Peripheral arterial disease (PAD) is defined as an atherosclerotic disease process occurring within the blood vessels outside of the heart. Peripheral arterial disease commonly occurs in the renal arteries of the kidneys, the carotid arteries of the neck, and the arteries of the lower extremities. Over the past 50 years, the incidence and prevalence of PAD have climbed steadily in the majority of westernized countries affecting approximately 12 million persons in the U.S., and PAD has strong associations with increased morbidity and mortality rates (1,2). Traditionally, PAD has been diagnosed via catheter-based angiography driven by the presentation of symptoms.

To the Editor: Peripheral arterial disease (PAD) is defined as an atherosclerotic disease process occurring within the blood vessels outside of the heart. Peripheral arterial disease commonly occurs in the renal arteries of the kidneys, the carotid arteries of the neck, and the arteries of the lower extremities. Over the past 50 years, the incidence and prevalence of PAD have climbed steadily in the majority of westernized countries affecting approximately 12 million persons in the U.S., and PAD has strong associations with increased morbidity and mortality rates (1,2). Traditionally, PAD has been diagnosed via catheter-based angiography driven by the presentation of symptoms.

Significant improvements in non-invasive computed tomography (CT) imaging have been observed during the past decade, and the reduced slice thickness and increased spatial resolution of 64-slice CT now afford the opportunity to non-invasively image the peripheral vessels (Fig. 1) (3). It is hypothesized that the 64-slice generation of CT scanner may improve upon PAD diagnostic accuracy and needs to be referenced with direct catheter angiography, which remains the gold standard. The aim of the present study was to evaluate the accuracy of 64-slice peripheral CT to determine if improved performance metrics offer a lower risk, more efficient, non-invasive mode of peripheral angiography, which in selected clinical situations may replace the need for catheter angiography.

Data from 212 adult subjects (renal = 61, carotid = 44, lower extremity = 107) having both catheter and CT angiography for suspicion of PAD at the South Carolina Heart Center, (Columbia, South Carolina) were included in this cross-sectional, accuracy analysis. Both angiographic procedures were performed within 30 days of each other.

Peripheral CT angiography was performed after informed consent was provided using the Siemens Somatom Sensation Cardiac 64-slice CT (Siemens Medical, Malvern, Pennsylvania). Using the 64-slice CT scanner, a volume data set was acquired (64 × 0.6 mm collimation, gantry rotation time 33 ms, pitch 0.2 mm, tube voltage of 120 kV). Cross-sectional images were reconstructed with a slice thickness of 0.75 mm overlapping in 0.4-mm intervals.

Catheter and CT peripheral angiography results were analyzed independently by two expert readers, each blinded to the opinion of the other, and to the results of the second angiographic procedure. Results were analyzed for the quality of the imaging study and hemodynamically significant lesions (>50%).

The 119 renal vessels evaluated included the left and right renal arteries. Eighty-eight carotid arteries were evaluated including both the left and right systems. The 770 vessels of the lower extremities evaluated included the iliac arteries, femoral arteries, superficial femoral arteries, and popliteal arteries. Direct catheter angiography was considered the gold standard for accuracy comparisons.

Statistical accuracy analyses were performed using the Statistix 7 (Windows, Tallahassee, Florida) computer statistical application within the South Carolina Heart Center, Department of Investigator Initiated Research. Data are expressed as descriptive and accuracy statistics (sensitivity, specificity, positive predictive value [PPV], negative predictive value [NPV]).

Among the 211 study subjects (118 men), 977 peripheral vessels were observed and evaluated. The 64-slice peripheral CT provided images of technical quality allowing for diagnosis among 99.5% (210 of 211) of study subjects. The mean age of our study population was \( \mu = 60.2 \pm 10 \).

Among 61 subjects evaluated for suspicion of renal artery disease, 119 renal arteries were observed and evaluated. The 64-slice peripheral CT provided images of technical quality allowing for diagnosis among 100% (61 of 61) of renal artery study subjects. The 64-slice peripheral CT identification of hemodynamically significant lesions (>50%) within evaluated renal arteries was sensitivity 92%, specificity 92%, PPV 88%, and NPV 92% (Table 1) when referenced with catheter angiography.

Among the 44 subjects evaluated for suspicion of carotid artery disease, 88 carotid arteries were observed and evaluated. The 64-slice peripheral CT provided images of technical quality allowing for diagnosis among 100% (44 of 44) of carotid artery study subjects. The 64-slice peripheral CT identification of hemodynamically significant lesions (>50%) within measured carotid arteries was sensitivity 96%, specificity 100%, PPV 100%, and NPV 95% (Table 1).

Among 107 subjects evaluated for suspicion of lower extremity peripheral vascular disease, 770 arteries of the legs were observed and evaluated. The 64-slice peripheral CT provided images of technical quality allowing for diagnosis among 99% (106 of 107) of lower extremity study subjects. The 64-slice peripheral CT identification of hemodynamically significant lesions (>50%) within the measured lower extremity vessels was sensitivity 88%, specificity 96%, PPV 91%, and NPV 90% (Table 1) when referenced with catheter angiography.

A vessel-by-vessel accuracy analysis was conducted for the arteries of the lower extremities (Table 1). The 64-slice peripheral CT

![Figure 1. The 64-slice carotid artery computed tomography image.](image-url)
identification of stenotic lesions >50% within the iliac arteries was sensitivity 86%, specificity 95%, PPV 89%, and NPV 80%. Identification of lesions >50% within the femoral arteries was sensitivity 86%, specificity 100%, PPV 100%, and NPV 94%. Identification of lesions >50% within the superficial femoral arteries was sensitivity 90%, specificity 90%, PPV 90%, and NPV 84%. Hemodynamically significant lesions (>50%) within the popliteal arteries were detected at sensitivity 90%, specificity 96%, PPV 82%, and NPV 98% via 64-slice peripheral CT.

With improved spatial resolution, decreased slice thickness, and reduced acquisition times, 64-slice CT angiography has the ability to detect significant atherosclerotic lesions of the peripheral vasculature, while maintaining the ability to reliably identify the absence of significant arterial blockage. Previous citations suggest that CT angiography is a valuable diagnostic tool, capable of accurately ruling out the presence of significant lesions based on sufficient specificity and negative predictive values (4,5). Previous limitations of CT angiography were the marginal ability to sufficiently detect significant lesions and positively predict disease at a high accuracy level (4). Our results suggest that the 64-slice generation of multislice CT has sufficient sensitivity and positive predictive value to allow peripheral CT angiography to be considered for routine diagnostic evaluations. The agreement between 64-slice peripheral CT and catheter angiography supports the strength of the latest generation of CT imaging.

The 64-slice peripheral CT angiography findings compare favorably with traditional catheterization in this study of patients assessed for PAD. The prospect of utilizing peripheral CT angiography in lieu of catheter angiography is appealing based upon the patient-friendly, non-invasive nature of the procedure, as well as the markedly reduced economic impact of CT angiography when compared to catheterization. Among the carotid, renal, and lower extremity arteries both sensitivity and specificity were sufficiently high to rely upon results of peripheral CT angiography when evaluating the presence of PAD.

Our analysis suggests that 64-slice peripheral CT angiography is an accurate and reliable method of non-invasively assessing PAD. The noninvasive nature of this diagnostic test allows for PAD detection that is time efficient for both the patient and medical care providers. Collectively, these advantages of 64-slice peripheral CT angiography may enhance its use as a PAD diagnostic tool.

*Jeffrey J. Fine, PhD, MS

*Cardiovascular Innovations (CVI), LLC
Vice President of Research and Education
10 Judge Island Drive
Beaufort, South Carolina 29907
E-mail: jfine@csaheart.com

REFERENCES


Letters to the Editor

Serum Plant Sterols and Atherosclerosis: Is There a Place for Statin–Ezetimibe Combination?

We read with interest the paper by Miettinen et al. (1) demonstrating that the higher the absorption of cholesterol, the higher the plant sterol contents in serum resulting in their higher contents in atherosclerotic plaque. The prospective Cardiovascular Minster (PROCAM) study found that people in the upper quartile of sitosterol levels had a 1.8-fold increased risk of major coronary events compared with those in the lower three quartiles (2). Statin treatment decreases cholesterol synthesis but increases absorption of plant sterols (3). In the Scandinavian Simvastatin Survival Study (4S), no reduction was observed in recurrence of coronary heart disease with the use of simvastatin in patients with high baseline plant sterol contents and with marked increase of serum plant sterols during the five-year treatment period (4). Additional treatment with inhibition of sterol absorption (e.g., with plant stanol esters) was suggested for this particular group of patients (3,4). To this respect, we were surprised that Miettinen et al. (1) did not consider the potential of combining ezetimibe with statin. Indeed, in addition to inhibiting intestinal cholesterol absorption, a well-known effect, ezetimibe also reduces plasma concentrations of the non-cholesterol sterols sitosterol and campesterol, suggesting an effect on the absorption of these compounds as well (5). It has been demonstrated recently that the Niemann-Pick