Ischemic Monomelic Neuropathy: A Disguised Diabetic Neuropathy

This disabling complication of upper extremity hemodialysis access is under diagnosed.

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Ischemic monomelic neuropathy (IMN) is an under diagnosed and disabling complication of upper extremity hemodialysis access. The hemodynamic disturbance that occurs during the time of access creation can lead to both neurologic and ischemic complications. These complications can occur as often as 10 percent of the time and are most commonly seen following proximal procedures involving the upper limbs.1

IMN is differentiated from other complications by its distinct presentation. It occurs secondary to the inference of blood flow from a major limb artery resulting in multiple, distal axonal loss mononeuropathies.

IMN typically presents with sensory symptoms in the hand and forearm and associated weakness or paralysis of muscles in the same area. The key differentiating feature of IMN is that it occurs within hours of fistula or graft formation.1 It is often disabling and irreversible but does not cause tissue necrosis.2 It is thought that the ischemia is transient, therefore not resulting in muscle or skin necrosis but instead leading to a severe ischemic nerve injury in susceptible patients.3 The typical patient populations most at risk for IMN are those with diabetes mellitus.2

CASE REPORT
A 62-year-old African American female was admitted with a one-week history of right arm pain and swelling. The patient had a right upper extremity graft revision one week prior to admission and had been experiencing the symptoms since the surgery. The patient’s medical history was significant for atrial fibrillation, hypertension, epilepsy, hyperlipidemia, diabetes mellitus II, and end stage renal disease on hemodialysis for the past four years. Other surgical history is significant for a non-functional left upper extremity fistula placed four years ago and a right upper extremity graft (axillary artery to axillary vein) placed five months prior to presentation.

On physical exam, the patient was found to have +3 radial pulses bilaterally with < 3 seconds capillary refill. A right upper extremity ultrasound was performed which demonstrated a fluid collection in the axillary incision and along the venous limb of the graft. The patient underwent exploration of the right upper extremity graft for evacuation of the fluid. The procedure was uncomplicated; however a few hours post-operatively she complained of increased swelling of her fingers and an “ice-like” pain that radiated down her right arm to her hand. She also endorsed sensitivity to cold, numbness and change in color of her fingers.

When examined, the radial pulse was intact and there was a bruit and thrill over the right graft. However, the hand was tender to light touch and the patient was unable to flex her fingers secondary to pain. To determine the etiology of the patient’s symptoms, further testing was pursued. A right upper extremity venous doppler ultrasound demonstrated a patent dialysis graft. Arterial doppler of the same region demonstrated normal blood flow in the right radial and

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ulnar arteries. Magnetic resonance imaging (MRI) of the cervical spine was performed and only demonstrated minimal spinal cord compression of C4/C5 and C6/C7.

A neurology consult was obtained at this time. Neurology recommended an electromyographic study (EMG) to confirm the diagnosis of IMN. The EMG was performed which demonstrated an acute median neuropathy with involvement of proximal median nerve branches with largely axonal pathophysiology. Also present was a baseline median entrapment neuropathy affecting both sides alongside a mild ulnar and radial sensory axonal neuropathy, probably part of a more diffuse polyneuropathy possibly secondary to diabetes. The EMG results were consistent with the diagnosis of IMN. No surgical intervention was pursued because it was believed that the neuropathy was irreversible at this time. The patient was discharged on gabapentin, with mild improvement of symptoms.

**DISCUSSION**

IMN is a rare complication of dialysis access, most commonly seen in the diabetic population. It is a distinct diagnosis that occurs in the setting of mild to moderate ischemia. The symptoms most commonly occur immediately post-operatively and the nerve deficits are disproportional to any ischemic changes seen in other tissues of the affected limb. Physiologically there is diversion of a large amount of blood away from the distal forearm and hand following the creation of the arterio-venous shunt in the proximal arm leading to the ischemia.

Clinically, there is often severe, intractable neuropathic pain and variable sensorimotor deficits seen as well. IMN tends to occur in those patients with pre-existing microvascular disease. Those at greatest risk are patients with diabetes mellitus, and those with access originating from the brachial artery. The differential in this patient population includes iatrogenic nerve injury, nerve compression due to hematoma or abscess, carpal tunnel syndrome, and exacerbated polyneuropathy.

Diagnosis is mainly made clinically, and an EMG and nerve conduction studies can be used to confirm the diagnosis. The EMG typically shows axonal loss, low amplitude or absent responses to the sensory and motor nerve stimulation, and relatively preserved conduction velocities.

When IMN is diagnosed, the vascular surgeon should normalize any alteration to extremity perfusion with a shunt revision. However, most patients will be left with residual neurologic impairment.

**SUSPICION AND RECOGNITION ARE IMPORTANT**

As in this case, often the diagnosis of ischemic monomelic neuropathy is missed and not made until a neurologist has evaluated the patient. It is important to recognize IMN as a distinct entity, which differs from other ischemic complications of dialysis access. Further treatment for IMN is mainly supportive and should include pain control.

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**ABOUT IMN**

**Risk Factors for IMN**

- Pre-existing microvascular disease
- Patients with diabetes mellitus
- Access originating from the brachial artery

**Diagnosis**

- Diagnosis is primarily made clinically
- EMG and nerve conduction studies can confirm diagnosis

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