Assessment of Dermographism at Different Anatomical Regions by Dermographometer

Vilaval Termklinchan MD*,
Kanokvalai Kulthanan MD**, Sumanas Bunyaratavej MD**

** Department of Family Medicine, the Bangkok Medical Metropolitan College and Vajira Hospital*
*** Department of Dermatology, Siriraj Hospital, Mahidol University*

Objective: *Classic dermographism refers to the ability of the skin to produce a linear wheal with a scratch pressure of 4,900 gm/cm^2. The authors manufactured a dermographometer to have precise and consistent measurement and tested it on different body regions to find the best location.*
Material and Method: *Twenty two patients with dermographism were enrolled. The pressure was applied to the volar aspect of the left forearm using the dermographometer and to the right forearm by the pen head. Then the pressure was applied to the upper back, abdomen, and shin using the dermographometer. The time onset and size of wheal, erythema and flare were recorded.*
Result: *The positive yield at the left forearm by the dermographometer was 72.7% and the positive yield at the right forearm by the pen head was 68.2%. The positive yield of back, abdomen and shin were 68.2%, 68.2% and 13.6%, respectively.*
Conclusion: *The dermographometer gave a comparable positive yield in diagnosing dermographism with the pen head and the dermographometer. The volar forearm, back and abdomen are the sensitive areas to produce dermographism while the shin is the least sensitive area. The site of the body that is most appropriate in testing is the forearm as it is easy to approach.*

Keywords: *Dermographism, Dermographometer, Urticaria*

J Med Assoc Thai 2006; 89 (7): 992-6
Full text. e-Journal: *http://www.medassocthai.org/journal*

Classic dermographism refers to the ability of the skin to produce a linear wheal with a scratch pressure of 4,900 gm/cm^2[1]. It is usually applied to cases when obvious whealing is produced by a single scratch with moderate pressure. Symptomatic dermographism refers to dermographism accompanied by moderate pruritus. The response of normal skin to firm stroking is called the triple response of Lewis[2]. The triple response of Lewis may be found in 25% to 50% of the normal population[2] however, the incidence of dermographism in the general population has been reported to be 5%[3].

Correspondence to : Kulthanan K, Department of Dermatology, Faculty of Medicine, Siriraj Hospital, Mahidol University, 2 Prannok Rd, Bangkoknoi, Bangkok 10700, Thailand. Phone: 0-2419-7000 ext 4333, Fax: 0-2411-5031, E-mail: sikkt@mahidol.ac.th

Generally, diagnosis involves a simple stroking of the skin with moderate pressure from the thumbnail, pen head or other kind of blunt object. Moderate pressure from the thumbnail, end-on to give only a few millimeters of contact, traversing 10 cm and causing perceptible discomfort produces roughly the diagnostic pressure level of 4,900 gm per cm^2[1].

The main problem is that, if a physician uses a light stroke, then a misleading minimal response is possible in a symptomatic patient. Because the degree of trauma required varies considerably and consists of a combination of pressure and traction[4], it is very difficult to standardize. Nevertheless, whether the point or edge of an instrument is pushed or dragged against the skin, the pressure used is the main component of the trauma[4]. The difficulty in standardizing the degree of pressure exerted has led to great differences in the incidence of dermographism. The pressure effect is

altered by the presence or absence of underlying bone, looseness of the skin, the presence of hair and the degree of sweating that may have some effect on wheal size. Therefore, the results may vary in different anatomical sites[4].

Although there are a variety of apparatuses for the standardized production of a dermographic stimulus, they are not commercially available. The objectives were for the authors to manufacture a dermographometer and to have precise and consistent measurement and to find the best location for testing in Thai patients.

Material and Method

Twenty-two patients (nineteen females) who attended the Bangkok Medical Metropolitan College and Vajira Hospital for Diseases of the Skin from August to October 2004, were enrolled in the present study. Twelve had been diagnosed with symptomatic dermographism and ten with chronic idiopathic urticaria and dermographism. This research was approved by the Hospital Review Board. All patients gave informed consent before the present study. The diagnoses of dermographism were made by a pen head stroke on their forearms. All patients were in the course of antihistamine treatment. However, antihistamine therapy was stopped 7 days prior to the assessment. The instrument the authors employed was a modified James and Warin device as described by Bettley[6]. This dermographometer has a rounded stylus of 0.09 cm^2 with a metal guide and a loaded spring to give pressure of 4,900 gm/cm^2. The stylus runs through a slot in a piece of flat metal, and the shoulders of the instrument run on the template so that friction variables and rucking of the skin are reduced. The pressure was applied to the volar aspect of the left forearm using the dermographometer, and to the right forearm with the pen head. Then the pressure was applied to the upper back, abdomen and shin using the dermographometer. The time onset and size of wheal, erythema, and flare were recorded. All of the readings in the research took up to 30 minutes after scratching because the wheal that occurred after 30 minutes (late dermographism) was rarely found. Positive dermographism was defined by a wheal of 2 mm or greater, with or without a flare response.

Results were presented as mean, median, standard deviation of the onset and size at different anatomical regions. Median test was used to compare between the results of the dermographometer at different anatomical regions with the result of the penhead. A p-value of less than 0.05 was considered significant difference.

Results

Of the 22 cases, 19 were female. The mean age was 32 years (range 14-52 years). Twelve patients were diagnosed with symptomatic dermographism, and ten with chronic idiopathic urticaria with dermographism. Their disease duration ranged from 2 months to 26 years (median 13 years). They were otherwise healthy. None were taking other medication except antihistamines. Fifteen patients (68.2%) gave positive results at the forearm by the pen head. Sixteen patients (72.7%) gave positive results at the forearm by the dermographometer. The positive yields of the back, abdomen and shin by the dermographometer were 68.2%, 68.2% and 13.6%, respectively.

Table 1 shows the time onset and size of wheals at different anatomical regions as produced by the dermographometer on the left forearm and by the pen head on the right forearm. They were not significantly different ($p > 0.05$). Considering the time onset produced by the dermographometer, the most rapid time of onset of the wheal was at the abdomen (median 130 seconds). The slowest onset time was at the shin (median 230 seconds). However, the time onset on the left forearm, abdomen and back was not statistically different ($p > 0.05$). The onset time at the shin was statistically less than that at the left forearm ($p < 0.05$). Wheal sizes at different anatomical regions did not show a statistically significant difference ($p > 0.05$). However, the abdominal region gave the widest wheal size (median 5 mm).

Table 2 shows the time onset and size of flare at different anatomical regions. The time onset and flare size produced by the dermographometer on the left forearm and by the pen head on the right forearm were

Table 1. Time onset and size of wheal at different anatomical regions

Region	Median (SD)	
	Onset (sec)	Size (mm)
Right forearm (P)	200 (60.3)	4 (1.2)
Left forearm (D)	170 (59.9)	4 (1.2)
Abdomen (D)	130 (78.3)	5 (1.2)
Back (D)	150 (84.9)	4 (0.9)
Shin (D)	230 (215.1)	4 (0.6)

Sec = seconds, mm = millimeter, SD = standard deviation, (P) = pen head, (D) = dermographometer

Table 2. Time onset and size of flare at different anatomical regions

Region	Median (SD)	
	Onset (sec)	Size (mm)
Right forearm (P)	340 (147.9)	10 (4.9)
Left forearm (D)	300 (171.4)	10 (6.2)
Abdomen (D)	300 (123.6)	15 (5.9)
Back (D)	292 (113.5)	13 (10.6)
Shin (D)	410 (226.4)	6 (2.6)

Sec = seconds, mm = millimeter, SD = standard deviation, (P) = pen head, (D) = dermographometer

not significantly different ($p > 0.05$). Considering the time onset produced by the dermographometer, the most rapid time of onset of the flare was at the back (median 292 seconds). The slowest onset time was at the shin (median 410 seconds). The abdominal region gave the widest flare size (median 15 mm). However, the time onset and flare size at the left forearm, abdomen, back and shin were not statistically different ($p > 0.05$).

Discussion

Physical urticaria frequently coexists with chronic idiopathic urticaria[7]. Dermographism is the most common type of physical urticaria and can be the cause of chronic urticaria in up to 22%[8] of the population. Typically moderate pressure from the thumbnail, pen head or another kind of blunt object roughly produces roughly the diagnostic pressure level of 4,900 g/cm^2. A lighter and heavier stroke is useful both for comparison and to assess the severity of the response[1]. Wong et al[2], Matthews et al[9] and Margolis et al[10] concluded that the body site tested is also important, as some areas frequently experience pressure and friction. Warin et al[11] showed that the pressure effect is increased by the presence of underlying bone, absence of hair, and absence of sweating. Furthermore, skin that has been chronically exposed to sunlight and the environment has fewer whealing tendencies[11].

In the present study, fifteen patients (68.2%) gave positive results at the forearm by the pen head and sixteen patients (72.7%) gave positive results at the forearm by the dermographometer. The authors' dermographometer gave a comparable positive yield in diagnosing dermographism with the pen head. The abdomen gave the most rapid time onset of the wheal and gave the widest wheal and flare size, while the back gave the most rapid time onset of the flare. However, the time onset of the wheal at the left forearm, abdomen and back were not statistically different ($p > 0.05$). The wheal sizes at different anatomical regions did not show

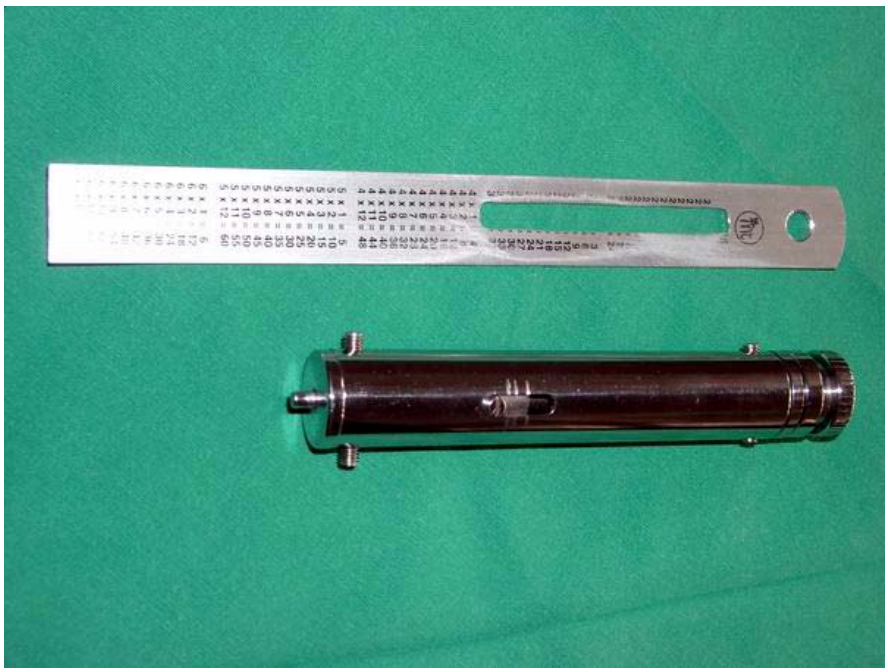

Fig. 1 Dermographometer (James and Warin's modification)

a statistically significant difference ($p > 0.05$) either. Therefore, the authors concluded that the volar forearm, back and abdomen are the sensitive areas to produce dermographism.

The onset time of the wheal at the shin was statistically less than that of the left forearm ($p < 0.05$) even though the onset time and flare size at the left forearm, abdomen, back and shin were not statistically different ($p > 0.05$). So the authors concluded that the shin is the least sensitive area. Even though the shin has an underlying bone and, as an exposed part can be tested easily, however, for some individual, however, this area has hair and is chronically exposed to sunlight and the environment. This may interfere with the results in the study.

Similarly, Nelson et al[12] reported the effect of the region of the body on results of skin prick tests. Skin test reactivity is less notable on the forearm than on the back for both histamine and allergen. This effect was more pronounced for allergen tests (16% to 27% decrease in mean wheal diameter) than for histamine tests.

In conclusion, the onset and size of the wheal and flare varied considerably from site to site. The volar forearm, back and abdomen are the sensitive areas to produce dermographism. The shin is the least sensitive area. The site of the body that is most appropriate in testing is the forearm because it is easy to approach.

References

1. Sibbald RG. Physical urticaria. Dermatol Clin 1985; 3: 57-69.
2. Wong RC, Fairley JA, Ellis CN. Dermographism: a review. J Am Acad Dermatol 1984; 11: 643-52.
3. Leelakitsap W, Kulthanan K. Symptomatic dermographism in Thai patients. Thai J Dermatol 2003; 19: 60-5.
4. Kirby JD, Matthews CN, James J, Duncan EH, Warin RP. The incidence and other aspects of factitious wealing (dermographism). Br J Dermatol 1971; 85: 331-5.
5. James J, Warin RP. Factitious wealing at the site of previous cutaneous response. Br J Dermatol 1969; 81: 882-4.
6. Bettley FR. A device for the measurement of factitious urticaria. J Invest Dermatol 1962; 39: 1.
7. Greaves MW, O'Donnell BF. Not all chronic urticaria is "idiopathic"! Exp Dermatol 1998; 7: 11-3.
8. Barlow RJ, Warburton F, Watson K, Black AK, Greaves MW. Diagnosis and incidence of delayed pressure urticaria in patients with chronic urticaria. J Am Acad Dermatol 1993; 29: 954-8.
9. Matthews CN, Kirby JD, James J, Warin RP. Dermographism: reduction in weal size by chlorpheniramine and hydroxyzine. Br J Dermatol 1973; 88: 279-82.
10. Margolis CF, Estes SA. Symptomatic dermographism. J Fam Pract 1981; 13: 993-5.
11. Warin RP, Champion RH. Urticaria. London: WB Saunders; 1974.
12. Nelson HS, Knoetzer J, Bucher B. Effect of distance between sites and region of the body on results of skin prick tests. J Allergy Clin Immunol 1996; 97: 596-601.

การเกิดผื่นลมพิษจากการขูดผิวหนังที่ตำแหน่งต่าง ๆ ของร่างกายโดยใช้ Dermographometer

วิลาวัลย์ เติมกลิ่นจันทร์, กนกวลัย กุลทนันทน์, สุมนัส บุณยะรัตเวช

ผื่นลมพิษที่เกิดจากการขูดขีดผิวหนัง (Dermographism) (DG) มีลักษณะคือ ผิวหนังเป็นเส้นนูนบวม (wheal) เมื่อใช้วัตถุปลายทู่ขูดด้วยแรง 4,900 กรัม/ตารางเซนติเมตร เครื่องมือที่เป็นมาตรฐานในการทดสอบ DG คือ Dermographometer แต่เครื่องมือนี้ ไม่มีขายตามท้องตลาด ในทางปฏิบัติการวินิจฉัยภาวะนี้จึงใช้วัตถุปลายทู่ เช่น หัวปากกา ขูดผิวหนังด้วยแรงกดพอประมาณ แต่การกดด้วยแรงกดของผู้ทดสอบแต่ละคนอาจไม่เท่ากัน หรือแม้ในคนคนเดียวกันก็อาจกดด้วยแรงที่ไม่เท่ากันทุกครั้ง คณะผู้วิจัยจึงได้ประดิษฐ์ Dermographometer ตามมาตรฐานสากล เพื่อให้แรงกดที่ 4,900 กรัม/ตารางเซนติเมตร ทุกครั้งที่ทดสอบ และนำเครื่องมือมาใช้เปรียบเทียบกับการขูดผิวหนังด้วยหัวปากกา โดยศึกษาในผู้ป่วยที่มี Dermographism 22 ราย เปรียบเทียบการขีดท้องแขนด้านซ้ายด้วย Dermographometer กับการขีดท้องแขนด้านขวาด้วยหัวปากกาทู่ บันทึกระยะเวลาที่เกิด wheal, รอยแดง รวมทั้งขนาด และยังใช้ Dermographometer ขีดเปรียบเทียบตามตำแหน่งอื่นของร่างกาย ได้แก่ หลังด้านบน, หน้าท้อง, หน้าแข้ง พบว่า Dermographometer ให้ผลบวก 72.7% ในขณะที่ปากกาให้ผลบวก 68.2% Dermographometer ให้ผลบวกที่หลัง, หน้าท้อง และหน้าแข้ง 68.2%, 68.2% และ 13.6% ตามลำดับ จากการศึกษานี้ Dermographometer มีความไวใกล้เคียงกับการขูดผิวหนังด้วยปากกา ท้องแขน, หลัง และหน้าท้อง เป็นบริเวณที่มีความไวดีต่อการทดสอบ ขณะที่หน้าแข้งมีความไวน้อยสุด คณะผู้วิจัยเสนอว่าตำแหน่งท้องแขนน่าจะเหมาะสมที่สุดเนื่องจากมีความสะดวก ในการที่จะทดสอบ