

Observational Study of Surveillance Based on the Combination of Online Dialysance and Thermodilution Methods in Hemodialysis Patients with Arteriovenous Fistulas.

Néstor Fontseré¹, Gaspar Mestres², Marta Burrel³, Marta Barrufet³, Xavier Montaña³, Marta Àrias¹, Raquel Ojeda¹, Francisco Maduell¹, Josep M^a Campistol¹.

Departments of Nephrology¹, Vascular Surgery² and Interventional Vascular Radiology³. Vascular Access Unit, Hospital Clinic. University of Barcelona. Barcelona. Spain.

* Current guidelines recommend the development of specific monitoring programs for vascular access with the goal of early diagnosis of vascular dysfunction, thus reducing the percentage of thrombosis and the number of central venous catheter. The incorporation of Online dialysance (Kt) and thermodilution (BTM-Qa) methods in hemodialysis monitors in the last few years could be important components in vascular access monitoring programs.

Fontseré N et al. *Hemodialysis International* 2011; 15: 108-111 and Fontseré N et al. *Blood Purif* 2011; 31: 1-8.

OBJECTIVES

The main aim of this study was to assess the effect of a screening program based on the combination of Kt and BTM-Qa in the detection of vascular outcomes (stenosis and thrombosis) and prevention of access loss, as well as to determine the total economic impact in our hemodialysis unit in comparison with a historical control group.

MATERIAL AND METHODS

-148 patients in a stable hemodialysis program with arteriovenous fistulas (AVF) were studied for 2 years (2011-2012):

- (a) During the first period (2011), the historical control group was monitored with clinical parameters: 74 patients (50 men) with OL-HDF with a mean age of 59 ± 11.5 years (range: 30-83).
- (b) In the study period (2012), we studied 74 patients (52 men) with OL-HDF with a mean age of 60.4 ± 14.6 years (range: 27-85). During the study period, the indications for vascular treatments were the Kt reduction ≥ 20% with respect to baseline values or Qa < 500 mL/min (or a decrease in flow > 20%). We obtained continuous online Kt measurements in each hemodialysis session (10,928 Kt determinations) and monthly Qa values with BTM in all patients with previous endovascular treatment and every 2 months or quarterly in the other patients (400 BTM-Qa determinations).

- All patients were undergoing hemodialysis with a 5008S Fresenius Medical Care machine and routine parameters with OL-HDF, dialysis buffer with bicarbonate and 1.5 or 1.8 m² high-flux polysulfone or Helixone filters.

- Differences between the Qa and Kt groups were tested using Student's t test or the Wilcoxon test, as appropriate. The χ² test was used to analyze the angioplasty and thrombosis rates compared with the historical control group. A p value ≤ 0.05 was considered statistically significant.

- The statistical analysis was performed by using the PASW 18 package (IBM SPSS Statistic, New York, N.Y., USA).

RESULTS

Table 1. Patient characteristics during the study period with online dialysance and thermodilution methods

Number	74
Males/females	52/22
Age, years	60.4±14.6
Proportion with diabetes, %	29.7
Proportion with hypertension, %	75.7
Time in the hemodialysis program, months	46.2±65
Hemodialysis modalities, number of patients	
OL-HDF 3 sessions/week (td: 4-5 h)	56
Nocturnal OL-HDF every other day (td: 7-8 h)	13
Short-term OL-HDF 6 sessions/week (td: 1.5-2 h)	5
Qb baseline, ml/min	414±32
Kt baseline, liters	73.4±21.1
Time with vascular access, years	3.5±4.9
AVF anastomotic site, n (%)	
Distal forearm	39 (52.7)
Elbow/upper arm	35 (47.3)

Mean ± SD or percentage. Qb = Extracorporeal blood flow's basal value; td = time of hemodialysis session.

$$\text{Access flow} = Q_s \times (1-R_x) \times (1-R_n) / (R_x-R_n)$$

Qs = effective blood flow (ml/min)

Rn = recirculation obtained with the tubing in the normal position

Rx = recirculation obtained with the tubing in the reversed position

Schneditz D et al. *J Am Soc Artif Intern Org* 1998; 44: 74-81

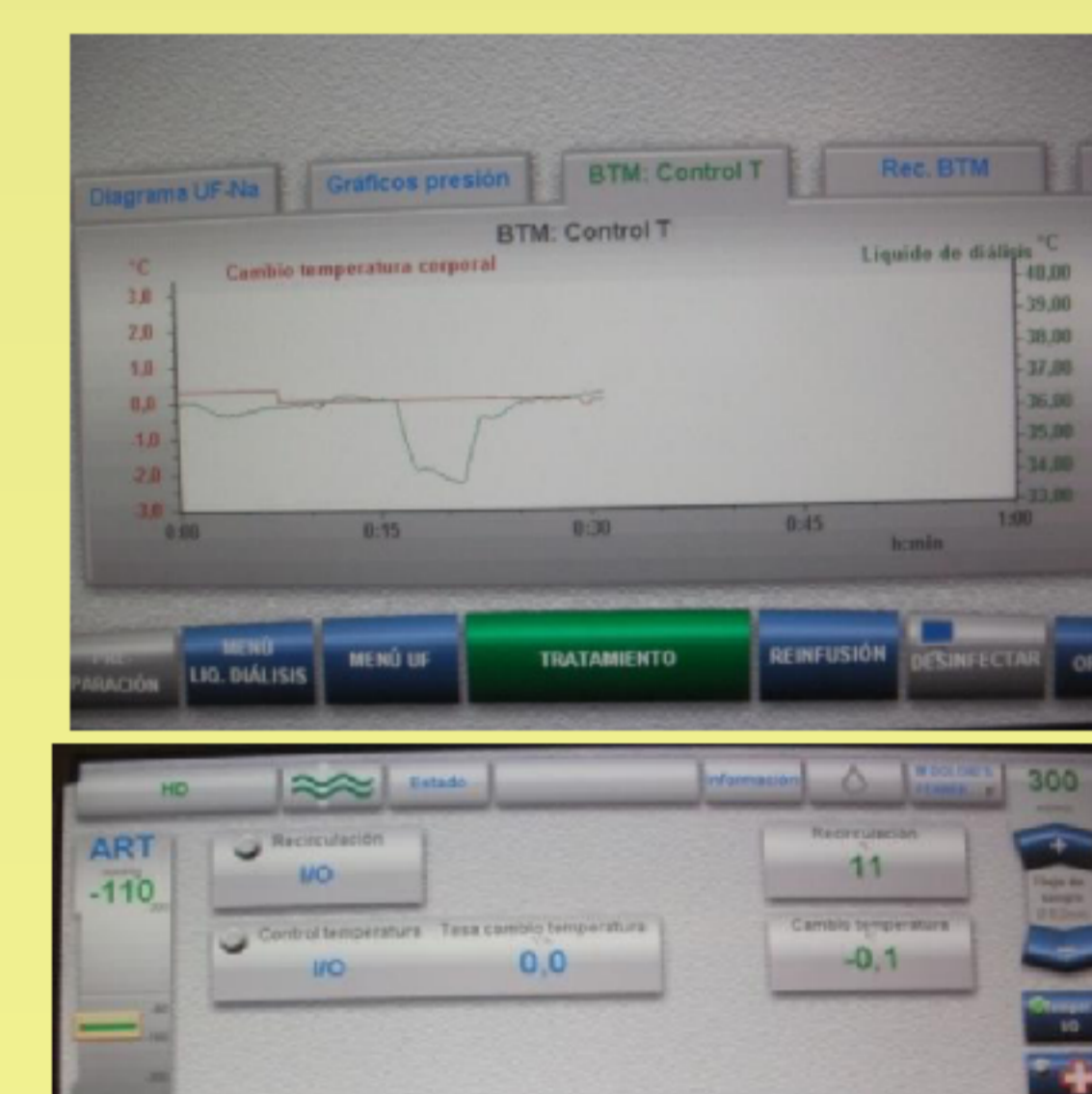


Table 2. Population rates of study outcomes

	Study			Control			p
	n	rate	95% CI	n	rate	95% CI	
Access imaging	15	0.203	0.127-0.308	20	0.270	0.182-0.381	0.333
Stenosis detection	14	0.189	0.116-0.293	13	0.176	0.106-0.278	0.831
Elective stenosis repair	13	0.176	0.106-0.278	10	0.135	0.075-0.231	0.496
Thrombosis	2	0.027	0.007-0.093	11	0.148	0.085-0.247	0.029*
Access loss	1	0.014	0.002-0.073	4	0.054	0.021-0.131	0.172

The study group included the combined monitoring program based on Kt and BTM-Qa (combined criterion). * p < 0.05.

Table 3. Cost analysis in euros/AVF-year

	Unitary cost cost, EUR	Study			Control			p
		n	mean cost, EUR	95% CI	n	mean cost, EUR	95% CI	
Elective angioplasty	1,328	12	215.4	101.2 to 329.5	13	233.3	115.4 to 351.2	
Thrombectomy	3,144	1	42.5	-42.1 to 127.2	7	297.4	82.8 to 512.0	
Tunneled catheter	1,029	1	13.9	-13.8 to 41.6	4	55.6	1.3 to 109.9	
Proximal reanastomosis	583	2	15.8	-6.3 to 37.8	0	0	0-0	
New vascular access	607	1	8.2	-8.1 to 24.6	2	16.4	-6.6 to 39.4	
Hemodialysis session	167	1	2.3	-2.2 to 6.8	7	15.8	4.4 to 27.2	
Hospitalization day	236	1	3.2	-3.1 to 9.5	7	22.3	6.2 to 38.4	
Total cost			301.1	140.8-461.5		640.9	379.7-902.0	0.033*

* p < 0.05.

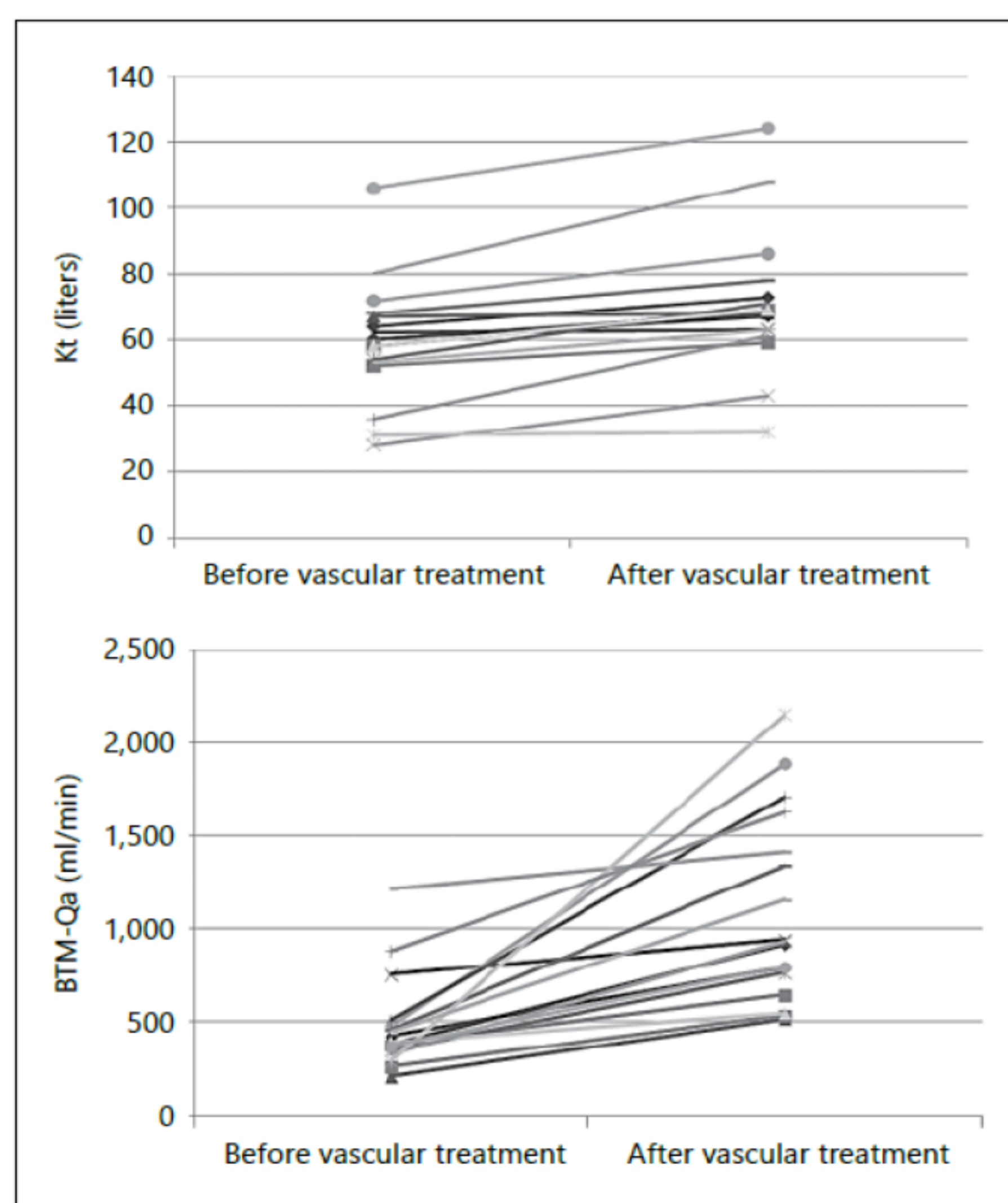


Fig. 1. Kt (liters) and BTM-Qa (ml/min) before and after endovascular (stenosis) and proximal reanastomosis in radiocephalic AVF. The indications for vascular treatments were the combination of Kt reduction by ≥20% in three consecutive hemodialysis sessions with respect to baseline or Qa < 500 ml/min (or a decrease in flow > 20%). After endovascular treatments, the dialysis dose measured with online dialysance [Kt] was 71.1 liters (59 liters; p = 0.001) and BTM-Qa was 1,218.6 ml/min (519.7 ml/min; p = 0.001).

Néstor Fontseré, MD, PhD. Nephrology Department and Vascular Access Unit. Hospital Clinic. Barcelona. Spain.

fontseren@clinic.ub.es

CONCLUSIONS

This study suggests that in adult patients with end-stage renal disease under hemodialysis, the combined monitoring program based in Kt and BTM-Qa is an effective screening method for the diagnosis of vascular access dysfunction. As shown by our results, these indirect methods significantly reduce the thrombosis rate and the economic costs of endovascular treatments in hemodialysis patients with AVF.

