Dialysis related parameters have influence on remodeling in venous part of native arteriovenous fistula

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OBJECTIVES

Successful maturation of arteriovenous fistula (AVF) rely on outward remodeling (OR) in the draining vein and adaptation of feeding artery. Venous neointimal hyperplasia (IH) is the most common cause of arteriovenous fistula dysfunction resulting in its narrowing. The needling points of AVF are frequently exposed on direct mechanical injury and influence of blood flow disturbances during hemodialysis (HD). Local negative pressure in blood drawing point due to blood aspiration and higher pressure in reinfusion point may be a cause of structural vascular remodeling resulting in OR or IH. These factors were never studied.

AIM

The aim of this study was to evaluate association of hemodialysis parameters with changes in the venous part of AVF in points of the needling.

METHODS

241 HD patients, age 64 14 years, on HD treatment for mean 47 [IQR 19,5-87] months with functioning fistula from three dialysis centers were recruited in this study. The history of vascular access (place of AVF creation, type of anastomosis), demographic data (age, height, weight, Body Surface Area, Body Mass Index), clinical (cause of kidney disease, comorbidity, Charlson Comorbidity Index), biochemistry (hemoglobin, potassium, sodium, albumine, cholesterol, calcium, phosphate, iPTH) and dialysis related (time of AVF use, blood pump velocity, KT/v, URR– urea reduction rate) parameters during the period of 2 years (2013-2014) ware analyzed. The cross-section area of the upper extremity vessels were measured using ultrasound. The examination included 2 points on the venous part of the fistula in A – arterial point (needling point for blood aspiration) and V – venous point (the point for returning the blood after purification). The difference between A and V (A-V) and the ratio (A/V) were calculated.

Table 1. Needling points cross-sections	1st Qu.	Median	Mean	3rd Qu.
A (cm²)	0,58	1,04	1,40	1,78
V (cm²)	0,41	0,74	1,04	1,39
A woman (cm²)	0,47	0,86	1,24	1,40
A man (cm²)	0,53	1,03	1,41	1,88
V woman (cm²)	0,36	0,63	0,89	1,15
V man (cm²)	0,46	0,77	1,11	1,43
A-V (cm²)	-0,04	0,17	0,36	0,64
A/V	0,94	1,24	1,59	1,93

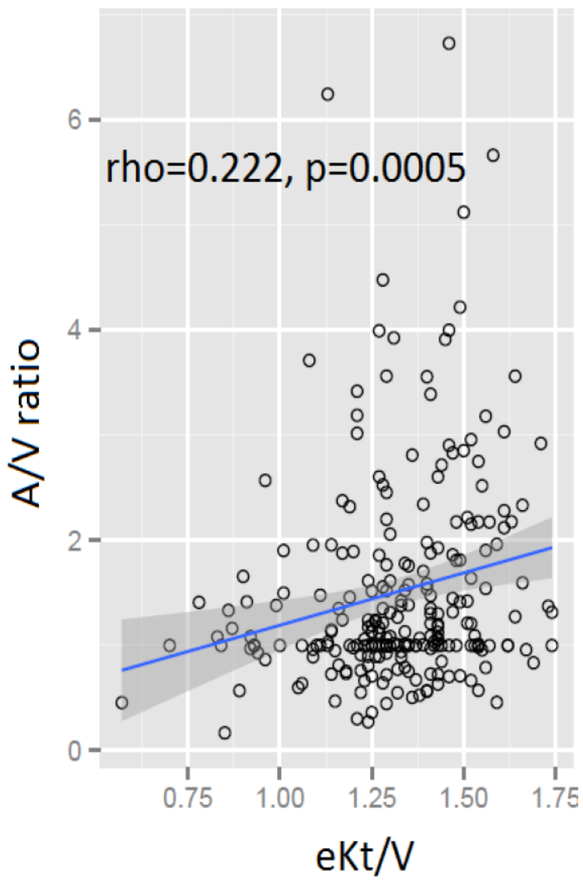

Table 2.	rho (A-V)	rho (A/V)
AVF - time in use (month)	0,29*	0,26*
Qb (mean blood flow) (ml/min)	0,17*	0,14*
OCM Kt/V	0,19*	0,21*
effective Kt/V	0,20*	0,22*
URR - Urea Reduction Rate (%)	0,20*	0,21*
*significance level p<0,05		

RESULTS

The cross-section area of A was larger than V (1,04 [IQR 0,58-1,7] vs. 0,74cm² [IQR 0,41 -1,39], p<0,0001). The median difference between A and V (A-V) was 0,17cm², and the (A/V) ratio was 1,24 (Table 1). These both indices (A-V and A/V) positively correlated with dialysis related parameters (mean blood flow (Qb), OCM Kt/V, effective Kt/V) and time of AVF use (Table 2 and Figure). Others factors (demographic, cause of kidney disease, comorbidity) have no influence on A-V and A/V index. In the multivariate analyses the independent factor increasing the difference (A-V) was mean blood flow achieved during HD sessions.

CONCLUSIONS

Higher blood pump velocity of the dialysis machine for achieving higher dialysis doses may influence on vein anatomy, namely cause a dilatation in arterial point of needling and narrowing in venous point of the fistula. This finding should be taken into account in choosing needling technique and place, especially when high speed pump is set.

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