

Cutaneous Microembolism of Fingers and Toes

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Abstract

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A macro vascular embolism is a well-known emergency. In contrast, cutaneous microembolism is a lesser known symptom. However, cutaneous microembolism of fingers and toes is a red flag symptom for vascular emergencies. The underlying cause may involve infectious, immunological, metabolic and physical disorders, coagulation disorders and malignancies. Early recognition can help to live safe.

Introduction

Vascular micro embolism results in acute pain and subsequent tissue necrosis. Typical causes for this emergency event are an embolus due to atrial fibrillation or thoracic outlet syndrome, or aneurysm of the ulnar artery [1]. Deep venous thrombosis can result in venous gangrene [2]. Another but rare cause is paradoxical embolism due to patent foramen ovale [3].

In contrast, cutaneous micro embolisms are less known in the dermatologic literature and may be easily overlooked. Lesions may not be limited to the acral region. Intermittent painful reddish, bluish macules of the finger tips and toes are a red flag for cutaneous micro embolism leading to the cutaneous vascular-occlusive crisis. In this short review, we will discuss possible causes and consequences.

Cutaneous microemboli

Cardiac disorders

The same conditions that show a higher risk for micro embolism may sometimes cause macroembolism of fingers or toes (Fig. 1). The latter may be overlooked in emergency care.



Figure 1: Arterial microembolism of the finger in a 74-year-old female patient with cardiac arrhythmia

Sepsis and another infectious disease

The most common cause of cutaneous microembolism is bacterial septicemia, leading to small pustules, papules and ulcers known as ecthyma gangrenosum (Fig. 2). Bacterial embolisms and vasculitis (bacterial vasculopathy) are responsible [4][5][6][7]. Although different bacteria can cause septicemic vasculitis, meningococci are the major cause in immunocompetent patients. In particular, meningococemia is characterized by a typical triad of persistent fever, arthralgia, and cutaneous rash [8]. In contrast, bacterial toxins induce petechia, ecchymosis, purpura fulminans, and larger ulcerations [9].



Figure 2: Arterial microembolism in a male patient (79-year-old) due to bacterial septicemia. (a) Foot with macular lesions and digital ulcers. (b) Detail of the heel. (c) Detail of the plantar region. (d) Macular lesions on the tip of the toes

Systemic fungal infections such as aspergillosis have to be considered in case of atypical signs and symptoms of sepsis, even in immunocompetent patients [10]. In any case of suspected septicemia, patients should be immediately be transferred to an intensive care unit.

A recently, re-emerging infectious disease is anthrax caused by Gram-positive *Bacillus anthracis*. Cutaneous anthrax presents typically with non-tender cutaneous ulcers with black eschar, oedema, or malignant pustules, and a history of butchering, or dressing/washing of cattle/goat or their meat. Fingers and hands can be the site of primary infection [11]. Treatment with systemic penicillin, amoxicillin or ciprofloxacin in combination with flucloxacillin for two weeks results in high cure rate [11][12].

Metabolic disorders

Crystal cholesterol embolisation is a multisystem ischemic damage characterised by the occlusion of small vessels with cholesterol crystals that originate from ruptured atherosclerotic plaques lining the walls of major arteries. It can cause acute cutaneous microembolism. Selective arteriography will demonstrate mild stenosis. Anticoagulation is not

recommended. Treatment of choice is filter-assisted stenting of the affected artery to prevent further embolisation [13].

Tumors and myeloproliferative disorders

Cardiac myxoma often presents with uncharacteristic symptoms. Cutaneous manifestations are often transient and non-specific. Rodríguez Bandera et al. (2015) presented a case of a 36-year-old woman with a 6-month history of intermittent, painful, violaceous, non-blanching macules on the thumb and fingertips of the left hand and right ankle. An urgent echocardiogram demonstrated an atrial mass, with subsequent histopathology confirming the clinical suspicion of atrial myxoma. Excision of a tumour avoided serious complications in this patient [14].

Cancers may alter the clotting system leading to a hypercoagulable state. Thromboembolism is a well-known risk factor for cancer patients with pulmonary embolism as the leading symptom [15]. Stelzner et al. (2012) reported on digital ischemia due to a hitherto unrecognised metastatic colon carcinoma. Anti-cancer treatment is the treatment of choice. In the acute setting, anticoagulation is required. In contrast, routine thrombo-prophylaxis to prevent venous thromboembolism in solid cancer patients is not recommended [16].

Polycythemia vera is marked by arterial and venous thromboembolism. There is a report of painful purple toes in two patients presenting normal peripheral pulses caused by this myeloproliferative disease [17]. Cytoreductive therapy keeping hematocrit threshold beneath 45% represents the cornerstone in the therapeutic approach [18].

Coagulation disorders

Factor V Leiden mutation is an inherited blood coagulation disorders, resulting in resistance to activated protein C and a significantly increased risk of deep leg vein thrombosis. In rare cases, it may cause arterial embolism of the upper extremities [19]. Dorweiler et al. (2003) reported about a 24-year-old woman with acute onset of critical ischemia of her left thumb and index finger. Intra-arterial angiography revealed an embolus in the distal radial artery and a thrombotic occlusion of the digital artery of the thumb and index finger. Immediate surgical embolectomy combined with subsequent local intra-arterial lysis for three days, anticoagulation, and prostaglandin E resulted in a rapid a complete remission [20].

Mechanical vascular damage

The hypothenar hammer syndrome is a type of secondary Raynaud's phenomenon, occurring mainly in subjects who use the hypothenar part of the

hand as a hammer. Occlusion and/or aneurysm of the ulnar artery results from repeated strikes of the hook of the hamate on the superficial palmar branch of the ulnar artery. In a series of 47 patients, multiple occlusions of the digital arteries were observed in 57.4% of cases [21]. Conservative approaches include calcium channel blocker or buflomedil alone or in combination with oral platelet aggregation inhibitors. Other options are hemodilution and prostacyclin analogue therapy. Despite conservative measures, some patients need vascular surgery [22][23].

Vasculitis and autoimmune connective tissue disorders

Vasculitis and autoimmune connective tissue disorders may cause digital ulcers, mostly by vasculitis but sometimes by micro embolism too (Fig. 3). Digital ulcers are more frequently seen in systemic sclerosis, anti-phospholipid syndrome, and Wegener's granulomatosis [24][25]. Immunosuppressive treatment of the underlying cause and adjuvant targeted vascular therapy are necessary. In systemic sclerosis, limited evidence suggests that iloprost, sildenafil and tadalafil may improve ulcer healing. Tadalafil has shown some protective effect as well [26].

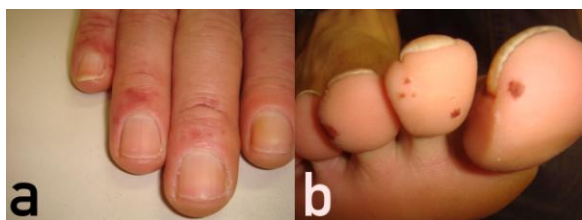


Figure 3: Arterial microembolism in a 49-year-old male patient with systemic lupus erythematosus. (a) Periungual erythema. (b) Cutaneous microembolism of the toes

Another promising approach is the use of autologous adipose-derived stromal vascular cells. A phase I open-label clinical trial (NTC01813279) assessed the safety of subcutaneous injection of the autologous adipose-derived stromal vascular fraction. There was a 33.1% decrease in hand pain, an 88.3% decrease in the Raynaud Condition Score, and a decrease in the number of digital ulcers number 22 and 30 months after treatment [27]. In anti-phospholipid syndrome, warfarin/ phenprocoumon or clopidogrel plus aspirin are appropriate treatments [28].

Physical factors

Perniones (frost bites) are caused by exposure to cold. They are an important differential diagnosis of cutaneous micro embolism [29]. We have seen a female patient presenting perniones together with clinical signs of a cutaneous micro embolism on the toes (Fig. 4). This can be explained by increased

blood coagulability in experimental frost bites [30].



Figure 4: Combination of perniones and cutaneous micro embolism on the toes

Differential diagnoses

Suspicion of cutaneous micro embolism warrants the confirmation by histopathological examination. There are some other disorders that need consideration because they also affect acral regions of the body. The majority of acral necrosis is due to small vessel disorders like diabetic angiopathy (predominance of toe ulcers) [31], scleroderma (finger ulcers are more frequent than toe ulcers) [32], thrombangiitis obliterans (predominant finger ulcers) [33], calciphylaxis [34], or rare entities such as autoimmune inflammatory syndromes like stimulator of interferon genes (STING)-associated vasculopathy with onset in infancy (SAVI) with associated interstitial lung disease (OMIM #615934) [35].

In conclusion, cutaneous microembolism of fingers and toes is a red flag symptom for vascular emergencies. The underlying cause is not uniform, and so is the treatment. Dermatologists should be able to recognise this particular type of macrovascular compromise and act as a pilot to ensure early diagnosis and treatment.

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