Case Report

Elastic Stocking-Induced Foot Necrosis in a Patient with Severe Pneumonia

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Elastic stockings (ES) are widely used for the prevention of venous thromboembolism. Here we report a case of foot ulcers induced by ES in patients with pneumonia and hypoxia. A 94-year-old woman was admitted for the treatment of pneumonia. The patient had been wearing an ES because of a history of deep vein thrombosis of the leg. Multiple foot ulcers occurred within 24 hours after the admission despite the absence of peripheral arterial occlusive disease. The ulcers took almost 5 months to heal. For patients with hypoxia, ES may further deteriorate local tissue hypoxia and thus should be used carefully.

Key words: foot ulcer, deep venous thrombosis, elastic stocking

INTRODUCTION

Elastic stockings (ES) are routinely used to prevent deep vein thrombosis. For critical care patients, mechanical prophylaxis, such as ES and intermittent pneumatic compression, is recommended over drug therapy because anti-thrombotic agents could increase the bleeding risk.¹⁾ Although the efficacy of ES has been demonstrated, there are several contraindications. One of them is peripheral arterial occlusive disease, and in patients with the disease, ES use increases the risk of compression and induces further deterioration of preexisting ischemia. Here, we report a case of ES inducing foot ulcers in a patient with pneumonia and hypoxia.

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CASE REPORT

A 94-year-old woman complaining of dyspnea and high fever was referred to Omaezaki Municipal Hospital. When she arrived at her physical examination, she had been wearing an elastic stocking (pressure 30 mm Hg at the ankle) on the right leg for 7 days for deep vein thrombosis of the leg. Her blood pressure and pulse rate were 103/56 mmHg and 120/min. With the administration of oxygen at 10 L/min, the PaO₂ was 48.6 Torr, and PaCO₂ was 28.7 Torr (oxygen saturation, 89%). Computed tomography did not demonstrate pulmonary thromboembolism, though it did detect infiltration of the right lower lobe. Therefore, we diagnosed the patient with pneumonia and administered antibiotics. Later on, the results of the sputum in bacterial culture identified *Haemophilus influenzae*. Since her bilateral posterior and anterior tibial artery pulsations were good, and the bilateral ankle/brachial pressure index (ABPI) was almost within the normal range (right side, 0.92; left side, 0.90), we excluded severe peripheral arterial occlusive disease.

Within sixteen hours after the admission, the patient developed necrosis of the skin on the dorsum of the right foot, great toe, and fifth toe (**Fig. 1 and 2**). We immediately removed the elastic stocking, debrided the necrotic tissue, and treated the ulcers with saline wash and povidone-iodine sugar ointment, which was continued for 3 months. As for

Fig. 1 Site of skin necrosis.
Necrosis was found on the dorsum of the right foot, medial aspect of the great toe, lateral aspect of the fifth toe, and heel.

Fig. 2 Ulcers on the dorsum of the right foot and medial aspect of the great toe, several days after debridement of ulcers.

the pneumonia, with the inhalation of oxygen, the rate of oxygen saturation improved to 95%, and the patient recovered from the pneumonia after 2 weeks. The foot ulcers took almost five months to heal (**Fig. 3**).

DISCUSSION

Elastic stockings are widely used for the treatment of deep venous thrombosis, lymphedema, and varicose

veins, as well as for preventing venous thromboembolism (VTE). Several guidelines have recommended the use of ES for preventing VTE.¹⁻³⁾ For trauma and critical care patients, mechanical prevention, such as ES or intermittent pneumatic compression (IPC), is recommended over anti-thrombotic therapy that increases bleeding risk.^{1,3)}

Contraindications in the use of ES are total occlusion of the deep venous system, severe skin disease and allergy. Peripheral arterial occlusive disease is also a con-

Fig. 3 Healed ulcers on the dorsum of the right foot and medial aspect of the great toe.

traindication. In particular, ES should not be worn by patients with an ankle blood pressure below 80 mmHg because compression could impair collateral flow and may cause irreversible ischemic damage.⁴⁾ In the present case, the foot ulcers developed within 24 hours after wearing ES. Severe peripheral artery occlusive disease was denied because the patient's bilateral ankle/brachial pressure index (ABI) was almost within the normal range when the ulcer was identified. Generally, local tissue oxygen metabolism is maintained by blood flow, oxygen consumption, and diffusion conditions. In the present case, local blood flow might be perturbed by compression therapy, and arterial PO_2 must be low, caused by the pneumonia-induced hypoxia. Therefore, we speculated that pneumonia-induced hypoxia caused local tissue hypoxia, which may have further deteriorated, caused by compression of blood vessels in the leg from wearing ES.

According to the guidelines, hypoxia with pulmonary diseases (i.e., pneumonia and chronic obstructive pulmonary disease) is not regarded as a contraindication for compression therapy. However, in critical limb ischemia, tissue PO_2 (tPO_2) is a predictive factor for amputation and wound healing.⁵⁻⁷⁾ Franzeck et al.⁵⁾ reported that the

tPO_2 reflects both local and systemic factors. Local factors include blood flow, oxygen consumption, and diffusion conditions, while systemic factors include arterial blood pressure, arterial PO_2 , and arterial oxygen concentration. Therefore, pneumonia and subsequent hypoxia possibly caused low tPO_2 in the present case. Under normal conditions, tPO_2 is about 40 Torr (and the arterial PO_2 is 80 Torr). In this patient, tPO_2 might have been very low because arterial PO_2 was 48.6 Torr, even while the patient inhaled oxygen. Even though we did not measure tPO_2 , local blood flow might be restricted by the ES compressing the leg, and tPO_2 might be further deteriorated.

In the present case, the foot ulcers developed within 16 hours after the admission. Unlike ischemic foot ulcer in peripheral artery occlusive disease, the ulcers located on the dorsum of the right foot, great toe, fifth toe, and heel, and did not occur in the fingers. These are the areas tightly compressed by the ES (the dorsum of the right foot, great toe, fifth toe, and heel). Removal of the ES and recovery of the patient from pneumonia allowed the ulcers to heal relatively faster than typical ischemic foot ulcers. According to ACCP guidelines, hypoxia is not

regarded as a contraindication of ES. However, in this case, the patient might have been better off if she did not use the ES. On the other hand, we should have checked the skin changes of the patient more frequently. To our knowledge, this is the first case report of an ES-induced foot ulcer occurring in a patient with hypoxia. In the intensive care unit, the use of ES by patients with hypoxia should be carefully considered, and if patients do use them, they should be checked for foot ulcers. IPC may be an alternative method to prevent VTE in such patients.

In conclusion, we described a case of foot ulcers induced by ES in a patient with systemic hypoxia due to pneumonia. In addition to peripheral artery occlusive disease, severe hypoxia seems to be a relative contraindication in the use of ES because the compression may cause deterioration of local tissue that develops into foot ulcers.

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