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RESEARCH ARTICLE

MEASUREMENT THE DIAMETER OF ABDOMINAL AORTIC AND FEMORAL ARTERY FOR DIABETIC AND HYPERTENSIVE PATIENTS IN CTA USING MDCT

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ABSTRACT

This study concern the measurement of the diameter of abdominal aortaat its bifurcation to right and left femur artery, for diabetic patients and hypertensive patients and normal ascontrol group using Multi Detector Computed Tomography MDCT 64 slice. Information was available for 300 patients, 100 patient's diabetics, 100 hypertensives and 100 normal as a control group, Diameter measurement of abdominal aortic at its bifurcation to right and left femur artery and the study sample diabetic patients and hypertensive and control group a normal; the average diameter of normal femoral artery was (7.96 mm) which is bigger than that of hypertensive patients (7.41 mm) and diabetic (5.91 mm) patients, for abdominal aorta bifurcation of hypertensive patients the diameter was (17.18 mm) which is bigger thanthe normal (16.47 mm) and diabetic patient's which is (14.89 mm). diameter of abdominal aorta and its bifurcation to left and right femoral artery show that the hypertensive patients showed bigger diameter than the normal and diabetic patients, and the dimension of left and right femoral artery the normal patients showed bigger diameter than hypertensive and diabetic patients.

INTRODUCTION

For many decades, invasive digital subtraction angiography (DSA) has been accepted as the gold standard technique for vascular imaging and for peripheral artery disease (PAD) evaluation. However, DSA only provides a two-dimensional view of the vessels, which may underestimate the degree of stenosis for eccentric lesions and tortuous vessels. Moreover, DSA has non-negligible risks associated with arterial puncture, iodinated contrast medium and ionizing radiation. At this point, it is easy to understand that recent and rapid developments in non-invasive techniques as computed tomography angiography (CTA) and magnetic resonance angiography (MRA) are replacing DSA in the diagnostic algorithm for PAD. In fact, DSA is nowadays primarily reserved for patients undergoing therapeutic endovascular interventions rather than purely diagnostic studies (Tendera, 2011). Both CTA and MRA allow us to obtain high-resolution multiplanar and three-dimensional images of the peripheral arteries in a noninvasive approach. Similarly, both are accurate techniques for evaluating PAD severity, with excellent (≈95%) sensitivities and specificities compared to the accepted standard DSA (Jens *et al*., 2013; Pollak *et al*., 2012 and Cao *et al*., 2011). Thus, the individual use of each modality depends on local availability, medical expertise, patient's characteristics (e.g. diabetes, renal insufficiency, implanted metal devices, prior bypass grafts, etc.), costs and information required. We facilitate a brief summary of the current state of both techniques from a clinical point of view, highlighting the strengths and limitations of each modality. The widespread availability of multidetector scanners has helped overcome the limitations of the older generations. Shorter acquisition times, thinner slices and higher spatial resolution reduce respiration and motion artefacts, allow visualization of smaller and distal vessels, and enable scanning of the entire vascular tree in a limited period with a decreasing (but still substantial) amount of contrast medium and radiation burden (Iglesias, 2014; Baim, 2006 and Poletti *et al*., 2004). The limitation of CTA is mainly the evaluation of severely calcified lesions, where the high attenuation induces blooming artefact that results in an overestimation of stenosis. This effect becomes more relevant in small vessels (such as the infra popliteal vessels), leading to a lower diagnostic performance of CTA in tibial disease than in aorta i1liac and femoral levels. The two main disadvantages of CTA are the need for potentially nephrotoxic contrast agents (median 100-120 ml) and radiation exposure (average radiation dose reported 7.5 mSv) (Iglesias, 2014; Baim, 2006

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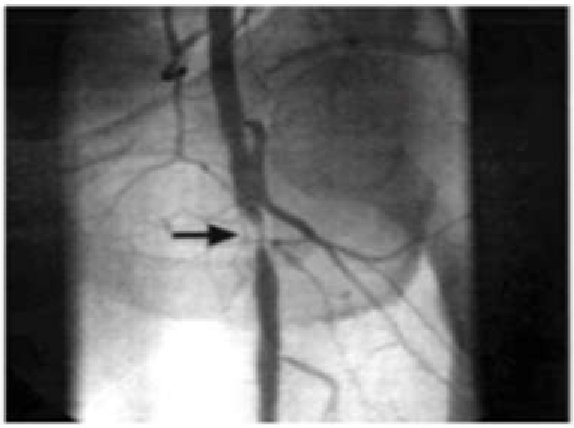
and Poletti *et al*., 2004). Lower-extremity arteriography is also easily performed using a single femoral access point. The ipsilateral lower limb can be imaged though the common femoral access sheath, while the contralateral lower limb can be imaged crossing the aorto-iliac bifurcation and selective iliac angiography. The optimal view for the common femoral bifurcation is 30 to 45º of ipsilateral oblique angulation. The superficial femoral artery can be imaged in an antero-posterior view with the addition of an oblique angle if a stenosis is suspected. The popliteal artery, tibio-peroneal trunk and trifurcation are best imaged in an ipsilateral oblique angle (30º).



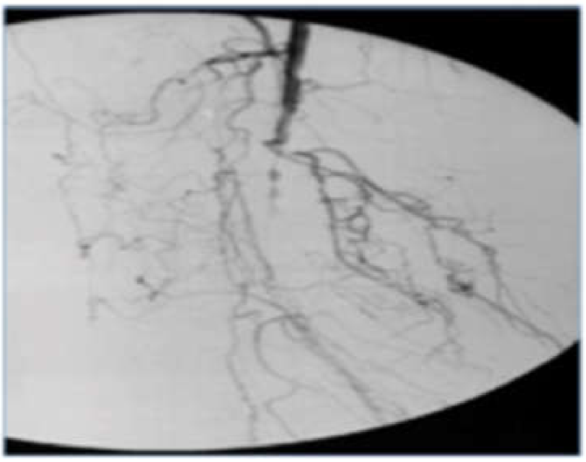


Figure 1. Left: Angiographic view of a severe stenosis in the left superficial femoral artery, Right: Angiographic appearance of an occlusion of the distal superficial femoral artery with collateral vessels

Peripheral arterial disease (PAD) is atherosclerosis leading to narrowing of the major arteries distal to the aortic arch. The diagnosis of PAD is challenging in patients with diabetes for a number of reasons. Firstly, co-existing symmetrical distal polyneuropathy, present in a signi cant proportion of patients with diabetes and particularly those with foot ulceration, may mask symptoms of PAD such as intermittent claudication and ischemic rest pain. Patients may therefore present at a more advanced PAD stage than their non-diabetic counterparts (Apelqvist *et al*., 2012). Physical examination is of limited value (Schaper *et al*., 2002) and does not provide reliable information to determine whether PAD is present nor doesit reliably assesses its severity. Oedema, neuropathy and infection, frequently co-existing in the presence of ulceration, make the clinical assessment for PAD dif cult and may hamper the performance of diagnostic tests for PAD. Moreover, the greater prevalence of medial sclerosis (medial arterial calci cation) among patients with diabetes can render pedal arteries incompressible on cuff in ation during external arterial pressure measurements such as with ABI or toe pressures (Jeffcoate *et al*., 2009). There are few robust data on the usefulness of tests to diagnose or rule out PAD, including ABI, in diabetes and particularly in those with ulcerated feet. The aim of this systematic review was to evaluate the performance of index non-invasive diagnostic tests against reference standard imaging techniques for the detection of PAD among patients with diabetes. Peripheral arterial disease in patients with diabetes adversely affects quality of life (Jeffcoate, 2009) and is associated with substantial functional impairment (Munger *et al*., 2004). The reduced walking speed anddistance associated with intermittent claudication may result in progressive loss of functionand long-term disability (Ness *et al*., 1999 and Beckman *et al*., 2002). With more severe disease, critical limb ischemia (CLI) may develop, resulting in ischemic ulceration of the foot and risk of limb loss (Khaira *et al*., 1996 and Vogt *et al*., 1994). Importantly, PAD is associated with a substantial increase in the risk of fatal and non-fatal cardiovascular and cerebrovascular events, including myocardial infarction (MI) and stroke (American Diabetes Association, 2003 and McDermott *et al*., 2004). Patients with diabetes and PAD are at higher risk of lower extremity amputation than those without diabetes (Hiatt *et al*., 2002). Furthermore, cardiovascular and cerebrovascular event rates are higher in diabetic individuals with PAD than in comparable non-diabetic populations (Ness *et al*., 1999). Although much is known about PAD in the general population, the management of PAD in those with diabetes is less clear. Recently, the American Diabetes Association (ADA) issued a consensus statement that provides guidelines for the diagnosis and management of PAD in patients with diabetes (Ness *et al*., 1999). The purpose of this article is to review the consensus statement and to discuss the treatment options available to help prevent future ischemic events in diabetic individuals with PAD. Patients with diabetes are clearly a high-risk group of individuals who are at risk of developing extensive vascular disease requiring a multi-discipline approach. Cardiovascular healthcare providers have a unique opportunity to reduce the disease burden in this population.

MATERIAL AND METHODS

The study was performed on 300 consecutive patientsin Khartoum state, MDCT 64 slice Toshiba All investigations were done with the subject in the supine position. The maximal anteroposterior diameter was registered with the CT machine for bifurcation and the right and left branches. CTA allows identification of the aneurysm and differential diagnosis from ectasia (caliber increasing less than 50%), the description of the lesion, evaluating location, length, extension, transverse diameter (valuated always perpendicularly to major vascular board), presence of calcifications and location of thrombotic apposition (concentric/ eccentric) measuring its maximum thickness, evaluating the look of its edges and excluding the possible presence of perversity that can suggest an instable nature of the thrombus.

RESULTS

Table 1. show statistical description of normal and diabetics patients

Classes		Mean	Std. Deviation
LowerLt	Normal	7.740	1.1075
	Diabetes	5.128	2.3988
MediumLt	Normal	7.896	1.0662
	Diabetes	5.750	2.1644
UpperLt	Normal	8.078	1.1687
	Diabetes	6.894	1.6572
LowerRt	Normal	7.992	1.1089
	Diabetes	5.322	1.8139
MediumRt	Normal	7.9680	1.15819
	Diabetes	5.7926	1.52981
UpperRt	Normal	8.100	1.1101
	Diabetes	6.561	1.3677
Bifurcation	Normal	16.4700	1.84759
	Diabetes	14.8993	2.86645

Table 2. Show independent sample T-Test for equality of means for normal and diabetics patients

	t-test for Equality of Means	
	t	p-value
LowerLt	7.035	.000
MediumLt	6.334	.000
UpperLt	4.178	.000
LowerRt	8.969	.000
MediumRt	8.126	.000
UpperRt	6.270	.000
Bifurcation	3.292	.001

Table 3. show statistical description of normal and hypertensive patients

Classes		Mean	Std. Deviation
LowerLt	Normal	7.740	1.1075
	Hypertensive	7.348	2.0344
MediumLt	Normal	7.896	1.0662
	Hypertensive	7.554	1.5871
UpperLt	Normal	8.078	1.1687
	Hypertensive	7.848	1.4733
LowerRt	Normal	7.992	1.1089
	Hypertensive	6.566	2.1859
MediumRt	Normal	7.9680	1.15819
	Hypertensive	7.3678	1.88747
UpperRt	Normal	8.100	1.1101
	Hypertensive	7.764	1.8051
Bifurcation	Normal	16.4700	1.84759
	Hypertensive	17.1940	2.11597

Table 4. show independent sample T-Test for equality of means for normal and hypertensive patients

	T-Test for Equality of Means	
	t	p-value
LowerLt	1.197	.234
MediumLt	1.265	.209
UpperLt	.865	.389
LowerRt	4.114	.000
MediumRt	1.916	.058
UpperRt	1.121	.265
Bifurcation	-1.822	.071

DISCUSSION

Measurement of abdominal aorta at its bifurcation to left and right femoral artery for normal, diabetic and hypertensive patients in regard to 300 patients with Computed Tomography

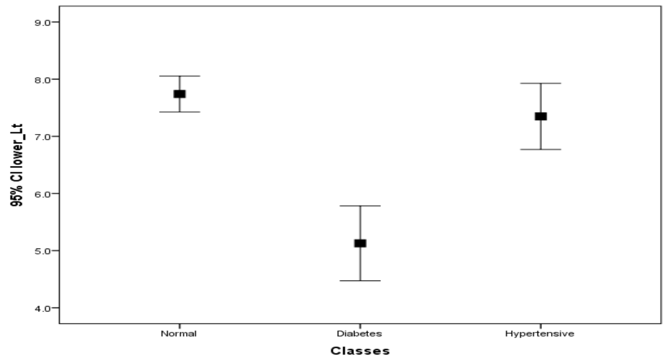


Fig 2. Show Error bar for normal, diabetics and hypertensive for left lower femoral artery

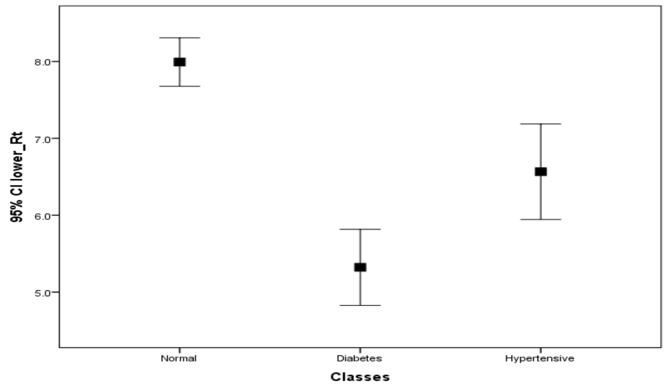


Fig 3. Show Error bar for normal, diabetics and hypertensive for right lower femoral artery

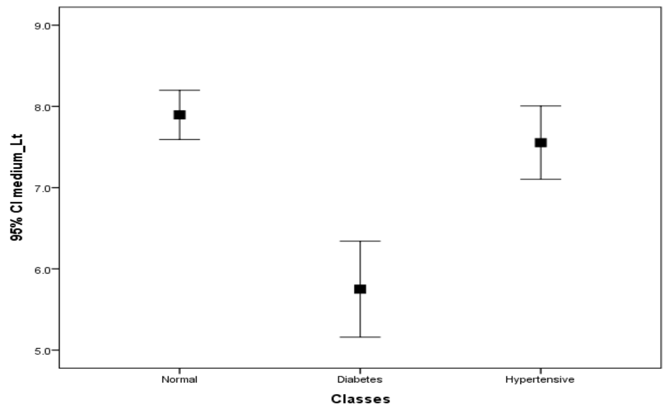


Fig 4. Show Error bar for normal, diabetics and hypertensive for left medium femoral artery

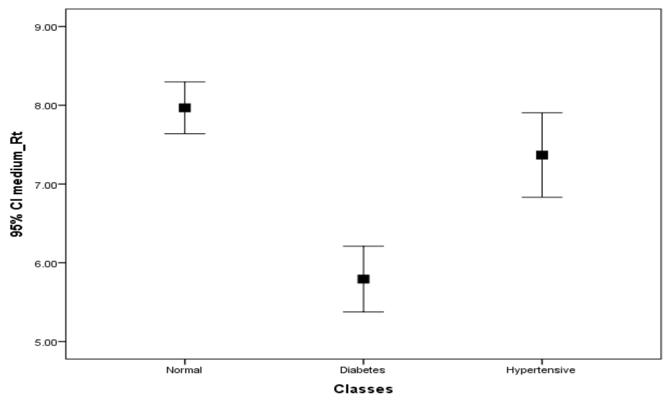


Fig 5. Show Error bar for normal, diabetics and hypertensive for right medium femoral artery

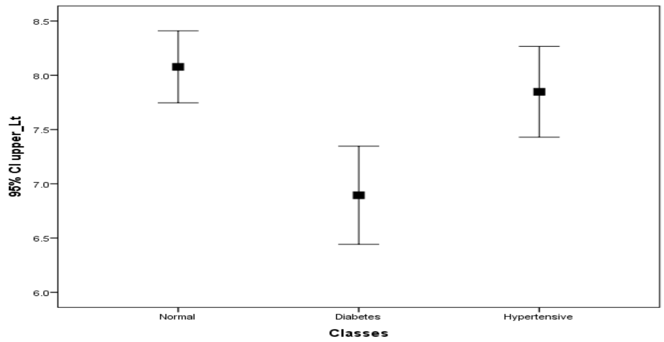


Fig 6. Show Error bar for normal, diabetics and hypertensive for left upper femoral artery

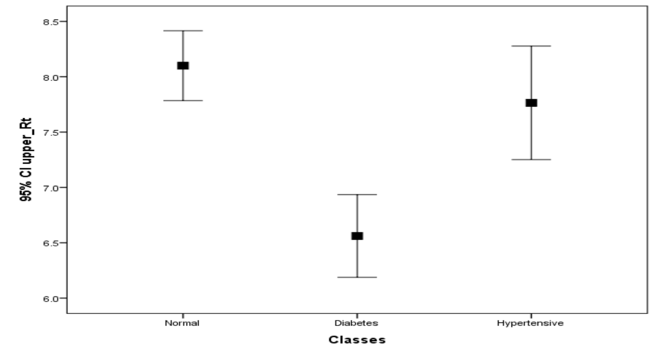


Fig 7. Show Error bar for normal, diabetics and hypertensive for right upper femoral artery

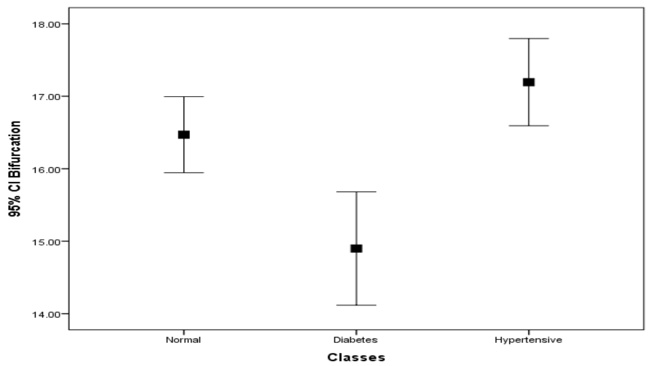


Fig 8. Show Error bar for normal, diabetics and hypertensive for bifurcation of abdominal artery

Angiography to lower limb, where all measures done in MDCT in Toshiba 64 slice and helping with RadiAnt DICOM viewer. Measurement of the lower, medium and upper left femoral artery (mean ± SD) for normal was 7.74±1.11, 7.89±1.07 and 8.08±1.17mm respectively while for diabetic patients were 5.13±2.39, 5.75±2.16 and 6.89±1.66; this result showed that there is differences between the normal and diabetic patients concerning left femoral artery. This differences was significant using t-test at p =0.05 (Table 1 &2). For the Rt side the measurement for normal patient it was 7.99±1.11, 7.96±1.16 and 10±1.11 mm respectively while for diabetic patient it was 5.32±1.81, 5.97±1.53 and 6.56±1.37 mm respectively also these differences was significant. These results dictated that in diabetic patient the diameter of the femoral artery (lt and Rt) at lower, medium and upper part were smaller than the normal patient. Similarly the diameter at bifurcation showed significant differences between the normal and diabetic patients where the diameter was bigger in normal than diabetic; 16.47±1.85 and 14.89±2.87 mm for normal and diabetic respectively (Table 1). The measurement for hypertensive patients in respect to the previous normal values was as follows; for Lt Sideof the femoral artery were 7.35±2.03, 7.55±1.59 and 7.84±1.47 mm this results showed slight change from the normal but this changes were not significant at p =0.05 using t-test. While for the Rt side the measurement was 6.57±2.18, 7.36±1.88 and 7.78±1.81mm only the lower Rt part of the femoral artery showed significant difference from normal; where the diameter in normal was bigger than the that of hypertensive patient. Concerning bifurcation there is difference between the normal and hypertensive patient; where it is slightly bigger in hypertensive than normal 17.19±2.12 and 16.47±1.85 but this differences were inconclusive using t-test at p = 0.05. Figure 2,3,4,5,6,7 and 8 an Error bar showed the distribution of the average diameter for the left and right side of femoral artery and abdominal aorta bifurcation.

Conclusion

Measurement dimeter of abdominal aortic at its bifurcation to right and left femur artery and the study sample diabetic patients and hypertensive and control group (normal), thediameter of left and right femoral artery, the diameter of normal bigger than the diameter of hypertensive and diabetic patients, but significant in case of diabetic patients, for abdominal aorta bifurcation the hypertensive patients showed slightly bigger diameter than normal and diabetic patient's diameter was smaller but this differences were inconclusive.

REFERENCES

Adler, A.I., Boyko, E.J., Ahroni, J.H., Smith, D.G. 1999. Lower-extremityamputation in diabetes. Diabetes Care, 22:1029 –35.

American Diabetes Association. 2003. Peripheral arterial disease in people with diabetes. Diabetes Care, 26:3333–41.

Apelqvist JA1, Lepäntalo MJ. 2012. The ulcerated leg: when to revascularize. *Diabetes Metab Res Rev,* 28(Suppl 1): 30–5.

Baim, DS. 2006. Grossman´s Cardiac Catheterization, Angiography and Intervention [7thedn].

Beckman JA, Creager MA, Libby P. 2002. Diabetes and atherosclerosis. Epidemiology, pathophysiology and management. JAMA., 287: 2570–81.

Cao P, Eckstein HH, De Rango P, Setacci C, Ricco JB, *et al.* 2011. Chapter II: Diagnostic methods. Eur J VascEndovascSurg 42 Suppl 2: S13-32.

Dormandy JA, 2000. Rutherford RB. Management of peripheral arterialdisease. TASC Working Group. *J Vasc Surg.,* 31:S1–296

Hiatt, W.R. 2002. Preventing atherothrombotic events in peripheral arterialdisease: the use of antiplatelet therapy. *J Intern Med,* 251:193–206.

Iglesias J, Peña C2 2014. Computed tomography angiography and magnetic resonance angiography imaging in critical limb ischemia: an overview. *Tech VascIntervRadiol* 17: 147-154.

Jeffcoate WJ, Rasmussen LM, Hofbauer LC, Game FL.2009. Medial arterial calci cation in diabetes and its relationship to neuropathy. Diabetologia, 52: 2478–88.

Jens S, Koelemay MJ, Reekers JA, Bipat S 2013. Diagnostic performance of computed tomography and contrast-enhanced magnetic resonance angiography in patients with critical limb ischaemia and intermittent claudication: systematic review and meta-analysis. *EurRadiol* 23:3104-3114.

Jude EB, Oyibo SO, Chalmers N, Boulton AJ. Peripheral arterialdisease in diabetic and nondiabetic patients: a comparison of severityand outcome. *Diabetes Care,* 24:1433–7

Khaira, H.S., Hanger, R., Shearman, C.P. 1996. Quality of life in patients with intermittent claudication. *Eur J VascEndovascSurg 1*996;11:65–9

McDermott, M.M., Liu, K, Greenland P, *et al*. 2004. Functional decline in peripheral arterial disease: associations with the ankle brachial indexand leg symptoms. JAMA, 292:453– 61.

Munger MA, Hawkins DW. 2004. Atherothrombosis: epidemiology, pathophysiology, and prevention. *J Am Pharm Assoc*, 44 Suppl1:S5–13.

Ness J, Aronow WS. 1999. Prevalence of coexistence of coronary artery disease, ischemic stroke, and peripheral arterial disease in older persons, mean age 80 years, in an academic hospital-based geriatrics practice. *J Am GeriatrSoc.,* 47:1255– 6.

Poletti PA, Rosset A, Didier D, Bachmann P, Verdun FR, *et al*. 2004. Subtraction CT angiography of the lower limbs: a new technique for the evaluation of acute arterial occlusion. *AJR Am J Roentgenol* 183: 1445-1448.

Pollak, A.W., Norton, P.T., Kramer, C.M. 2012. Multimodality imaging of lower extremity peripheral arterial disease: current role and future directions. Circ Cardiovasc Imaging 5 : 797-807.

Schaper NC, Nabuurs-Franssen MH. The diabetic foot: pathogenesis and clinical evaluation. *SeminVasc Med* 2002; 2: 221–228.

Tendera M, Aboyans V, Bartelink ML, Baumgartner I, Clement D, *et al*. 2011. ESC Guidelines on the diagnosis and treatment of peripheral artery diseases: Document covering atherosclerotic disease of extracranial carotid and vertebral, mesenteric, renal, upper and lower extremity arteries: the Task Force on the Diagnosis and Treatment of Peripheral Artery Diseases of the European Society of Cardiology (ESC). *Eur Heart J* 32: 2851-2906.

Vogt MT, Cauley JA, Kuller LH, Nevitt MC. Functional status and mobility among elderly women with lower extremity arterial disease. *J Am GeriatrSoc*., 1994; 42:923–9.

Weitz JI, Byrne J, Clagett GP, *et al*. Diagnosis and treatment ofchronic arterial insuf ciency of the lower extremities: a critical review. *Circulation* 1996; 94:3026 –49.

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