

Alexandra Romann, MSc¹, Pascal Rheame, MD², Jason Clement, MD², Mercedeh Kiaii, MD² and Ravindar Sidhu, MD², Monica Beaulieu, MD².
¹BC Renal Agency, Vancouver, BC, Canada and ²Division of Nephrology, University of British Columbia, Vancouver, BC, Canada

Introduction

The most common arteriovenous fistula (AVF) complication is stenosis. Percutaneous transluminal angioplasty (PTA) has generally replaced surgical procedures to treat AVF stenosis. However, there is little data examining post-intervention patency after PTA, and even less data identifying the factors that predict success of this endovascular approach.

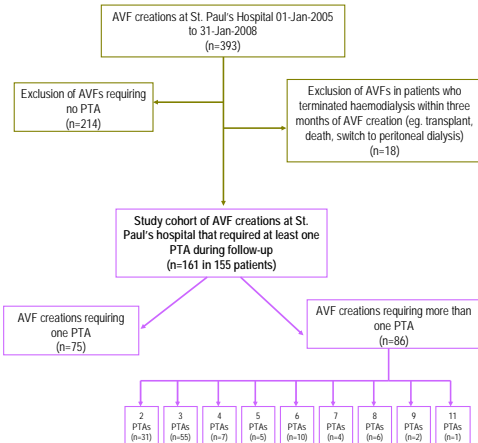
Objectives

- The objectives of this study were to
- assess patency after PTA of dysfunctional AVFs, and
 - identify factors predictive of PTA failure after a first radiological salvage.

Methods

We selected pre-dialysis and dialysis patients for our study cohort from the Provincial Record and Outcome Management Information System (PROMIS), which stores prospectively collected data from all patients referred for kidney disease in British Columbia, Canada. We performed a retrospective analysis of all AVF creations at St. Paul's Hospital in Vancouver between January 1 2005 and January 31 2008, ensuring at least one year follow-up until January 2009. The figure below describes the cohort and exclusion criteria in detail.

Figure 1: Patient Cohort



Statistical Methods

- Descriptive statistics are presented as mean with standard deviation or median with interquartile range, depending on the underlying distribution.
- Continuous and categorical variables were compared between patients requiring one versus two or more PTAs using ANOVA or Kruskal-Wallis and chi-square tests, respectively.
- The Cox proportional hazards model and Competing Risk analysis were used to find factors associated with post-intervention outcomes.
- Kaplan-Meier curves were employed to illustrate post-intervention primary and secondary patency graphically.

Definitions

Post-intervention primary patency = Time from first PTA to second PTA or until AVF failure
 Post-intervention secondary patency = Time from first PTA until AVF failure
 Primary failure = Failure of AVF without even having been in use, or failure of AVF to provide reliable access for one month.

Results

Table 1: Patient Characteristics at Baseline (at first PTA)

Variable	Total	Number of PTAs during study		P value
		1	>1	
Number of patients	161	75	86	-
Age in years:				0.50
<65	64 (40%)	30 (40%)	34 (40%)	
65-75	45 (28%)	18 (24%)	27 (31%)	
>75	52 (32%)	27 (36%)	25 (29%)	
Male	109 (68%)	48 (64%)	61 (71%)	0.35
Race:				0.12
Caucasian	54 (34%)	31 (41%)	23 (27%)	
Asian	71 (44%)	27 (36%)	44 (51%)	
South Asian	14 (9%)	5 (7%)	9 (10%)	
Other/Unknown	22 (14%)	12 (16%)	10 (12%)	
Primary renal diagnosis:				0.09
Diabetorenal vascular	100 (62%)	39 (52%)	61 (71%)	
Hereditary causes	6 (4%)	3 (4%)	3 (3%)	
GN & vasculitis	26 (16%)	15 (20%)	11 (13%)	
Other/Unknown	29 (18%)	18 (24%)	11 (13%)	
AVF used before first PTA	110 (68%)	52 (69%)	58 (67%)	0.80
Outflow vein lesion prior to first PTA	134 (83%)	57 (75%)	78 (91%)	0.0066
Multiple lesions prior to first PTA	44 (27%)	17 (23%)	27 (31%)	0.22
% Stenosis prior to first PTA				0.35
<50%	24 (15%)	8 (11%)	16 (19%)	
50-75%	82 (51%)	41 (55%)	41 (48%)	
>75%	55 (34%)	26 (35%)	29 (34%)	
Stenosis length prior to first PTA >2cm	70 (43%)	26 (35%)	44 (51%)	0.035
First PTA a technical success	130 (81%)	57 (76%)	73 (85%)	0.15

AVF location, DM, CVD, medication (antiplatelet, anticoagulation, statin), whether AVF was creation prior to dialysis start, AVF number, complications after first PTA were not statistically different between the two groups.

Figure 2: AVF Post-Intervention Primary Patency

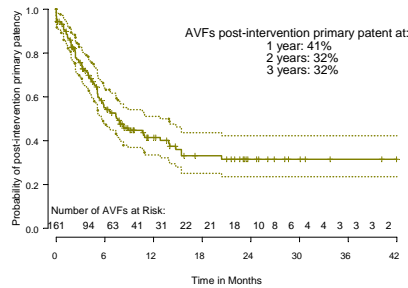
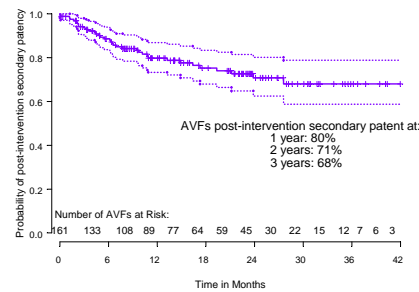


Figure 3: AVF Post-Intervention Secondary Patency



Results

Figure 4: Patient and AVF Outcomes During Study Period

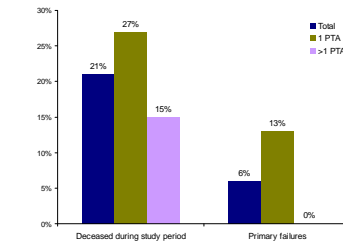


Figure 5: Multivariate Cox Proportional Hazards Model, Adjusted for Age and Gender.

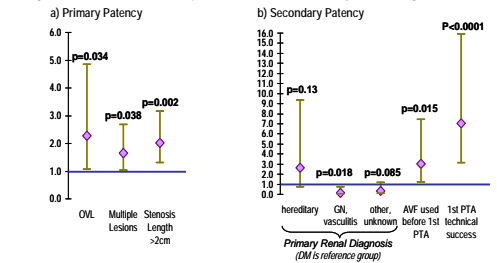
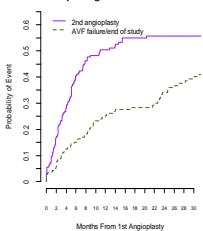


Table 2: Multivariate Competing Risks Analysis of Requiring a 2nd PTA in the Presence of the Competing risk of AVF Failure, Study End or Death, adjusted for age and gender.

Variable	2 nd PTA			AVF failure / end of study		
	HR	95% CI	p	HR	95% CI	p
Age in years:						
<65	Reference	-	-	Reference	-	-
65-75	1.32	0.85-2.15	0.27	0.81	0.41-1.58	0.53
>75	1.06	0.63-1.79	0.83	0.97	0.54-1.75	0.93
Male	1.15	0.70-1.88	0.59	0.76	0.45-1.29	0.30
Stenosis length prior to first PTA >2cm	1.64	1.07-2.51	0.02	0.64	0.37-1.12	0.12
Outflow vein lesion prior to first PTA	2.48	1.17-5.23	0.02	0.39	0.23-0.67	0.0006
First PTA a technical success	1.35	0.70-2.62	0.37	0.48	0.26-0.90	0.02

Figure 6: Cumulative Incidence of Competing Risks



Conclusions

- Knowing when to abandon an AVF after numerous PTAs is key due to the strain on patients' comfort and the ever-increasing desire to make cost- and resource-effective decisions.
- Our analysis of 161 patients resulted in post-intervention primary patency of 41%, 32%, and 32% at 1, 2, and 3 years respectively; while the post-intervention secondary patency was 80%, 71%, and 68%.
- Multivariate Cox Proportional Hazards analysis of post-intervention primary, adjusted for age and gender, identified outflow vein lesion, multiple lesions, and stenosis greater than 2 cm as good predictors of requiring a second PTA.
- Multivariate competing risks analysis, adjusted for age and gender, found stenosis greater than 2cm and outflow vein lesion to be good predictors of requiring a second PTA, in the presence of the competing risk of AVF failure, study end, or death.
- In conclusion, the location and size of the stenotic lesion as well as the number of lesions are most predictive of post-intervention primary patency.
- Future studies are needed to determine the optimal approach to treating these lesions, especially once they require several repeated PTAs.