

Vascular and Fibrotic Remodeling in Periprosthetic Joint Infections: A Link to Reinfection Risk

Renqiu Qiao

Charité Universitätsmedizin, Berlin, Deutschland

Stefanie Donner

Charité Universitätsmedizin, Berlin, Deutschland

Georg Duda

Charité Universitätsmedizin, Berlin, Deutschland

Carsten Perka

Charité Universitätsmedizin, Berlin, Deutschland

Stephanie Kirschbaum

Charité Universitätsmedizin, Berlin, Deutschland

Arne Kienzle*

Charité Universitätsmedizin, Berlin, Deutschland

Abstract:

Background and Objective: Reinfection risk remains high following periprosthetic joint infection (PJI) of the knee, yet the underlying mechanisms are not well understood. The prevailing assumption that bone and soft tissues fully recover after post-explant revision surgery has been challenged by emerging evidence of ongoing pathological changes. This study investigates whether alterations in soft tissue vascularization and fibrosis contribute to PJI pathogenesis and the increased risk of reinfection.

Methods: Joint capsule samples were collected from 69 patients undergoing knee arthroplasty: 26 PJI patients undergoing prosthesis reimplantation after temporary arthrodesis, 22 PJI patients undergoing prosthesis explantation, and 21 control patients undergoing primary TKA. Histological analyses included hematoxylin and eosin (HE), Masson's trichrome, and Sirius red staining. Immunofluorescence staining was used to assess vascular structure, while gene expression was analyzed by real-time quantitative PCR (RT-qPCR).

Results: Compared to controls, PJI samples showed increased numbers of blood vessels but reduced vessel area, diameter, and perimeter. Both explantation and reimplantation stages exhibited a significant thinning of smooth muscle cell and pericyte layers, along with reduced pericyte coverage on arterial walls. Fibrotic remodeling was evident at both PJI stages, with greater collagen deposition than in controls. Gene expression analysis revealed dynamic changes: PDGFA and FNI were downregulated