

# The Limitations of Angiography in Guiding Peripheral Vascular Interventions



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Hello and welcome to the February 2018 edition of *Vascular Disease Management*. I have again decided to deviate from my standard practice of commenting on submitted articles and case reports to comment on interventionalists' reliance on diagnostic angiography as the "gold standard" in guiding peripheral vascular interventions in leg arteries.

Angiography is presently the most utilized procedure to determine anatomical indications for intervention, extent of treatment required, vessel sizing, and procedural adequacy of interventional outcomes. In the overwhelming majority of interventional peripheral arterial procedures being performed in the United States, angiography is the only modality that is actively utilized during the intervention to guide therapy. Unfortunately, angiography has many limitations. Angiography may fail to identify significant obstructive lesions; fail to identify morphological characteristics of lesions; fail to ideally determine true vessel size, particularly with long diffuse disease or total occlusions; and fail to ideally determine adequacy of the therapeutic intervention in achieving physiological goals.<sup>1</sup>

Intravascular ultrasound (IVUS) is utilized infrequently in peripheral arterial interventions performed in the United States. Published data have demonstrated clearly that IVUS is superior in assessing anatomy, vessel size, plaque characteristics, and adequacy of interventional results.<sup>1</sup> Iida and colleagues demonstrated improved outcomes with less restenosis at 1 year following femoral arterial stenting when the procedure was guided by IVUS.<sup>2</sup> Multiple studies have demonstrated that stents that are oversized or undersized have higher rates of restenosis. Information gleaned

from the use of IVUS imaging has the potential to guide sizing, determine the sites of needed treatment that may be missed by conventional angiography, and determine adequacy of treatment.<sup>3</sup> IVUS also has the potential to better characterize lesion characteristics to aid in choice of therapy. Additionally, IVUS shows potential to dramatically limit the amount of contrast utilized in interventional procedures.

External duplex utilized during intervention is probably also underutilized. External duplex not only is associated with excellent anatomical lesion assessment, but it can also provide physiological information. External duplex can help guide complex wire crossing, particularly of totally occluded vessels, as the vessel is seen by duplex images but not by angiography. Duplex can accurately assess vessel size and determine adequacy of interventional therapy.

Although diagnostic angiography has made great strides with techniques such as digital subtraction angiography (DSA) and the utilization of CO<sub>2</sub> angiography, it may fail to ideally size vessels, determine plaque characteristics, identify some significant obstructions, and determine adequacy of therapy and ideal stent apposition and expansion. One must question if a partial explanation of high restenosis rates observed with leg arterial interventions is related to factors such as failing to treat all of the disease, failure to apply the appropriate therapy, failure to fully expand stents, failure to adequately size therapy to vessel size, and failure to identify and treat complications such as deep dissections or residual significant stenosis not identified by angiography. How much is restenosis related to the vascular bed that has been treated versus how much is it related to suboptimal therapy must ultimately be determined. Clearly appropriate sizing is directly related to ultimate outcomes with any type of peripheral intervention.

At present, IVUS and duplex imaging during hospital-based procedures are not reimbursed to cover the additional cost of utilizing these techniques. IVUS is reimbursed at office-based labs, but external duplex is not similarly reimbursed. These techniques

may increase procedural time. We do not have information at present to accurately determine overall cost effectiveness and to stratify when these techniques should be utilized.

I believe that it is time for randomized controlled trials to determine if routine utilization of external duplex or IVUS imaging in peripheral arterial interventional procedures will result in improved outcomes and whether routine application of these techniques is cost effective.

#### REFERENCES

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