RJNMSR
Review Journal of Neurological & Medical Sciences Review

Volume 3, Issue 3, 2025

DEVELOPMENT OF PLANTAR FASCIITIS IN A DIABETIC PATIENT WITH PARTIAL TOE AMPUTATION: A CASE REPORT

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DOI: https:/doi.org/

Received	Accepted	Published
20 June, 2025	23 July, 2025	30 July , 2025

ABSTRACT

Background: Plantar fasciitis (PF) is the most common cause of heel pain, often associated with abnormal foot biomechanics. Diabetes mellitus (DM) if uncontrolled lead to complications such as diabetic foot neuropathy and amputation of toe following foot and leg. toe amputation can alter normal foot load distribution. However, plantar fasciitis after partial toe amputation in prolonged diabetic patients is rarely reported.

Case Presentation: We report a case of a 62-years old male with prolonged (14 years history of DM) type 2 diabetes mellitus who developed severe plantar fasciitis (right side) following partial amputation of the second, third and fourth toes of his right foot due to the development of gangrene and infected diabetic ulcers. The patient presented with typical symptoms of plantar fasciitis, including early morning heel pain and tenderness at the medial calcaneal tubercle of the right foot. Clinical assessment based on physical therapy special tests was performed and Windlass test is used for the diagnostic purpose during physical examination, the test with high specificity of 100% and low sensitivity of 32% which confirmed the diagnosis. Conservative management including physiotherapy, custom orthotics, and activity modification resulted in significant symptom relief.

Conclusion: This clinical case report highlights a link between partial toe amputation and the development of unilateral (Amputation side) plantar fasciitis in diabetic individuals. Identifying altered biomechanics in post-amputation feet is crucial for early diagnosis and appropriate conservative intervention.

Keywords: Diabetes mellitus, Toe amputation, Plantar fasciitis, Diabetic foot, Foot biomechanics, Case report

INTRODUCTION

Plantar fascia is type of connective tissues having fibers that upholds the motionless structure of longitudinal arch of the foot. In response to pressure and load, this fascia

lengthens and serving as shock absorber(1) Plantar Fasciitis (PF) is the most common musculoskeletal disorder which affect individuals across all ages and all occupations, over 10 Lacs patient with this condition visit physician or physiotherapists annually in the United State Despite the name of the condition, plantar fasciitis is degenerative pathology rather than an inflammatory condition(1, 2) The capacity of lengthening of the plantar fascia is about four percent, failure in lengthening requires a force of one thousand Newton square approximately(3) Plantar fasciitis is the most prevalent cause of heel pain and is often associated with overuse, overweight or obesity, and biomechanical abnormalities or abnormal forces distributions on foot(1, 3). Diabetes mellitus (DM) predisposes individuals to multiple foot complications, including peripheral neuropathy, ulceration, and limb amputation(4) fascio-cutaneous layer of the irregular suture provide a stabilization and protection of the base bones this fascio-cutaneous layer underlying bones are protecting the branch of plantar nerve or Else, lateral plantar nerve can be oppressed to suffer plantar fasciitis making the partial foot re-amputated(3, 5)The prevalence of Plantar fasciitis is reported about 0.5% to 8% and Approximately one out of ten individual will have PF in their lifespan.(6-8) The incidence of plantar fasciitis is reported 3.83 cases per one thousand patient per year, little higher in females than males. In most of the cases PF is reported unilaterally, but may present bilaterally in one third of the reported cases(1, 9) (10, 11) Plantar fasciitis (PF) is the most common and worsening musculoskeletal disorder which affect almost 10% of the population once in their lifetime (6) Plantar fasciitis is also identified by other names such as painful heel syndrome, heel spurs, runner's heels, sub-calcaneal discomfort, joggers' heel, heel spur syndrome calcaneodynia, and calcaneal periostitis (12) Plantar fasciitis progresses when the thick band of the sole of foot gets inflamed, the common site of inflammation is distal calcaneum, which cause discomfort and pain in heel may leads degeneration of the thick fascia(6) This disorder most commonly affects athletes affecting about 17.4% of the runners and soldierly employees, although this may affect all other population, particularly women of middle-age ranges from 40 to 60 (13) This condition is characterized by discomfort and pain in the medial side of heel that is aggravated by load-bearing activities, as well as after rest or non-weight bearing activities(14) PF was originally thought to be an acute inflammatory disease, but histologic findings of samples from patients undergoing surgery showed myxoid degeneration with fragmentation and degeneration of the plantar fascia, reflecting a chronic degenerative process without inflammation. The most common complaint of plantar fasciitis is pain in heel, especially during the first few steps in the morning or after rest, that's why PF is known as first-step pain The pain may worsen due to long standing and walking but sometime the pain decreases with movement(6, 15) older age, flat foot or pes planus, increased pronation, improper footwear, obesity, and reduced dorsiflexion at ankle joint are the major causes of PF(10, 15) In adults PF is the common cause of pain in the heel, irritating for both physicians and their patients, in about 90% of the cases the signs and symptoms resolve in almost 10 months, PF was initially believed to be an acute inflammatory disorder, but patient findings exposed it as chronic degenerative disorder caused by many factors, including repetitive abnormal stresses, vascular or metabolic diseases, excess of free radicals, increase temperatures, rheumatoid arthritis, spondyloarthropathies and genetic factors may also contribute to this.PF may also be

associated with poor health related quality of life, including sedentary life style, poor health status, and socially isolation, furthermore, the cost associated with the treatment of PF was recently calculated to be $284 million in United States per year(7, 8, 15)The risk factors of the plantar fasciitis are abnormal ergonomic weight-bearing, Patho-mechanics like decreased ankle dorsiflexion, increase body mass index or obese adults, and among these the reduced range of motion at ankle joint, specifically ankle dorsiflexion found to be the most significant one. despite these other risk factors may also contribute including pes planus or flat feet, pes cavus or high arched feet, excessive running, and leg length difference or discrepancies LLD .PF is also found mostly in patients with autoimmune disorders, such as Rheumatoid arthritis(16, 17)The basic diagnostic criteria for PF comprise pain and discomfort at the inferior or medial heel, stiffness with pain during first few steps early in the morning. Pain usually decreases after activities; the pain mostly increases at the end of the day. Tenderness may also be felt at medial heel. Windlass test is widely used for the diagnostic purpose of PF during physical examination, the test with high specificity of 100% but very low sensitivity of 32%.(1) plantar fasciitis is commonly reported in the general population, its occurrence following digital amputation in diabetic patients is rarely described. This clinical case report illustrates the impact of altered foot mechanics due to partial toe amputation on plantar fascia stress, leading to plantar fasciitis.

Guideline: this case report is carried out as per CARE guidelines (for **CA**se **Re**ports) (developed by an international group of experts to support an increase in the accuracy, transparency, and usefulness of case reports)

Patient Information: 62-year-old male, retired Professor, having medical history of Type 2 diabetes mellitus (diagnosed 14 years ago) the patient was also having Hypertension (controlled with medication) Diabetic neuropathy (confirmed by monofilament and other laboratory test) Social History of the patient was widower, Non-smoker, no alcohol use and sedentary lifestyle (possibly due to toe amputation) Surgical History presented was Underwent right foot second toe amputation surgery following another partial amputation surgery of right foot 1st ,3rd and 4th toe amputation 08 months ago due to infected diabetic foot ulcers secondary to diabetic neuropathy.

Clinical Findings: 62 years old prolong Diabetic Retired professor presented at Physical therapy OPD of School of Health Sciences, Peshawar with a Chief complaint of post operative (Partial toe amputation Heel pain on the right foot, worsening over the last 04 weeks, the nature of the Pain was Sharp, stabbing pain localized to the medial aspect of the heel, particularly severe during the first steps in the morning and after prolonged standing, On inspection: Absence of first, second, third and fourth toes on right foot (Amputation of toe except big toe); callus formation under the metatarsal heads were found, On palpation: Tenderness at the medial calcaneal tubercle insertion of fascia, Functional impairment: Limping and difficulty bearing weight during initial steps.

Time line events

Duration	Event
10 months ago,	Underwent toe amputation (2nd toe) 1st surgery
08 month ago,	Underwent another surgery (Amputation of 1st, 3rd and 4th toe)
2 months ago,	Gradual onset of right heel pain with morning stiffness
Presenting day	Referred to physical therapy OPD for assessment
Week 1–4	Initiated conservative management (physiotherapy, Ultrasound therapy, stretching exercises offloading, orthotics)
Week 6	Pain improved by 70%; on visual analogue scale and numeric pain rating scale, resumed moderate walking activity

Diagnostic Assessment: Based on typical presentation of PF (morning heel stiffness with pain, location of tenderness) Physical Therapy special test "Windlass test" was used for diagnosis and confirming the case, windlass test is widely used for the diagnostic purpose of PF during physical examination, the test with specificity of 100% and sensitivity of 32%**.** Thickness of plantar fascia measured through ultrasound was 5.3 mm, Hypoechoic appearance at origin**,** no tear or calcaneal spur found.

Differential diagnoses considered: Calcaneal stress fracture ruled out via history and lack of trauma and Tarsal tunnel syndrome ruled out due to localized tenderness and no neurologic signs and symptoms.

Therapeutic Intervention: Conservative management through physical therapy consisting of plantar fascia-specific stretching, heel cushioning, footwear modification, and custom orthotics led to significant symptom relief. Orthotic devices like arch support and heel padding played a key role in redistributing plantar pressures and minimizing the strain on plantar fascia during gait. Additionally, the involvement of a multidisciplinary rehabilitation team ensured comprehensive care addressing the mechanical, metabolic, and functional components of the condition.

Patient Education: Advised on offloading techniques, home exercise plan-based foot care and exercises.

Follow-up and Outcomes: Short-term outcome (4 weeks) Visual Analog Scale (VAS) for pain reduction was used and pain reduced from 8/10 to 2/10**,** functionally the patient Improved in walking, gait was also improved, tolerance to walk**,** no new ulcerations or complications reported.

Long-term plan: Ongoing foot care monitoring with proper exercises and US therapy at OPD, Periodic orthotic reassessment, encouraged regular activity within tolerance, apart from these strong diet plan and diabetic control was supervised by nutritionist.

Discussion: the main function of toe is to enlarge the weight-bearing area of the foot so that when the heel is raised during walking gait full body-weight will not be loaded on the metatarsal heads alone(18) toes play a critical role in maintaining normal foot biomechanics, including stabilizing the foot during stance and providing propulsion during walking gait, The big toe play a major role in the function of the foot. In standing, the big toe exerts extra pressure than those of the five metatarsal heads and the heel (18, 19) During walking, the big toe passively dorsiflexes, the longitudinal arch is raised, the rearfoot supinated, the leg externally rotated, and the plantar aponeurosis become stressed(20)when the great toe is eliminated, it is assume that the importance of the 3rd and 4th toes increases during walking gait and the pressures on the big toe and the 2nd toe will be increase as the speed increases(21) In this case, the patient of age 62 had undergone amputation of all toes except the big toe on the right foot, which significantly altered his gait mechanics specially during walking. Toe amputations in diabetic patients are often required due to chronic ulcers or infections due to peripheral neuropathy and impaired wound healing. However, their biomechanical consequences are frequently underappreciated in follow-up care. Peripheral neuropathy, a common complication of long-standing diabetes, further complicates this type of cases by diminishing protective sensation. In the current case the patient reported heel discomfort only after several weeks of progressive degeneration, indicating that neuropathy may have delayed symptom recognition and presentation. This highlights the importance of proactive screening in diabetic amputees for secondary complications, even in the absence of reported pain. The absence of four toes on right foot in this case disturbs the capacity and anatomy of forefoot to distribute the body load normally on foot with equal and natural plantar pressure during gait. Precisely, the loss of the lateral toes leads to increased and abnormal loading with improper biomechanics on the medial and posterior segments of the foot, particularly the load will transfer pathologically to heel and the first metatarsophalangeal joint of the big toe. Over time, this uneven and abnormal weight distribution on foot can create excessive strain on the thick band of the sole i.e. plantar fascia. which may have overloaded the plantar fascia and initiated the degenerative-inflammatory process associated with plantar fasciitis, especially at the origin of plantar fascia at the medial calcaneal tubercle sooner or

later this improper weight distribution and poor biomechanics will be triggering the onset of plantar fasciitis. toe or foot amputations are relatively common in diabetic patients, the relationship between the loss of digits and plantar fasciitis is underreported. This case emphasizes the importance of proactively evaluating foot biomechanics post-amputation and recognizing early signs of plantar fasciitis. Till date, very few case reports or studies have documented plantar fasciitis as a result of partial digital amputation in diabetic patients. Mostly the literature focuses on ulcer prevention, offloading, and surgical outcomes, with minimal emphasis on long-term biomechanical complications. This case fills a critical gap in clinical reporting and draws attention to the importance of long-term musculoskeletal investigation in post-amputation diabetic patients.

In summary, the current case report demonstrates that even distal digital amputations can have deep effects on foot biomechanics and may lead to secondary overuse inflammatory conditions like plantar fasciitis. Clinicians must maintain a high index of suspicion for musculoskeletal complications in diabetic foot post amputation patients and consider early referral to physical therapy and rehabilitation services following amputation. Timely intervention can significantly improve patient mobility and walking gait, reduce pain, avoid musculoskeletal disorders secondary to the amputation (PF in this case) and enhance quality of life.

Patient Perspective: *"After my second toe surgery 8 months ago at Hayatabad Medical complex, Peshawar, I thought I was healing well, but then the pain in my right-side heel started. The pain was more severe at morning, even I was unable to touch the ground early in the morning. The pain was worse than the ulcer pain sometimes. With physical therapy treatment and proper footwear suggested by rehab team, I can now walk comfortably again. I hope my experience with physical therapy and publishing of this article will helps others like me."*

Informed Consent: Written informed consent was obtained from the patient for publication of this case report and accompanying images.

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