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Ng, T, Julea, M, Jevsikov, J, Stowell, C, Almeida, G, Zolgharni, Massoud ORCID logoORCID: https://orcid.org/0000-0003-0904-2904, Francis, D P and Shun-Shin, M J (2026) What modifies the rate of aortic dilatation? Using AI to analyse and interpret a decade of echocardiographic images from three hospital surveillance clinics. In: ESC Congress 2026, 28–31 August 2026, Munich, Germany.

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What modifies the rate of aortic dilatation? Using AI to analyse and interpret a decade of echocardiographic images from three hospital surveillance clinics

T. Ng[1], M. Julea[2], J. Jevsikov[1], C. Stowell[1], G. Almeida[3], M. Zolgharni[4], D.P. Francis[1], M.J. Shun-Shin[1]

[1]Imperial College Healthcare NHS Trust, London, United Kingdom of Great Britain & Northern Ireland
[2]Doncaster and Bassetlaw Teaching Hospital, Doncaster Royal Infirmary., Critical Care Department, South Yorkshire, United Kingdom of Great Britain & Northern Ireland
[3]Universidade Federal de Sergipe, State of Sergipe, Brazil
[4]University of West London, Department of Computing and Engineering, London, United Kingdom of Great Britain & Northern Ireland
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Purpose: Use clinical AI to retrospectively analyze a decade of surveillance data to derive the rate of progression of aortic root dimensions and identify modifiers of progression.

Methods: From a multi-hospital clinical echocardiographic database covering three surveillance clinics, patients were included if they had three or more echocardiograms over >1 year within the surveillance programme. The echocardiograms were analysed using a clinical AI platform without human intervention. Associated risk factors (smoking, diabetes, hypertension, hyperlipidaemia, use of statins, beta-blockers, or ACE inhibitors / angiotensin receptor blockers) were also collected. Progression, and the impact of cardiovascular risk factors were quantified using mixed-effects modelling and deriving marginal means.

Results: 388 patients met the inclusion criteria, with 2374 echocardiograms over 13 years undergoing surveillance for aortic dilatation. Over 10 years, on average, there was only a slow increase in the average aortic dimensions: SoV 0.66 mm/decade, 95% CI 0.08 to 1.25; aortic annulus -0.09 mm/decade, 95% CI -0.49 to 0.30cm ; STJ 0.27 mm/decade, 95% CI -0.37 to 0.90; proximal ascending aorta 0.55 mm/decade 95% CI -0.19 to 1.30 (Figure 1).

For most risk factors on most parts of the aorta, the impact on the rate of progression was small (<0.2mm/decade) and did not reach statistical significance (Figure 2). Smoking however was associated with accelerated progression at the sinus of Valsalva (2.43 mm/decade, 95% CI 1.04–3.83, p=0.001) and sinotubular junction (1.58 mm/decade, 95% CI 0.09–3.08, p=0.038). Hyperlipidaemia was associated with reduced progression at the ascending aorta (−2.21 mm/decade, 95% CI −3.72 to −0.69, p=0.004), the sinotubular junction (−1.59 mm/decade, 95% CI −2.87 to −0.31, p=0.015), and the sinus of Valsalva (−1.36 mm/decade, 95% CI −2.55 to −0.16, p=0.026). Diabetes was associated with accelerated progression at the aortic valve annulus of (1.87 mm/decade, 95% CI 0.83 to 2.90, p=0.0004).

Conclusion: In a retrospective analysis, harnessing automated AI measurements of surveillance data spanning a decade, progression of aortic dilatation is slow (<0.7mm/decade). Therefore, yearly or even alternate year follow-up may not be an efficient use of resources. Smoking and diabetes were identified as a significant risk factor for increased rate of dilatation, but the increase was < 2mm/decade.

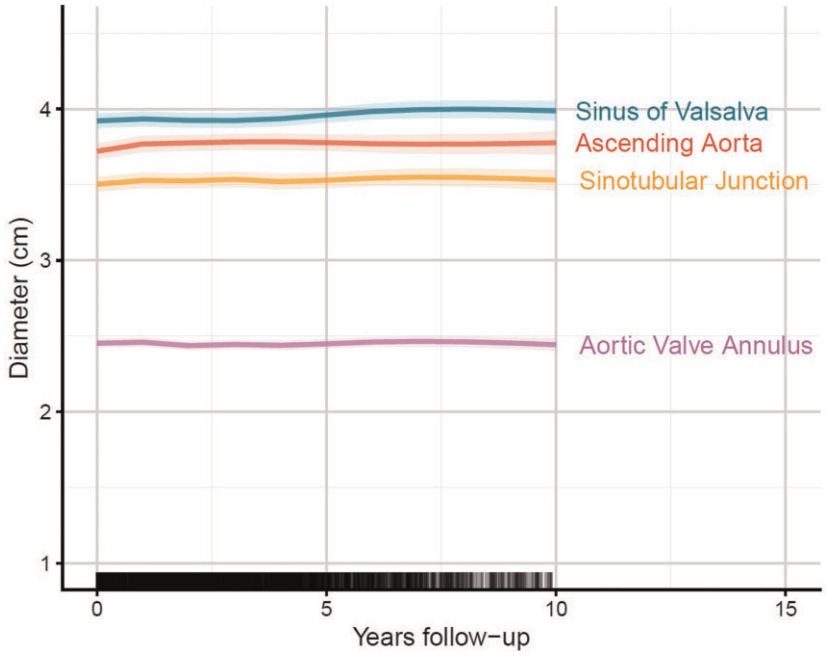


Figure 1

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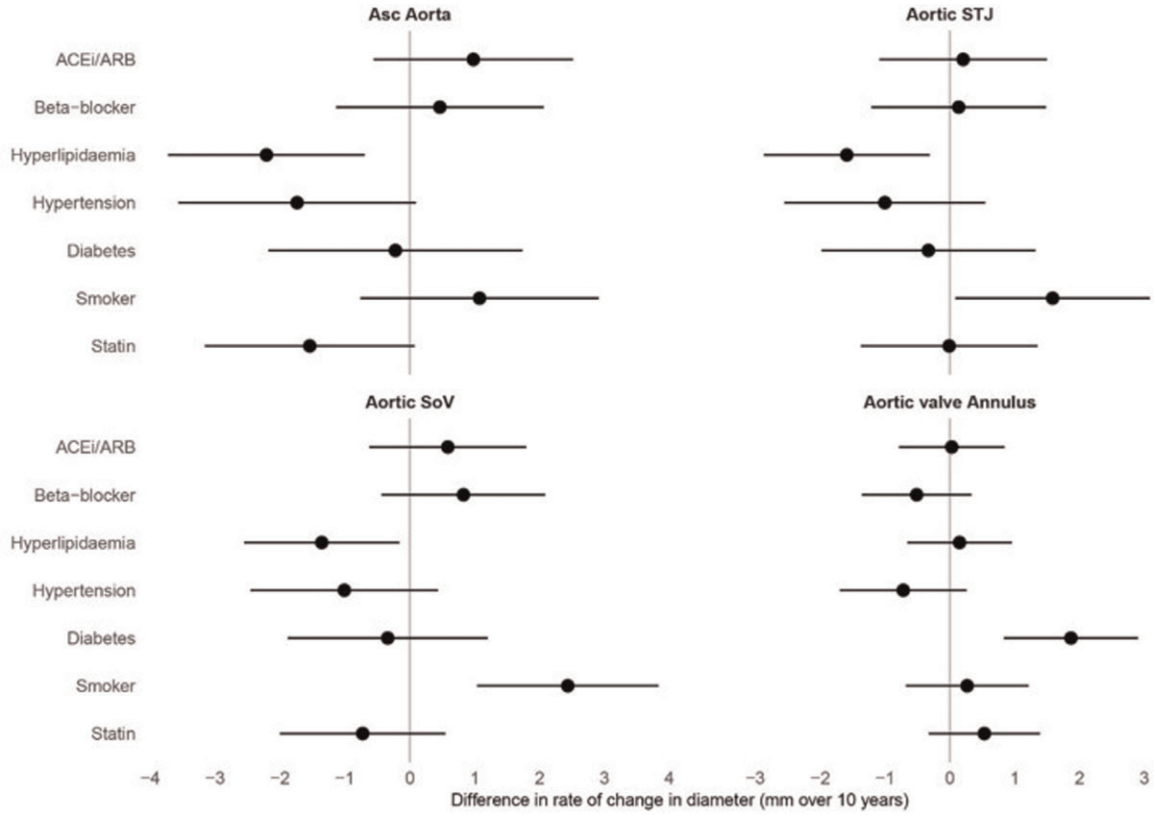


Figure 2

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