

Is Assessment of Popliteal Artery Diameter in Patients Undergoing Screening for Abdominal Aortic Aneurysms a Worthwhile Procedure

G. Morris-Stiff,^{1*} M. Haynes,¹ S. Ogunbiyi,¹ E. Townsend,¹ S. Shetty,¹ R.K. Winter² and M.H. Lewis¹

Departments of ¹Surgery, and ²Radiology, Royal Glamorgan Hospital, Ynysmaerdy, Llantrisant, Rhondda Cynon Taf, UK

Purpose. The aim of this study was to assess whether screening of popliteal arteries in patients undergoing ultrasound screening of their abdominal aortas was worthwhile.

Methods. All male patients undergoing ultrasound screening for abdominal aortic aneurysm (AAA) during the period February 2000 to June 2002 were offered scanning of their popliteal arteries. All scans were performed by a single, trained operator using a Sonosite 180.

Results. Four hundred and forty-nine patients underwent screening and thus 898 popliteal arteries were assessed. The mean aortic diameter was 2.1 standard deviations (SD) 0.5 cm and the upper limit of normal (2 SD) was 2.7 cm. The mean diameter of the popliteal arteries was 0.74 SD 0.11 and the upper limit of normal was 0.96 cm. Thirty patients had aortic diameters greater than 2.5 cm (ectatic or aneurysmal aortas) but based on a popliteal diameter of 2 cm, no popliteal aneurysms were detected. However, 39 (4.3%) popliteal arteries measured ≥ 1 cm ($>$ mean + 2 SD); 3/60 (5%) in the ectatic/AAA subgroup and 36/838 (4.3%) in the non-AAA subgroup.

Conclusions. This study has shown that, using conventional definitions, the imaging of popliteal arteries during screening for AAAs does not detect any popliteal aneurysms and is thus of limited value. However, if a definition of popliteal aneurysm of ≥ 1 cm (based on mean + 2 SD) is used then 39/898 (4.3%) of arteries would be regarded as having abnormal diameters and may require surveillance.

Keywords: Popliteal artery; Abdominal aorta; Aneurysm; Ultrasound; Screening.

The Multicentre Aneurysm Screening Study (MASS) has provided reliable evidence as to the benefit of screening for abdominal aortic aneurysms (AAAs)¹ and has supported the data from other randomised trials.^{2–5} Furthermore, a recent consensus statement representing the views of American surgeons and radiologists has recommended screening for all men aged 60–85 years.⁶ There are as yet no randomised trials assessing the role of screening for peripheral aneurysms.

Popliteal artery aneurysms (PAAs) are the commonest peripheral artery aneurysm and like aortic aneurysms, they typically present in the seventh decade with a high male predominance of around

30:1.⁷ They are typically defined as a popliteal artery diameter of 2 cm or greater.^{7,8} Szilagyi and colleagues,⁷ based on their experience of 87 PAAs suggested operative intervention for patients with a popliteal artery diameter greater than 2.0 cm.

Half of all PAAs are detected either during systemic arterial examination or as incidental radiological findings. However, this means that up to 50% of aneurysms present as emergencies with complications such as rupture, compression of local structures (popliteal vein or nerve) or acute ischaemia of the distal limb as a result of thrombosis or embolus. These are all potentially limb threatening conditions and surgery for these conditions yields inferior results to elective surgery with increased amputation rates, a higher mortality rate and reduced graft patency rates.^{8,9} As a result, surgery for asymptomatic PAAs, once detected, is advocated.

Up to 40% of patients with popliteal aneurysms

Abbreviations: AAA, Abdominal aortic aneurysm; PAA, Popliteal artery aneurysm; SD, Standard deviation.

*Corresponding author. Mr G. Morris-Stiff, MB BCh, MD, 1 Golygfa'r Eglwys, Maesycod, Pontypridd, Rhondda Cynon Taf CF37 1JL, UK.

E-mail address: garethmorrisstiff@hotmail.com

have associated abdominal aortic aneurysms (AAAs), rising to 70% if they have bilateral popliteal aneurysms.^{10,11} A recent study from the United States¹² has added further controversy as it suggested that as many as one in seven patients with AAAs also have a popliteal aneurysm thus prompting the question—should we be looking for popliteal aneurysms in patients with AAAs?

In our region, screening for AAAs commenced in 1991 with a formal screening program being instituted in 1994.¹³ This gave the opportunity of screening for asymptomatic PAAs at the same time as screening for AAAs.

Patients and Methods

The study was approved by the local research and ethics committee prior to its commencement. All male patients undergoing scanning of their aortas as part of our community AAA ultrasound screening program during the period February 2000 to June 2002 were invited to give informed consent to the performance of an ultrasound assessment of the diameter of their popliteal arteries.

All scans were performed by a vascular nurse specialist using a Sonosite 180 (Sonosite, Bothell, WA, USA) portable ultrasound scanner. The maximum transverse and anteroposterior diameters of the aorta were determined and if either measurement was ≥ 2.5 cm the aorta was considered aneurysmal. Likewise, for the popliteal arteries, both the transverse and anteroposterior diameters were recorded. For the purposes of the study, the larger of the two diameters in each case was used during the analysis. The inter- and intra-observer variability of the portable ultrasound scanner has been discussed previously.⁷

The aortic and popliteal diameters were plotted and the data tested for normality using the statistics package SPSS 11.0 (SPSS Inc., Chicago, IL, USA). According to the principles of Gaussian distribution a value outside that of mean + 2 SD is regarded as being outside the normal range. In the case of the aorta and popliteal artery this was taken to represent an aneurysmal vessel.

Results

During the period of the study, 449 male patients aged 60 years or older were assessed, thus providing 898 popliteal arteries from which measurements of diameter could be obtained. The mean patient age was 67.5 (SD 5.3) years. Aortic diameters determined in 449

patients fitted the bell-shaped pattern of normal distribution (Fig. 1). The mean aortic diameter was 2.1 cm and the upper limit of normal (mean + 2 SD) was calculated to be 2.7 cm. Thirty patients were identified as having AAAs based on an aortic diameter of ≥ 3 cm.

For the popliteal artery the distribution of external diameters of 898 was assessed and the plot found to fit a Gaussian distribution (Fig. 2). The mean diameter of the popliteal artery in this population was 0.72 cm and the upper limit of normal was calculated to be 0.98 cm. Given this information, 39 arteries should be regarded as being ectatic or aneurysmal. In eight patients, there were bilateral arteries ≥ 1 cm, in 10 cases the left artery was large and in 13 cases the right popliteal artery was enlarged. Overall, 31 patients had one or more popliteal arteries measuring ≥ 1 cm.

The cardiovascular risk factors according to size of the popliteal artery are summarised in Table 1. Hypertension, hypercholesterolaemia and diabetes mellitus were defined as the need for medication to control these factors namely antihypertensive medications, lipid lowering agents and hypoglycaemic (oral or insulin), respectively. There was no significant difference in the prevalence of risk factors between the two groups apart from that of diabetes mellitus which appeared to be more common in patients with normal diameter popliteal arteries.

Discussion

The primary finding of this study was that of the 898 popliteal arteries examined in 419 patients undergoing screening for AAAs, no PAAs were detected. There is, however, some debate as to the definition of the size of a popliteal artery aneurysm and indeed the size of a normal popliteal artery. Johnston *et al.* on behalf of the Society for Vascular Surgery and the North American Chapter of the International Society for Cardiothoracic Surgery defined the standards for reporting on arterial aneurysms.¹⁴ It quoted only a single paper on the size of the popliteal artery which was published in 1977 and used B-mode ultrasound as its method of investigation. This study noted a mean of 0.9 cm and SD of 0.2 cm giving a range of 0.5–1.3 cm for the normal popliteal artery diameter. Johnston and colleagues also suggested that the definition of an aneurysm should be '...permanent localized (i.e. focal) dilation of an artery having at least a 50% increase in diameter compared to the expected normal diameter of the artery in question'. This would translate to a diameter of 1.35 cm in Johnston's paper and 1.07 in our series.

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