#31 - Poster

Effects Of Wall Shear Stress In Venous Neointimal Hyperplasia Of Arteriovenous Fistulae

Vascular access creation

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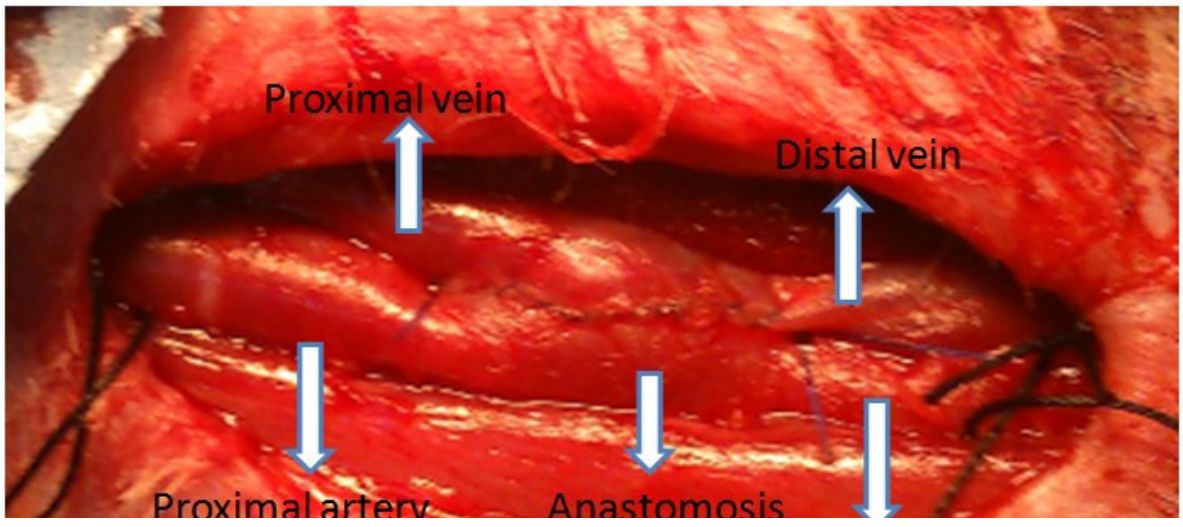
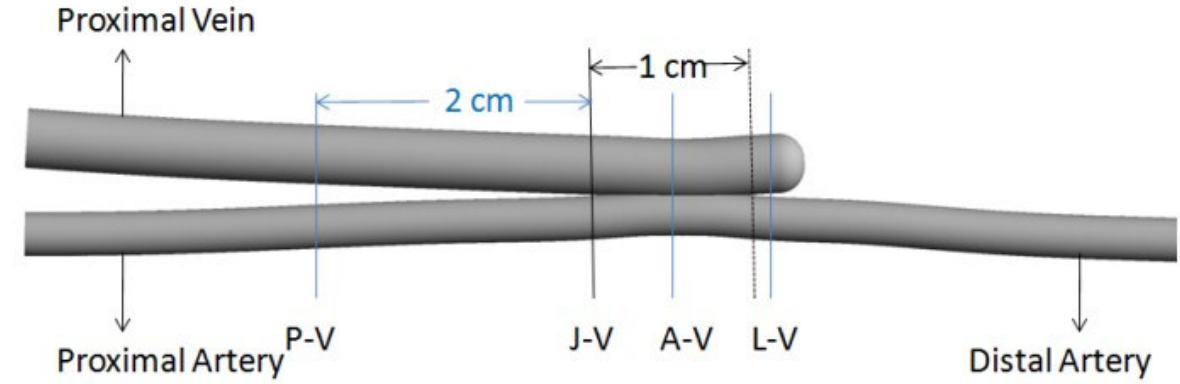
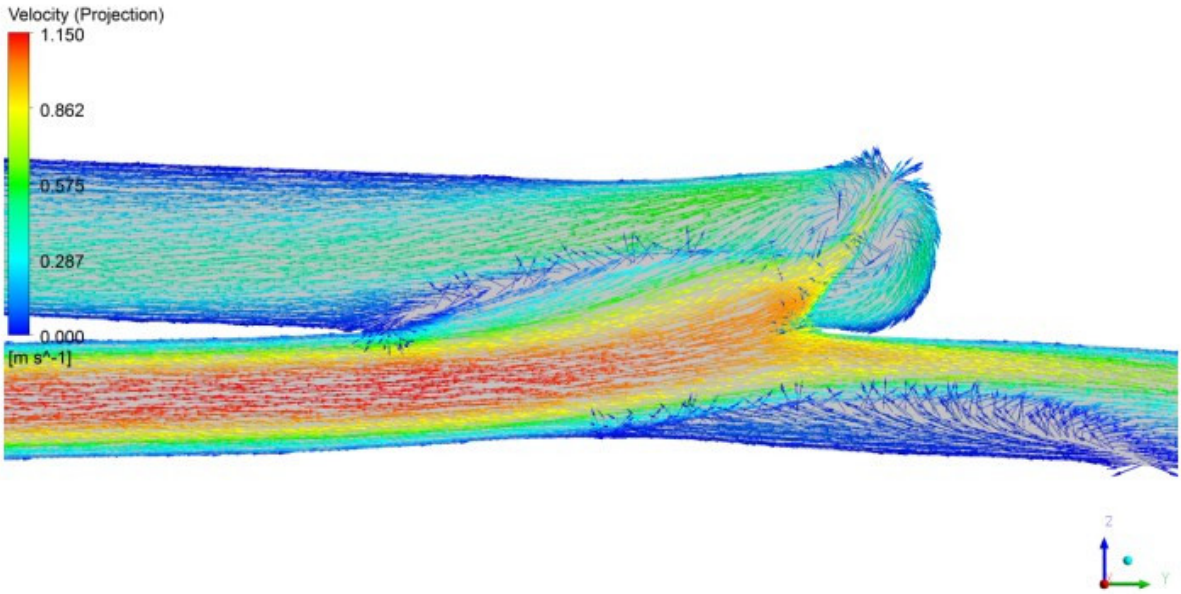
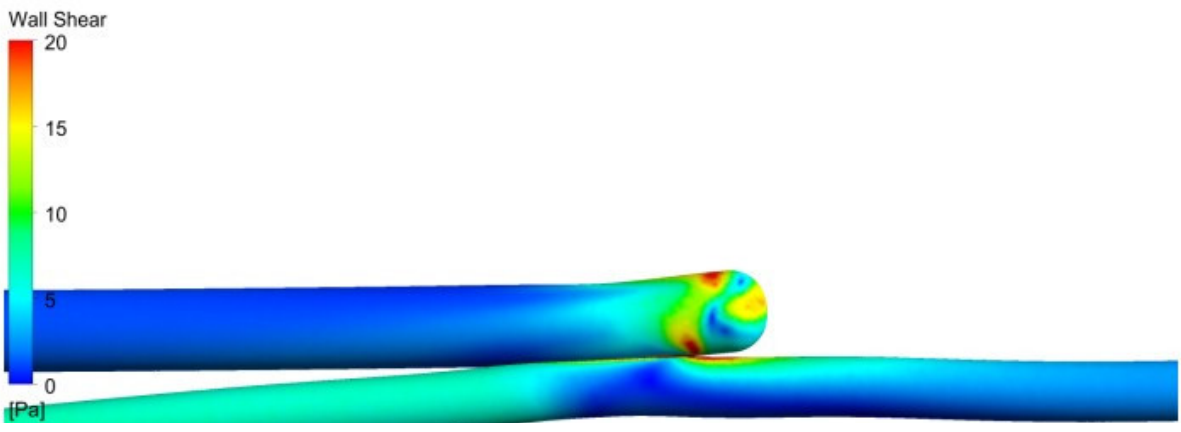
Introduction and Objectives
An arteriovenous fistulae (AVF) is the preferred vascular access for maintenance hemodialysis patients. Its dysfunction is often due to venous stenosis, which is mainly caused by neointimal hyperplasia. Additionally, hemodynamic forces, especially wall shear stress (WSS), as a mechanical stimuli to venous wall have a significant role in neointimal hyperplasia. The purpose of this study was to evaluate the association between WSS and neointimal hyperplasia.
Material and Methods
An 'end-to-side' AVF was created between the right femoral artery and vein of canines. Canines were sacrificed at 7 and 28 days post-surgery. The velocity and WSS in the three-dimensional computational model of AVF were simulated using computational fluid dynamics (CFDs). The four typical sites of the vein evaluated in this study, chosen according to the hemodynamic analysis, included the arteriovenous anastomosis (A-V), the juxta-anastomotic segment (J-V), the juxta-ligation segment (L-V) and the proximal vein (P-V) (Figure1). The specimens were hematoxylin-eosin stained and the intima-media thickening was then measured (Figure2).
Results
Neointimal hyperplasia was more obvious in the inner wall of the J-V and L-V (low-and-disturbed WSS) sites compared with the P-V and A-V sites, and the outer wall of the L-V and J-V segments (high-and-laminar WSS) ($p<0.01$).
Conclusion
In this study, we described the hemodynamic condition in the AVF and found that neointimal hyperplasia predisposed to occur in the inner wall of venous segment near the anastomosis. We also found that not only the neointimal hyperplasia has a strong inverse correlation with WSS levels, but also is related to flow patterns.

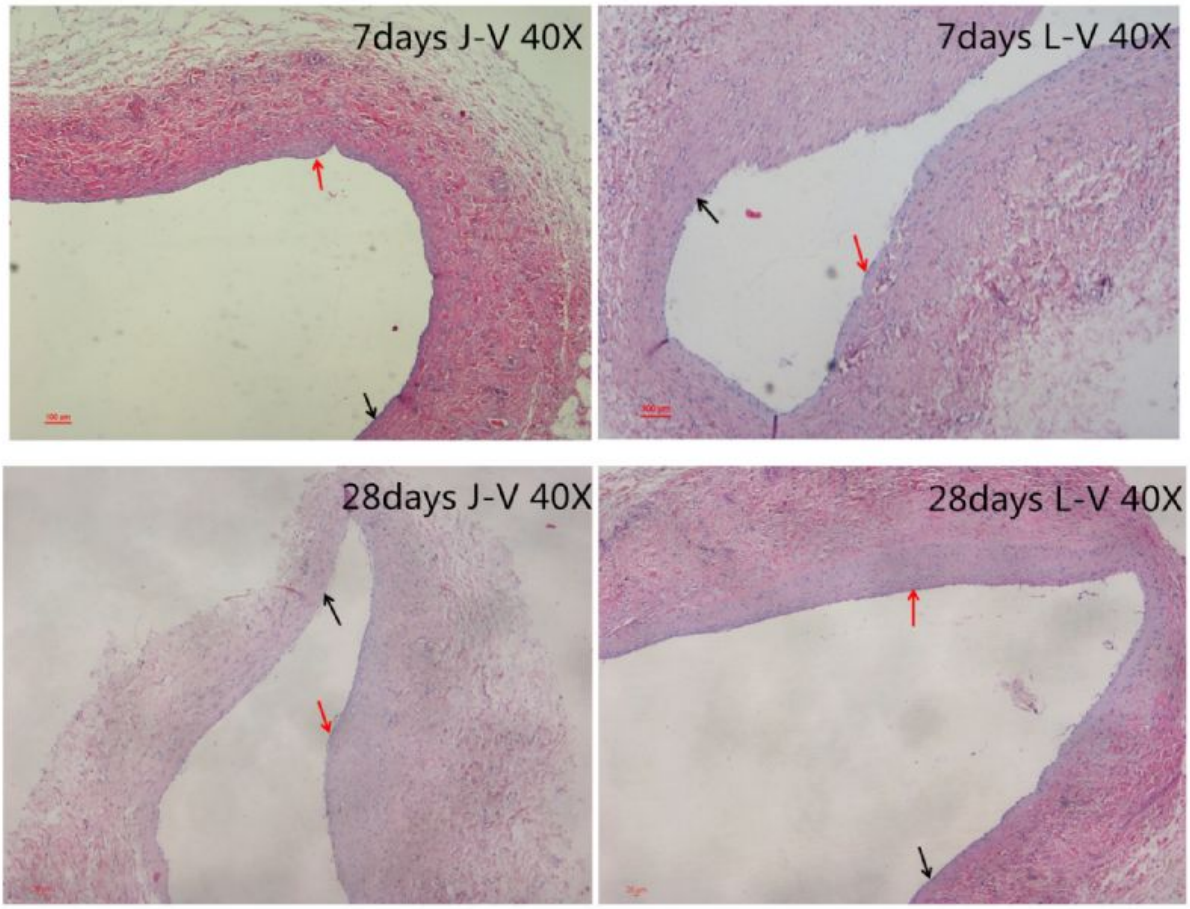



Distal artery


Proximal Vein
2 cm
1 cm
Proximal Artery
P-V
J-V
A-V
L-V
Distal Artery


Velocity (Projection)
1.150
0.862
0.575
0.287
0.000
[m s^-1]


Wall Shear
20
15
10
5
0
[Pa]


7days J-V 40X
7days L-V 40X
28days J-V 40X
28days L-V 40X