

# Pressurized Air Injection Causing Subcutaneous Emphysema in a Pediatric Patient

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*This report describes the case of a young boy who sustained a bicycle-spoke puncture wound during which the tire air nozzle penetrated the cutaneous barrier about the ankle. Pressurized air was injected into the tissues resulting in subcutaneous emphysema. The subcutaneous gas was confirmed by roentgenogram, and a full recovery resulted after local wound care and antibiotic therapy. Care was taken to distinguish traumatic air injection from gas gangrene. ACFAS Level of Clinical Evidence: 4. (The Journal of Foot & Ankle Surgery 47(1):66–68, 2008)*

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**B**icycle-spoke injuries can occur when the lower extremity gets trapped between the wheel spokes and the bicycle frame, wherein the extremity is rapidly wedged between the rigid frame and the moving wheel, resulting in cutaneous compromise that ranges from puncture to crush wound, often occurring at the level of the ankle. Such injuries, while typically associated with soft tissue defects, may also be accompanied by skeletal injuries. Bicycle-spoke injuries, moreover, can appear deceptively mild (1, 2). Furthermore, the association of subcutaneous emphysema with open cutaneous compromise should alert the clinician to the possibility of gas gangrene secondary to myonecrosis or necrotizing fasciitis. In such cases, limb-threatening, and even potentially life-threatening, infection with Clostridia should be taken into consideration. Once the clinician has ruled out the presence of a gas-forming infection, other causes of subcutaneous emphysema should be considered (3–7).

In this report, I describe the case of an unusual bicycle-spoke injury that was associated with subcutaneous emphysema at the time of presentation.

## Case Report

A 10-year-old boy presented to my clinic with a chief complaint of mild pain and paresthesia localized to the

posterior aspect of his right leg in association with a 3-cm laceration at the posterior aspect of his right lateral malleolus (Figure 1). The injury occurred approximately 24 hours earlier when he was riding, as a passenger, on a bicycle. At that time, he had been taken to an emergency department where the ankle laceration was cleansed and primarily closed, and he was started on oral cephalexin therapy. In response to our inquiries as to the mechanism of injury, he noted that he had been wearing slippers while riding as a passenger on the rear seat of the bicycle when the bicycle fell to the right and his right ankle was trapped between the wheel and the bicycle frame, causing one of the spokes of the wheel to puncture and, with continued rotation, lacerate the posterior aspect of his lateral malleolus. Thereafter, the uncapped inner tube air nozzle was forced into the laceration, and pressurized air was injected into the subcutaneous tissues.

On physical examination he displayed mild swelling involving his right calf, and there was diffuse, palpable, subcutaneous crepitus extending from the lateral aspect of the hindfoot up to the mid-thigh. The neurovascular status to the foot was intact, and there were no signs or symptoms consistent with compartment syndrome. His vital signs were normal and there were no constitutional signs or symptoms of infection. The peripheral white blood cell count and the erythrocyte sedimentation rate were also normal. Standard radiographs of the right lower extremity revealed the presence of subcutaneous gas in the foot and leg (Figure 2).

Despite the absence of constitutional symptoms, our initial concern was for the possibility of a gas-forming infection. The previously placed sutures were removed, and inspection revealed no evidence of purulent drainage or malodor. After the margins were anesthetized with local anesthesia, the wound was irrigated with copious amounts

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**FIGURE 1** Initial clinical appearance of the leg of a 10-year-old boy shortly after sustaining a bicycle spoke puncture wound to the posterior aspect of his right ankle.

of normal saline. Specimens for microbiological culture and sensitivity were obtained from deep within the foot and leg confines of the wound, and Gram-stain specimens revealed no evidence of the presence of microscopic organisms. Based on these findings, we admitted the patient for intravenous antibiotics, local wound care, and observation. The initial course of antibiotic therapy consisted of Clindamycin 450 mg/tds/IV, Vancomycin 500 mg/bid/IV, Ceftriaxone 1 gram/bid/IV. Over the 6-day course of the hospital stay, during which the right lower extremity was gently supported by means of mild compression, the wound remained clean and never displayed any purulent drainage, and the subcutaneous crepitus gradually diminished until it was no longer evident after 10 days. The wound healed by secondary intention, and the patient had fully recovered by 2 weeks following the hospital admission.

## Discussion

The association of subcutaneous emphysema and palpable crepitation with a cutaneous wound should alert the clinician to the possibility of gas-producing infection, namely gas gangrene. Other possible causes of subcutaneous emphysema, such as traumatically injected gas, should also be borne in mind. Air trapped in the subcutaneous tissues can also occur in association with trauma or surgical dissection, generation of gas by chemicals (hydrogen peroxide) introduced into the wound, accidental injection of



**FIGURE 2** Lateral radiograph depicting gas in the subcutaneous tissues at the time of admission.

compressed air, and air introduced into the deeper tissues as a result of air-trapping by valve-like wound edges or as a result of high-pressure water injection or improper irrigation (3–7). Management of air-injection injuries rarely requires surgical intervention, but should include radiographic inspection of the subcutaneous tissues in an effort to identify air expansion, combined with clinical observation and symptomatic treatment along with prophylactic administration of antibiotics (5).

In the patient described in this report, overall good general health, negative bacterial culture, normal peripheral white blood cell count and erythrocyte sedimentation rate, and the lack of a purulent reaction provided clinical evidence of the absence of infection at the time of presentation. The description that the patient provided in regard to his seated posture on the rear board of the bicycle was, moreover, a precarious position and, in conjunction with his lack of protective shoe gear, predisposed him to spoke puncture. Furthermore, the rear tire had no spoke guards and the air nozzle for inflation of the inner tube was not capped. This report emphasizes the need for clinicians to correlate the clinical presence of subcutaneous emphysema with a detailed accident history, and to consider the possibility of gas-producing infection that, if present, requires prompt surgical intervention.

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