This study analyzes the lethal clinical condition of aortic dissections from a numerical point of view. On the basis of our previous contributions [1,2], we apply a holistic geometrical approach to fracture, namely the crack phase-field, which inherits the intrinsic features of gradient damage and variational fracture mechanics. The continuum framework captures anisotropy, is thermodynamically consistent and based on finite strains. The balance of linear momentum and the crack evolution equation govern the coupled mechanical and phase-field problem. The solution scheme features the robust one–pass operator–splitting algorithm upon temporal and spatial discretizations. Based on experimental data of diseased human thoracic aortic samples, the elastic material parameters are identified followed by a sensitivity analysis of the anisotropic phase-field model. Finally, we simulate an incipient propagation of an aortic dissection within a multi–layered segment of a thoracic aorta that involves a prescribed initial tear [3]. The finite element results demonstrate a severe damage zone around the initial tear, exhibit a rather helical crack pattern, which aligns with the fiber orientation.

REFERENCES

