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INVITED COMMENTARY

Biofilm is the Target

Commentary on: "A Narrative Review of Experimental Assessment to Study Vascular Biomaterials Infection and Infectability"

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Puges et al. reviewed the key features of infection and infectability assessment techniques in vascular graft or endograft (VGE) infection experimental models.[1] The authors should be congratulated for this exhaustive study on a still debated pathology.[2] They demonstrated the multiple experimental protocols deemed to study VGE infection and infectability, and highlighted the need for protocol standardisation but also the importance of selecting accurate techniques to get closer to the truth about VGE infectibility and infection.

The authors also pointed out the hidden enemy: biofilm. The preferred mode of growth of pathogenic microorganisms is within a surface biofilm.[3] Biofilm matrix can develop within hours to days and produces a recalcitrant infectious process, especially in the presence of a prosthetic graft. Initially reported as an arcane behaviour of a bacterial population, biofilm formation is now recognised as a principle virulence factor in many infections. This is not primarily due to genetic resistance that arises by mutation, although the increased microbial cell density may favour transfer of resistance genes, but rather because microorganisms that reside in biofilms may develop tolerance to traditional antibiotics or antimicrobial agents through metabolic dormancy or molecular persistence programmes. Moreover, the role of the extracellular matrix in conferring antimicrobial tolerance to biofilms is being recognised. Accordingly, biofilm can be targeted in VGE infection or infectibility prevention.[3]

Coatings could also offer a potential to prevent VGE infectibility. Over the years, different coating strategies have been introduced in clinical practice (e.g., rifampicin, silver, silver and triclosan), but none of these strategies has been able to demonstrate any significant benefit.[3,4] The use of antibiotics in monotherapy as a coating strategy is currently being discouraged due to antibiotic resistance but also since antibiotics find it very difficult to eradicate bacteria embedded in a biofilm matrix. About 80% of all chronic infections are caused by biofilms. New coating strategies focused on antibiofilm coating are coming. These studies focus on bacterial adhesion through enzymatic activity but no further translation into clinical trials is currently available.[4]

The role of biofilm in VGE infection diagnosis is also important. Microbiological culturing of explanted devices is hampered by biofilm formation of the causative pathogens, which leads to a lower culture sensitivity and may result in false negative culture results. Sonication of explanted grafts may increase the microbiological yield of these biofilm associated infections, since ultrasonic waves can disrupt the biofilm. Moreover, sonication is expected to provide more homogeneous inoculation of the culture medium than the rolling technique on solid agars used by most laboratories for graft culture. Braams et al. performed a prospective study comparing conventional culture with sonication culture of explanted VGE infection.[5] Sonication culture detected clinically relevant microorganisms that went unnoticed by conventional culturing in 16% of samples (nine of 57 samples) and provided additional relevant information regarding growth densities in 19% of samples (11 of 57 samples). Overall, sonication culture allowed for a better discrimination between contaminants and true pathogens.

In conclusion, future directions in the field of VGE infectibility or infection might focus on preventing biofilm formation and treating existing biofilms.

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