

Looking Beyond the Cell in Cellulitis

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ABSTRACT

BACKGROUND: Patients with erythematous skin are likely to receive a diagnosis of cellulitis; however, the accuracy of this diagnosis is approximately only 33%. The diagnosis of cellulitis should be made only after a thorough evaluation of all possible differential diagnoses. Cellulitis may be a primary process (superficial spreading infective process involving only the epidermis and dermis) versus a secondary (reactive) process incited by a subcutaneous process, such as an abscess, tenosynovitis, necrotizing fasciitis, and osteomyelitis.

CASE PRESENTATION: A 50-year-old man was admitted to a general hospital with the diagnosis of cellulitis. He was initially treated with systemic antibiotics without improvement. Following consultation with a wound management physician, the patient received a diagnosis of a pretibial abscess and was treated with surgical evacuation and postoperative systemic antibiotic therapy guided by tissue cultures. A postoperative wound was successfully treated with inelastic compression therapy.

CONCLUSIONS: This case demonstrates the potential for misdiagnosis when evaluating erythematous skin. Furthermore, concluding that the erythema is due to a primary cellulitis may result in monotherapy with systemic antimicrobial agents. In such cases, making a correct diagnosis through a skillful and complete physical examination of the patient, coupled with appropriate investigations, will lead to the best possible outcome. A comprehensive treatment approach may include systemic antimicrobials, as well as surgical options and compression therapy.

KEYWORDS: cellulitis, inelastic compression, infrared thermometry, Levine culture technique, lipodermatosclerosis, venolymphedema, wound management

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183 $\mu\text{mol/L}$. Clinically, his right leg displayed diffuse erythema anteriorly, medially, and laterally. He had normal peripheral pulses, with no evidence of deep vein thrombosis or superficial thrombophlebitis. He was admitted to the hospital for treatment of suspected cellulitis and prerenal azotemia. Although definitive ulcers were not present, superficial erosions were swabbed without using the Levine technique.¹ Empiric therapy with intravenous crystalloids, ceftriaxone, and clindamycin was initiated. The swab ultimately demonstrated methicillin-resistant *Staphylococcus aureus*. Over the next 72 hours, the patient's fever dissipated, and his white blood cell count and serum creatinine normalized. However, the erythema did not resolve.

On day 6 of the patient's admission, a wound management physician was consulted to assess the orders for wound dressing prior to home discharge. The wound management physician noted persistent erythema, diffuse swelling, and fluctuance involving the anterior, medial, and lateral aspects of the right leg together with exquisite tenderness over the right tibia (Figure 1). He also noted the presence of venous varicosities together with clinical evidence of chronic venous leg hypertension, such as lipodermatosclerosis and venolymphedema. Infrared thermometry was performed at the bedside, and a 7° F temperature gradient was detected between the erythematous area and normal surrounding integument.² Given that a more serious condition was suspected, discharge plans were postponed. An urgent magnetic resonance imaging of the right leg was performed and documented the presence of a large fluid collection overlying the pretibial fascia. The area measured 18 cm craniocaudally by 7.5 cm transversely by 1.9 cm anteroposteriorly (Figure 2).

On day 9, percutaneous drainage of the fluid collection via interventional radiology was attempted but unsuccessful. An urgent orthopedic surgery consultation was obtained. On day 10, the patient underwent surgery. A vertical incision facilitated the evacuation of the large pretibial abscess, debridement, and irrigation, together with a primary closure with sutures (Figure 3). Intraoperative tissue cultures grew *Streptococcus dysgalactiae*, and intravenous penicillin G was initiated. Postoperatively, the patient developed a small area of wound dehiscence, superiorly, measuring approximately 2 cm in diameter. This ulcer was treated by packing it with Curity AMD 0.25-inch gauze ribbon (Medtronic, Minneapolis, Minnesota) and wrapping the entire right lower limb with Coban 2 (3M, St Paul, Minnesota), an inelastic leg compression system, every 2 days. The

An otherwise healthy and nondiabetic 50-year-old man presented to the emergency department of an urban acute general hospital with increasing redness, swelling, and pain in his right lower leg that evolved, without provoking incidents, over 3 to 4 weeks. On arrival, he was febrile but hemodynamically stable. Laboratory investigations showed an elevated white blood cell count of 21.8×10^9 per L and absolute neutrophil count of 18.7×10^9 /L. The patient was also in acute renal failure with an elevated creatinine of

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Figure 1.
LEG OBSERVED BY WOUND MANAGEMENT PHYSICIAN



Figure 3.
POSTOPERATIVE APPEARANCE



Figure 2.
PREOPERATIVE MAGNETIC RESONANCE IMAGING SCAN OF THE RIGHT LEG

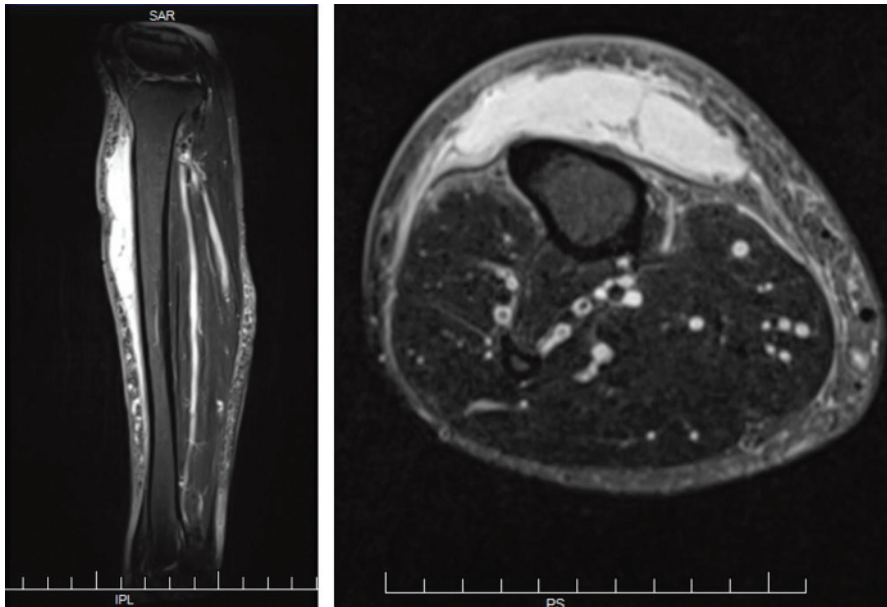


Figure 4.
COMPLETELY HEALED



patient's abnormal laboratory parameters normalized, and he was discharged home 16 days after his admission. He received follow-up through the hospital's wound management outpatient clinic. The ulcer was declared fully healed 130 days after his original admission (Figure 4).

DISCUSSION

Wounds, especially skin and soft tissue infections, are a common reason for admission to acute hospitals, and their prevalence and associated socioeconomic costs are rising.^{3,4} Patients

with erythematous skin are most likely to receive a diagnosis of cellulitis; yet, the accuracy of this diagnosis is approximately only 33%.⁵ Thus, the diagnosis of cellulitis should be made only after a thorough evaluation of all possible differential diagnoses (Table 1).^{6,7} Furthermore, cellulitis may be a primary process (superficial spreading infective process involving only the epidermis and dermis) versus a secondary (reactive) process incited by a subcutaneous process, such as an abscess, tenosynovitis, necrotizing fasciitis, and osteomyelitis. The key to achieving a correct diagnosis begins with a detailed history and comprehensive physical examination of the patient; this guides the clinician to order targeted investigations, such as diagnostic imaging, laboratory tests, and histopathology. In addition, the use of noninvasive infrared thermometry at the bedside is highly specific for the diagnosis of deep space infections, inflammatory processes, and related complications.²

The case discussed likely began as untreated primary cellulitis that extended subcutaneously, becoming a pretibial abscess. The bacterial swabs taken on admission probably revealed contamination and/or colonization, rather than identifying the organisms that were invading tissue and causing deep space infection. Although tissue cultures are the criterion standard in identifying invasive organisms, the Levine swab technique has been demonstrated to correlate well with the results of tissue cultures.¹

Although systemic antibiotics may be the complete and single solution for cellulitis as a primary process, that is not typically the case when cellulitis is a secondary process, or when it is not cellulitis at all. Case-control studies have demonstrated venolymphedema to be the strongest risk factor for the development of cellulitis.⁸ Histopathologic studies have demonstrated that venolymphedema is associated with sluggish capillary bed perfusion that leads to reduced leukocyte chemotaxis, capillary bed ischemia, and reduced antibiotic penetrance, all of which mitigate against wound healing and resolution of infection.⁹ In addition, episodes of cellulitis are capable of damaging venules and lymphatic channels, thus exacerbating venolymphedema. Therefore, a reciprocal relationship has been postulated between cellulitis and venolymphedema that is tantamount to a vicious cycle.¹⁰ Chronic venolymphedema also

Table 1.

DIFFERENTIAL DIAGNOSES OF ERYTHEMATOUS SKIN

Infections	Hypersensitivity	Vascular	Immunologic	Autoimmune	Other
Cellulitis	Allergic dermatitis	Lipodermatosclerosis	Erythema multiforme	Vasculitis	Neoplastic
Erysipelas	Asteatotic eczema	Deep venous thrombosis	Stevens-Johnson syndrome	Polyarteritis nodosa	Lichen simplex chronicus
Subcutaneous abscess	Drug hypersensitivity	Superficial thrombophlebitis	Toxic epidermal necrolysis	Systemic lupus erythematosus	Porphyria
Tenosynovitis	Eczema			Morphea	Erythroderma
Viral exanthems	Serum sickness				Erythromelalgia
Necrotizing fasciitis	Urticaria				
Tinea corporis					

promotes the development of lipodermatosclerosis, a major risk factor for venous leg ulcerations.⁹

A Cochrane database systematic review of randomized controlled studies for venous leg ulcers concluded that compression therapy increases ulcer healing rates compared with no compression, whereas multicomponent systems were more effective than single-component systems.¹¹ Therefore, compression therapy is an integral part of the overall treatment and prevention of cellulitis, especially when occurring concomitantly with venolymphedema, lipodermatosclerosis, and ulcers.

CONCLUSIONS

This case demonstrates how clinicians may diagnose primary cellulitis when evaluating erythematous skin. Furthermore, concluding that the erythema is due to a primary cellulitis may lead to only monotherapy with systemic antimicrobial agents. The key to achieving the best possible outcomes in such cases is predicated on making a correct diagnosis through a skillful and complete physical examination of the entire patient, coupled with appropriate investigations. A comprehensive treatment approach may include surgical options and compression therapy, in addition to systemic antimicrobials. Educational content on skin and

wound management is an area of glaring deficiency within undergraduate medical curricula that warrants reform. ●

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