

A Recalcitrant Skin Lesion and Subsequent Infection in a Recreational Intramural Male Athlete: A Case Report

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A 35-year-old intramural male athlete presented to the athletic training staff with a 4.5- × 2.2-cm itchy, painful, swollen, and infected insidious skin lesion on his right lateral malleolus due to an underlying dermatologic deficiency. Suspecting infection, the patient was referred to his nurse practitioner and was diagnosed with atopic dermatitis caused by a ceramide deficiency. He was placed on cefalexin and mupirocin 2% ointment but returned due to the lesion increasing to 8.5 × 6 cm, although the infection seemed controlled. He was instructed to use Ceravé topical

cream, clobetasol propionate 5%, and to consume foods rich in healthy oils (omega-3 fatty acids, olive oil). Unmitigated, this lesion could have resulted in severe infection and tissue damage. Atopic dermatitis is relatively common in the general population, but its appearance in healthy athletes highlights that athletic trainers need to be well versed in not just apparent causes of skin ailments (ie, infection) but also root causes.

Key Words: ceramide, etiology, skin disorder, xerosis

Key Points

- Ceramide deficiencies are common in the population but relatively unknown in athletic populations.
- Athletic trainers must be well versed in a variety of skin-related pathologies.
- Team-based approaches to general medical conditions are best practices for complex medical issues such as ceramide deficiency.

The integumentary system (ie, skin) is the largest organ in the human body.¹ Given that this organ serves as the external barrier between the environment and the inner body, it also is highly susceptible to damage and infection.¹ Dermatologic conditions are fairly common in the general population. In athletic populations, the nature of exposure to infectious agents via sports environments, the higher likelihood for trauma (mechanical, friction, secondary), and the frequency of contact among others place athletes at higher risk for skin infections and subsequent disorders.^{2,3} In fact, an estimated 8.5% of high school sports and 20.9% of collegiate sports ailments are related to skin disorders. In college athletics, herpes viral infections are the most commonly reported (47%), followed by impetigo (37%), tinea fungi (7%), cellulitis (6%), and methicillin-resistant *Staphylococcus aureus* (MRSA; 3%).⁴ Sports and activities that involve direct contact (eg, wrestling) have the highest incidence; however, infections are not dependent solely on direct contact, as in the case of tinea fungal infections (ie, athlete's foot).^{2,4}

Although skin infections are common, as previously noted, the skin can also signal other internal pathologies of the body and its systems (eg, the autoimmune system). Autoimmune issues can leave an athlete in a weakened state and thus possibly more susceptible to other illnesses.⁵ For example, psoriasis

and eczema are 2 common autoimmune ailments that present with dermatologic signs and symptoms, such as patches, itching (pruritus), and scaling, among others.^{4,5} Mechanical and environmental stress, such as friction (blisters) and heat (sunburns), also may cause damage to the dermis.³ Breach of the dermis itself also can come from within, as in the case of genetic predispositions (eg, lupus, vasculitis, pemphigus) and nutrient deficiencies (eg, scurvy); one such autoimmune and nutrient issue is a ceramide deficiency, which can provoke responses such as atopic dermatitis (AD).^{1,5}

Ceramides are a class of waxy lipid molecules derived from cholesterol that are present in the composition of skin (specifically the stratum corneum; Figure 1).^{1,6} Ceramides serve a variety of functions, including creating a barrier through cell wall integrity and maintenance as well as facilitating the transport of molecules, inflammatory signaling, and apoptosis.⁶ Aging, among other factors (eg, diet), can greatly affect ceramide production.⁷ People tend to lose skin volume and tautness as they age or experience undue stress, thus weakening the dermis over time.⁶ The latter can be partly ameliorated with a diet rich in healthy fats and oils (eg, omega-3 fatty acids) as well as avoiding or minimizing environmental and chemical stress (eg, pollution, alcohol, drugs).^{6,7} Unsurprisingly, a deficiency of ceramides can greatly affect skin function, ranging from dry, scaly, and itchy patches to

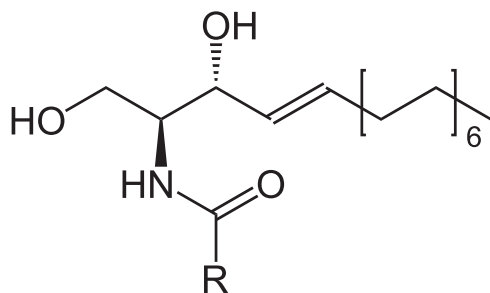


Figure 1. Chemical structure of ceramides. Source: By NEUROtiker - Own work, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=2147184>

lesions that, if not treated, grow and potentially become infected. Although people can take steps to maintain ceramide production through healthier lifestyle choices, some segments of the population have a genetic predisposition to diminished ceramide production.⁷

The most common clinical presentation of an underlying ceramide deficiency is AD, commonly referred to as eczema. It is estimated that 15% to 20% of the population (particularly children), with 2% to 5% of adults, can be classified as having a lifetime prevalence of AD.^{8,9} For those with persistent AD, deficiency in ceramide production often leads to skin irritation and subsequent insidious lesions.⁸ These lesions can increase the risk of bacterial and other infections, given that 1.5% to 3% of the population are colonized with MRSA, which can be higher (12%–16%) in populations with AD and ceramide deficiencies.^{7,8} It has been proposed that AD and likely ceramide deficiency have increased in industrialized countries over the past several decades, suggesting a link to the influence of environmental health and pollutants on the dermis.¹⁰ Accurate epidemiology of ceramide issues vis-à-vis AD is challenging due to the diversity of diagnostic access and testing; however, Barbarot et al noted an approximately 5% prevalence in US adults, with a lower occurrence in men and as people aged.¹¹ Of note in the study was that prevalence was lowest in Japan at 2.1% and highest in the United States at 4.9%, plausibly illustrating the strong connection with diet and environmental exposure.

Ceramide deficiencies often present with skin irritation that can progress to other forms of dermal insult (eg, lesions, secondary infection). During physical activity, particularly sports, there are numerous exposures that can compromise skin integrity, including, but not limited to, abrasions, communicable diseases, and equipment/friction. Anyone can experience skin trauma; however, people with a ceramide deficiency and/or autoimmune disorders could be more susceptible to the aforementioned issues. Due to the heterogeneity of athletes athletic trainers (ATs) may encounter, it is important to recognize and effectively manage issues related to the dermatologic system. Treatment can vary, ranging from topical ointments and antibiotics (for secondary infections) to dietary modifications and autoimmune drugs; however, the primacy of the issue is accurate recognition and management. To the authors' knowledge, there are no formal case studies in previous sports medicine literature that have explored insidious infection prompted by AD, likely caused by an underlying ceramide deficiency. Therefore, the purpose of this case report is to present a case of AD and

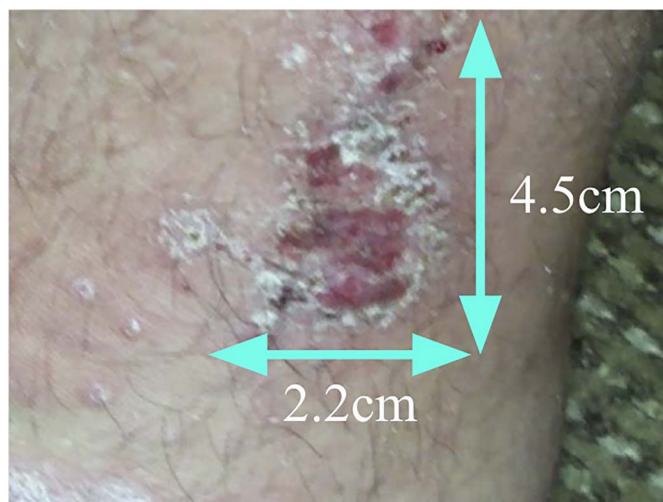


Figure 2. Initial lesion presentation, November 4.

ceramide deficiency in a recreational intramural athlete that led to secondary infection.

CASE REPORT

Note: The athlete consented to the use of all images, laboratory values, and information contained herein for this case report.

Patient

A 35-year-old White male recreational intramural athlete (tennis) presented to the staff AT with complaints of an itchy, insidious skin lesion on his right lateral malleolus (Figure 2). This otherwise healthy male athlete reported having noticed an “itchy patch” of skin on his right lateral malleolus several days prior (Table) and was seeking consultation because it had become inflamed and “slightly painful to the touch.” Upon physical examination, he appeared to be alert and in good psychological and physical health and had no evidence of any other dermatologic concerns. He also denied any trauma to the area but reported a “weird” itchy lesion approximately 7 years prior on the posterior left leg near the gastrocnemius muscle and diffuse itchy spots on his left ear and right eyebrow ridge. He denied any changes to his diet or activities of daily living (including consistent washing of clothing and no alterations in soaps or detergents). He was approximately 1.83 m in height and 83.9 kg in weight, and all vital signs were within normal limits.

Upon inspection, the lesion was observed to be a 4.5- × 2.2-cm irregularly shaped area of desquamative skin that was mostly flat in the center, slightly erythematous, and warm to the touch. Diffuse swelling around the lateral ankle was also noted during inspection. Due to the unknown nature of the lesion and a high index of suspicion for infection, the athlete was referred to a nurse practitioner (NP) on campus for further evaluation and treatment. The skin is the largest organ in the human body and is vulnerable to a variety of potential insults and diseases. The very nature of sports puts this system at an even greater risk for disease and damage. Considering the current case, the following pathologies and conditions were considered in the

Table. Athlete's Medical Timeline

Date	Signs and Symptoms	Treatment and Medications	Comments
November 4	<ul style="list-style-type: none"> • Lesion is 4.5×2.2 cm on right lateral ankle (malleolus) • Desquamative skin around central red lesion • Reports "itchy" (pruritus) and sensitive to the touch • Signs of diffuse swelling around ankle • Signs of active infection noted (erythema, rubor, dolor) 	<ul style="list-style-type: none"> • Referred to nurse practitioner due to signs of infection • Cefalexin 250 mg 3 times a day for 10 days • Mupirocin 2% topical ointment twice a day • Follow-up in 1 week 	<ul style="list-style-type: none"> • Initial presentation • See Figure 2
November 10	<ul style="list-style-type: none"> • Lesion is 8.5×6 cm • Notable desquamated tissue and scaling over the entire lesion • Purulent drainage • No odor detected 	<ul style="list-style-type: none"> • Cefalexin was continued, but Mupirocin ointment was discontinued • Referral to dermatologist 	<ul style="list-style-type: none"> • Athlete returned due to concern about lesion progression • Lesion area more than doubled in size • No obvious signs of infection; seems controlled • See Figure 3
November 12	<ul style="list-style-type: none"> • Same as previous (November 10) 	<ul style="list-style-type: none"> • Saw dermatologist for evaluation • Instructed to add Ceravé cream 3 times a day • Clobetasol propionate 5% cream (for the inflammation) twice a day • Dietary consult to add foods rich in healthy oils (omega-3 fatty acids, olive oil) to daily diet • Continued previous treatment protocol 	<ul style="list-style-type: none"> • Diagnosed with ceramide deficiency • Skin scraping ordered to rule out other infection/disease
November 14	<ul style="list-style-type: none"> • Noted lessening of desquamated tissue • Size of the lesion remained consistent (8.5×6 cm) • Lesion is pink in color without signs of infection • Pruritus is controlled • Granulated tissue is noted • Not physically assessed • Laboratory results communicated to athletic training staff from dermatologist • Continued notable healing • Less desquamated tissue (only on wound margins) 		<ul style="list-style-type: none"> • Reassessment • See Figure 4
November 15	<ul style="list-style-type: none"> • Further granulated tissue • Nearly all desquamated tissue has resolved • Wound is dry and nonsensitive to the touch • Margins slightly reduced in size (approximately 5.5×4 cm) 	<ul style="list-style-type: none"> • Continued previous treatment protocol 	<ul style="list-style-type: none"> • Skin scraping was negative and within normal limits
November 26	<ul style="list-style-type: none"> • Nearly complete wound resolution • Slightly erythematous • Skin is smooth and responsive to treatment 	<ul style="list-style-type: none"> • Continued previous treatment protocol as needed • Discontinued clobetasol propionate 5% cream 	<ul style="list-style-type: none"> • See Figure 5 • See Figure 6



Figure 3. Lesion expansion, November 10.

diagnosis: bacterial infection (potentially MRSA), insect bite (several types), diabetes (types 1 and 2), squamous cell carcinoma, xerosis, eczema, leprosy, psoriasis, dermatitis (atopic, contact, seborrheic), and ceramide deficiency. Following evaluation, it was determined that an infection was present, and for treatment he was placed on cefalexin 250 mg 3 times daily for 10 days, along with mupirocin 2% topical ointment.

Intervention

Although the athlete was under treatment for the infection, 6 days after the initial evaluation, he returned to the athletic training staff inquiring about the torpid healing status of the lesion. Upon inspection, it was noted that the lesion had grown in diameter to 8.5×6 cm, with notable desquamation, scaling over the entire lesion, purulent drainage, and pruritus, but no odor (Figure 3). Curiously, there did not seem to be any signs of active infection (dolor, calor, expansive rubor) in or around the lesion, and at this time, a referral was made to a dermatologist. Cefalexin was continued as prescribed; however, the mupirocin 2% topical ointment was discontinued due to a suspicion that it was causing further irritation.

The athlete was evaluated by a dermatologist, who determined that he had AD (eczema) likely caused by a ceramide deficiency. Lacking proper ceramides feasibly had caused the skin to become vulnerable, irritated, and itchy, prompting the athlete to rub and scratch the affected site. Scratching was deemed a likely cause of the secondary skin infection, which responded well to the cefalexin regimen of antibiotics. To rule out any other pathology (eg,

parasites, fungal infections), a skin scraping was performed and sent to the laboratory for further analysis. A variety of approaches can be taken with AD, but in this case, the primary goal was to identify the main cause of the issue via culturing and treating the bacterial infection while preventing further skin breakdown with topical steroids and emollients. To reduce bacterial colonization, bleach baths 2 to 3 times per week could also have been considered in the treatment regimen but were not used here.¹² In the meantime, the athlete was instructed to use Ceravé (L'Oréal USA, Inc) cream 3 times daily and clobetasol propionate 5% cream (for the inflammation) twice daily, and it was recommended to add foods rich in healthy oils (omega-3 fatty acids, olive oil) to his daily diet.

A few days later, the skin scraping results came back negative for any pathogen, thus confirming the suspected AD. The athlete was instructed to continue the prescribed regimen from the dermatologist and to follow up with the athletic training staff every few days for reassessment. Figures 4 and 5 show an approximately 3-week progression of the lesion. Adhering to a strict treatment regimen while also adding foods and supplements rich in healthy oils led to a successful course of treatment for this athlete. Figure 6 illustrates a near-complete resolution of symptoms at the 6-week mark. The athlete reported no further exacerbation of symptoms at both 3 and 6 months posttreatment.

Comparative Outcomes

The course of treatment evolved based on how the lesion responded (or did not). The Table captures the evolution of the treatments from initial presentation and throughout the nearly 6-week course of follow-up and beyond. We did not find any examples of this type of disorder in our search for comparative studies and outcomes in sports medicine-related literature, thus making this report novel. Ultimately, through careful coordination with the sports medicine team and related medical providers, this athlete was diagnosed with an autoimmune-related AD likely exacerbated by an underlying ceramide deficiency.

Although skin conditions are quite prevalent in both the athletic and general population, the underlying cause of this skin disorder was further complicated by the presence of a secondary infection. Obvious signs of infection (calor, dolor, rubor, tumor, etc) that did not fully respond to an aggressive course of antibiotics led to further inquiry and deviation from the expected, ultimately revealing an autoimmune issue via ceramide deficiency. Further complicating the resolution of



Figure 4. Lesion healing progression, November 14.



Figure 5. Lesion healing, November 30.

this case is the paucity of literature of ceramide deficiency epidemiology in younger athletic populations, leading to the pursuit of less-responsive treatments and testing (ie, antibiotics, steroids, skin scrapings). This case certainly presented with elements that deviated from the expected; clinicians can compare their own experiences with features presented in this one.

DISCUSSION

This was an exploratory clinical case presented with hopes of driving improved recognition, assessing better prevalence estimates, and clearly identifying key clinical features of ceramide deficiencies. Although AD and ceramide deficiency are documented in the general literature, we are unaware of any reports in the sports medicine literature.^{2-4,7} Athletic trainers encounter a wide variety of skin disorders and related dermal trauma in their everyday practice. This case presents a skin lesion based on a previously undiagnosed underlying autoimmune disorder (AD caused by a ceramide deficiency), further complicated by a secondary infection. An awareness of how the skin responds to expected treatment (or, in this case, did not respond) is crucial to avoid further complications to the dermis. For example, in this case, although the secondary

infection appeared to have been controlled 1-week post-assessment with the use of antibiotics, the lesion persisted without resolution of the desquamated tissue and pruritus. This contrast in the expected versus the unexpected is an important skill to be observed by the AT and should be reinforced in athletic training education to fully bring the issue to resolution. Ultimately, the more familiar ATs can be with a variety of skin disorders, the better we can serve our populations. Perhaps better prevalence estimates are warranted in athletic populations so best practices and outcomes can be achieved; this may require ATs to work more closely with other medical providers (eg, dermatologists) as well as epidemiologists in these and similar conditions.

This case also stresses the role of active monitoring and follow-up care provided by the athletic training staff. Regular access to athletic training services allowed for an expedited referral to the NP and dermatologist to control the infection and ultimately identify the cause of the lesion. The multifactorial nature of this case stresses the need for an active team-based approach in sports medicine. Beyond control of the active lesion, consultation with a sports nutritionist may be warranted to address the underlying nutritional deficiencies needed to resolve and perhaps prevent this type of disorder. Following sound nutrition principles and supplementation can play a major role in controlling and even preventing AD and the underlying ceramide deficiency, as evidenced in this case report.⁸

As noted in this case, ATs often are the first professionals to encounter and assess a variety of skin issues and related disorders in athletes; therefore, being well trained at identification and possessing strong differential diagnosis skills is crucial for high-level clinical care and positive clinical outcomes. Additionally, ATs' breadth and depth of training and experience in a variety of settings is illustrated in this case working with an older intramural athlete. The relatively commonplace presentation of a skin lesion was a complex series of interrelated issues occurring simultaneously. Athletic trainers are skilled in assessing a wide variety of skin disorders and bear the responsibility of staying current with the literature and identifying unexpected conditions should they arise. The positive outcomes of this case report were made possible by access and follow-up to athletic training care, communication with university medical support staff and resources (NP and nutritionist), expedited access and treatment from specialists (dermatologist and laboratory), and ultimately the athletic training staff serving to link all these services to deliver excellent patient care and resolution of the issue. This case demonstrates the



Figure 6. Nearly complete wound healing, December 14.

need for ATs to continually challenge their paradigm and clinical skills to deliver the highest level of clinical care to the athletes and populations we serve. With changing dietary practices and needs, along with the heterogeneous nature of the populations that we serve, more research and epidemiologic data are needed concerning athletes and AD and ceramide deficiencies.

CLINICAL BOTTOM LINE

Atopic dermatitis and ceramide deficiency may occur more frequently than once thought in athletics due to lack of prevalence estimates and general unfamiliarity. Although AD is common, other dermatologic look-alikes can confound a differential diagnosis and prolong treatment due to a lack of specificity in approaches to treatment, as noted in this case. We recommend considering the clinical key features of this disorder when approaching skin-related disorders, particularly if they do not readily respond to conventional treatment.

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