



## Orbiting a treatment for some with critical hand ischemia<sup>☆☆☆</sup>

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The forearm contains a network of arterial vessels that can be found in an analogous configuration in just about every mammal from the tiniest shrew to modern man. Evolutionary forces have shaped this part to be resilient to ischemic injury and well supported with collaterals. Components of the system may be individually removed, such as using the radial artery for a bypass conduit [1], or functional by removed through radial artery occlusion after radial access for vascular procedures [2], with little concern for hand ischemia. Unfortunately for man, chronic disease and, in particular, systemic diseases that can affect the arterial health, do occasionally produce enough diffuse obstruction to the forearm vasculature that ultimately overwhelms the inherent redundancy and may produce critical ischemia.

Critical hand ischemia is a subset of the critical limb ischemic group of diseases. The symptoms are comparable to critical leg ischemia and manifest as hand pain, non-healing wounds, gangrene, and the potential for amputation. Hand ischemia is far less common than lower limb ischemia. Given the robust collateralization in the upper extremity, symptoms in the hand are typically not the result of an isolated acute insult, but rather the result of chronic systemic disease. Autoimmune connective tissue diseases, such as systemic scleroderma, rheumatoid arthritis and systemic lupus erythematosus that have a proclivity for vasculitis, have been associated with critical hand ischemia. The Hypothenar Hammer Syndrome that results from long-term repeated physical trauma to the vascular tree can end with chronic ischemia. Atherosclerosis and diabetes, often in combination with end-stage renal disease is perhaps the most common disease states associated with critical hand ischemia, most frequently set off by arterial flow disruption incurring after renal vascular access surgery [3].

Treatment of this disorder is less than satisfying as often symptoms reflect an end-stage result of diffuse destruction of the vascular bed. Occasionally, a reversible factor can be found such as focal stenosis where treatment may result in symptomatic relief. Bahro and colleagues [4], in this month's Journal, described their experience in treating such disease and reviewed the limited reports in the literature. Their patient, like many others described in the literature, had underlying dialysis-dependent renal disease,

along with diabetes. He had a poorly healing ulcerations and high-grade ulnar stenosis on the background of diffusely calcified forearm arteries. Using an orbital atherectomy device (Cardiovascular Systems, Inc., St. Paul, MN) and follow up dilatation with the non-compliant, Chocolate PTA balloon (Medtronic, Dublin, Ireland) at prolonged but low pressures (4 ATM), they obtained a good angiographic result. The result was healing of the ulcerations and recovery of viable tissue. Similar successful reports are scattered thru the literature using a variety of interventional and surgical techniques. Publication bias may be playing a role in this positive general outcome, but at least this demonstrates some potential hope for at least some of these patients.

While a well-thought-out intervention may be life transforming for the correct patient, caution should be considered. Critical hand ischemia is not a disease state that is common, and the diffuse nature of the underlying disease process will drive ultimate prognosis and may temper attempts at revascularization. Success in the literature has been based on focal lesions analogous to focal disease in the coronaries and not diffuse disease. For instance, disease states with calcium deposits in the arterial media are found in renal dialysis patients. Media calcification is a bone and calcium deposition problem and, while dramatic on X-ray, may not affect local blood flow [5]. This would not be a reasonable indication to pass a calcium ablative device as it would add trauma to the arterial system without benefit.

Atherosclerosis can be seen in the background of media calcification, but this is an intima disease that ultimately results in local endoluminal obstruction. This type of focal disease is a potential target for intervention. In the forearm, like in the coronaries, the mere presence of stenosis should not suggest the need for an intervention, as some evidence for ischemia should also exist. The forearm and hand are inherently well protected from ischemia, and isolated stenosis may be of no consequence. On the other hand, ischemic pain and poor wound healing would be symptomatic of the type of stenosis that may be best considered for revascularization therapy such as described by this report.

Surgical options for these patients are potentially available but limited by the small diameter of the vessels and the otherwise diffusely diseased nature of the vessel walls. The use of calcium modifying devices such as an orbital atherectomy system may also be problematic. If the target vessel is also too small and there may be a risk entrapment. In addition, there may be little room for error in traversing the region of disease before the arborization of the distal vessels into microvasculature. Attention to vascular spasm and flow through the microvascular is also essential. The small limb vessels have a propensity to spasm although their diffused calcified state may attenuate this characteristic. These patients also tend to suffer

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from diffuse small vessel disease and the run-off in the distal forearm is limited, so effects of microembolization need to be controlled and no-flow states managed expectantly. The orbital atherectomy system does produce relatively small microparticulate debris on the order of 2.0  $\mu\text{m}$  that is smaller than that seen with high-speed rotational systems and may, therefore, make the orbital device attractive for this type of vascular work [6].

The cases shown and reviewed by Bahro and colleagues [4] demonstrate the potential for interventional techniques to mitigate the morbidity of hand ischemia. The reader is left with novel ideas and a potential solution that might be the trick that works when few other options remain. But, this is a solution for a well-circumscribed population. This requires focal disease without upstream stenosis in the large vessels, an appropriately sized artery, and this disease is causing symptoms attributed to the lesion discovered. Most of the patients with this type of disease will have diffuse vascular disease, and its general course will drive the ultimate prognosis. The use of the technique described should be reserved for those who have the real potential to improve their quality of life.

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