Editorial

Aortic wall inflammation: a more accurate predictor of aneurysm expansion and aneurysm rupture risk than aortic diameter?

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According to the 2018 Society for Vascular Surgery recommendations regarding the management of patients with abdominal aortic aneurysms (AAAs), elective repair is strongly recommended for the patients at an average risk for surgery with a fusiform AAA ≥5.5 cm in diameter [level of recommendation: 1 (strong); quality of evidence: A (high)] (1). A weaker recommendation is provided for patients with saccular aneurysms of any size [level of recommendation: 2 (weak); quality of evidence: C (low)], as well as for females with an AAA that is 5.0–5.4 cm in maximum diameter [level of recommendation: 2 (weak); quality of evidence: B (moderate)] (1).

Traditionally, the maximum AAA diameter has been considered as the main criterion to consider an elective repair. The 5.5-cm-diameter threshold was not selected randomly. It has been demonstrated that when the diameter of AAAs exceeds the 5.5 cm threshold, their risk of rupture is greater than the perioperative mortality which is associated with an open surgical AAA repair. Nevertheless, a maximum AAA diameter of 5.5 cm is not an absolute criterion indicating AAA rupture risk. Some AAAs (particularly in females) rupture at a smaller diameter, whereas others expand to 7.0, 8.0 or even >9.0 cm without rupturing. In a 20-year retrospective analysis of a single-centre AAA surveillance database (n=692 patients), 3.9% of patients in surveillance ruptured and 40.7% of those had a maximum anteroposterior diameter below 5.5 cm in diameter (2). On the other side, a study assessing the survival rates of AAA in patients who were deemed unfit for an elective repair showed that the mean AAA diameter in those patients that died of AAA rupture was 7.4 (range, 6.2–8.5) cm (3). This suggests that other prognostic factors need to be identified able to predict more accurately AAA expansion and AAA rupture risk.

The recently published, multicenter MA^{3}RS study [magnetic resonance imaging (MRI) using ultrasound superparamagnetic particles of iron oxide to predict clinical outcome in patients under surveillance for AAAs] prospectively enrolled patients who were under regular ultrasound surveillance for their AAA (4). The purpose of this trial was the measurement of ultrasmall superparamagnetic particles of iron oxide (USPIO), which is a class of MRI contrast agent to be taken up by tissue-resident macrophages. USPIO may identify inflammation at the cellular level within tissues including AAA (4). Patients (n=342) were recruited from 3 centers in Scotland, who had a maximum anteroposterior AAA diameter of ≥40 mm by abdominal ultrasound. Besides a full clinical assessment, each patient received a USPIO-enhanced MRI and a computed tomography aortography.

A total of 146 participants (42.7% of the cohort) had demonstrated a USPIO enhancement of the AAA, whereas another 191 patients (55.8% of the group) had no USPIO enhancement and in 5 patients (1.5% of the study participants) it was indeterminate (4). The authors found a strong association between the USPIO enhancement and

the current smoking status as well as with baseline AAA size and the presence of a common iliac aneurysm. The average AAA growth rate during the study was 2.8±2.4 mm/year (n=279) and was found to be greater in patients with USPIO enhancement [3.1±2.5 *vs.* 2.5±2.4 mm/year; difference: 0.6 mm/year; 95% confidence interval (CI): 0.02–1.2; P=0.0424]. The composite of an AAA rupture or AAA repair occurred more frequently in participants with USPIO enhancement of AAA (69 of 146 *vs.* 68 of 191 patients, or 47.3% *vs.* 35.6%, respectively; difference: 11.7%, 95% CI: 1.1–22.2%; P=0.0308). Patients with USPIO enhancements also had a reduced event-free survival (P=0.0275). Patients with smaller AAAs had lower rates of USPIO enhancements when compared with patients with larger AAAs [65 (35.1%) *vs.* 81 (53.3%); difference: 18.2%; 95% CI: 7.7–28.9%; P=0.0008] (4). Patients with smaller aneurysms demonstrating USPIO enhancement had double the rates of AAA repair or rupture. In contrast, those individuals with larger AAAs had demonstrated USPIO enhancement, the reverse occurred, with a more than doubling of mortality but no effect on the primary end point. The conclusion reached was that USPIO-enhanced MRI predicts the rate of AAA expansion, as well as the risk of AAA rupture and AAA repair (4).

The theory that inflammation may predict AAA rupture risk is not novel. Inflammation plays a key role in the development of AAAs (5). Furthermore, increased 18F-fluorodeoxyglucose (18F-FDG) uptake that is detected by positron emission tomography (PET) in AAAs has been demonstrated to be associated with inflammation, aortic wall instability and an increased AAA rupture risk (6,7). The MA^{3}RS study therefore extends the results of previous studies and shows that USPIO-enhanced MRI predicts the rate of AAA expansion, as well as the risk of AAA rupture and AAA repair. This novel finding is particularly important, especially in high-risk and unfit patients, as it can identify those individuals more likely to benefit from a prophylactic AAA repair, or those who can safely be managed conservatively. Future studies should verify the results of the MA^{3}RS study and help establish this novel method of AAA rupture risk stratification.

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Footnote

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