



Pediatric Plantar Puncture Wound Through Rubber-Soled Footwear: A Case Report Highlighting Antibiotic Stewardship in Urgent Care

Urgent Message: Low-risk plantar puncture wounds in healthy children can be safely managed without antibiotics. Parents should receive instructions for return precautions.

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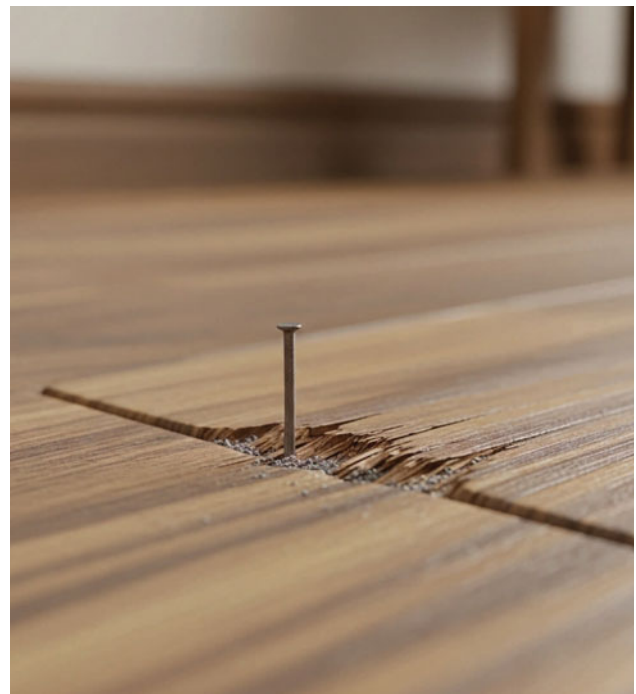
Keywords: plantar puncture wound; pediatric puncture wound; rubber-soled footwear; *Pseudomonas aeruginosa*; antibiotic stewardship; foreign body risk

Abstract

Introduction: Puncture wounds that occur through rubber-soled footwear increase the risk of infection from *Pseudomonas aeruginosa*. Prophylactic oral fluoroquinolones are frequently provided to adults for high-risk injuries. However, pediatric care is complicated by limited oral antipseudomonal choices and fluoroquinolone safety concerns. Therefore, some low-risk plantar puncture wounds in healthy children can be safely managed without antibiotics.

Presentation: A 7-year-old girl stepped on a nail with her left foot while wearing rubber-soled footwear. She presented to urgent care within 16 hours of the injury. She reported mild pain and denied fever or systemic symptoms. The family had washed the wound at home with soap and water. She had no past medical history.

Physical Examination: Vital signs were normal. The



puncture was pinpoint on the left plantar forefoot. There was no erythema, swelling, drainage, or bleeding. Gait was normal. Sensation, pulses, and capillary refill were intact. There was no tenderness outside the entry site. The wound appeared shallow and clean.

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Diagnosis: The early presentation and benign features lowered suspicion for a retained foreign body. There were no findings to suggest cellulitis, abscess, septic arthritis, or deep infection. The final diagnosis was a clean puncture wound without complication.

Management: The wound was cleaned with antiseptic solution. No antibiotics were given. The decision to observe was based on timing, appearance, and the patient's immunocompetence. Tetanus vaccination was up to date. The family received clear instructions for return precautions.

Conclusion: This case highlights the limitations in pediatric oral antipseudomonal therapy for footwear-related puncture injuries and supports a stewardship-based observation strategy for early, clean plantar puncture wounds in healthy children with reliable follow-up.

Introduction

Foot puncture wounds commonly present to urgent care centers.¹ Injuries through rubber-soled footwear raise concern for *Pseudomonas aeruginosa*, which is a known cause of soft tissue infection and osteomyelitis.^{1,2,3} Pediatric management is more complex because safe oral antipseudomonal options are limited and safety concerns guide antibiotic use.^{4,5} This case shows a low-risk puncture wound that was managed safely without antibiotics.

Case Presentation

A 7-year-old female presented to an urgent care center with her mother after stepping on a nail 16 hours earlier while wearing rubber-soled footwear. At home, the wound was washed with soap and water. She reported mild pain rated 2 out of 10, walked without difficulty, and had no fever or systemic symptoms. She had no past medical history.

Vital signs were normal. Physical exam showed a pinpoint puncture on the plantar surface of the left foot just inferior to the second metatarsal head. There was no erythema, swelling, drainage, or bleeding. Neurovascular status was intact with normal pulses, sensation, and capillary refill. Tetanus immunization was up to date per Centers for Disease Control and Prevention (CDC) guidance.⁶

Medical Decision-Making

The benign appearance of the wound and normal patient foot function lowered suspicion for a retained for-

eign body.² Plain radiographs were considered but deferred because the mechanism was low energy, gait was normal, and there was no focal tenderness. Prophylactic oral antibiotics were considered but deferred because the patient presented within 24 hours, had a clean superficial-appearing wound, and had normal gait and neurovascular status.

Differential Diagnosis

The differential diagnosis included clean puncture wound, localized cellulitis, abscess, retained foreign body, septic arthritis, osteomyelitis, and tetanus. Plantar puncture wounds can appear superficial while the track extends into deeper tissue planes than the skin opening suggests, which makes careful assessment essential.^{2,3} Cellulitis was unlikely given the absence of erythema, warmth, or tenderness beyond the puncture site, and the patient was afebrile.^{2,3} An abscess was unlikely given the absence of fluctuance or purulent drainage.² A retained foreign body was less likely because the wound was small, the mechanism was low energy, and the patient had normal function.² Septic arthritis was improbable because the puncture was distal to the joints and joint movement was normal. Osteomyelitis is uncommon in early presentations, but risk increases with delayed care, deeper penetration, retained foreign body, or comorbidities.^{2,3} Tetanus was not a concern because the wound was clean and immunizations were current.⁶

Discussion

Antibiotic decisions for plantar puncture wounds should follow stewardship principles across all ages. The most common skin contaminants in these injuries are *Staphylococcus aureus* and *Streptococcus* species, and empiric decisions should account for these organisms as well as the potential for *Pseudomonas* in rubber-soled footwear injuries.^{1,2,3,7} Adults have more available oral antipseudomonal options, but pediatric management is constrained by safety considerations. Fluoroquinolones are used with caution due to musculoskeletal risks, although ciprofloxacin remains an accepted option in high-risk pediatric cases when the benefit outweighs the risk.^{4,5} Careful risk stratification is essential.^{2,3}

Urgent care clinicians should assess timing, wound appearance, and host factors before prescribing antibiotics. Early presentation (under 24 hours) is associated with lower rates of infection, particularly in pediatric patients without high-risk features.^{2,3} Early, clean plantar punctures in immunocompetent children without severe local findings may be observed safely with close follow-up.^{2,3} This approach avoids unnecessary treat-

ment while preserving a clear pathway for escalation.

Antibiotic consideration is warranted in pediatric patients with high-risk host factors, including immunocompromise, diabetes, delayed presentation, suspected deep penetration, retained foreign body, or inability to ensure reliable follow-up.^{2,3} In pediatric patients with these high-risk features, the benefits of fluoroquinolones may outweigh the risks.^{4,5} In this described low-risk case, observation with clear follow-up instructions supported no antibiotic use.

Escalation of care is appropriate for patients with delayed presentation, visible contamination, severe local findings, or high-risk comorbidities.³ Severe findings include spreading erythema, tense swelling, purulent drainage, marked tenderness, and pain with passive movement. In such scenarios, imaging to evaluate for a retained foreign body or deep infection is warranted, with parenteral antibiotic therapy initiation when indicated.^{3,8}

Plain radiographs are appropriate when there is concern for a retained radiopaque foreign body, deep penetration, delayed presentation, or evolving signs of infection.^{3,8} Radiographs may identify metallic fragments and late bony changes, but early osteomyelitis may not be radiographically apparent.⁸ Advanced imaging such as magnetic resonance imaging is reserved for persistent pain, progressive swelling, systemic symptoms, or clinical concern for deep space infection or early osteomyelitis.⁸ In this case, the absence of erythema, swelling, gait disturbance, or systemic findings supported deferring imaging at initial presentation.^{2,3}

Tetanus prophylaxis should be addressed in all puncture wounds. According to CDC guidance, contaminated wounds require a tetanus booster if 5 or more years have elapsed since the last dose, and tetanus immune globulin is indicated for patients with unknown or incomplete immunization status.⁶ Verification of vaccination history and appropriate booster administration remain essential components of urgent care management.⁶

Disposition

In the urgent care center, the wound was cleaned with an antiseptic solution. No dressing was applied because there was no active bleeding. The patient was discharged with instructions for wound hygiene and limited activity. Strict return precautions were provided should the patient experience fever, spreading redness, tense swelling, purulent drainage, difficulty bearing weight, or neurologic changes. Follow-up was arranged within 48 hours. At that time, the mother was contacted by phone

and reported that the patient remained well without concerning signs or symptoms.

Ethics Statement

The patient's mother provided consent for publication.

Takeaway Points

- In a pediatric patient with a plantar puncture wound, confirm timing, wound appearance, and host factors to determine if antibiotics are indicated.
- Early, clean plantar puncture wounds in healthy children can be observed without antibiotics with close follow-up.
- Escalate clinical care for delayed presentation, contamination, severe local findings, or high-risk comorbidities.
- Use imaging when there is concern for a foreign body or deep infection.
- Review tetanus vaccination status and update according to guidance. ■

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