

acute ischemic stroke. These catheters are designed for aspiration in small-caliber cerebral vessels and therefore are well suited for the distal tibial and plantar arteries or even smaller vessels in the extremities. The case we have described of a recanalization obtained in a very distal peripheral district with an excellent outcome is a good example of the utility of this system beyond acute ischemic stroke.

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Digital Ischemia in a Young Woman after Minor Wrist Trauma—A Rare Diagnosis and an Innovative Multidisciplinary Treatment

From: Bouke J. Koeneman, MD

Tjerk de Nijs, MD

Gerard A. Rongen, MD, PhD

Rein Ketelaars, MD

Han J. Bonenkamp, MD, PhD

Giel G. Koning, MD, PhD, FEBVS

Leo J. Schultze Kool, MD, PhD

Departments of Internal Medicine (B.J.K., T.d.N., G.A.R.)

Pharmacology and Toxicology (G.A.R.)

Anesthesiology, Pain and Palliative Medicine (R.K.)

Surgery (H.J.B., G.G.K.), and

Interventional Radiology (L.J.S.K.)

Radboudumc Geert Grooteplein 8

Nijmegen 6525GA, The Netherlands

Editor:

Acute digital ischemia outside of the context of Raynaud phenomenon is not frequently seen in general practice. The rarity of this condition can lead to delay in diagnosis, whereas finger salvage relies on quick recognition and either surgical or medical treatment (1). Also, when neither surgical nor medical treatment is practical or sufficient, the need for an alternative treatment modality emerges.

Institutional review board approval was not required for this report. A 22-year-old woman with a medical history of hypothyroidism, who was currently taking levothyroxine and oral contraceptives, presented to the emergency department because of progressive pain and pale discoloration of the second to fourth digits of her right hand. She had experienced a minor fall on the

outstretched wrist 6 weeks earlier. Severe pain persisted, despite the use of acetaminophen, diclofenac, and oxycodone. There was no history of previous thrombosis, although her family history was notable for factor V Leiden mutation and associated venous thrombosis on one side of the family. On examination, the second to fourth fingers of her right hand were blue (Fig 1) and cold, and sensory function was impaired. Pulsations in both the ulnar and the radial artery were intact. Examination of the contralateral hand was unremarkable. The main differential diagnostic consideration was digital arterial embolization from a cardiac source or downstream arterial origin. Raynaud disease, thromboangiitis obliterans, and hypothenar hammer syndrome were ruled out based on the history.

Finger pressure measurement confirmed severe arterial insufficiency in the second to fourth digits (Fig 2, left panel) whereas Doppler ultrasound showed normal triphasic flow over the radial and ulnar artery. Electrocardiogram showed normal sinus rhythm. Computed tomography angiography of the chest and right arm showed no structural abnormalities, apart from an irregularity in the distal ulnar artery. Subsequent digital subtraction angiography revealed a dissection of the ulnar artery at the level of the pisiform bone, with occlusions of digital arteries (Fig 3). Local administration of vasodilating agents did not improve blood flow. The patient repeatedly tested positive for lupus anticoagulant, anti-beta 2-glycoprotein, and anticardiolipin, compatible with the antiphospholipid syndrome. After the diagnosis of ulnar artery dissection and consequent digital arterial embolisms had been established, the patient promptly received acetylsalicylic acid and clopidogrel combined with a therapeutic dose of nadroparin. Adequate pain control enabled aggressive physical therapy to be given to stimulate collateral vascularization. Surgical intervention in the digital



Figure 1. Severe cyanosis in three fingers of the right hand of the patient at presentation.

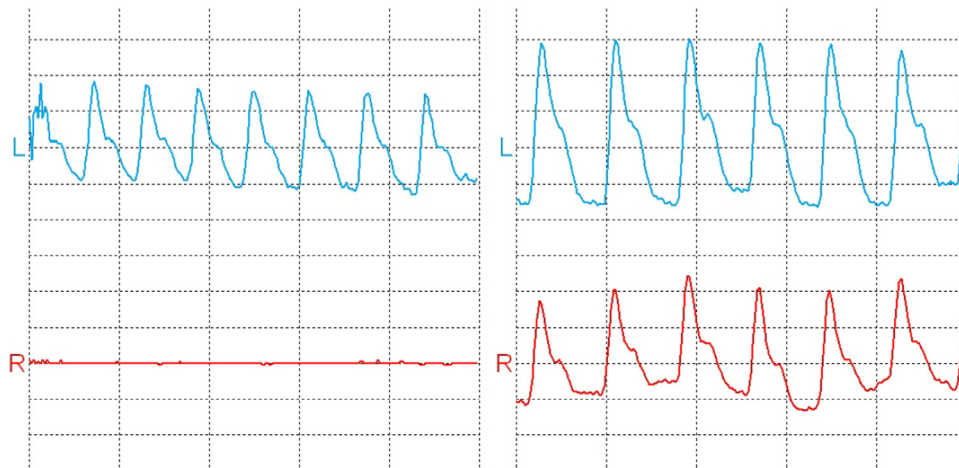


Figure 2. Finger pressure measurements indicating severe arterial insufficiency of the right index finger compared with the healthy left side (left panel) and normalization of measurements during follow-up (right panel).

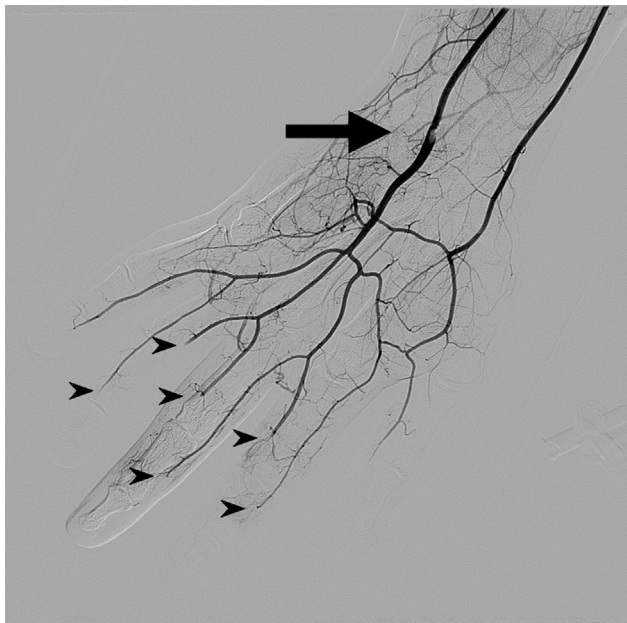


Figure 3. Digital subtraction angiography showing contrast stops in the digital arteries of the second to fifth digits.

arteries was not feasible considering the long time since onset and the possibility of damaging neovascular structures. The localization of the arterial dissection over the wrist joint did not allow placement of a stent graft. Conservative treatment was considered, but the condition of the fingers deteriorated.

It was hypothesized that local diffusion of urokinase into the distal thrombi could be facilitated by administration of a high dose of urokinase. However, systemic exposure to urokinase to achieve sufficiently high concentrations at the site of the thrombi would inevitably result in a severe bleeding risk. To avoid this risk, isolated perfusion of the forearm with recombinant tissue plasminogen activator (rTPA) was performed with

the patient under general anesthesia in an operating room (**Fig 4**) (2). First, arterial and venous catheters were placed percutaneously in the femoral artery and femoral vein; the tips of both sheaths were positioned in the right brachial artery and vein, distal to a compression cuff that was inflated around the upper arm. During catheter positioning, remote ischemic preconditioning (RIPC) of the contralateral forearm was performed. A cardiopulmonary bypass pump with membrane oxygenator was used in a low-flow setting to establish oxygenated perfusion. Nuclear monitoring was used to observe systemic leakage and to confirm complete separation of the forearm circulation. To the perfusate, 10 mg of rTPA (Boehringer Ingelheim GmbH, Ingelheim am Rhein, Germany) was , and circulation was maintained for 30 minutes. A second term of perfusion was allowed for another 30 minutes, with continuous infusion of adenosine (Sanofi-Aventis, Paris, France) and an additional 10 mg of rTPA, doubling the local concentration of rTPA. Perfusion pressure was maintained with infusion of isotonic saline (150 mL) and a Gelofusine 4% solution (50 mL) during the procedure. Postoperative digital subtraction angiography revealed substantial improvement of arterial flow in the fingers. Capillary refill was again present in the entire third and fourth fingers and a large part of the second finger. The patient was discharged a few days later with warfarin therapy. After a few weeks, she reported full functional recovery, and her hand was normal except for a necrotic tip of the index finger (**Fig 5**). Finger pressure measurement was within normal range (**Fig 2**, right panel).

At the present time, different treatment strategies for digital ischemia are in use. Open or endovascular embolectomy is used for obstruction proximal of and including the palmar arch, and a microsurgical approach is possible for digital thrombi (1). In the case presented here, dual antiplatelet therapy initially was started to

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