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NEWS, VIEWS, AND REVIEWS

Keeping Cool: An Updated Review on Cold-Induced Dermatoses and Cold-Associated Injury

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INTRODUCTION

The skin's protective role as the first defense against environmental exposures makes it susceptible to climatic stressors. Low temperatures, in particular, compromise the skin's barrier through the activity of transient receptor potential ion channels in keratinocytes, immune cells, and nerves. Cold exposure induces the production of proinflammatory cytokines, causing a deficiency of epidermal barrier proteins and an increase in transepidermal water loss.[1]

While cool temperatures have been shown to exacerbate chronic skin conditions, like atopic dermatitis, there is a subset of cutaneous dermatoses and injuries that are induced entirely by cold exposure.[1] Cold-induced dermatoses are a diverse group of conditions, ranging from benign perniosis to cold anaphylaxis. As accurate diagnosis, guided by clinical features and targeted testing, is essential for effective management and prevention of complications, this review highlights the key presentations, diagnostic considerations, and treatment strategies for these conditions.

Cold Perniosis (Chilblains)

Perniosis, also known as chilblains, results from exposure to cold, damp environments. Commonly occurring in young and middle-aged women, perniosis may be idiopathic or present secondarily to other conditions such as systemic lupus erythematosus, in which patients may develop chilblains lupus erythematosus (CLE) in response to cold.[2] The erythematous, painful, pruritic, purpuric nodules and plaques of perniosis affect acral surfaces, with an affinity for the dorsal digits.[3]

Perniosis may be diagnosed clinically, with skin biopsies reserved for cases of diagnostic uncertainty. In one investigation of 23 cases of perniosis, chilblains, and CLE, the authors determined that evaluation of cryoglobulin levels in the initial workup of perniosis is not indicated.[3] Perniosis occurs within hours of cold exposure and often self-resolves within weeks.[4]

An array of treatments are available as second-line therapies for severe or persistent manifestations of perniosis, including calcium channel blockers, pentoxifylline (400 mg three times daily for 2-3 weeks), and topical steroids (betamethasone valerate 0.1% twice daily for 6 weeks).[5,6] Available evidence best supports the use of nifedipine at varying dosing regimens (10-20 mg daily to three times daily), with studies often employing therapy for 1 to 6 weeks before down titrating or discontinuing treatment.[6]

Cold-induced Panniculitis

Cold panniculitis occurs due to trauma to the subcutis secondary to cold exposure. Prolonged exposure to popsicles, tight clothing, and ice packs can induce cold panniculitis. Interestingly, the use of aesthetic cryolipolysis harnesses cold-induced adipocyte destruction, and in one patient report, cryolipolysis caused cold panniculitis.[7]

Cold panniculitis more often occurs in infants and children due to the higher saturated fatty acid concentration in their subcutaneous tissues, allowing for less severe cold temperatures to induce adipocyte solidification. The presenting location may vary; it is commonly seen in the cheeks of children with "popsicle panniculitis" or the upper thighs of equestrians wearing tight, non-insulated pants. After cold exposure, erythema appears within 15 to 20 minutes, and "pruritic, erythematous to violaceous, hard papules, nodules and/or plaques" develop within 48 to 72 hours.[7-10]

Cold panniculitis is a clinical diagnosis that should be elucidated through a careful history, avoiding unnecessary testing. The condition has a benign, self-limiting course, with management focused on minimizing exposures. While healing typically occurs within 2 to 3 weeks, postinflammatory hyperpigmentation may develop.[8-11]

Raynaud's Phenomenon

Raynaud's phenomenon (RP) describes reversible digital vasospasm-induced skin blanching. RP induced by cold is considered primary RP, while secondary RP is observed in an array of connective tissue disorders, occupational and drug exposures, endocrinopathies, malignancies, or other trauma. RP may manifest in other acral locations, including the tongue, ear lobes, nasal tip, and nipples. While perniosis has a similar predilection for acral sites, it is regarded as less painful and more pruritic than RP with a differing morphology. Interestingly, RP may occur in areas of previously healthy ischemic tissue damage after cold exposure.[12]

As with other cold-induced dermatoses, a thorough patient history is key in diagnosing RP. However, unlike previously discussed conditions, testing is indicated, including a CBC, ESR or CRP, and ANA. Treatment is dictated by a patient's level of pain and quality of life. Level C evidence supports lifestyle changes, including donning warm clothing and avoiding cold exposures, while level A evidence recommends calcium channel blockers, specifically nifedipine 10 to 20 mg taken twice daily or three times daily, as the first-line treatment if lifestyle management is not sufficient. Limited evidence supports

the use of other vasodilatory medications like losartan, fluoxetine, and phosphodiesterase inhibitors, while oral prostaglandins and endothelin receptor antagonists are not evidence-backed options. While surgical management of RP is not supported by strong evidence, it may be indicated in cases of severe digital ulceration.[12]

Cold Urticaria and Cold Anaphylaxis

Cold is among the many causative agents of chronic inducible urticaria. Exposure to cold air, liquids or solids, and consumption of cold food or drinks are all culprits. In typical presentations of cold-induced urticaria (CindU), wheals form at the site of cold stimulation, while in atypical CindU wheals form adjacent to exposure sites.[13] CindU can be diagnosed using the ice cube test, and a CBC and CRP are recommended upon diagnosis to rule out alternative etiologies. Treatment is with doses of second-generation antihistamines titrated to up to four times the standard dose. Any patient with a history of severe CindU should be prescribed an autoinjectable adrenaline kit.[14]

Cold anaphylaxis is a severe, life-threatening presentation occurring in 4 to 47% of patients with typical CindU. In one cross-sectional multinational study of 551 patients with CindU, researchers identified those with angioedema, oropharyngeal/laryngeal symptoms, and pruritic earlobes as meeting criteria to be prescribed an autoinjectable adrenaline kit.[13]

CONCLUSION

Cold-induced dermatoses encompass a spectrum of conditions, each with distinct pathophysiologies, clinical presentations, and management strategies. Perniosis, cold panniculitis, Raynaud's phenomenon, cold urticaria, and cold anaphylaxis highlight the diverse effects of cold exposure on skin and tissue. Multiple case reports of adult patients using ice packs for chronic low back pain have described a cold-induced dermatosis with features of both cold panniculitis and perniosis, highlighting the existence of these conditions along a spectrum.[15,16]

Accurate diagnosis of cold-induced dermatoses relies on a thorough history and clinical evaluation, with testing reserved for specific conditions or cases of uncertainty. Many cold-induced dermatoses, such as perniosis and cold panniculitis, are self-limited, while others, like Raynaud's phenomenon and cold urticaria, may require targeted pharmacological interventions to mitigate symptoms and improve patients' quality of life. For severe conditions like cold anaphylaxis, rapid identification, and management are critical to prevent long-term complications or life-threatening outcomes. Advancing our understanding of these conditions and optimizing treatment approaches can significantly improve the care of patients with cold-induced dermatoses.

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