Journal of Cardiology Cases 20 (2019) 155–157

Contents lists available at ScienceDirect

Journal of Cardiology Cases

journal homepage: www.elsevier.com/locate/jccase

Case Report

Skin ulcer due to hemodialysis access-induced distal ischemia treated with arteriovenous fistula banding and endovascular therapy

Susumu Odajima (MD), Takumi Inoue (MD)*, Tomoyo Hamana (MD), Ryota Masaki (MD), Wataru Fujimoto (MD), Koji Kuroda (MD), Yutaka Hatani (MD), Masamichi Iwasaki (MD), Hiroshi Okamoto (MD), Masanori Okuda (MD), Takatoshi Hayashi (MD FJCC)

Hyogo Prefectural Awaji Medical Center, Cardiovascular Medicine, 1-1-137 Shioya, Sumoto, Hyogo 656-0021, Japan

ARTICLE INFO

Article history:
Received 14 February 2019
Received in revised form 5 June 2019
Accepted 23 July 2019

Keywords:
Arteriovenous fistula
Hemodialysis
Steal syndrome
Hemodialysis access-induced distal ischemia
Arteriovenous fistula banding

ABSTRACT

A 58-year-old woman with pallor on her left hand due to chronic hemodialysis presented with a recent intractable skin ulcer on her left 3rd finger; the skin perfusion pressure (SPP) was 19 mmHg. Preoperative angiography revealed an occluded proximal left radial artery, no communication between the ulnar and superficial palmar arteries, several collaterals from the left ulnar to the radial artery, and no visualization of the finger arteries. Successful endovascular therapy to the occluded radial artery increased flow to the arteriovenous fistula (AVF), but not to the fingertips. Slightly compressing the AVF augmented the flow and wound blush at the wound sites on the 3rd fingertip, leading to a diagnosis of hemodialysis access-induced distal ischemia (HAIDI). Surgical AVF banding with intra-operative SPP monitoring improved the SPP to 34 mmHg, leading to complete wound healing over 1 month with a preserved AVF. We performed a bilateral temporal artery biopsy and diagnosed giant cell arteritis. As the angiographic wound blush at wound sites is reportedly an important factor for wound healing, angiography with AVF manual compression is essential to diagnose HAIDI and evaluate the blood flow for wound healing.

<**Learning objective:** Hemodialysis access-induced distal ischemia (HAIDI) is a potentially devastating complication of an arteriovenous fistula (AVF). As it is difficult to diagnose, it may necessitate major amputation. The angiographic wound blush is related to wound healing, making angiography an essential modality for evaluating blood flow in HAIDI, especially in case of an ischemic intractable ulcer. Angiography with AVF manual compression is not only essential to diagnose HAIDI, but also effective to evaluate the flow for wound healing.>

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Introduction

Unilateral ischemia develops in 1.6–8% of all hemodialysis patients with an arteriovenous fistula (AVF). This condition, earlier referred to as steal syndrome, is now named hemodialysis access-induced distal ischemia (HAIDI) [1]. In some cases, HAIDI can cause an intractable ulcer. Diagnosing this condition is also difficult, for various reasons. Treatment options depend on the etiology of the ischemia: inflow arterial obstruction and/or distal arterial lesions are treated with small-caliber balloons and stent implantation [2]. High-flow AVFs are eligible for flow-reducing procedures like AVF banding and distal arterial extension [3]. AVF banding while monitoring skin perfusion pressure (SPP), which is based on evaluating blood flow to the fingertips with manual compression of the AVF in angiography, is rare.

We describe a rare case of ischemic skin ulcer of the fingertip without amputation in a HAIDI patient treated with a combination of successful endovascular therapy (EVT) and surgical AVF banding using intra-operative SPP monitoring.

Case report

A 58-year-old woman had developed pallor on her left hand, caused by chronic hemodialysis that had been ongoing for 18 years for an unknown cause. She was referred to our hospital with an intractable skin ulcer on her left 3rd finger, which had not responded to antiplatelet therapy, antibiotic therapy, and debridement at a nearby clinic (Fig. 1A). Along with hemodialysis, she had developed polyarthritis with fever due to polymyalgia

* Corresponding author.
E-mail address: tinoue@awajimc.jp (T. Inoue).

https://doi.org/10.1016/j.jccase.2019.07.005
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Fig. 1. (A) Intractable skin ulcer on the left 3rd fingertip at the initial visit. (B) The fingertip healed completely 1 month after endovascular therapy and arteriovenous fistula banding procedure.

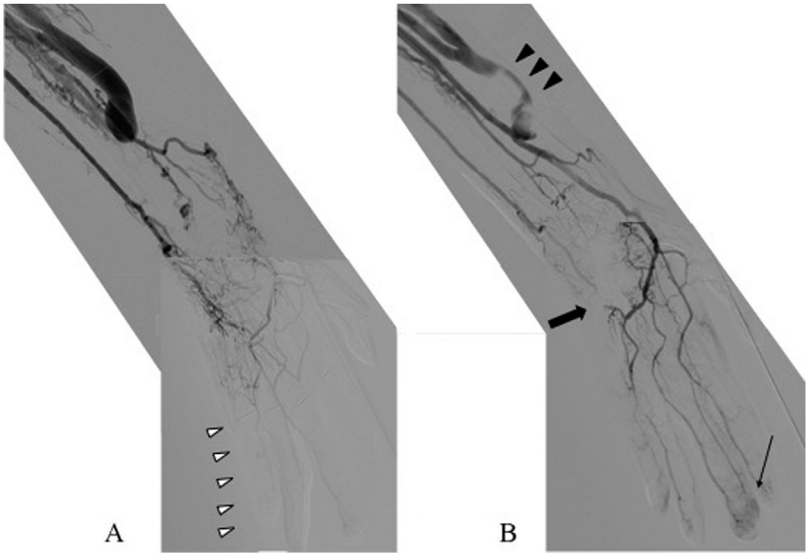

Fig. 2. (A) Digital subtraction angiography (DSA) after successful endovascular therapy for radial artery occlusion apparently increased flow to the arteriovenous fistula (AVF) but did not improve flow to the left fingertips. (B) DSA on compressing AVF showing increased flow to the finger arteries and caused the appearance of a wound blush at the left 3rd finger. The white arrowhead indicates no visualization of the finger arteries. The black arrowhead indicates a manually compressed AVF. The thin arrow indicates a wound blush at the left 3rd finger. The black arrow indicates no communication between the ulnar and superficial palmar artery due to occlusion.

rheumatica (PMR) and remitting seronegative symmetrical synovitis with pitting edema (RS3PE) syndrome one year prior, for which she was taking prednisolone 5 mg per day as a maintenance dose. Her left 3rd fingertip was ulcerated with an SPP value of 19 mmHg, despite taking 200 mg cilostazol (the maximum dose). Duplex ultrasound (DUS) examination of the left forearm at the initial visit showed no stenosis, but occlusive disease of the proximal left radial artery was seen. We performed EVT on the occluded proximal left radial artery. Subsequent digital subtraction angiography (DSA) after successful EVT revealed increased flow to the AVF, but no communication between the ulnar and superficial palmar arteries, several collaterals from the left ulnar to the radial artery, and no visualization of the finger arteries (Fig. 2A).

Slightly compressing the AVF augmented the flow to the fingertips and brought about a wound blush at the wound site on the 3rd fingertip, leading to a diagnosis of HAIDI (Fig. 2B).

We therefore performed AVF banding under intra-operative SPP monitoring to determine objectively to what degree the AVF banding improved conditions.

This improved the SPP value from 19 to 34 mmHg, leading to complete wound healing over 1 month with a preserved AVF (Fig. 1B). During the 6-month period when the patient was followed up, the hemodialysis continued uninterrupted without restenosis of the proximal radial artery or the banded AVF. Unfortunately, the patient died after that from sepsis due to severe pneumonitis.

Discussion

HAIDI, earlier referred to as steal syndrome, affects 1.6–8.0% of all hemodialysis patients with AVF at some point in their life and occurs in 5–10% of cases when the brachial artery is used for inflow but in less than 1% of radiocephalic AVFs [1,2,4].

Earlier, DSA and DUS were reported to be useful modalities for diagnosing HAIDI. DUS is a non-invasive method; however, DSA with manual AVF compression can not only diagnose the presence of HAIDI but also visualize the blood flow to the fingertips and evaluate the angiographic wound blush at the wound site on the fingertips. Utsunomiya et al. reported that presence of angiographic wound blush after EVT was associated with higher SPP, both of which are associated with higher rates of limb salvage for patients with critical limb ischemia [5].

Therefore, DSA with AVF manual compression is essential for HAIDI patients, especially those with an ischemic intractable ulcer.

The treatment options for HAIDI differ depending on the etiology of ischemia: inflow arterial obstruction and/or distal arterial lesions are treated with small-caliber balloon angioplasty, and high-flow AVFs are eligible for flow-reducing procedures such as AVF banding and distal arterial extension [2]. In this case, as the etiology of the ischemia was associated with both inflow arterial obstruction and high-flow AVF, we had to reduce the high-flow AVF after successful EVT for the occluded proximal left radial artery.

Indeed, AVF closure is the most certain method to augment blood flow to the fingertip in a case of HAIDI with high-flow AVF, but AVF-preserving surgery such as AVF banding is a more reasonable and feasible method, because reconstructing an AVF is difficult once a high-flow AVF has been closed. Furthermore, we need to assess objectively and intra-operatively the degree of AVF banding required. Previous reports described AVF banding monitored using DUS or SPP [6,7]. If the SPP at the wound site remains below 30 mmHg, wound healing is not expected to occur [8]; therefore, we performed AVF banding using intra-operative SPP monitoring. We checked the SPP value at the dorsal side of the left 3rd finger after AVF was banded and adjusted the degree of AVF banding when the intra-operative SPP value at the wound site was >30 mmHg. We finalized the AVF banding procedure because the SPP improved from 19 to 34

mmHg, leading to complete wound healing over 1 month, with a preserved AVF.

Conflict of interest

The authors declare that there is no conflict of interest.

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