

Abstract

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An Artificial Neural Network Stratifies the Risks of Reintervention and Mortality after Endovascular Aneurysm Repair a Retrospective Observational study

Background Lifelong surveillance after endovascular repair (EVAR) of abdominal aortic aneurysms (AAA) is considered mandatory to detect potentially life-threatening endograft complications. A minority of patients require reintervention but cannot be predictively identified by existing methods. This study aimed to improve the prediction of endograft complications and mortality, through the application of machine-learning techniques. **Methods** Patients undergoing EVAR at 2 centres were studied from 2004-2010. Pre-operative aneurysm morphology was quantified and endograft complications were recorded up to 5 years following surgery. An artificial neural networks (ANN) approach was used to predict whether patients would be at low- high-risk of endograft complications (aortic/limb) mortality. Centre 1 data were used for training and centre 2 data for validation. ANN performance was assessed by Kaplan-Meier analysis to compare the incidence of aortic complications, limb complications, and mortality in patients predicted to be low-risk, versus those predicted to be high-risk. **Results** 761 patients aged 75 +/- 7 years underwent EVAR. Mean follow-up was 36+/- 20 months. An ANN was created from morphological features including angulation/length/areas/diameters/volume/tortuosity of the aneurysm neck/sac/iliac segments. ANN models predicted endograft complications and mortality with excellent discrimination between a low-risk and high-risk group. In external validation, the 5-year rates of freedom from aortic complications, limb complications and mortality were 95.9% vs 67.9% 99.3% vs 92.0% and 87.9% vs 79.3% respectively (p<0.001) **Conclusion** This study presents ANN models that stratify the 5-year risk of endograft complications mortality using routinely available pre-operative data.