



Case Report

Bier Spots are an Under-recognized Cutaneous Manifestation of Lower Extremity Lymphedema: A Case Series and Brief Review of the Literature

Steven M. Dean,¹ and Matthew Zirwas,² Columbus, Ohio

Bier spots represent a benign vascular mottling characterized by multiple irregular white macules along the extensor surfaces of the arms and legs. They have been reported in a variety of diverse conditions with no consistent disease association. We have identified a novel association between these physiologic anemic macules and lower extremity lymphedema. Eleven patients between 23 and 70 years of age (5 male and 6 female) were diagnosed with Bier spots as evidenced by reversible white macules ranging from 3 to 8 mm in diameter on the extensor portions of the feet, ankles, and calves. The thighs were affected as well in 2 morbidly obese subjects. We suspect that these lesions are not uncommon in lymphedema but are simply under-recognized.

Bier spots represent a benign unique display of vascular mottling with multiple irregular white macules along the extensor surfaces of the arms and legs. Although initially provoked in an 1898 peripheral vascular laboratory experiment via tourniquet application to the arm,¹ subsequent examples have been incidentally recognized in individual case reports. Most examples involve young adults with a variety of diverse conditions, and no consistent disease association has been recognized. Herein we report 11 novel cases of Bier spots occurring in the setting of lower extremity lymphedema.

¹Division of Cardiovascular Medicine, Department of Internal Medicine, The Ohio State University Wexner Medical Center, Columbus, OH.

²Division of Dermatology, Department of Internal Medicine, The Ohio State University Wexner Medical Center, Columbus, OH.

Correspondence to: Steven M. Dean, DO, FACP, RPVI, 200 Davis Heart & Lung Research Institute, 473 W 12th Street, Columbus, OH 43210, USA; E-mails: steven.dean@osumc.edu or smdean@outlook.com

Ann Vasc Surg 2014; ■: 1–4

<http://dx.doi.org/10.1016/j.avsg.2014.07.005>

© 2014 Elsevier Inc. All rights reserved.

Manuscript received: June 4, 2014; manuscript accepted: July 1, 2014; published online: ■ ■ ■.

CASE REPORTS

Eleven subjects (5 male and 6 female) between 23 and 70 years of age were referred for management of lower extremity lymphedema. A board certified vascular medicine specialist clinically confirmed the diagnosis of lymphedema and a corroborative lymphoscintigraphy was not required. Neither the patients nor their referring physicians were aware of associated whitish macules. The preponderance of cases presented with International Society of Lymphology² (ISL) stage II lymphedema with exception of 2 patients with stage III lymphedema (elephantiasis). [Table 1](#) outlines the ISL staging criteria for lower extremity lymphedema. Primary and secondary subtypes of lower extremity lymphedema were relatively equally distributed including 5 primary and 6 secondary cases. Risk factors for secondary lymphedema included lipedema, lipohypertrophy, surgery, recurrent ulcerations/cellulitis, chronic venous insufficiency, and morbid obesity ([Table II](#)). One patient had black skin whereas the remaining subjects were white skinned. Stereotypical white asymptomatic macules ranging from 3 to 8 mm in diameter were identified on the extensor portions of the feet ([Figs. 1 and 3](#)), ankles, and calves of all subjects. The thighs were affected in 2 subjects with morbid obesity ([Fig. 2](#)). The interposed skin was either normal or minimally erythematous in appearance. Neither the trunk

Table I. Staging of lymphedema²

Stage 0	Latent or subclinical condition where swelling is not yet evident despite impaired lymphatic transport.
Stage I	Early accumulation of fluid which subsides with limb elevation. Pitting is typically present.
Stage II	Early in stage II, limb elevation rarely reduces tissue swelling and pitting is evident. Late in stage II, the limb may or may not pit as excess fat and fibrosis appears.
Stage III	Includes lymphostatic elephantiasis where pitting is absent and trophic skin changes such as acanthosis, increased deposition of fat and fibrosis, and warty overgrowths have developed.

Table II. Clinical characteristics of 11 patients with lower extremity lymphedema and Bier spots

Age	Gender	Etiology	ISL stage ²
70	Female	Secondary (recurrent cellulitis and chronic ulcerations)	II
23	Female	Primary	II
64	Male	Secondary (surgery)	II
40	Male	Primary	III
33	Female	Primary	II
34	Female	Secondary (surgery, morbid obesity, and lipedema)	II
35	Male	Primary	II
62	Male	Secondary (chronic venous insufficiency)	II
58	Female	Secondary (chronic venous insufficiency)	II
54	Male	Secondary (morbid obesity and lipohypertrophy)	III
44	Female	Primary	II

print & web 4C/FPO

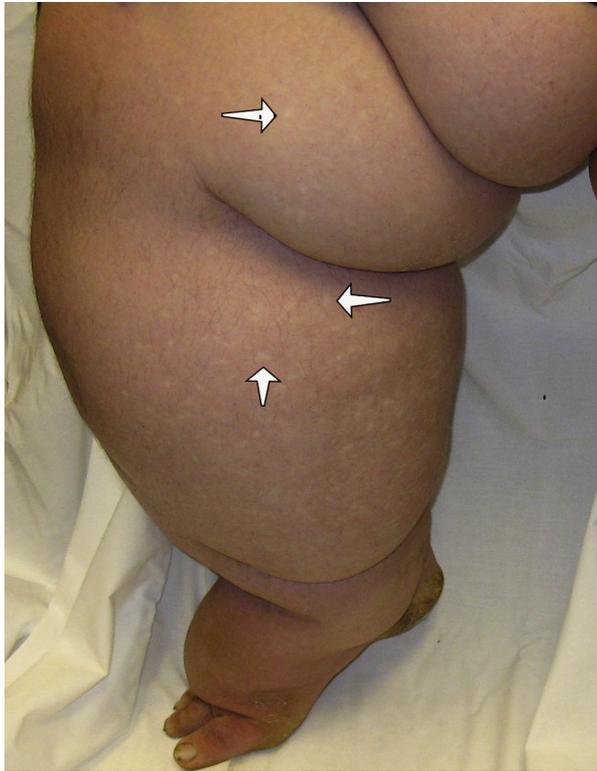
**Fig. 1.** Multiple stereotypical irregular white macules along the dependent dorsal foot of a 33-year-old female with late ISL stage II primary lymphedema.

nor upper extremities were affected. The lesions were markedly accentuated with the limb in a dependent position yet attenuated with limb elevation. Pressure to the surrounding skin provoked temporary disappearance of the white macules. Routine laboratory tests were normal in all patients. A diagnosis of lower extremity Bier spots was rendered on the basis of the aforementioned clinical manifestations. Skin biopsies were not performed. Other than continuing typical compression therapy for lymphedema, no specific treatment for Bier spots was administered.

DISCUSSION

In 1898, Dr. Augustus Bier, a German surgeon, conducted a series of reproducible vascular experiments whereby arterial flow to the distal upper extremity was attenuated via application of a tourniquet over the brachial artery.¹ The resultant tissue hypoxia created not only cyanotic skin but also small white spots throughout the forearm and hand. On release of the tourniquet, the pale spots quickly abated; however they recurred in the same location when the artery was again compressed. Consequently, the eponymous designation “Bier spots” was created. Alternative terms for these evanescent white lesions include physiological anemic macules and angiospastic macules.

The mechanism underlying Bier spots has been traditionally reported to represent an exaggerated nonphysiologic or physiologic vasoconstrictive response within arterioles to tissue hypoxemia.^{1,3,4} However, Gniadecki and Gniadecka⁵ surprisingly documented *higher* perfusion within these macules than the surrounding skin. In an experiment involving 6 patients, limbs were placed in a dependent position to activate the venoarteriolar reflex and evoking the characteristic Bier spots. The venoarterial/venoarteriolar reflex or postural vasoconstriction reflex decreases blood flow within a dependent limb including reduced cutaneous perfusion due to an increase in precapillary vascular



print & web 4C/FPO

Fig. 2. One of 2 subjects that manifested Bier spots not only within the typical infrageniculate distribution but along the distal medial thigh as well. The patient was a 54-year-old male with early ISL stage III secondary lymphedema due to morbid obesity and associated lipohypertrophy. White arrows illustrate several of the large number of calf and thigh macules.

resistance. By using laser Doppler analysis, a mean (standard deviation) reduction in flux of 72% in the unaffected skin was obtained, yet a decrease of only 20.8% in the white macules was documented ($P < 0.01$, t test). Consequently, data reported by Gniadecki suggested a focal failure of physiologically appropriate vasoconstriction within the ascending arterioles supplying the anemic macules. At present, there is no consensus on the pathogenesis of Bier spots, and it is possible that either excessive arteriolar vasoconstriction or a failure of physiological vasoconstriction may be responsible depending on the underlying clinical scenario.

In a 2009 case series ($n = 6$) and review of the literature, Fan et al.⁶ identified 69 cases of Bier spots. They noted that most cases occurred in young adults 20 to 40 years of age (range, 15–75) and men were affected twice as often as women. Tunca et al. recently reported 2 cases of Bier spots in an 11-year-old boy and a 12-year-old girl.⁷ The prevalence is reportedly rare yet in our experience they are not uncommon.



print & web 4C/FPO

Fig. 3. Unique documentation of multiple physiologic anemic macules along the dorsal foot of a 44-year-old woman with dark skin that presented with late ISL stage II primary lymphedema.

These physiologic macules are asymptomatic, hypopigmented, mildly irregular, and range from 1 to 10 mm in diameter. Although the extensor surfaces of the upper and lower extremities are typically affected, involvement of the trunk can rarely occur. The lesions are usually provoked by limb dependency whereas raising the extremities, warming the skin, and/or blanching the surrounding skin causes the spots to disappear. Fan et al. noted lesion accentuation with emotional stress yet diminution with physical activity in 4 of their 6 cases.⁶ The histopathology of Bier spots is normal.⁶

Bier spots are most often idiopathic yet have been reported in a wide variety of diverse conditions including pregnancy,⁸ scleroderma renal crisis,⁹ aortic hypoplasia¹⁰ and coarctation,¹¹ alopecia areata, Peutz–Jeghers syndrome, lichen planus, tachycardia, and palmar hyperhidrosis.⁶ One author recently noted that a strong association between Bier spots does not definitively exist with any medical condition.⁷ To the best of our knowledge, Bier

spots have never been reported in the setting of lower extremity lymphedema. Additionally, we documented these lesions in a dark skinned individual which also appears to be a new finding (Fig. 3). Of interest, white macules were equally represented in both males and females and in both primary and secondary forms of lower extremity lymphedema. Although always located on the extensor surfaces of the lower extremities, Bier spots were most visible along the dorsal feet (Figs. 1 and 3). The presence of these asymptomatic macules did not appear to portend a more sinister prognosis in regards to their lymphedema.

Potential mimics of Bier spots include other entities with white macules including vitiligo, pityriasis versicolor, postinflammatory hypopigmentation, and nevus anemicus. However, these disorders often involve the trunk which is not a typical distribution for physiological anemic macules. Additionally, the previously mentioned diseases cause a persistent lack of pigmentation that fails to abate with pressure and/or limb elevation.

In addition to knowing the characteristic cutaneous manifestations of lower extremity lymphedema such as hyperkeratosis, peau d'orange appearance, and lymphostatic verrucosa, one should be cognizant that Bier spots may exist as well. We suspect they are not uncommon yet are simply under-recognized in the setting of lymphatic hypertension. Once identified, a vascular clinician can be reasonably confident that these white macules are a benign and physiological skin finding that should not require additional investigation or specific therapy. However, considering the absence

of histologic data regarding Bier spots in lower extremity lymphedema, a skin biopsy could be undertaken if the diagnosis is indeterminate or to yield supplementary information.

REFERENCES

1. Bier A. Die Entstehung des Kollateralkreislaufs, II: Der Rückfluss des Blutes. aus ischämischen Körpertheilen. *Arch Pathol Anat* 1898;153:306–34.
2. International Society of Lymphology. The diagnosis and treatment of peripheral lymphedema: 2013 consensus document of the International Society of Lymphology. *Lymphology* 2013;46:1–11.
3. Collier JG, Dernhorst AC. Bier's spots: evidence that they are mediated by an intravascular vasoconstrictor substance. *J Physiol* 1970;209(suppl 1):12–3.
4. Wilkin JK, Marin H. Bier's spots reconsidered: a tale of two sports, with speculation on a humerus vein. *J Am Acad Dermatol* 1986;14:411–9.
5. Gniadecki R, Gniadecka M. Constitutive speckled vascular mottling of the skin resembling Bier white spots: lack of venoarteriolar reflux in dermal arterioles. *Arch Dermatol* 2000;136:674–5.
6. Fan YM, Yang YP, Li W, Li SF. Bier spots: six case reports. *J Am Acad Dermatol* 2009;61:e11–12.
7. Tunca M, Caliskan E, Erbil H, Akar A. Bier spots in two children. *Pediatr Dermatol* 2011 Sep-Oct;28:581–3.
8. Schoenlaub P, Dupre D, Redon JY, et al. Numerous and large Bier's spots associated with pregnancy. *Eur J Dermatol* 1999;9:230–1.
9. Peyrot I, Boulinguez S, Sparsa A, et al. Bier's white spots associated with scleroderma renal crisis. *Clin Exp Dermatol* 2007;32:165–7.
10. Cabanillas M, Suarez-Amor O, Loureiro M, et al. Bier's spots in association with hypoplasia of the aorta. *Dermatology* 2007;215:166–7.
11. Pearson IC, Holden CA. Delayed presentation of persistent unilateral cutaneous mottling of the arm following coarctation of the aorta. *Br J Dermatol* 2003;148:1066–8.