Print this Page

Presentation Abstract

Session: Monday General Poster Session

Presentation: Assessment of Arteriovenous Fistula Functionality using Hemodynamic Based Diagnostic Parameters

Presentation Time: Monday, Jul 07, 2014, 11:00 AM - 9:30 PM

Author(s): **E. Rajabi-Jaghargh**, R. Banerjee;
Mechanical Engineering Program, Mechanical and Materials Engineering Department, University of Cincinnati, Cincinnati, OH.

Abstract: **Introduction**. The inability to detect the arteriovenous fistula (AVF) dysfunction in a timely manner under the current surveillance programs, based on either diameter (d), flow rate (Q), or pressure measurements, is one of the major challenges to dialysis treatment. Thus, our *aim* is to introduce new functional diagnostic parameters that can better predict the AVF maturation status.

Methods. 6 AVFs[1] were created between the femoral arteries and veins of 3 pigs, each pig having 2 AVFs on either limb (Figure 1). The raw data from our previous publication[1] was reassessed in the present study. The pressure drop ([[unable to display character: ∆]]p) in AVFs were obtained via numerical analysis utilizing CT-scan and Doppler Ultrasound data at 2D (D: days), 7D, and 28D post-surgery (Figure 1). Also, two new diagnostic parameters, pressure drop coefficient (C_p = [[unable to display character: ∆]]p/($0.5\rho v^2$) and C_p^* = [[unable to display character: ∆]]p/($0.5\rho v^{*2}$)) and resistance index (R = [[unable to display character: ∆]]p/v and R^* = [[unable to display character: ∆]]p/v^*), were introduced. Here, v represents the average velocity at proximal artery, while v^* is the corresponding scaled velocity with the curvature ratio (δ) of anastomosis ($v^*=v/\sqrt{2\delta}$).

Results. A marginal significant (p = 0.1) increase in d from 2D to 7D along with a significant increase in Q accompanied by an almost unchanged [[unable to display character: ∆]]p (Table 1). However, the insignificant increase in d and Q from 7D to 28D accompanied by the elevation in [[unable to display character: ∆]]p (Table 1). The increase in [[unable to display character: ∆]]p possibly corresponds to either insufficient dilation for the amount of blood flow rate or venous stenosis; both being signs of adverse remodeling. The functional diagnostic parameters (Figure 2), R and C_p, decreased from 2D to 7D, and then increased from 7D to 28D with a marginal significance. However, the increase in scaled diagnostic parameters (R^* and C_p^*) from 7D to 28D were significant ($p < 0.05$).

Conclusion. Although the differences in hemodynamic parameters (d, Q, and [[unable to display character: ∆]]p) from 7D to 28D were insignificant, changes in their combined effects in the form of diagnostic parameters were significant. Therefore, the functional diagnostic parameters are capable of better distinguishing changes in hemodynamic parameters and thus, could be promising endpoints to diagnose the AVFs functionality over time.

Table 1. Variation of diameter (d), flow rate (Q) and pressure drop (Δp) over time.

	2D (D: days)	7D	28D
d (mm)	5.40 ± 0.7	6.83 ± 0.7	7.84 ± 0.82
Q (ml/min)	967 ± 273	1943 ± 273	2181 ± 378
Δp (mmHg)	16.42 ± 4.63	16.40 ± 4.63	24.65 ± 6.55

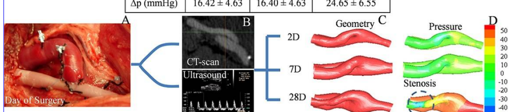

Figure 1[1]. (A) AVF surgical configuration, (B) CT-scan and Doppler Ultrasound data, (C) Reconstructed geometries of one AVF over time, and (D) corresponding pressure contours.

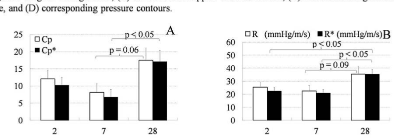

Figure 2. Variation of function diagnostic parameters: (A) pressure drop coefficient (C_p and C_p^*) and (B) resistance index (R and R^*) over time.

For technical inquiries, click here to contact OASIS Helpdesk or call 217-398-1792.