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Symptomatic Dermatographism: Current Concepts in Clinical Practice With an Emphasis on the Pediatric Population

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Symptomatic dermatographism reflects an exaggerated cutaneous response to the physical stimulus of pressure. Some consider it a common type of childhood physical urticaria. Its etiology can vary widely from drug reactions and infectious agents to systemic diseases and genetic inheritance. The mechanism is thought to be related to histamine degranulation due to a mechanoimmunologic trigger, leading to the common symptoms of pruritus and burning in areas exposed to increased pressure, such as tight clothing, belts, and waistbands. The diagnosis typically is made with a blunt object such as a tongue blade or unopened ball-point pen pressed along the back and/or forearm, which elicits urtication. The mainstay of treatment is H_1- and H_2-receptor antagonists but also can include immunosuppressive agents, steroids, and phototherapy for refractory or severe cases.

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Dermatographism is a condition in which there is an exaggerated response of the skin to the physical stimulus of stroking, rubbing, or pressing with an object.[1] The term literally means to write on the skin. It is the most common form of physical urticaria.[2,3] A wheal and flare response can be seen minutes after stroking the patient's skin.

Dermatographism can be divided into simple dermatographism and symptomatic dermatographism. The latter can substantially affect a patient's quality of life. Simple dermatographism is a normal physiologic process with the skin becoming raised and inflamed after being stroked, which is described as the triple response of Lewis and Zotterman[4] (capillary dilatation, arteriolar dilatation, transudation of fluid/edema). It typically is nonpruritic. Symptomatic dermatographism, however, involves an exaggeration of this physiologic response that results in itching and burning of the involved area. The prevalence of simple dermatographism is estimated to be 1.5% to 5% in the general population, but it may be as high as 24% in children.[1,3] The prevalence of symptomatic dermatographism is not known but is much less common than its counterpart. Symptomatic dermatographism has been evaluated mainly among adults with little focus on children. We will discuss the current clinical concepts of dermatographism and pay particular attention to the pediatric population.

Classification

The classification scheme for dermatographism is based on chronicity and morphologic variants, including cholinergic, red, follicular, white, cold-dependent, and tache cérébrale subtypes (Table 1).[2,5] Chronicity in this construct is based on the time it takes for urticaria to appear after stroking the skin as well as the duration of the urticaria from its onset. The onset of urticaria occurs anywhere from 2 to 5 minutes up to 4 to 6 hours after stroking the skin; it usually lasts approximately 30 minutes but can persist for up to 24 to 48 hours.[2,5]

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Table 1.

Dermatographism Subtypes Based on Variant Morphology

Subtype	Description
Cholinergic dermatographism	Usually coexists with cholinergic subtype of physical urticaria; stroking the skin produces an erythematous band studded with small wheals[6]
Red dermatographism	Uncommon variant in which repeated rubbing is necessary to induce erythematous bands and diffuse whealing[7]
Follicular dermatographism	Described in 1983; transitory, discrete, follicular, urticarial papules elicited by stroking the skin, especially around hair follicles[8]
White dermatographism	Instead of the normal erythema surrounding the wheal, an area of white surrounds the wheal possibly due to capillary vasoconstriction[9]
Cold-dependent dermatographism	Requires the skin to be cold before dermatographism is observed[10]
Tache cérébrale	Described by Trousseau[11] in the late 1800s as an erythematous line elicited by firmly stroking the skin; associated with meningitis

Etiology

Symptomatic dermatographism typically is deemed idiopathic; however, it may be a sign of localized or systemic disease or other factors (Table 2). Systemic and infectious triggers include hyperthyroidism and type 2 diabetes mellitus as well as poststreptococcal glomerulonephritis and scabies.[12,13] It may occur as a drug reaction to medications such as amoxicillin, cefaclor, atorvastatin calcium, and famotidine.[9,13-15] In addition, symptomatic dermatographism also is seen concomitantly with physical urticaria, most commonly cholinergic and cold urticaria, as well as atopic dermatitis.[1,13] Psychologic factors may play a role. Multiple studies have noted patients reporting a link between psychosocial stressors and exacerbation of their symptoms.[2,13,16,17] Genetic factors also may be contributory. Common HLA antigen associations with symptomatic dermatographism are HLA-A2, HLA-B16, HLA-A1, and HLA-B5.[18] In addition, at least 1 familial case has been described with a probable autosomal dominant mode of transmission.[19]

Table 2.

Etiologies of Secondary Dermatographism

Etiology	Examples
Systemic disease	Hyperthyroidism; type 2 diabetes mellitus; mast cell disease
Drug reactions	Amoxicillin; cefaclor; atorvastatin calcium; famotidine
Infectious triggers	Poststreptococcal glomerulonephritis; scabies
Psychologic factors	Stress; anxiety

Pathogenesis

The pathogenesis of symptomatic dermatographism is believed to be an exaggerated immunologic response at the level of the mast cell, which is characterized by either excessive histamine degranulation or a lower threshold for degranulation.[20] The exact trigger for this degranulation is unknown; some believe the

mechanical trauma releases an unknown antigen that interacts with the IgE receptors on mast cells.[2] This theory is supported by dermatographism being elicited in normal subjects via passive serum transfer.[21]

Clinical Characteristics

The most common manifestations of symptomatic dermatographism include pruritus and burning.[1-3,12,13,22] Patients exhibit a Köbner phenomenon,[23] which is a wheal and flare response at sites of pressure that is commonly elicited from tight clothing, belts, and waistbands. All body surfaces can be involved, including the palms and soles; however, the scalp and genitalia are less often affected.[24] Pruritus often is out of proportion to the amount of whealing observed and is exacerbated at night.[24,25] This condition has been well-delineated in the adult population aged 25 to 75 years. In this study of 50 patients, the peak age of onset was in the second and third decades of life with most patients (78% [39/50]) having resolution within 5 years.[25] A retrospective survey given to parents of children with physical urticaria found dermatographism, classified as a type of physical urticaria, in at least 38% (20/53) of the respondents; 17% (9/53) were classified as mixed, most commonly dermatographic and cholinergic urticaria.[3] Another report described infantile dermatographism with onset less than 18 hours after birth. It resolved without any therapy or intervention.[26]

Laboratory Characteristics and Histopathologic Features

Results of laboratory studies, including a complete blood cell count and urinalysis, typically are normal.[12] The diagnosis is made from the history and physical examination. However, a skin biopsy specimen may prove useful to rule out other conditions in the differential diagnosis including systemic mastocytosis, connective-tissue diseases, and systemic vasculitides, especially if the patient has a persistent fever, arthralgia, elevated sedimentation rate, or associated petechia or purpura.[12] The histopathology of dermatographism is nonspecific. It appears similar to acute urticaria with dermal edema and occasional mononuclear cells.[2,27] We recommend performing stains for mast cells using toluidine blue or Giemsa.

Diagnosis

An accurate history and physical examination should include the medical history and medication use. One should emphasize associated activities and environmental triggers leading to symptoms of specific types of physical urticaria brought on by sunlight, water, extremes or changes in temperature, exercise, or pressure. Prior to testing, the patient should avoid the use of antihistamines. The diagnosis can be made in the clinical setting by simply stroking the patient's skin with a tongue blade, unopened ball-point pen, or similar blunt object. However, for a more standardized and objective method, threshold pressure levels have been defined as 4900 and 3200 g/cm^2 for simple and symptomatic dermatographism, respectively, and can be measured with a dermographometer.[5] These cutoffs correspond to the amount of pressure needed to produce urticaria and not necessarily symptoms. The length of the stroking area should be approximately 10 cm; the location should be on the back and/or forearm (Figure).[5,22] The skin reaction and its time course should be recorded, as this information can be used to objectively follow the course of disease.

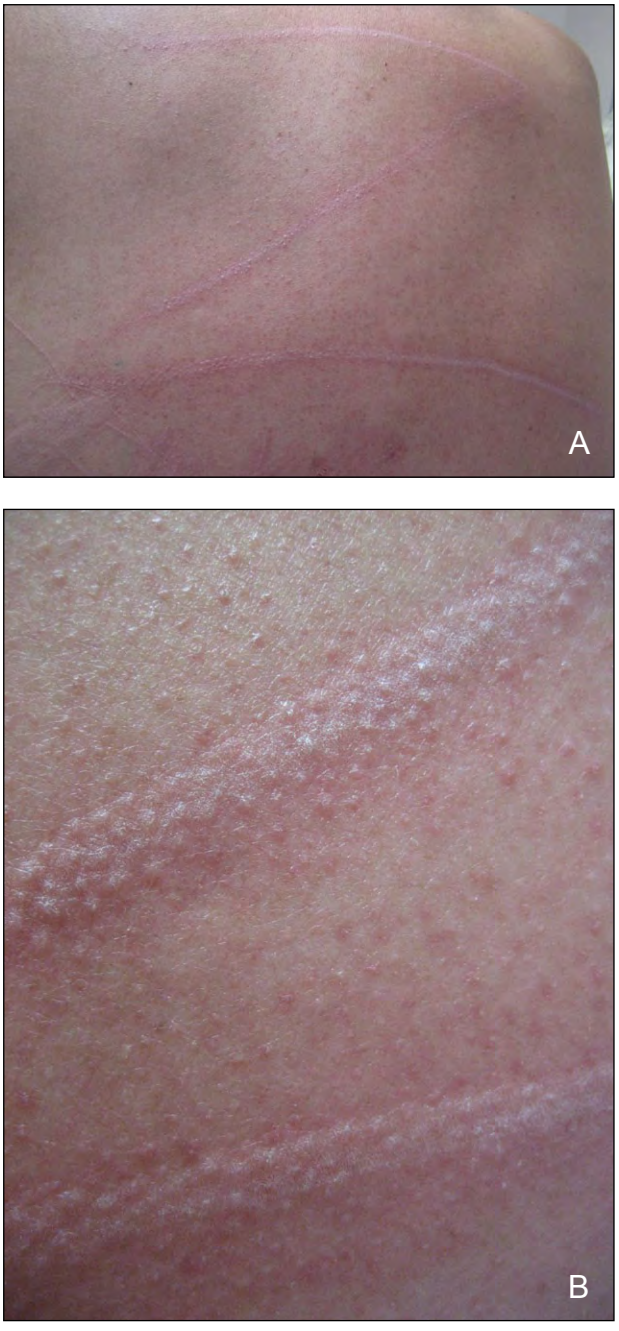
The differential diagnoses for symptomatic dermatographism include systemic mastocytosis, contact dermatitis, thyroid disease, drug reactions, infectious agents, and other coexistent chronic and physical urticaria. Because symptomatic dermatographism has been associated with and linked to systemic diseases such as hyperthyroidism, type 2 diabetes mellitus, and mast cell disease, these conditions should be ruled out before assuming an idiopathic nature.

Blood work can be performed, though it may be unnecessary in clear-cut cases.[28] Still, we suggest obtaining a thyroid-stimulating hormone level and a fasting blood glucose level.

Therapy

Therapy consists of avoiding precipitating physical triggers by wearing loose-fitting clothing and reducing stress and anxiety. The mainstay of treatment of symptomatic dermatographism is a nonsedating H_1-receptor antagonist.[2,12] Drugs from this class include fexofenadine hydrochloride, loratadine, and cetirizine hydrochloride. These medications should be employed at indicated pediatric dosages, which vary depending on the age of the child and the specific antihistamine selected. We commonly double the dose of antihistamine given to our pediatric population, partially because of the well-known increase in metabolism in children.[29,30] Side effects, including sedation, should be emphasized.

In addition to H_1-receptor antagonists, some will add H_2-receptor antagonists. The theory behind using H_2-receptor antagonists is that 15% of the histamine receptors in the skin are of the H_2 subtype.[2,12] However, controversy exists on the efficacy of adding an H_2-receptor antagonist if the H_1-receptor antagonist alone does not alleviate symptoms. One randomized, double-blind, crossover study of 19 patients demonstrated no significant difference in symptoms when an H_2 blocker was added to an H_1-receptor antagonist as opposed to an H_1-receptor antagonist plus a placebo.[31]



Symptomatic dermatographism as exhibited by the *z* elicited with a tongue blade on the patient's back (A). A close-up view of the same patient showed the reaction (B).

However, other studies argue the additive effect is substantial and therefore combination H_1- and H_2-receptor antagonist therapy should be employed when deemed appropriate.[32] Common drugs in this class include cimetidine hydrochloride, famotidine, and ranitidine hydrochloride, which may be dosed twice daily. Again, increasing doses may be considered if symptoms persist, with side effects including headache (all 3), gynecomastia (cimetidine), and diarrhea (famotidine). Pediatric dosing should be followed.

Doxepin hydrochloride, a tricyclic antidepressant used primarily at bedtime but may be divided into 4-times-daily dosing, blocks both H_1 and H_2 receptors. However, its side-effect profile is considerable, including increased sedation and anticholinergic effects such as dry mouth, constipation, urinary retention, and blurred vision.[12,33] Furthermore, there is no approved pediatric dosing and it may only be considered in adult-sized adolescents.

Other options may merit scrutiny. Leukotriene antagonists also have been shown to be more beneficial than placebo in multiple trials[34,35] and can be prescribed as an adjunct to antihistamine therapy. Most common therapies include zafirlukast 10 to 20 mg twice daily and montelukast sodium 4 to 10 mg daily. Side effects include headache and rare accounts of hepatotoxicity and Churg-Strauss syndrome. Although antihistamines and leukotriene antagonists have long been used in the pediatric population for other conditions such as asthma with established safety, other treatments such as long-term steroids, immunosuppressive therapy, and narrowband UVB phototherapy are much less studied and their safety profiles for the pediatric population are not well-documented. They may be considered as a last resort in the treatment of symptomatic dermatographism. Oral steroids should only be used for severe dermatographism with a decreased quality of life, exemplified by poor sleep and negative effects on social life. Other immunosuppressive modalities include cyclosporine[12,36,37] and narrowband UVB phototherapy. The latter can be an adjunct to antihistamines by virtue of its anti-inflammatory and immunosuppressive effects.[38,39]

Conclusion

Symptomatic dermatographism is an interesting disorder of children and adults. It is often self-limited with resolution within 5 years. Avoidance of triggers and antihistamines remain the mainstay of therapy.

REFERENCES

1. Martorell A, Sanz J, Ortiz M, et al. Prevalence of dermographism in children. *J Investig Allergol Clin Immunol*. 2000;10:166-169.
2. Bhute D, Doshi B, Pande S, et al. Dermatographism. *Indian J Dermatol Venereol Leprol*. 2008;74:177-179.
3. Khakoo G, Sofianou-Katsoulis A, Perkin MR, et al. Clinical features and natural history of physical urticaria in children [published online ahead of print December 27, 2007]. *Pediatr Allergy Immunol*. 2008;19:363-366.

4. Lewis T, Zotterman Y. Vascular reactions of the skin to injury: part VIII. the resistance of the human skin to constant currents, in relation to injury and vascular response. *J Physiol*. 1927;62:280-288.
5. Kontou-Fili K, Borici-Mazi R, Kapp A, et al. Physical urticaria: classification and diagnostic guidelines. an EAACI position paper. *Allergy*. 1997;52:504-513.
6. Mayou SC, Kobza Black A, Eady RA, et al. Cholinergic dermographism. *Br J Dermatol*. 1986;115:371-377.
7. Warin RP. Factitious urticaria: red dermographism. *Br J Dermatol*. 1981;104:285-288.
8. Shelley WB, Shelley ED. Follicular dermographism. *Cutis*. 1983;32:244-245, 254, 260.
9. Warner DM, Ramos-Caro FA, Flowers FP. Famotidine (pepcid)-induced symptomatic dermatographism. *J Am Acad Dermatol*. 1994;31:677-678.
10. Kaplan AP. Unusual cold-induced disorders: cold-dependent dermatographism and systemic cold urticaria. *J Allergy Clin Immunol*. 1984;73:453-456.
11. Trousseau A. *Clinique Médicale de l'Hôtel-Dieu de Paris*. Paris, France: Librairie JB Bailliére et fils; 1882.
12. Kaplan AP. Clinical practice. chronic urticaria and angioedema. *N Engl J Med*. 2002;346:175-179.
13. Taşkapan O, Harmanyeri Y. Evaluation of patients with symptomatic dermographism. *J Eur Acad Dermatol Venereol*. 2006;20:58-62.
14. Adcock BB, Hornsby LB, Jenkins K. Dermographism: an adverse effect of atorvastatin. *J Am Board Fam Pract*. 2001;14:148-151.
15. Smith JA, Mansfield LE, Fokakis A, et al. Dermographia caused by IgE mediated penicillin allergy. *Ann Allergy*. 1983;51(1, pt 1):30-32.
16. Anliker MD, Itin P. Psychic factors as a trigger in factitial urticaria and urticaria with positive dermographism [letter]. *Allergy*. 2001;56:32.
17. Wallengren J, Isaksson A. Urticarial dermographism: clinical features and response to psychosocial stress. *Acta Derm Venereol*. 2007;87:493-498.
18. Salazar Villa RM, Acosta Ortíz R, Mejía Ortega J, et al. Symptomatic dermatographism and HLA antigens [in Spanish]. *Rev Alerg*. 1992;39:89-95.
19. Jedele KB, Michels VV. Familial dermographism. *Am J Med Genet*. 1991;39:201-203.
20. Garafalo J, Kaplan AP. Histamine release and therapy of severe dermatographism. *J Allergy Clin Immunol*. 1981;68:103-105.
21. Murphy GM, Zollman PE, Greaves MW, et al. Symptomatic dermographism (factitious urticaria)—passive transfer experiments from human to monkey. *Br J Dermatol*. 1987;116:801-804.
22. Warin RP, Champion RH. *Urticaria*. Philadelphia, PA: Saunders; 1974.
23. Greaves MW. The physical urticarias. *Clin Exp Allergy*. 1991;21(suppl 1):284-289.
24. Rook A, Wilkinson DS, Ebling FJG, et al. *Rook/Wilkinson/Ebling Textbook of Dermatology*. 6th ed. Malden, MA: Blackwell Science; 1998.
25. Breathnach SM, Allen R, Ward AM, et al. Symptomatic dermographism: natural history, clinical features laboratory investigations and response to therapy. *Clin Exp Dermatol*. 1983;8:463-476.
26. La Shell MS, Tankersley MS. Transient dermatographism presenting within the first 18 hours after birth in an otherwise healthy newborn. *Pediatr Dermatol*. 2008;25:130-131.
27. Lever WF, Elder DE. *Lever's Histopathology of the Skin*. 9th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2005.
28. Margolis CF, Estes SA. Symptomatic dermographism. *J Fam Pract*. 1981;13:993-995.
29. Gupta SK, Kantesaria B, Banfield C, et al. Desloratadine dose selection in children aged 6 months to 2 years: comparison of population pharmacokinetics between children and adults [published online ahead of print February 23, 2007]. *Br J Clin Pharmacol*. 2007;64:174-184.
30. Simons FE, Simons KJ. Levocetirizine: pharmacokinetics and pharmacodynamics in children age 6 to 11 years. *J Allergy Clin Immunol*. 2005;116:355-361.
31. Sharpe GR, Shuster S. In dermographic urticaria H_2 receptor antagonists have a small but therapeutically irrelevant additional effect compared with H_1 antagonists alone. *Br J Dermatol*. 1993;129:575-579.
32. Harvey RP, Wegs J, Schocket AL. A controlled trial of therapy in chronic urticaria. *J Allergy Clin Immunol*. 1981;68:262-266.
33. Goldsobel AB, Rohr AS, Siegel SC, et al. Efficacy of doxepin in the treatment of chronic idiopathic urticaria. *J Allergy Clin Immunol*. 1986;78(5, pt 1):867-873.
34. Ellis MH. Successful treatment of chronic urticaria with leukotriene antagonists. *J Allergy Clin Immunol*. 1998;102:876-877.
35. Spector S, Tan RA. Antileukotrienes in chronic urticaria [letter]. *J Allergy Clin Immunol*. 1998;101(4, pt 1):572.
36. Grattan CE, O'Donnell BF, Francis DM, et al. Randomized double-blind study of cyclosporin in chronic 'idiopathic' urticaria. *Br J Dermatol*. 2000;143:365-372.
37. Toubi E, Blant A, Kessel A, et al. Low-dose cyclosporin A in the treatment of severe chronic idiopathic urticaria [letter]. *Allergy*. 1997;52:312-316.
38. Engin B, Ozdemir M, Balevi A, et al. Treatment of chronic urticaria with narrowband ultraviolet B phototherapy: a randomized controlled trial. *Acta Derm Venereol*. 2008;88:247-251.
39. Gambichler T, Breuckmann F, Boms S, et al. Narrowband UVB phototherapy in skin conditions beyond psoriasis. *J Am Acad Dermatol*. 2005;52:660-670.