



Vascular Access Surveillance Reduces Vascular Access Thrombosis Rates (VATR)

G Zasuwa, S Frinak, A Besarab, J Yee. Henry Ford Health System, Detroit MI, U.S.

Abstract

BACKGROUND: Vascular access thromboses result in missed treatments (Tx), disrupted patient Tx schedules and reduce dialysis facility revenues. Detection of hemodynamically significant stenoses should reduce vascular access thrombosis rates (VATR). Adoption of KDOQI Vascular Access Surveillance (VAS) Guidelines by hemodialysis centers is anticipated to reduce VATR and offset the effort required by VAS. VAS by access flow does not reduce VATR, while duplex ultrasonography (DU) stenosis detection does. DU is cost-prohibitive for large-scale implementation. Consequently, we developed an algorithm that derived access pressure ratios (intra access pressure/MAP) Vasc-Alert® and explored the following hypothesis: Vasc-Alert® usage followed by referral for correction decreases VATR.

METHODS: A single dialysis center contributed data from 07/2003 through 05/2005 for analysis. Tx with permanent and temporary catheters were excluded. Baseline data were accrued from 06/03–12/03 and data were analyzed at 6-mo intervals by linear regression and results expressed as means ± s.e.m.

RESULTS: A total of 48,678 Tx were analyzed by the Vasc-Alert® surveillance algorithm. The baseline VATR prior to the completion of Vasc-Alert® implementation equaled 0.60 ± 0.12. A persistent and steady decline of VATR was demonstrated during interval follow-up: 0.54 ± 0.12, 0.33 ± 0.11 and 0.21 ± 0.05 (linear regression: $Y = -0.18X + 0.41$; $P = 0.048$). The last VATR mean approaches the previously reported minimum VATR (Besarab et al. *Kidney Int.* 47:1364–1373, 1995).

DISCUSSION: We conclude that Vasc-Alert® surveillance reduces VATR in a heterogeneous dialysis population. The large dataset compiled from each patient with Vasc-Alert® facilitates large-scale trend analysis that is unavailable with current existing technologies.

Introduction

Vascular access thromboses result in missed treatments (Tx), disrupted patient Tx schedules and reduce dialysis facility revenues. Adoption of KDOQI Vascular Access Surveillance Guidelines by hemodialysis (HD) centers is anticipated to reduce the vascular access thrombosis rate (VATR) by detecting hemodynamically significant stenoses, thereby permitting appropriate “elective” intervention prior to vascular access thrombosis. Methods of VAS include access flow, duplex ultrasonography (DU) and some form of intra-access pressure monitoring. DU is cost-prohibitive for large-scale implementation. We have developed an algorithm that derives intra-access pressure ratios (intra-access pressure / MAP) from routinely collected venous drip chamber pressure and blood pump settings (Vasc-Alert®) and explored this hypothesis: Vasc-Alert® usage, followed by referral to a vascular surgeon for correction, reduces VATR.

Methods

- Thrombotic events for native fistulas and synthetic grafts were tracked for 24 months in a large urban dialysis center.
- The inability to cannulate, obtain blood flow from a permanent access, with consequent inability to perform HD was defined as a thrombotic event.
- Vascular access surveillance was introduced in the first 6-month period and utilized until the present time.
- Thrombotic events were calculated using the following considerations:
 - Event rate = [Thrombotic events / Tx No.] in a specified interval of time = VATR
 - Rate per treatment year (events / pt-yr) = VATR × 156 (assuming 12 treatment months with 13 treatments per month),

Aim of Study

To determine if access surveillance benefits can be demonstrated in reducing the vascular access thrombosis rate in a large urban dialysis center.

Results

Monthly data is shown (Table 1). An average of 96 ± 7 graft and 69 ± 5 fistula patients were treated each month. During the study 104 grafts and 30 fistulas thrombosed. Baseline VATR for 6 months prior to the completion of Vasc-Alert® implementation was 0.60 ± 0.12 events/ pt-yr. A persistent and steady decline of VATR was demonstrated during interval follow-up periods (Table 2. and Figure 1.)

Table 2

Observation Period (6 mo)	Thrombosis Rate (events / pt-yr)
Control	0.60 ± 0.12
Period 1	0.54 ± 0.12
Period 2	0.33 ± 0.11
Period 3	0.18 ± 0.05

linear regression of mean data: $Y = 0.773 - 0.144X$, $R = .981$, $P < 0.05$

Study Patients Raw-Data

Period	Date	Thrombotic Events			Number of Patients			Thrombosis	
		Graft	Fistula	Total	Graft	Fistula	Total	Rate / Mo	Events/Pt-Yr
Control	2003 07	7	0	7	104	75	179	0.039	0.47
	2003 08	8	0	8	96	69	165	0.048	0.58
	2003 09	4	0	4	96	70	166	0.024	0.29
	2003 10	9	1	10	100	73	174	0.058	0.69
	2003 11	13	2	15	91	69	160	0.094	1.12
2003 12	4	2	6	95	78	174	0.035	0.41	
Period 1	2004 01	3	2	5	86	72	158	0.032	0.38
	2004 02	7	5	12	78	65	143	0.084	1.01
	2004 03	5	3	8	91	71	163	0.049	0.59
	2004 04	1	2	3	88	64	152	0.020	0.32
	2004 05	7	2	9	88	66	154	0.058	0.70
2004 06	1	2	3	88	67	155	0.019	0.23	
Period 2	2004 07	2	1	3	92	70	163	0.018	0.22
	2004 08	2	1	3	95	68	164	0.018	0.22
	2004 09	8	3	11	92	69	161	0.068	0.82
	2004 10	6	0	6	93	67	160	0.037	0.45
	2004 11	2	1	3	96	64	160	0.019	0.08
2004 12	3	0	3	99	63	162	0.018	0.22	
Period 3	2005 01	2	3	5	98	58	156	0.032	0.38
	2005 02	2	0	2	91	59	149	0.013	0.16
	2005 03	4	0	4	106	71	177	0.023	0.27
	2005 04	2	0	2	105	71	176	0.011	0.14
	2005 05	1	0	1	103	71	174	0.006	0.07
2005 06	1	0	1	100	72	172	0.006	0.07	
Recent Data	2005 07	2	0	2	99	69	168	0.012	0.07
	2005 08	2	1	3	102	76	178	0.017	0.14

Table 1. Monthly thrombotic events compared with the total number of patients treated for each access type. 104 grafts and 30 fistulas clotted during the study. There was a persistent decline in thrombotic events/pt-yr following the introduction of Vasc-Alert surveillance.

Vascular Access Thrombosis Rates

Dialysis Thrombotic Events

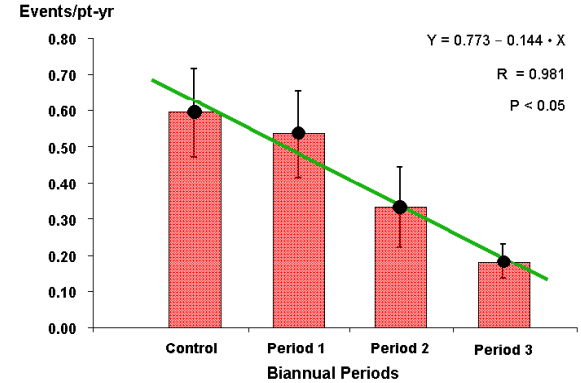


Figure 1. The thrombosis rate declined significantly $P < 0.05$ after introducing vascular access surveillance with Vasc-Alert® during Period 1.

Discussion

We conclude that access pressure surveillance with Vasc-Alert® reduces VATR in a heterogeneous dialysis population. The large dataset compiled from each patient with Vasc-Alert® facilitates large-scale trend analysis that is unavailable with current existing technologies. Aggressive monitoring provided with each “treatment pressure surveillance” reduces thrombotic events in the treatment setting.

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