Minimizing Surface-Initiated Thrombogenesis in COVID-19 Patients Using the Fibronectin-Derived Peptide P12

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Vascular occlusion is a well-documented phenomenon known to be associated with cases of COVID-19 infection. Recent work establishes that vascular occlusion is related to fibrin(ogen) aggregation on blood vessel surfaces, followed by microthrombi formation. Fibrinogen molecules adsorb spontaneously onto hydrophobic surfaces, exposing their alpha-C domains and fibronectin-binding site without the need for thrombin cleavage, leading to fibrinogen fiber polymerization. This mechanism could explain the formation of clots and the large number of thrombogenic events reported in COVID-19 patients as the virus has been found to damage blood vessels and turn them hydrophobic, potentially serving as an adsorption site for fibrinogen monomers. This study showed that the fibronectin-derived oligopeptide P12 exhibits an inhibitory effect on this kind of fiber formation. Spin-cast polystyrene was exposed to fibrinogen solutions with and without a solution of P12. Polystyrene, PMMA, and PLA were also spun cast onto Kapton film and placed in the path of a circulating solution of fibrinogen and platelet-rich plasma. All surfaces were examined with OM, AFM, or SEM and the addition of P12 completely eliminated the formation of large fibers on all surfaces. Platelet binding was reduced by more than two orders of magnitude, indicating that obstruction of the αC domain by P12 also prevents platelet adhesion and clot formation. Studies in H1N1-infected MDCK-2 cells as an analogy to COVID-19 confirmed the effectiveness of P12 in live cell cultures. These results suggest that P12 may be a powerful treatment for preventing surface-induced thrombogenesis and consequent blood clots in COVID-19 patients.