Clinical applications of artificial intelligence to improve diagnosis and risk stratification for patients with aortic aneurysms

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Abstract: Aortic aneurysms (AAs) are a pathologic dilatation of the aorta beyond 1.5 times its normal diameter. Most abdominal aortic aneurysms (AAAs) are completely asymptomatic and diagnosed incidentally, but if left untreated, progressive growth can lead to rupture, a catastrophic complication with mortality of up to 80%. Despite the high mortality associated with a AAA at risk of rupture, current screening guidelines and surveillance recommendations are rudimentary, based solely on patient gender, age and smoking history. The protocol for follow-up surveillance studies is determined only by aneurysm size, a strategy that can put a number of patients with accelerated growth at rupture risk. For men with an aneurysm measuring >5.5 cm and women >5.0 cm, surgical intervention is advised. Elective repair carries a very small perioperative risk making timely diagnosis, assessment of individual rupture risk and well-designed follow up protocol’s key components of successful patient outcomes without prohibitive cost.

Without the discovery of new risk factors or imaging biomarkers, vascular surgeons have found it difficult to improve on current preventative strategies for patients with aneurysmal disease. This is particularly true for patients with smaller aneurysms that do not require elective repair. For some of them, interval imaging can be as long as 3 years. Shifting current preventative strategies towards a more personalized approach based on unique patient risk profiles has proven to be elusive due to the difficulties inherent in longitudinally capturing, monitoring and properly analyzing all variables that may contribute to the progression of AA disease.

We describe a collaborative project between the Department of Vascular Surgery and Department of Biomedical Informatics aiming to improve the identification and care of asymptomatic AA patients through the application of validated machine learning algorithms to EMR-captured data and relevant imaging studies. The implementation of these machine learning modalities will allow us to develop a self-sustaining comprehensive database for AA patients – one which allows for optimal monitoring, individual risk stratification, and personalized approach to AA disease management.

Educational Objectives: Upon completion, participants should be able to:
- Describe current screening and care challenges for patients with aortic aneurysms
- Discuss novel artificial intelligence methodologies for the extraction, longitudinal collection, and analysis of clinical data pertinent to aortic aneurysm disease
- Describe the role of artificial intelligence algorithms in establishing a refined individual risk profile for patients with aortic aneurysms

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