LEADING ARTICLE

Underutilisation of Duplex Scanning for the Assessment of Lower Extremity Arterial Disease

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Introduction

Compared to other non-invasive tests, duplex scanning of the aortoiliac and femoropopliteal arteries has been extensively studied over the past 20 years. Comparative studies with angiography, by many considered as the “gold standard”, have been published since 1985. In a recent meta-analysis of methodologically sound studies, it has been shown that haemodynamically significant stenoses and occlusions in the aortoiliac and femoropopliteal arteries can be diagnosed with a sensitivity as high as 80–86% and a specificity of more than 95%. It is unlikely that these results will improve further, as the interpretation of both the “gold standard” and duplex scanning are subject to interobserver variability. Over the years, the peak systolic velocity ratio has proved to be a useful and simple diagnostic parameter to grade stenoses. This ratio, defined as the peak systolic velocity in the stenosis divided by that in the pre- or post-stenotic region, is directly related to changes in the luminal cross-sectional area. It also appeared that parameters like spectral broadening, phase of the signal and end diastolic velocity have a limited diagnostic value. The failure rate of duplex scanning is about 10% and the inability to accurately assess the arteries most often occurs in patients with a distended abdomen or extensive calcification of the arterial wall.

The aim of this article is to formulate a tentative answer to the question of whether or not duplex scanning can influence clinical decision making and, if so, whether this technique reduces significantly the need for angiography in patients with arterial disease of the lower extremities.

Duplex Scanning and Decision Making

Few studies have been directed at the clinical impact of duplex scanning. However, these studies indicate that diagnostic angiography can be avoided in a considerable number of patients. The greatest reduction can be accomplished in patients with intermittent claudication in whom a percutaneous transluminal angioplasty (PTA) is being considered. The decision to subject a patient to PTA can be based on duplex scanning alone, without additional angiography, in 80–90% of cases. In candidates for conservative therapy, because of extensive disease without an indication for surgery, additional angiography can be omitted, thus merely basing the therapy on duplex scanning. Such a work-up improves the comfort of the patient and avoids unnecessary angiography. The therapy of choice can be decided in the outpatient department and more efficient admission schedules can be drawn up.

In patients being considered for surgical intervention, most surgeons feel that duplex scanning provides insufficient information for the planning of an operative reconstruction and that angiography is required. This is true for patients who need a femorodistal bypass as knowledge of the cruropedal outflow and the location of the distal anastomosis is essential for an operative reconstruction. The accuracy of duplex scanning of the lower leg arteries is, as yet, insufficiently validated. In contrast, it appears that there is less need for complementary angiography.
in patients requiring an aortoiliac reconstruction. Assessment of the aortoiliac arteries and the femoral outflow by duplex scanning is accurate and angiography seldom provides extra information which leads to a change in operative strategy.\(^1,5,9\) For instance, in a patient with a normal aorta, an occlusion of the ipsilateral iliac artery and patent femoral and contralateral iliac arteries on the duplex scan, the decision to do a central bypass, endarterectomy or femorofemoral crossover can easily be made without additional angiography. Most patients with aortoiliac stenosis or short occlusions will nowadays undergo a PTA whereas patients with long occlusions may need a surgical intervention. Therefore it is obvious that duplex scanning will have the greatest impact in the work-up of these patients and can replace angiography in many cases.

**Implementation and Potential of Duplex Scanning**

What are the prerequisites for duplex scanning to replace angiography as a preinterventional technique? Clinicians traditionally adhere to angiographic pictures of atherosclerotic lesions as a basis for therapy. To make a final decision solely based on duplex scanning requires a fundamental change of attitude. The clinician should turn both to changes in blood flow velocities in order to grade stenoses and to anatomic descriptions or drawings by the vascular technologist. Close collaboration between the vascular technologist, vascular surgeon and radiologist is necessary to render a complete and successful non-invasive work-up. Therefore, it is necessary that the surgeon and the radiologist are familiar with basic concepts, diagnostic criteria and pitfalls of duplex scanning.

The fact that experienced vascular technologists are not widely available, hampers the widespread implementation of duplex scanning. Only extension of the number of training programs, stimulated by the vascular societies, will remove this limitation.

Duplex scanning has the potential to further replace invasive investigations. Technical improvements of duplex scanners have made it possible to obtain details about small vessels like intracranial or crural arteries. It is conceivable that in the future femorodistal bypasses can, in selected cases, be performed without angiography. Certainly, duplex scanning already has additional value in case of failure of angiography to show patent arteries as a result of a low contrast load due to slow flow. In these cases duplex scanning may demonstrate a patent artery to which a graft can be anastomosed.

Intra-arterial pressure measurement at rest and under hyperaemic conditions is still the "gold standard" for the haemodynamic assessment of borderline lesions in the aortoiliac arteries. Current diagnostic duplex parameters, as well as angiography, may underestimate the haemodynamic significance of aortoiliac stenoses in up to 25% of cases.\(^13\) Usually, duplex scanning is performed under resting conditions, but a duplex scan after induction of hyperaemic flow is also possible.\(^5,14\) So far adequate "hyperaemic" Doppler criteria for clinical decision making have not been formulated. However, if these can be defined even the need for intra-arterial pressure measurements might be removed.

**References**


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