Expansion Rates of Asymptomatic Popliteal Artery Aneurysms

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Objectives. In the absence of symptoms the decision to operate on popliteal artery aneurysms (PA) is often made on PA diameter. Little information exists on growth rate and therefore optimum scanning intervals. The aim of this paper is to define growth rate of PA managed conservatively.

Methods. A prospective study of patients with asymptomatic PA was carried out. Patients were invited for ultrasound scanning at 6–12 months intervals. Diameter changes between consecutive pairs of scans were measured. A decision to operate was made in fit patients if PA became symptomatic and/or had a diameter above 3 cm.

Results. Twenty-one men (24 aneurysms) with a median age of 69 years (46–86) underwent 78 scans. Sixteen PA were on the right and eight on the left. Eighteen patients had bilateral aneurysms, 15 of which were complicated on one side at presentation and were dealt with surgically on that side. The median size at first scan was 19 mm (14–36). The median time interval to the first follow-up scan was 9 months and subsequent scans were 12 months. The mean rate of expansion at aneurysm sizes below 20 mm diameter was 1.5 mm/year. PA grew by 3.0 mm/year at sizes 20–30 mm and by 3.7 mm/year at sizes >30 mm. Among the risk factors analysed, hypertension appeared to increase the risk of aneurysm growth.

Conclusion. The expansion rate of PA increases with increasing size of the PA. This rate of growth in relation to size at previous scan and threshold diameter for intervention should be borne in mind when planning surveillance intervals.

Key Words: Aneurysm; Popliteal artery; Expansion rate.

Introduction

Management of asymptomatic popliteal artery aneurysms remains controversial. On the one hand thrombosis is associated with a high limb loss.1 However, popliteal artery aneurysms (PA) often occur in old men with significant co-morbidities. Furthermore both limb loss and mortality following elective repair have been reported. The average rate of development of symptoms in patients with PA is approximately 14% per year.1 Factors which have been suggested as being associated with thrombosis, and therefore indicators of early elective repair, include thrombus within the aneurysm,2 distortion or stenosis of the aneurysm,3 poor run-off4 and diameter. Some authors suggest a diameter of more than 2 cm but others 3 cm as the cut-off point for advising elective repair.5 Whatever the threshold size chosen data regarding growth of PA are important in deciding scanning intervals. The aim of this paper is to describe growth rates of asymptomatic popliteal artery aneurysms undergoing ultrasound surveillance.

Methods

A prospective study of all patients with popliteal artery aneurysms presenting to one institution was undertaken from January 1988 to August 2003. Popliteal aneurysm was defined as a localised dilatation of the popliteal artery greater than 2 cm or greater than 150% of the normal proximal artery calibre.6,7 In the early years of the study (1988–Jan 1993) the threshold for operation was 2 cm diameter. However, since then a threshold of 3 cm was chosen. This decision was based upon our previous findings that size greater than 3 cm and distortion within or outside the aneurysm were significant risk factors for thrombosis.3

A total of 105 popliteal artery aneurysms presented to the unit in the study period. Forty-four were thrombosed at presentation. Of the 61 that were non-thrombosed, 40 were asymptomatic. Of these 24 underwent surveillance. The patients who underwent

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conservative management and were invited for surveillance were those having aneurysms less than 3 cm in diameter and did not have evidence on angiography of distortion or stenosis within or above or below the aneurysm. Other aneurysms managed conservatively were those where the patients were unfit or declined an operation.

Patients were invited for ultrasound scanning at 6–12 monthly intervals. Statistical analysis was undertaken using Mann–Whitney test or Fishers exact test, as appropriate (Prism2.01, GraphPad software).

**Results**

Some 21 men (24 aneurysms) with a median age of 69 years (46–86 years) underwent 78 scans. Eighteen patients had bilateral aneurysms. Fifteen of these were complicated on one side at presentation and were dealt with surgically on that side. Sixteen PAA were on the right and eight on the left. The median size at first scan was 19 mm (14–36). Cardiovascular risk factors included ischaemic heart disease (seven), hypertension (seven), and stroke or TIA (three). Seven patients were smoking at time of initial presentation and 13 had abdominal aortic aneurysms. Fig. 1 shows the results of serial ultrasound scans in the 24 aneurysms. Growth rates are shown in Table 1. Smaller PA grew more slowly than larger aneurysms. However, this failed to reach statistical significance ($p = 0.15 < 2$ cm versus $2–3$ cm; $p = 0.44 2–3$ cm versus $>3$ cm). In the three patients with bilateral PAA, expansion was similar in both legs. Of these, in two patients none of the PAA grew, while in the third it expanded by 8 mm in 54 months in one leg and by 6 mm in 48 months in the other. Eight of the 24 popliteal aneurysms exhibited no growth throughout the study. These were in the seven patients who had no history of hypertension. Thus PAA in patients with no hypertension were more likely to remain stable in size compared with those in patients with hypertension ($p = 0.02$). There was no difference in the original size of PA in patients with or without hypertension (14–36 mm, median 21 versus 14–30 mm, median 19, respectively, $p = 0.27$). None of the other risk factors correlated with expansion or lack of expansion of the popliteal aneurysms.

**Fig. 1.** Serial ultrasound scans of 24 aneurysms. X-axis represents time since diagnosis. Y-axis the diameter in mm. Each USS episode is represented by (●).
Table 1. Annual growth rate of PAA at different sizes

<table>
<thead>
<tr>
<th>n Popliteal aneurysms</th>
<th>n Scans</th>
<th>Annual mean growth rate (mm)</th>
<th>95% Confidence intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2 cm</td>
<td>34</td>
<td>1.5</td>
<td>-0.018 – 3.018</td>
</tr>
<tr>
<td>2–3 cm</td>
<td>28</td>
<td>3.0</td>
<td>0.191 – 5.727</td>
</tr>
<tr>
<td>&gt;3 cm</td>
<td>16</td>
<td>3.7</td>
<td>0.216 – 7.272</td>
</tr>
</tbody>
</table>

**Discussion**

This study has shown that in a manner similar to abdominal aortic aneurysms larger popliteal aneurysms enlarge more rapidly than smaller ones. Similar results have been described by Stiegler et al., who found that PA less than 2 cm enlarged by 0.7 mm per year compared with those greater than 2 cm which enlarged by 1.5 mm per year. Although their overall growth rates were less than ours both series show a doubling of growth rates of those aneurysms more than 2 cm in diameter compared with smaller ones.

The presence of hypertension in our study did seem an important factor in determining which PA will grow and which will remain stable in size. Patients with no history of hypertension in our series had a significantly higher chance of having popliteal aneurysms which did not grow.

As most surgeons use size as a determinant of whether to operate on asymptomatic PA these results are important in defining screening intervals. As the upper 95% confidence interval in PA less than 2 cm in diameter was approximately 3 mm, then if 2 cm is the cut off point at which elective repair is advised for PA less than 17 mm in diameter annual scans would seem satisfactory. Whereas those PA greater than 17 mm in diameter should perhaps have scans at 6 monthly intervals. Similarly, if 3 cm is taken as the determining size for elective repair then PA up to 2.4 cm in diameter can undergo ultrasound surveillance annually whereas those 2.5 cm and greater in diameter should have scans at 6 monthly intervals.

**References**


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