

## *Focus on:*

# I – The nephrologist's role in arteriovenous fistulae monitoring and surveillance

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## ■ ABSTRACT

The vascular access is critical in chronic haemodialysis patients. A well functional arteriovenous fistula (AVF) is associated with reduced morbidity and mortality. Monitoring and surveillance programmes for early recognition and treatment of vascular access dysfunction could increase patency rates. An AVF monitoring and surveillance programme is proposed, correlating parameters of the dialysis treatment, physical examination and access blood flow measurements (Qa). The central role of nephrologists is emphasized, along with the critical interventions for success of this process: leadership, multidisciplinary involvement, regular and standardized assessment of the vascular access, training/education and regular auditing of outcomes.

**KeyWords:** Haemodialysis; monitoring; surveillance; vascular access.

## ■ RESUMO

O acesso vascular é um elemento crítico nos doentes em hemodiálise. A utilização de fístula arteriovenosa (FAV) como acesso vascular associa-se a menor morbi-mortalidade. Os programas de monitorização e vigilância permitem o reconhecimento e tratamento atempados dos problemas de acessos vasculares, aumentando a taxa de patência. Neste artigo propomos um programa de vigilância de FAV, que integra os parâmetros do tratamento dialítico, exame físico e medição do débito intra-acesso. Enunciam-se os princípios essenciais para a implementação de um programa de vigilância e manutenção de AV, valorizando o papel essencial do nefrologista e o envolvimento multidisciplinar, onde os programas de treino e formação contínua, a avaliação sistematizada e regular dos acessos e a auditoria de resultados e processos são essenciais.

**Palavras-Chave:** Acesso vascular; hemodiálise; monitorização.

## ■ INTRODUCTION

A well-functioning vascular access (VA) improves dialysis efficiency and reduces morbidity and mortality<sup>1-3</sup>. The arteriovenous fistula (AFV) is recognized as the best vascular access, as stated by several scientific societies and its importance has deserved specific initiatives worldwide in order to improve its prevalence<sup>4-6</sup>. The nephrologist's responsibility in the VA management, in order to promote a growing number of patients with AVF, is very wide and includes: a) preservation of vascular heritage and choice of the most appropriate VA for each patient; b) VA maintenance, including the diagnosis and/or treatment of dysfunctional VAs.

The aim of this article is to reflect on how we can operationalize the nephrologist role in HD units.

## ■ DEFINING, ORGANIZING AND IMPLEMENTING A VA MONITORING PROGRAMME

Despite the fact that a definitive evidence in literature linking the implementation of VA monitoring programmes and a measurable impact in prognosis is lacking, with some authors further suggesting that they can lead to increased costs with unnecessary interventions, several international guidelines clearly state that dialysis centres should implement monitoring and surveillance programmes to timely detect and refer VA problems<sup>7-13</sup>. The question arises on how to implement these programmes, perceiving that it is essential to involve and coordinate broad multidisciplinary teams that include nephrologists, nurses, vascular surgeons and the patients themselves, with continuous education and training programmes, adequate records and audits of the results in order to ensure well functioning AVFs, preserve the vascular heritage and ultimately contribute to a better quality of life and improved survival<sup>6,14-18</sup>.

When organizing a VA monitoring and surveillance programme, it is mandatory to define **who** is responsible for it, **how** to do it and **when** to do it. A sustainable programme should be based in procedures that are quick, easy to perform, reproducible and with economic rationality.

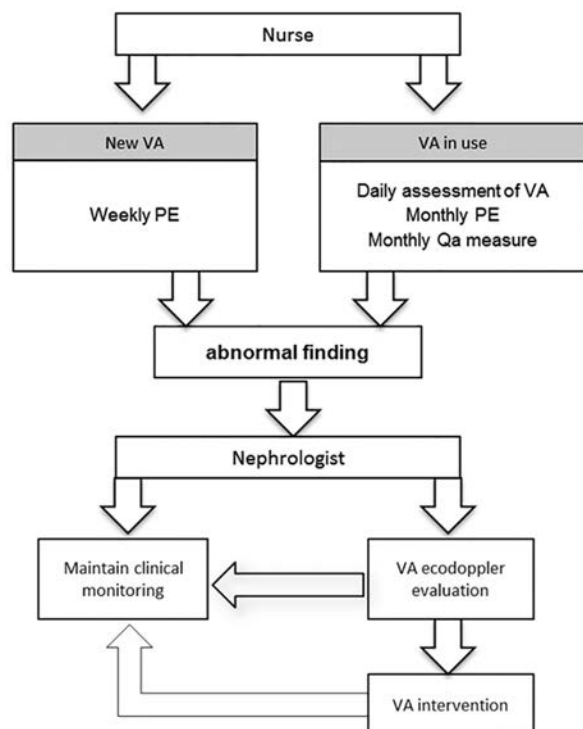
There is a number of VA monitoring and surveillance methods described in the literature: physical examination (PE); measurement of access blood flow (Qa); ratio intra access pressure/mean arterial pressure; recirculation rate; among others. Many of these methods have good accuracy to detect stenosis, and have been shown to improve AVF patency. Among these, PE has been revisited recently, showing a high accuracy in detecting inflow or outflow stenosis when comparing to doppler ultrasound or angiography with the additional advantage of diagnosing other problems of AVF, like steal syndrome or infection, not detected by other surveillance tests<sup>4,19-23</sup>. Regardless of what methods are used, a well-designed programme should be able to detect early dysfunction and a close monitoring of the progression of a known stenosis or hand ischaemia allowing a timely referral for surgical or endovascular intervention. In either case, the intervention should only be considered when truly necessary, thus avoiding procedures that would solely increase costs and inflict pain and distress to the patient<sup>10,24,25</sup>. Combining VA function assessment in every treatment event, along with regular PE and screening tests, seems to be the most efficient approach to organize a VA monitoring programme<sup>7,25-27</sup>.

Bearing in mind that nurses handle the vascular access on a daily basis, they must be considered as key players in any VA monitoring/surveillance programme. They should be proficient with the skills of VA monitoring. Any perceived abnormality should prompt a nephrologist consultation whom, in turn, will proceed according to the findings, planning whether to keep a close clinical monitoring or referring for a VA consultation for further assessment (Fig. 1)<sup>4,6,28,29</sup>. In the event of a newly created VA, nurses should assess its maturation through a weekly PE, looking for inadequate development of the draining vein or signs of steal syndrome. An AVF that is not well developed at 6 weeks should be referred for a VA consultation. Early complications of the AVF are quite common and detecting them at an early stage allows for an adequate intervention, reducing the central venous catheter (CVC) use time<sup>14,15,20</sup>.

When an AVF is already in use, the monitoring programme should include at least an access assessment in every treatment session. In each

**Figure 1**

Definition of a VA monitoring programme



hemodialysis (HD) session signs of potential problems or access dysfunction should be checked: inflammatory signs, difficulties in cannulation; vascular access pressures (AP, VP), blood flow rate changes; prescribed blood flow not achieved during the treatment and prolonged bleeding time after needle removal. A systematic PE of the AVF before cannulation and assessment access blood flow (Qa) must also be performed on a monthly basis<sup>4,19,20,25</sup>.

Physical examination of the AVF should be simple, quick and systematic so it can be done by all nurses on a monthly basis<sup>9,19</sup>. For these reasons we propose a simplified PE that includes 7 steps:

1. Thrill assessment
2. Pulse assessment
3. Veins collapse assessment after arm elevation
4. Presence of thoracic and neck collateral circulation

5. Presence of arm swelling
6. Identifying signs and symptoms of steal syndrome
7. Presence and characteristics of sneurisms

Adding other physical examination steps, such as auscultation of VA and pulse augmentation test, is time consuming, increases complexity and difficulty on interpretation without a clear advantage for early detection of VA dysfunction.

Monthly measure of Qa should be included in the surveillance programme to maximize the results of PE. The gold standard method to measure Qa is doppler ultrasound, but several other indirect methods are validated (e.g., thermodilutional, conductivity) and can be made available at dialysis units for routine use<sup>22</sup>. Qa measured has great variability between haemodialysis sessions but has shown good accuracy in the detection of stenosis, further improving vascular access monitoring/surveillance accuracy<sup>7,8,23-25</sup>. Abnormal Qa findings should be carefully interpreted, giving special relevance to the trends of several evaluations and correlating them with PE findings and other dialysis parameters.

## EDUCATION AND TRAINING

Education and training, targeting all professionals involved, is a key element to implement a sustainable monitoring programme. It should include knowledge of VA anatomy, functional aspects and clinical assessment<sup>18</sup>. Nephrologists should play a central role in these education and training programmes. They must guarantee that, after being trained, all members of the staff are proficient in performing a PE in less than 3 minutes and capable of interpreting its findings<sup>4,6,19,20</sup>. Table I resumes the main findings of a normal physical examination of a VA. Education and training must also include the main VA complications (Table II).

Tailored educational programmes targeting patients and families are also important. Teaching VA care (e.g., hygiene, isometric exercises, etc.) and to identify the most important signs of dysfunction (e.g., steal syndrome, prolonged bleeding time, changes in thrill or pulse) are relevant focuses of this education<sup>4,18</sup>.

**Table I**

Simplified physical examination of AVF

Steps of physical examination of va	Normal	Abnormal
Thrill	Felt throughout the vein for at least 10 cm upwards from anastomosis	Absent Felt throughout the vein in segments for less than 10 cm upwards from anastomosis
Pulse	Soft Vein easily compressible	Strong Vein compressible with difficulty
Veins collapse after arm elevation	The fistulae collapse completely	The fistulae do not collapse completely
Thoracic and neck collateral circulation	Absent	Present
Arm swelling	Absent	Present
Steal syndrome	No symptoms	Pale and cold hand Distal pain and/or numbness Changes of fine motor skills Ischaemic fingertip lesions
Aneurisms	No pulsatility Collapse after arm elevation Stable size Skin integrity	Pulsatility is increased Do not collapse after arm elevation Rapid growth Thin skin Skin lesions

**Table II**

Clinical findings in AVF complications

		Infection	Thrombosis	Juxta-anastomotic stenosis	Venous stenosis	Central vein stenosis	Steal syndrome
<b>VA assessment in treatment</b>	Inflammatory signs	Present	Possibly present			Possibly present	
	Difficulties in cannulation			Present			
	VA pressures			Pa < 200	PV > 200	PV > 200	
	Blood flow changes			Present			
<b>Physical Examination</b>	Haemostasis				Difficult	Difficult	
	Thrill		Absent	Palpable in less than 10cm			
	Pulse			Possibly strong on anastomosis	Strong		
	Veins collapse after arm elevation				No	No	
	Thoracic and neck collateral circulation					Present	
	Arm swelling					Present	
	Steal syndrome						Present
<b>Qa measure</b>	Aneurisms				Possible pulsatile aneurisms		
	Qa			Decreased	Possibly decreased		

## REGISTRIES AND AUDITING

A solid VA monitoring and surveillance programme needs accurate records allowing the assessment of the trends in the assessed parameters<sup>4,7,14,15</sup>. Regardless of how these programmes are implemented, it is fundamental to audit results and analyse data looking for parameters such as: a) AVF thrombosis rates, b) AVF primary failures, c) VA related hospital admissions and, d) number and time of dialysis catheter. These data portrait the programme's efficiency and allow its revision and adjustment, according to the perceived needs<sup>29-31</sup>. As specified by the international guidelines, the expected outcomes regarding quality parameters are thrombosis rate lower than 0.25 and 0.5 episodes/patient/year at risk, for AVF and grafts respectively<sup>4</sup>.

The literature clearly recognizes that continuous evaluation of the obtained results allows improvement of patency rates and outcome of VAs<sup>15</sup>.

## CONCLUSION

Caring for patients in haemodialysis requires a holistic approach involving many players. The vascular access has a central role in this process. The arteriovenous fistula is recognized to be the best option for most patients. Establishing a policy targeting the implementation of the international guidelines for increasing AVF rate requires a multidisciplinary approach where nephrologists must have a central role.

Education and training for early recognition of AVF dysfunction is a key issue for implementation of VA monitoring/surveillance programmes with recognized impact on morbidity, quality of life and mortality,

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