

Using the Literature to Understand Achilles Fate

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Abstract

According to Greek mythology, Achilles was fatally wounded in his heel, bled out, and died. Several unproven hypotheses mention poisoning, infection, allergy, hemophilia, thyrotoxic storm (ie, pain and stress), and suicide. The author, a plastic surgeon who often treats chronic wounds, proposes an additional scenario: Although not mortally wounded, Achilles was considered dead, because in his time a wounded hero was as good as a dead hero, so he lived out the remainder of his life as former hero with a chronic wound far away from everyone. To determine whether his injury was enough to cause fatal bleeding and quick death or if other factors might have been in play, a search of the literature was conducted to enhance what is known about Achilles, basically through the tale related in *The Iliad* and the clinical impact of an Achilles' injury. Search terms utilized included *bleeding tibialis posterior artery* (3 manuscripts were found) and *chronic wound, Achilles tendon* (631 manuscripts were located). Although science may not be able to explain how and why Achilles died, the literature supported the conjecture that Achilles probably had a chronic wound with skin and paratenon defect, de-vascularized tendon tissue, bleeding, granulation, and repeated infections. It is interesting to consider the state of his injury and his mind in the making of this legend.

Keywords: review, Achilles tendon, injuries, tibialis posterior artery, chronic wound

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In Greek mythology, Achilles, the Greek hero of *The Iliad*, was the son of Peleus, the king of the Myrmidons, and the nymph Thetis. Fate brought him everything: exceptional strength, obvious beauty, and great courage. As a 10-year-old boy, he strangled a wild boar with his bare hands and caught up with a running deer. He fought for 9 years, conquering 23 cities. He was ruthless in the battle with Trojans; he is said to have “resembled a fire in a dry pine forest.” His presence alone caused fear among Trojans. He killed Hector, the prince of Troy, to avenge a friend's death and then repeatedly dragged the corpse around the city walls.¹

Achilles' only weakness was his heel. According to legend, his mother had taken him to the River Styx, which was supposed to offer powers of invincibility, and dipped his body into the water. Because she held him by the heel, it was not washed over by the water of the magical river (see Figure 1). When Achilles was wounded in his heel, he bled out and died.¹ “Achilles' heel” became a synonym for a vulnerable spot or human physical or mental weakness.

Historical perspective. In the 11th and 12th centuries BC (ie, the years around 1200 BC and the Mycenaean civilization and the Trojan War), medicine largely had its origin in magic and priestly practices; humans were healed by the grace of the gods. Priests used rational therapy (ie, nonmagical practice) in addition to rituals, but patients could not clearly understand the difference. Scientific principles of observation, comprehension, diagnosis, and treatment were slowly developing.^{2,3}

Descriptions of war wounds and their treatment depict surgery from an empirical point of view. Physicians in *The Iliad* are referred to as persons “far more valuable than other persons.” This leads to the conclusion a physician had specific skills and was successful in treating people. Asclepius, the God of Medicine and healing, resurrected people from the dead and performed operations (ie, Caesarian sections) so successfully that Hades, God of the Underworld, complained to Zeus that nobody was dying; he asked Zeus to throw a thunderbolt at the Asclepius to kill him.^{1,4} Two sons of Asclepius treated the injured during the Trojan War.⁵

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Although the exact dates of the Trojan War are not clear (ie, whether it was during the Mycenaean civilization or during the Dark Age of Greece), the decline of the Mycenaean civilization resulted in wars, migration, and the destruction of the culture, literacy, communications, trade, and medicine. Regardless of when it occurred, the literature concludes that during the Trojan War, physicians were aware of the importance of body and therefore wound hygiene. Wounds were cleaned and sutured and herbs were used. To stop the bleeding, a red-hot iron was used (early cauterization). In those days, micro-organisms were unknown, and asepsis procedures and antibiotics were not used.^{2,3}

What is known today is the anatomy of Achilles' heel — a strong, wide, and thick tendon that plays an important role in the biomechanics of the foot — was partially understood in ancient Greece. The heel enables standing on the toes, walking, running, and jumping. Two arteries carry blood to the heel — the peroneal artery and the tibialis posterior artery (the latter ranging in diameter from 0.93–3.1 mm)⁶— that descend behind the external and internal malleolus. The tendon has no blood vessels of its own sheath; the paratenon, a sheer, gossamer layer of connective tissue matrix fortified with capillaries, helps nourish the tendon.

Achilles' legend. The story of Achilles is one of the most important legends in Greek mythology. Achilles was said to have died from a heel wound as the result of a poisoned arrow shot by Paris, Hector's brother (see Figure 2).⁵ Arctinus of Miletus wrote, "The arrow hit Achilles in the right heel, his only vulnerable spot, and he died in terrible pain."⁵ Were the injury and subsequent bleeding enough to immediately kill Achilles?⁷ Or did the wound become chronic?

Few medical publications address the circumstances surrounding Achilles' death.⁷⁻⁹ Some historians question the legend — that the myth of Achilles, half God, half human, is a fiction with no proof of existence.¹⁰ Some even question the reality of the Trojan War. The ancient Greeks believed the Trojan War was a historical event, but most of the information comes from *The Iliad* and *The Odyssey*, attributed without full certainty to Homer. The surrounding myths describe Homer as a blind poet who played lyre and recited poems. He lived in the 8th and 7th centuries BC, 4 or 5 centuries after the (alleged) Trojan War.⁸ As such, the author believed Achilles' death was not sufficiently explained; the author subsequently considered whether Achilles survived the aforementioned tendon wound and suffered from a chronic wound; if so, how would a war hero react to living with a chronic wound?

To explore the legend/myth of Achilles, a literature search through the Pubmed database was conducted using the following terms: *bleeding tibialis posterior artery*, *chronic wound*, *Achilles tendon*. In addition, a search was conducted of history books that address Achilles and/or the time in which he lived.

Key Points

- The myth of Achilles' heel injury lives on as a metaphor for vulnerability, but how this injury caused his death remains a question.
- The author reviewed the history of Achilles' injury and available historical and current literature to explore how the injury could have caused Achilles' death.

Results and Discussion

Literature. A significant disproportion exists between the number of publications on a chronic Achilles' tendon wound (631) and those that focus on the problem of bleeding in the heel area (ie, Achilles tendon; 3 publications). Several texts^{1-5,10,11} covered the historical period or the epoch in which Achilles lived.

Biological warfare. Lee and Jacobs⁹ posited whether Achilles' death could be attributed to bacteria that caused infection (eg, *Clostridium tetany*, *C. botulinum*, *C. perfringens*, *Yerseniapestis*) and if these bacteria were used as biological weapons/poison. Bacteria have always existed but probably not deliberately used as a biological weapon. No one knew about bacteria in Achilles' times. Although some publications state warriors dipped the tips of arrows into dead people's fluids, this was probably because of beliefs that death magically can be transferred,⁴ not because warriors knew these fluids contain bacteria.

Infection. *C. tetany* can be found in the intestinal tract of horses, cattle, and sheep (bred in ancient Greece). Could these bacteria get into a wound and cause tetanus? The tetanus agent develops toxin only in wounds lacking oxygen (anaerobic conditions). Tetanus is not likely to develop in open, bleeding wounds such as Achilles'.¹ However, if the wound was narrow and deep, this would create favorable conditions for the development of tetanus. In addition, the description of Achilles' armor mentions he had a shield and a helmet "with a mane of a horse that shines like a star..." (see Figure 3). A tetanus agent can be found in horsehair, so contact with the wound would not have been impossible.¹⁰

Botulinum toxin is found in rotten meat and canned food (anaerobic conditions). In ancient Greece, food included meat, fish, and olives.¹¹ Finding food was difficult and it probably was consumed quickly; if not, the meat was not preserved properly. Botulinum toxin is the strongest toxin known to man; even a small dose (median lethal dose is 30 pg/kg) would be enough to kill Achilles if it entered the wound and was carried through the bloodstream.¹²

Arrowhead. It is highly unlikely that the tip of the arrow was made of lead, so lead poisoning can be eliminated as a possibility.⁹ Lead is a soft metal with a high density and low melting point, making it unsuitable for making arrows. In

Figure 1. xxxx

Figure 2. xxxx

those days, shields and weapons were made of bronze. In addition, lead is not a factor in acute poisoning because it has a cumulative effect. It is also unlikely Achilles' death was due to an allergen on the tip of the arrow.⁹

Pain and stress. Another potential cause of death could be thyrotoxic storm because of the pain and stress.⁹ However, the pain that accompanies an Achilles injury typically subsides when resting. Achilles tendon injury is a very common injury in professional athletes¹³; warriors in the time of the Trojan War were surely in the same top physical shape and accustomed to the same athletic prowess. In terms of stress, Achilles' entire life as a warrior was stressful, so why would this event be decisive? Thus, no clear connection exists in the literature between such an injury and thyrotoxic storm.

Suicide. An immobilized Achilles might have feared falling into enemy hands. A wound near the triceps tendon is right beneath the skin, insufficiently protected, and exposed to mechanical influence. This area is poorly vascularized and any injury, defect, or lack of skin on the heel may lead to infection and a chronic wound that does not heal for weeks or months. Even a closed injury of the Achilles tendon requires rest (6 to 8 weeks), and typically weeks of immobilization and rehabilitation.¹⁵

Shot by Paris, Achilles was crippled and angry, presumably felt severe pain, and could not run or walk. Were pain and loss of mobility enough cause for suicide for a war hero? This half-god, skillful, fearless, previously invincible warrior had spread fear among enemies by just standing in front of them. Per the legend, enemies retreated at the sight of Achilles' armor (which in one circumstance, he had loaned to a friend). In *The Iliad*, Zeus gave permission to the assembly of gods "that each god may assist the army of his choice, in

order to weaken the great power of Achilles, who could on that day and in spite of destiny, conquer Troy."

During the war, Achilles led not only the Myrmidones, but also often all of the Achaean forces, which included Spartan tribes, who must have influenced Achilles. Sparta, famous for its military force and civil discipline, completely focused on military training and excellence. Spartans managed to compensate for their paucity of numbers, which was their main disadvantage, by focusing on perfect discipline. Spartan warriors always wore red to cover the blood, if injured. For them, leaving the battlefield was never an option. Spartan mothers stayed physically active during their pregnancy in order to give birth to strong children; when they sent their sons to war, they gave them their shields saying, "With the shield or on the shield,"¹¹ meaning their sons could return from war either as victors or dead on the shield. Therefore, Spartans and other warriors in ancient Greece would have respected a warrior who committed suicide. Suicide was not only accepted among warriors, it was, in a way, expected. As a hero among heroes, Achilles could choose his fate — either a long and inglorious life or a short and glorious one. Therefore, the possibility that Achilles committed suicide is not far-fetched.

Further conjecture. Homer might have wanted to present Achilles' death as a heroic end (hit with a poisonous arrow, bleeding out, and dying). Could Achilles have lived as a helpless man with a cane? One might suppose that if Achilles survived his injury (which may be true), he would have hoped the wound would heal quickly and he could once again be a great warrior. However, during the Trojan War, all wounds seemed to become deadly or heal slowly (chronic). Wounds rarely healed per *primam intentionem*. According to Herodotus (5th century BC), the Trojan War may have never hap-

Figure 3. xxxx

pened if the king of the Teucrians had not visited Greece in hope to heal his wound. The prophetess told him only the person who injured him (Achilles) could cure him. When this came to pass, the king, out of gratitude, told the Greeks how to find Troy. Perhaps Achilles hoped the same fate would await his debilitating wound.

But what if a cure seemed never to come? Each time Achilles stepped on the foot, he would be reminded he was no longer invincible — that he had become vulnerable and incapable and that a full recovery may be impossible. For the Greek people, Achilles was dead the moment he stopped being a warrior, because he could not lead the army anymore. Perhaps he did not want the people to see him limping, to pity him. He might have secluded himself far away from people, to die alone with a chronic wound.

Conclusion

Based on what is known of the injury, Achilles probably had a chronic wound with skin and paratenon defect, devitalized tendon tissue, bleeding, granulation tissue, and repeated infections. Each time he stepped on the foot, he would be reminded he was no longer invincible — how and how quickly had the end come? For the Greek people, Achilles was dead the moment lost the ability to fight.

The myth of the hero Achilles is still very much alive and fraught with questions. Did Achilles die immediately after the arrow pierced his heel and had he bled out? Or did he live, abandoned and lonely, with a chronic wound because he was no longer a capable warrior? There is reason to believe the latter, because the literature does not show any patient who has bled out and died due to an injury of the Achilles tendon. Rather, a large number of manuscripts focus on a chronic

wound of Achilles tendon, leaving clinicians and historians to wonder about the nature and management of Achilles' wound. Could the two "known" associated factors, bleeding and a poisonous arrow,⁷ have led to his death?

Then, as now, a patient with an Achilles' tendon injury is constantly reminded of his/her helplessness with every painful step. Because long-lasting treatment causes fear and anxiety in any person suffering from an Achilles tendon injury, it is not too far-fetched to consider the possibility that Achilles took himself away to deal on his own with the issues related to a chronic wound. To this day, an Achilles' tendon injury poses a dilemma: now, it is should the Achilles tendon be left to heal in time using just immobilization and walking aids or should surgery be performed and, if so, what type?^{14,15} The answer is in the foot of the patient and the hands of the clinician. ■

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References:

1. *General Encyclopedia of the Yugoslav*. Zagreb, Republic of Croatia: Lexicographical Institute. 1979;5.
2. Lain Entralgo P. The human body in Greek culture. *Ann R Acad Nac Med (Madr)*. 1988;105(2):219–233.
3. Lain Entralgo P. Rumour and reality of Hippocrates. *Folia Clin Int (Barc)*. 1973;23(4):258–270. Spanish
4. Graves R. Asklepij, *Grčki bogovi i heroji*. Ed 49-50. Translated by Mirajana Petrovic, Alnari. Beograd, 2003.
5. Graves R. The death of Achilles. In: **[AU: editor?]** *The Greek Myths*. London, UK: Penguin Books;1992;675–683.
6. Sabatier MJ, Stoner L, Reifenberger M, Mc Cully K. Doppler ultrasound assessment of posterior tibial artery size in humans. *J Clin Ultrasound*. 2006;34(5):223–230.
7. Anagnostopoulou S, Mavridis. I. Achilles' death: anatomical consideration regarding the most famous trauma of the Trojan War. *J Trauma Acute Care Surg*. 2013;74(3):946–947.
8. Wolf FA. *Prolegomena to Homer*, 1795, ed 124. Princeton, NJ: Princeton Univ. Press;1988.
9. Lee CC, Jacobs RL. Achilles (the man, the myth, the tendon). *Iowa Orthop J*. 2002;22:108–109.
10. Caslav Djordjevic Predrag Lucic **[AU: First initial, last name?]** Iliad. Literature and Serbian language: I. pages 124-129. Leonardo, Novi Sad, 2007**[AU: Still needs clarification: Please write as name of chapter author. Name of chapter. Name of editor. Name of publication. Location and name of publisher. Year of publication.]**
11. Sherrat A. *The Cambridge Encyclopedia of Archeology*. Cambridge, UK: Cambridge University Press;1980.
12. Jankovic J, SchWartz K, Donovan DT. Botulinum toxin treatment of cranial-cervical dystonia, spasmodic dysphonia, other focal dystonias and hemifacial spasm. *J Neurol Neurosurg Psychiatr*. 1990;53(8):633–639.
13. Elias DA, Carne A, Bethapudi S, Engebretsen L, Budgett R, O'Connor P. Imaging of plantar fascia and Achilles injuries undertaken at the London 2012 Olympics. *Skeletal Radiol*. 2013;42:1645–1655
14. Klein EE, Weil L Jr, Baker JR, Weil LS Sr, Sung W, Knight. Retrospective analysis of mini-open repair versus open repair for acute Achilles tendon ruptures. *J Foot Ankle Spec*. 2013;6(1):15–20.
15. Krapf D, Kaipel M, Majewski M. Structural and biomechanical characteristics after mobilisation in an Achilles tendon rupture model: operative versus non-operative treatment. *Orthopedics*. 2012;35(9):e1383–e1388.