%
Laborer	7	14.6%
Armed force	2	4.2%
Housewife	4	8.3%
Driver	1	2.1%
Gardner	1	2.1%
Private/Business	4	8.3%
Not available	2	4.2%
Laterality		
Right	25	52.1%
Left	23	47.9%



Figure 1. Floor leveled squat toilet



Figure 2. Achilles tendon lacerations. Complete laceration (a), Incomplete laceration (b)

Table 2. A mechanism, type of injury, and other structure involvement in patients with Achilles tendon laceration at tertiary care centre from January 2018 to December 2020 (n=48)

Variables	Number of cases	Percentage
Mechanism of injury		
Slip in the squat toilet	41	85.4%
Slip in drain	2	4.2%
Cut with sharp objects*	4	8.3%
Cut with chain	1	2.1%
Type of injury		
Complete laceration	38	79.2%
Incomplete laceration	10	20.8%
Involvement of other structure		
PTN [†] involvement	2	4.2 %
PBT [‡] involvement	1	2.1 %
Bone avulsion	1	2.1 %
Limited to AT [§]	41	85.4 %

*Sharp objects (3 knife, 1 spade)

[†]posterior tibial nerve

[‡]peroneus brevis tendon

[§]Achilles tendon

Management and complications

All the cases initially underwent thorough wound irrigation, debridement, administration of empirical intravenous (IV) antibiotics (cephazolin and gentamycin), and administration of tetanus prophylaxis.

Of the thirty-eight cases with complete laceration, thirty cases underwent primary repair of the tendon with modified Kessler’s technique. Ethibond (size 2) was used as the core suture and 2-0 vicryl was used for suturing the epitendon. One case had repair of the tendon with a 2-strand modified Kessler technique

and augmentation with flexor hallucis longus. Posterior tibial nerve laceration (observed in 2 patients) was repaired with 5-0 nylon. Peroneus brevis tendon laceration (seen in 1 patient) was repaired with 1-0 vicryl. The youngest patient (9 years) in this study had a complete laceration of the Achilles tendon and avulsion of the calcaneus at the level of tendon insertion. Since the tendon was small, it was repaired with 1-0 vicryl and the bony avulsion was fixed with a cancellous screw. The remaining 3 patients with complete laceration presented 48 hours after injury with an already infected wound. Therefore, these patients underwent wound debridement with a delayed repair.

There were 10 cases with incomplete laceration, of which 8 cases underwent wound debridement and repair of the tendon with 1-0 vicryl. Two cases had less than 50% laceration of the tendon. Therefore, they underwent only wound debridement with primary closure of the wound.

Short leg cast with the ankle in equinus was applied postoperatively for all the patients. The cast window was created after 24 hours for the assessment of the wound. Once the wound was healed, sutures were removed after 2 weeks and the cast was reapplied with the foot in plantigrade position for 4 more weeks. The total duration of immobilization was 6 weeks. This was followed by gradual weight-bearing and initiation of range of motion exercises under the guidance of a physiotherapist. The postoperative period of the majority of patients was uneventful. However, nine patients developed complications, of which seven patients had an immediate post-operative infection and two patients had late complications. Among the seven patients with immediate post-operative infection, four patients had to undergo repeated wound debridement along with the application of negative pressure wound therapy. Two patients developed skin necrosis with infections. They underwent repeated wound debridement with a split-thickness skin graft (STSG).



Figure 3. Case with late wound infection

Two patients developed a late infection due to reaction to the non-absorbable suture material (Figure 3).

In one case, it healed after the removal of the non-absorbable suture. However, the other patient had to undergo multiple debridement leading to a soft tissue defect. He also developed a painful neuroma of the sural nerve. The soft tissue defect was managed by using negative pressure wound therapy followed by STSG and local flap, and neuroma excision was also performed. The management and complications of the patients are summarized in Table 3.

Table 3. Management and complications of Open Achilles tendon laceration in a tertiary care centre from January 2018 to December 2020 (n=48)

Procedures	Number of cases (%)
Complete laceration Management	38 (79.2%)
- WIRT* with 4 strand modified Kessler technique	30 (62.5%)
- WIRT* with 2 strand modified Kessler technique and augmentation with FHL†	1 (2.1%)
- WIRT* 4 strand modified Kessler technique‡ nerve repair	2 (4.2%)
- WIRT* 4 strand modified Kessler technique‡ peroneus brevis repair	1 (2.1%)
- WIRT* with fixation of avulsion fracture with screw	1 (2.1%)
- WIRT*- delayed repair	3 (6.3%)
Incomplete laceration management	10 (20.8%)
- Wound debridement with direct repair	8 (16.7%)
- Wound debridement with closure of wound	2 (4.2%)
Complication	
Immediate post-op-infection	7 (14.6%)
Delayed post-op- infection	2 (4.2%)
Uneventful	39 (81.3%)

*Wound irrigation and repair of tendon
 †flexor hallucis longus

DISCUSSION

There are only a few reported cases of open Achilles tendon laceration (ATL). The largest reported series were from Middle East countries^{6,9}. Open Achilles tendon injuries are common in developing countries⁹. However, the existence of baseline data on open ATL in the Bhutanese population is unknown. In our institution, open laceration (48 cases) was found to be more frequent than closed rupture (13 cases which were excluded from the study). Similar to previous studies from Africa and Qatar^{8,9}, male patients were mostly affected in our study with a male to female ratio of 3:1. Adult patients in the age group of 21-60 years

were the most affected, which is concordant with the study done by Awe et al⁸.

According to the reports from Qatar and India, the commonest cause of open ATL was due to slipping in the bathroom and floor-leveled traditional squatting type of toilet^{2,6,9}. In a study by Chatterjee et al², all of his 18 patients had a history of slipping the foot into the hole of the lavatory pan. The injury was sustained during the entry and extraction of the foot from the hole². A similar mechanism of injury was observed in the study by Said et al⁶. Similar to the above studies, the majority of the patients (85.4%) in our study had a history of slip in the squat toilet. The slip was predisposed by wet and slippery floors and poor lighting in the toilets. In our patients, the broken porcelain pan of a squat toilet has inflicted the laceration during the extraction of the foot (Figure 4a) and in some cases the sharp edges of the porcelain pan have inflicted the injury during the entry of the foot (Figure 4b).

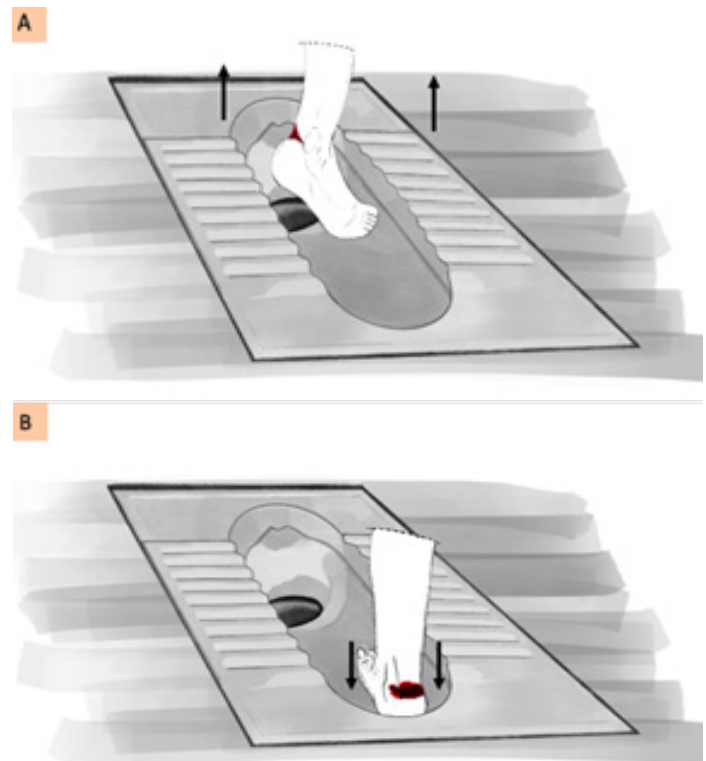


Figure 4. Mechanism of Achilles tendon laceration following slip in squat toilet (a) Open injury inflicted by broken edge during the extraction of the foot, (b) Open injury caused by the sharp edge of the pan during the entry of the foot

In Bhutan, the squat toilet is the most common design used in rural areas while the urban communities have both squat and commode toilets. We feel that changing the toilet designs to commode type and installing proper lighting in the toilet would significantly reduce the incidence of open injury. In contrast to our study, the most common cause of open ATL in Nigeria was due to motorcycle accidents⁸. Open ATL in Western countries

were mostly caused by bicycle spoke injuries¹³ and non-lethal weapons¹⁴.

Management of open ATL can be challenging as the wound is irregular and contaminated by the toilet. However, surgical treatment is known to provide an excellent outcome in the majority of the cases⁶. The complications related to open Achilles tendon injury can vary from superficial infection to deep wound infection, wound dehiscence, seroma formation, hematoma formation, sural nerve irritation, deep vein thrombosis, and re-rupture, which can affect the patient's function and mobility in long run^{2,9,15-16}. Nevertheless, the incidence of major complications was found to be relatively low⁶.

Our patients were given empirical IV antibiotics and underwent a thorough wound irrigation, followed by definitive surgical treatment within 24 hours of the injury. Three patients underwent delayed repair of the tendon as they presented only after 48 hours of injury with the features of wound infection. Although the majority of the patients in our study had an uneventful postoperative period, two patients had reaction to the non-absorbable suture material and developed a late infection. Using an absorbable suture material or monofilament such as polydioxanone suture for all the repairs is known to prevent the occurrence of such complications¹⁷. The use of absorbable sutures has less incidence of suture reaction¹⁷.

Generally, patients with underlying diseases such as diabetes mellitus, peripheral vascular disease, and smokers are at increased risk of developing surgical complications. Fortunately, all of our patients were healthy individuals without any underlying co-morbidities. The main limitation of this study is that being a retrospective study, the surgical outcome of the patients could not be assessed. Moreover, wound cultures were not taken during the initial debridement. Therefore, the specific organism causing the wound infection could not be ascertained.

CONCLUSIONS

Open Achilles tendon laceration is not an uncommon entity in a developing country like Bhutan where the squat toilet is still being used regularly. Slipping in the squat toilet was the most common cause of laceration. Changing the toilet designs to commode type, installing proper lighting in the toilet, and educating patients on keeping the toilet floor dry would significantly reduce the incidence of open injury. Although management can be challenging due to the irregular nature of the wound and contaminated environment, the postoperative outcome can be good with the administration of empirical broad-spectrum intravenous antibiotics, thorough wound irrigation, appropriate surgical debridement, and tendon repair.

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AUTHORS CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

KW: Concept, design, data collection and analysis, manuscript writing and review.

SR: Concept, design, data collection, manuscript review

SD: Concept, design, manuscript review

SC: Concept, design, data analysis, manuscript review

Author agree to be accountable for all respects of the work in ensuring that questions related to the accuracy and integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

None

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