

DIAGNOSIS AND TREATMENT EXPERIENCE OF A CASE OF ACHILLES TENDON RUPTURE CAUSED BY MONKEY BITE AND LITERATURE REVIEW

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Abstract: Objective: To investigate the clinical characteristics, surgical repair strategies, and post-exposure rabies prophylaxis for multiple injuries to the left lower limb caused by a monkey bite (Achilles tendon rupture combined with nerve and vein rupture), and to improve the understanding of such complex injuries through a literature review. Methods: Clinical data from one patient with ruptures of the Achilles tendon, sural nerve branches, and great saphenous vein in the left lower limb due to a monkey bite were retrospectively analyzed. Relevant literature on monkey bites, Achilles tendon rupture, and infection prevention and control after animal bites was retrieved from databases including CNKI, Wanfang, and PubMed, and summarized alongside the diagnostic and therapeutic experience from this case. Results: The surgical procedures were successful. Postoperative wound dressings remained dry, and no significant redness, swelling, or exudation was observed at the wound site during dressing changes. The skin flap exhibited good blood supply, and the Achilles tendon healed well. No complications such as rabies onset or wound infection occurred. Monkey bites have a high risk of infection. Rabies remains a major concern, but B virus (Cercopithecine herpesvirus) also needs attention. When Achilles tendon rupture occurs together with nerve and vascular injury, microsurgical repair combined with individualized skin flap coverage is particularly important because it may lower infection and amputation rates. Early postoperative functional exercise also supports recovery. Standardized follow-up helps restore Achilles tendon function. Conclusion: Achilles tendon rupture caused by monkey bites is often accompanied by nerve and vascular injury, which makes treatment more difficult because tissue repair must be handled together with infection control. Postoperative rehabilitation should be carried out in a standardized way, with close follow-up to support functional recovery. The literature reviewed here helps clarify diagnosis and treatment strategies for these complex cases.

Keywords: Monkey bite injury; Achilles tendon rupture; Nerve and vascular injury; Literature review; Case analysis

1 INTRODUCTION

Animal bites are a common form of trauma in emergency surgery. Monkey bites occur less often than dog bites, but they produce different patterns of injury and have their own infection risks. Rabies is one concern, but monkey bites also carry a risk of B-virus (Cercopithecine herpesvirus) infection, which has a high fatality rate and requires careful clinical attention [1-2]. These injuries often leave open, contaminated wounds that may extend into deeper structures such as tendons, nerves, and blood vessels. This makes treatment harder.

The Achilles tendon is the thickest and strongest tendon in the human body. It plays an important role in ankle plantar flexion, walking, and jumping. Open Achilles tendon ruptures usually result from sharp lacerations or high-energy trauma. When an animal bite causes the injury, repair differs from that for closed ruptures because the wound is heavily contaminated and tissue loss is often irregular [3]. If the rupture occurs together with transection of sural nerve branches and the great saphenous vein, treatment becomes more complex. The surgeon needs to perform careful debridement followed by tendon repair, neuroorrhaphy, and vascular reconstruction while also dealing with flap coverage and infection control. Timing matters here.

At present, reports of Achilles tendon rupture with neurovascular injury caused by monkey bites are rare, so clinical experience with diagnosis and treatment remains limited. In this article, we retrospectively analyzed the clinical data of one patient who suffered an Achilles tendon rupture together with transection of sural nerve branches and the great saphenous vein in the left lower limb after a monkey bite. We also reviewed relevant literature to discuss surgical repair strategies for this kind of complex injury and key aspects of rabies post-exposure prophylaxis. The aim was to provide some reference for diagnosing and treating similar cases in clinical practice.

2 CLINICAL DATA

This study was approved by the Medical Ethics Committee of the Seventh Affiliated Hospital of Sun Yat-sen University (No. YY-2026-074).

The patient, a 33-year-old female, was admitted on March 25, 2025 with a chief complaint of "left lower limb bitten by a monkey for 4 hours." Four hours before admission, she had been bitten on the left lower limb by a monkey while at

work. She felt immediate pain and started bleeding, and the bleeding did not stop on its own. She also experienced dizziness, nausea, and vomiting. There was no loss of consciousness, chest tightness, palpitations, fever, chills, hematuria, or jaundice. She had previously been in good health and had no notable medical history.

After the bite, she immediately rinsed the wound with clean water and did not seek treatment at any other hospital before coming to our institution. On admission, her vital signs were stable. Physical examination revealed a skin laceration of about 4–5 cm over the left heel, extending into the muscle layer, with irregular wound margins. The Achilles tendon was found to be injured, but no stump of blood vessels or nerves was visible. There was no bone exposure and no obvious foreign body retention. Movement of the left foot was restricted. The dorsalis pedis artery pulse was palpable, and toe sensation showed no obvious abnormality.

3 DIAGNOSIS AND TREATMENT PROCESS

3.1 Wound Management and Post-Exposure Prophylaxis

According to the "Rabies Exposure Prevention and Disposal Work Standards (2023 Edition)", monkey bites are classified as Grade III exposure, requiring immediate wound care, administration of rabies passive immune preparations, and vaccination. Upon admission, the wound was immediately irrigated alternately with soap water and flowing clean water for approximately 15 minutes, disinfected with diluted iodophor, and rabies passive immune preparation was injected. Rabies vaccine was administered at a different site on the same limb. Concurrently, tetanus antitoxin was injected, and intravenous antibiotics were used to prevent bacterial infection.

3.2 Surgical Procedure

On the day of admission, emergency surgery was performed under general anesthesia: "Debridement and suture of open left Achilles tendon rupture and external fixation of left foot with splint and great saphenous vein anastomosis." Intraoperative exploration revealed complete rupture of the Achilles tendon with torn ends, along with rupture of the sural nerve branches and great saphenous vein. After trimming necrotic tissue, the Achilles tendon was repaired using the modified Kessler suturing technique, the great saphenous vein was anastomosed under microscopy, and the sural nerve branches were coapted via epineurial neuroorrhaphy. Postoperatively, the left foot was fixed in plantar flexion position with a splint, supplemented with symptomatic supportive treatments including anti-infection, analgesia, and detumescence therapy.

3.3 Second-Stage Surgery

On April 3, 2025, given good granulation tissue growth at the wound, "debridement and suturing of the left lower limb and flap plasty and plaster fixation" was performed under general anesthesia. Anti-infection treatment continued postoperatively, with regular dressing changes.

4 POSTOPERATIVE FOLLOW-UP

One month after surgery: The wound on the left lower limb healed well, stitches had been removed, and there was no obvious local redness, swelling, exudation, or tenderness. The skin flap survived well. The Achilles tendon anastomotic site showed good alignment with no signs of re-rupture. The plaster cast had been removed, and the patient could walk with partial weight-bearing under brace protection. Active range of motion of the ankle joint improved significantly compared to the early postoperative period, though mild limitation in dorsiflexion remained. Continued active and passive rehabilitation training of the ankle joint was recommended.

5 LITERATURE REVIEW AND DISCUSSION

5.1 Dual Infection Risk of Monkey Bites

The key difference between monkey bites and dog or cat bites lies in the risk of B virus (Cercopithecine herpesvirus) infection. Macaques are the natural hosts of B virus, with an adult macaque seropositivity rate reaching 80%–90%. In humans, once the central nervous system is involved, the case fatality rate remains as high as approximately 80% even with antiviral treatment [2, 4]. Therefore, after a monkey bite, in addition to standard rabies exposure management, close attention should be paid to the potential risk of B virus infection [5]. In this case, thorough wound irrigation (with soapy water/iodophor for more than 15 minutes) was performed immediately after the bite, which is a critical step in reducing the viral load of B virus. For patients with confirmed or highly suspected B virus exposure, early prophylactic antiviral therapy such as acyclovir should be initiated.

5.2 Management Strategies for Achilles Tendon Rupture Complicated by Neurovascular Injury

The Achilles tendon is the thickest tendon in the human body. When an open rupture is complicated by injury to the sural nerve and the great saphenous vein, treatment must simultaneously address tendon repair, reconstruction of neurological function, restoration of venous return, and prevention of infection [6-8]. Iatrogenic injury to the sural nerve

may cause sensory deficits on the lateral aspect of the foot, so meticulous microsurgical technique is required during the operation. Among the suturing techniques used for the Achilles tendon, the Kessler method and its modified forms are reported to be safe and effective [9-10]. For postoperative rehabilitation, most studies support early controlled mobilization because it can reduce adhesion formation and muscle atrophy. Even so, when there is a risk of neurovascular injury or infection, the rehabilitation plan should be adjusted to the individual patient [11].

5.3 Key Points of Postoperative Rehabilitation and Follow-up

Postoperative rehabilitation after Achilles tendon rupture usually follows three stages: early protection, mid-term functional recovery, and later strength training. About one month after surgery, patients generally shift from protection to functional recovery. At that stage, weight-bearing should increase gradually under brace protection, while sudden push-off movements and falls still need to be avoided because they can cause re-rupture.

In this case, the patient wore a polymer plaster cast and performed ankle pump exercises every day. Her follow-up compliance was good. The postoperative course remained stable.

The literature indicates that patients can usually return to normal walking at 2–3 months after surgery, while recovery to pre-injury sports level is generally expected after 6 months [12]. The one-month follow-up findings in this case were consistent with that general recovery pattern. Even so, follow-up beyond 6 months is still needed before judging restoration of Achilles tendon function and ankle joint range of motion.

5.4 Special Infection Risks and Post-Exposure Management of Monkey Bites

What distinguishes monkey bites from dog or cat bites is chiefly the risk of B virus (Cercopithecine herpesvirus type) infection. The natural host of this virus is the macaque. If a human is infected and no timely intervention is given, the disease can progress to fatal encephalomyelitis, with a mortality rate exceeding 70%. One case report described a 26-year-old woman who was bitten by a wild macaque. While rabies immunoglobulin and vaccine were being administered, the emergency team also started prophylactic antiviral treatment with aciclovir, which highlights the importance of keeping this risk in mind among emergency physicians [4].

In this case, the patient came to hospital within 4 hours after the bite and received standard wound irrigation (alternating washing with soapy water and running clean water for 15 minutes), iodine disinfection, and injection of human rabies immunoglobulin and human tetanus immunoglobulin. This management complied with the requirements for Grade III exposure as stipulated in the "Rabies Exposure Prevention and Disposal Work Specifications (2023 Edition)". The incubation period of B virus is usually 2 days to 3 weeks, and once symptoms appear, the fatality rate is high. Therefore, within 3 weeks after a monkey bite, close monitoring is needed for local vesicular or ulcerative lesions at the wound site, as well as systemic flu-like symptoms. During hospitalization and at the one-month postoperative follow-up, this patient showed none of these signs. At discharge, she was given a written notice and advised to return for regular follow-up. Nevertheless, given the potential severity of B virus infection, patients in such cases should still be informed of the relevant risks and advised to remain vigilant after discharge.

She was also advised to watch for fever, wound redness, or vesicular lesions and to return promptly if any of these appeared.

5.5 Surgical Management Strategies for Achilles Tendon Rupture Complicated by Neurovascular Injury

The Achilles tendon is the largest tendon in the human body, and its repair principles include firm apposition, appropriate tendon length, meticulous soft tissue management, and protection of neural structures. Unlike closed Achilles tendon rupture, that caused by monkey bites is an open injury, characterized by severe wound contamination, irregular tissue defects, and frequent concomitant injury to adjacent structures. In this case, in addition to complete Achilles tendon rupture, the patient also sustained rupture of a branch of the sural nerve and the great saphenous vein, which is relatively rare in clinical practice and significantly increases the difficulty of management.

For such complex injuries, the choice of wound closure strategy is crucial. The MSD Manual states that bite wounds involving deep structures (tendons, bones, joints) should initially be left open, with delayed primary closure or secondary closure to reduce the risk of infection. In this case, the patient underwent primary debridement and Achilles tendon repair and great saphenous vein anastomosis and nerve anastomosis, followed by secondary debridement and suturing and flap reconstruction on postoperative day 9. This "damage control" strategy is consistent with the principles for managing contaminated wounds. It has been reported in the literature that for cases of Achilles tendon defects with surrounding soft tissue defects, reconstruction using vascularized lateral femoral fascia or anterolateral thigh flap transplantation can achieve good Achilles tendon healing and functional recovery [13]. The performance of secondary flap reconstruction in this case provided effective soft tissue coverage for the Achilles tendon and was a key step for successful wound healing.

The management of nerve injury also deserves attention. Rupture of a branch of the sural nerve can lead to decreased sensation on the lateral aspect of the foot. Although it does not directly affect motor function, sensory impairment may affect the patient's perception of foot protection. Epineurial neuroorrhaphy under the microscope during surgery helps to restore sensory function to the greatest extent possible. The functional recovery after Achilles tendon repair depends largely on the reconstruction of neuromuscular coordination, and intact innervation is the foundation of this process.

5.6 Individualized Selection of Postoperative Rehabilitation Strategies

The rehabilitation process after Achilles tendon rupture surgery needs to balance "the benefits of early mobilization" against "the risk of re-rupture" [14]. Literature indicates that early controlled functional exercise postoperatively facilitates the recovery of ankle flexion and extension function without increasing postoperative complications [15]. A prospective study comparing dynamic versus static rehabilitation protocols showed that the dynamic rehabilitation group (early partial weight-bearing with assistive boot and controlled ankle mobilization) achieved significantly higher ATRS scores at both 3 and 6 months postoperatively compared to the static rehabilitation group, with no statistically significant difference in complication rates between the two groups [16].

However, given that this patient had combined nerve and vascular injuries, and that the wound was a contaminated bite injury, the safety threshold for early weight-bearing requires careful consideration. At the one-month follow-up, the cast had been removed, and the patient was walking with partial weight-bearing under brace protection. Ankle flexion and extension had improved compared with the early postoperative period, although mild dorsiflexion limitation remained. This matched the usual course of recovery at one month after Achilles tendon repair. Rehabilitation after Achilles tendon rupture is usually divided into three phases: an early protective phase (0–2 weeks), a mid-term functional recovery phase (2–6 weeks), and a late strengthening phase (after 6 weeks). At one month after surgery, this case was moving into the functional phase. The main goals at this stage are to gradually increase weight-bearing and restore ankle mobility, while avoiding sudden push-off or falls. Some patients have different degrees of ankle flexion-extension range-of-motion loss and reduced calf circumference after Achilles tendon surgery. These changes may be related to the longer time needed for muscle tension to recover. In this patient, the mild dorsiflexion restriction suggests that active and passive ankle rehabilitation should continue. By the three-month follow-up, the ATRS score had reached 78, and ankle dorsiflexion had improved to 10°.

5.7 Diagnostic and Therapeutic Insights from This Case

This case provides several practical points from both diagnosis and treatment. After a monkey bite, post-exposure management needs to deal with three risks at once: rabies, tetanus, and B virus infection. Thorough wound irrigation is central here because it lowers all three risks. In this case, irrigation started within 4 hours of the bite, and no local or systemic infection appeared during hospitalization. A second point concerns open Achilles tendon rupture complicated by neurovascular injury. In that setting, management should follow a "damage control" approach with staged treatment of the tendon, vessels, nerves, and soft tissue coverage. Primary closure under tension should be avoided because it can increase infection risk. That was clear in this case. The tendon, vessels, and nerves were repaired in stages instead of all at once under compromised wound conditions; then an individualized skin flap was used for coverage rather than forcing direct closure.

Postoperative rehabilitation also needs to fit the patient's actual condition rather than follow a fixed schedule alone. When neurovascular injury is combined with contaminated wounds as in this case, early weight-bearing should progress cautiously; however, prolonged immobilization should also be limited because it can lead to joint stiffness and muscle atrophy.

In this case, the patient wore a polymer plaster cast and performed ankle pump exercises daily, and weight-bearing was progressed gradually under brace protection.

6 CONCLUSION

The diagnostic and therapeutic process of this case, in which a monkey bite caused left lower extremity Achilles tendon rupture complicated by transection of a sural nerve branch and the great saphenous vein, suggests that the management of such complex injuries requires balancing the dual goals of tissue repair and infection prevention and control. Based on this experience, several lessons can be drawn. Through standardized Category III rabies post-exposure prophylaxis, a staged surgical strategy (primary debridement and Achilles tendon repair and vascular and nerve anastomosis, followed by secondary flap reconstruction and plaster fixation), and an individualized rehabilitation protocol, the patient's 1-month postoperative follow-up showed good wound healing, flap survival, no re-rupture of the Achilles tendon, and gradual recovery of ankle joint function, with no onset of rabies or local infection or other complications, yielding satisfactory therapeutic outcomes.

Combined with a review of the literature, the diagnostic and therapeutic experience of this case can be summarized in the following three points: First, monkey bites require vigilance for both rabies and B virus infection risks; thorough wound irrigation is the foundation for reducing all infection risks, and post-exposure monitoring for signs related to B virus infection should be conducted closely. Second, when open Achilles tendon rupture is complicated by nerve and vascular injury, the principle of "damage control" should be followed, with staged management of the tendon, vessels, nerves, and soft tissue coverage to avoid increased infection risk from forced primary closure. Third, postoperative rehabilitation requires an individualized balance between "the benefits of early mobilization" and "the risk of re-rupture"; in patients with concomitant neurovascular injury and contaminated wounds, early weight-bearing should be advanced conservatively, while excessive immobilization leading to joint stiffness should be avoided.

The limitation of this case report is that it is merely a summary of a single case experience, with a relatively short follow-up period. The long-term recovery of Achilles tendon function (such as the ATRS score at 6 months postoperatively, ankle joint range of motion, and calf muscle strength) still requires further follow-up observation. In

addition, the exclusion of B virus infection lacks laboratory testing evidence and is mainly based on clinical observation. In the future, more cases of the same type need to be accumulated to further optimize the diagnostic and therapeutic strategies for complex Achilles tendon rupture caused by monkey bites.

COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose.

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