

# Surveillance Intervals for Small Abdominal Aortic Aneurysms

## A Meta-analysis

**Importance** Small abdominal aortic aneurysms (AAAs [3.0 cm–5.4 cm in diameter]) are monitored by ultrasound surveillance. The intervals between surveillance scans should be chosen to detect an expanding aneurysm prior to rupture.

**Objective** To limit risk of aneurysm rupture or excessive growth by optimizing ultrasound surveillance intervals.

**Data Sources and Study Selection** Individual patient data from studies of small AAA growth and rupture were assessed. Studies were identified for inclusion through a systematic literature search through December 2010. Study authors were contacted, which yielded 18 data sets providing repeated ultrasound measurements of AAA diameter over time in 15 471 patients.

**Data Extraction** AAA diameters were analyzed using a random-effects model that allowed for between-patient variability in size and growth rate. Rupture rates were analyzed by proportional hazards regression using the modeled AAA diameter as a time-varying covariate. Predictions of the risks of exceeding 5.5-cm diameter and of rupture within given time intervals were estimated and pooled across studies by random effects meta-analysis.

**Results** AAA growth and rupture rates varied considerably across studies. For each 0.5-cm increase in AAA diameter, growth rates increased on average by 0.59 mm per year (95% CI, 0.51–0.66) and rupture rates increased by a factor of 1.91 (95% CI, 1.61–2.25). For example, to control the AAA growth risk in men of exceeding 5.5 cm to below 10%, on average, a 7.4-year surveillance interval (95% CI, 6.7–8.1) is sufficient for a 3.0-cm AAA, while an 8-month interval (95% CI, 7–10) is necessary for a 5.0-cm AAA. To control the risk of rupture in men to below 1%, the corresponding estimated surveillance intervals are 8.5 years (95% CI, 7.0–10.5) and 17 months (95% CI, 14–22).

**Conclusion and Relevance** In contrast to the commonly adopted surveillance intervals in current AAA screening programs, surveillance intervals of several years may be clinically acceptable for the majority of patients with small AAA.

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### AAA Growth

In male patients, a 3.0-cm AAA had an estimated mean growth rate of 1.28 mm per year (95% CI, 1.03–1.53;  $I^2=96%$ ). When the aneurysm diameter was 5.0 cm, the mean estimated growth rate was 3.61 mm per year (95% CI, 3.34–3.88;  $I^2=89%$ ; TABLE 1). Each 0.5-cm increase in baseline AAA diameter resulted in a 0.59-mm per year increase (95% CI, 0.51–0.66) in mean aortic growth rate (eFigure 1, eFigure 2).

**Table 1.** Pooled (Meta-Analysis) Estimates of Abdominal Aortic Aneurysm Growth and Rupture for Men and Women

	AAA Diameter, cm									
	3.0		3.5		4.0		4.5		5.0	
	Mean (95% CI)	95% PI	Mean (95% CI)	95% PI	Mean (95% CI)	95% PI	Mean (95% CI)	95% PI	Mean (95% CI)	95% PI
Growth rate, mm/y										
Men	1.28 (1.03–1.53)	0.17–2.40	1.86 (1.64–2.08)	0.85–2.88	2.44 (2.22–2.65)	1.47–3.41	3.02 (2.79–3.25)	2.00–4.04	3.61 (3.34–3.88)	2.45–4.77
Women	1.46 (1.07–1.85)	0.03–2.89	1.98 (1.65–2.32)	0.75–3.22	2.51 (2.22–2.81)	1.47–3.56	3.06 (2.80–3.33)	2.18–3.95	3.62 (3.36–3.89)	2.79–4.45
Time to breach surgery threshold, y <sup>a</sup>										
Men	7.4 (6.7–8.1)	4.9–11.3	5.0 (4.6–5.4)	3.4–7.1	3.2 (3.0–3.4)	2.3–4.4	1.8 (1.7–2.0)	1.3–2.5	0.7 (0.6–0.8)	0.4–1.2
Women	6.9 (6.1–7.8)	4.5–10.6	4.8 (4.3–5.3)	3.3–6.8	3.1 (2.9–3.4)	2.3–4.3	1.8 (1.7–2.0)	1.3–2.5	0.7 (0.6–0.8)	0.4–1.3
Rate of rupture, per 1000 person-years										
Men	0.5 (0.3–0.7)	0.3–0.7	0.9 (0.6–1.3)	0.5–1.5	1.7 (1.1–2.4)	0.6–4.3	3.2 (2.2–4.6)	1.0–10.0	6.4 (4.3–9.5)	1.7–23.5
Women	2.2 (1.3–4.0)	0.9–5.7	4.5 (2.8–7.2)	2.1–9.7	7.9 (4.5–13.9)	1.7–36.1	14.7 (8.1–27.7)	2.3–95.1	29.7 (15.9–55.4)	3.9–222.9
Time to 1% chance of rupture, y <sup>b</sup>										
Men	8.5 (7.0–10.5)	5.1–14.2	5.5 (4.4–6.8)	2.8–10.7	3.5 (2.8–4.3)	1.8–6.9	2.2 (1.8–2.8)	1.1–4.4	1.4 (1.2–1.8)	0.7–2.8
Women	3.5 (1.9–6.4)	0.8–14.6	2.1 (1.2–3.6)	0.4–11.1	1.4 (0.9–2.1)	0.3–5.8	0.9 (0.6–1.4)	0.2–3.5	0.7 (0.5–1.1)	0.2–3.3

Abbreviation: AAA, aortic abdominal aneurysm; PI, prediction interval.

<sup>a</sup>Time taken to reach a 10% chance that the 5.5-cm threshold for surgery has been crossed.

<sup>b</sup>Time taken to reach a 1% chance of rupture.