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Hemodialysis vascular access coordinator: Three-level model for access management

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Abstract

Management of vascular access is a challenge for the dialysis team, particularly to keep the arteriovenous access working. The vascular access coordinator can positively contribute to increase the number of arteriovenous fistulas and reduce central venous catheters. In this article, we introduce a new approach to vascular access management centered on (the results of setting up) the role of vascular access coordinator. We described the three-level model (3Level_M) for vascular access management organized in three levels: vascular access nurse manager, vascular access coordinator, and vascular access consultant. We defined the instrumental skills and training required to be developed by each element and clarify the articulation between the model and all members of the dialysis team related to vascular access.

1 | INTRODUCTION

The implementation and effectiveness of renal replacement therapy (RRT) depend directly on appropriate vascular access, such as arteriovenous fistula (AVF) (best choice), or alternatively a graft or a central venous catheter (CVC).¹

Nowadays, chronic kidney disease (CKD) patients are older, suffer from a larger number of comorbidities, and have more complex vascular accesses. Therefore, the dialysis team and patients face new challenges. The complications of the arteriovenous accesses are already documented and require supervision (monitoring and surveillance) in order to decide the appropriate time to intervene.^{1,2}

Literature shows that the vascular access coordinator can have an important contribution in the identification of these situations and in the implementation of a new approach leading to the best results in clinical care.³⁻⁸ The vascular access coordinator's role can be crucial to improve the planning of timely interventions free of thrombosis,^{7,6} improve vascular access outcomes,^{3,7} decrease the number of grafts and CVCs,⁵ and apply a quality policy with the vascular access.⁶ The purpose of this article is to analyze the vascular access coordinator's contribution (to) in the vascular access outcomes and introduce a new approach on vascular access management, the three-level model (3Level_M).

1.1 | Vascular access coordinator

Literature shows the importance of the vascular access coordinator to increase the number of AVFs⁷ and reduce the number of CVCs^{3,5} and patient hospitalizations related with vascular access problems.

A few articles describe the role and the responsibilities of a vascular access coordinator^{3,5,7} who is usually a nurse with experience in hemodialysis, who understands the importance of the vascular access and has good communication skills.

Each organization has a vascular access-coordinator model focused on the nurse working in collaboration with a nephrologist or vascular surgeon (Table 1). The study by Loon et al⁷ involved 2300 patients who participated on a program to improve the quality of the vascular access in 47 dialysis centers in the Netherlands during 3 years. A working group was created including nephrologists, vascular surgeons, radiologists, and three nurses trained as vascular access coordinators. This taskforce developed multidisciplinary procedures and protocols for the construction, surveillance, and intervention in vascular accesses. Their model increased the AVF success rate from 69% to 77% ($p < 0.01$) and increased the percentage of interventional access by percutaneous transluminal angioplasty (from 0.39 to 0.50 patient/year, $p < 0.001$).⁷

One of the most important tasks of the vascular access coordinator is monitoring and surveillance of the arteriovenous access through physical examination, pressure monitoring, and access flow.⁷ Kalman et al⁴ showed a reduction in CVC permanence (2.5 ± 0.06 vs. 1.1 ± 0.03 days, $p = 0.001$), and Dwyer et al³ found an increase of the AVF success rate from 45% to 64.3% ($p < 0.001$), explained by the tasks associated the vascular access coordinator.

In a study with 184 patients with end-stage renal failure starting hemodialysis therapy, the role of the vascular access-coordinator nurse was used to reduce the incidence of CVC in patients on hemodialysis.⁵ The vascular access coordinator decreased the number of catheter-days (2833 vs. 4685 days) and increased the AVF success rate from 56% to 75% ($p = 0.007$).⁵

Every study shows the vascular access coordinator must train the patient about vascular access care and maintenance,³⁻⁷ which are considered an important coordinator's task. However, no study has defined the skills or the training required for nurses to be a vascular access coordinator. Experience in hemodialysis was the only factor mentioned in two studies.^{3,5}

Literature does not clearly show how the vascular access coordinator should be trained nor what instrumental skills and educational background are required to take on this job. These issues should be made clear, and the articulation among the dialysis team members should be set.

2 | 3LEVEL_MOF THE VASCULAR ACCESS MANAGEMENT

Vascular access management is complex and a challenge for the entire dialysis team (nephrologist, nephrologist nurse, nurse, and patient).⁹

Maintaining the vascular access in a good condition for an effective hemodialysis treatment requires a monitoring and surveillance program designed to detect complications and to define the "best" time to intervene.^{1,8,10}

Literature shows the hemodialysis vascular access coordinator can optimize the vascular access management and increase the number of AVFs, providing better cost-effectiveness.⁷ However, literature is not very clear about the academic education and training required by a vascular access coordinator. From this point of view, setting up a vascular access coordinator must be organized and well planned in order to extract the full potential from this position.

The vascular access management model focused on the vascular access coordinator requires thinking about the role of the dialysis nurse in regard to access monitoring and surveillance. We describe a vascular access management model, called the three-level model, which consists of three levels, the most relevant being the vascular access coordinator (Figure 1). The first level is called the vascular access management nurse, the second level is the coordinator and the third level is the consultant. The 3Level_M defines the academic background, education/training, and skills competencies required for each level.

2.1 | Vascular access manager nurse

The first level is the dialysis nurse who is responsible for the physical examination of the arteriovenous access,¹⁰ the analysis of recommendations for cannulation,¹¹ implementation of monitoring and/or surveillance programs,¹² and patient education.¹³⁻¹⁵ The number of patients to be carefully assessed by any nurse should be no greater than five. The nurse must document all the vascular access information and notify the vascular access coordinator new changes or findings in the vascular access.

The nurse at this level needs specific training on vascular access such as a basic vascular access course focused on physical examination (normal and with complications) and surveillance methods.¹² Complete physical examination (inspection, palpation, and auscultation)¹⁰ should be done every fortnight. This training should be developed in a clinical context using simulation for 50 h. When a situation may lead to a process of vascular access dysfunction is detected or when doubts about some aspects of monitoring and/or surveillance arise, the manager nurse must let the coordinator know.

2.2 | Vascular access coordinator

The second level of the vascular access management model is the vascular access coordinator. He is required to be experienced in vascular access, and particularly, in access physiology, pathophysiology of complications, ultrasonography, physical exercises to improve the vascular network, and intervention approaches. Patient assessment should be carried out in a vascular access consultation, dedicated to access mapping, detection of complications and their impact on the vascular

TABLE 1 Description of the activities of vascular access coordinator.

Study	Coordinator	Activities	Results	Weakness
Kalman et al (1999)	Registered nurse	<ul style="list-style-type: none"> • Surveillance of the vascular access • Identification of complications • Schedule and organization of access interventions • Weekly consultation with the vascular surgeon for patient evaluation • Patient education 	<ul style="list-style-type: none"> • Reduction in the length of stay before and after the implementation of the vascular access coordinator (2.5 ± 0.06 vs. 1.1 ± 0.03 days, $p = 0.001$) 	It does not define the nurse's skills
Loon et al (2007)	Nurse (group that included the nephrologist, the radiologist, and the vascular access surgeon)	<ul style="list-style-type: none"> • Regular education (meetings) • Created multidisciplinary procedures and protocols for the construction, maintenance and intervention on vascular accesses • Education program in institution • Surveillance program (physical examination, monitoring pressures, and access flow) • Appointed a vascular access nurse in each unit to run the program • The vascular access nurse made the connection between the dialysis unit, involving the nephrologist and the vascular access coordinator 	<ul style="list-style-type: none"> • Increased the AVF rate from 69% to 77% ($p < 0.01$) • Decreased the number of temporary subclavian vein catheters (34% vs. 11%, $p < 0.01$) • Increased the percentage of jugular vein catheters (23%–35%) • Increased the percentage of interventions by percutaneous transluminal angioplasty due to access malfunctioning (from 0.39 to 0.50 patient/year, $p < 0.001$) • Increased the percentage of surgical revisions (from 0.06 to 0.12 per patient/year, $p < 0.001$) 	It does not define the training required by the vascular access coordinator and by the vascular access nurse
Polkinghorne et al (2009)	Nurse (experience on HD and understanding the importance of the vascular access)	<ul style="list-style-type: none"> • Planning and coordination of end stage renal disease patients vascular access procedures • Scheduling and organization of access interventions • Determine the classification of patients in the waiting list in terms of priority for surgery • Patency and primary failure assessment • Patients' education 	<ul style="list-style-type: none"> • Increased the AVF rate from 56% to 75% ($p = 0.007$) • Decreased the number of catheter-days (2833 vs. 4685 days) 	It does not define the training required by the vascular access coordinator
Dwyer et al (2012)	Registered nurse (with 20 years of hemodialysis experience)	<ul style="list-style-type: none"> • Monthly monitoring of all vascular accesses by physical examination • Monthly review of venous and arterial pressures and blood flow rates of the last 12 dialysis treatments • Schedule vascular access procedures (angiography, vein mapping, surgical appointments and procedures) 	<ul style="list-style-type: none"> • Increased the AVF rate from 45% to 64.3% ($p < 0.001$) • Decreased the number of grafts • Percentage of dialysis catheters used for more than 90 days was cut in half 	It does not define the nurse's skills, only the experience in years

(Continues)

TABLE 1 (Continued)

Study	Coordinator	Activities	Results	Weakness
		<ul style="list-style-type: none"> Monitoring blood cultures in patients with a catheter and fever Assess difficult cannulations and all new accesses Provide recommendations to dialysis staff about access-needle size Educate patients and staff about vascular access care and maintenance Work with the director of interventional nephrology to design policies and procedures 		
Pundir et al (2021)	Operation theater nurse	<ul style="list-style-type: none"> Counseling patients regarding options and need for permanent dialysis access Reviewing history of patients including frequency and duration of dialysis catheter insertions and requesting a venogram to rule out central venous stenosis Ultrasound-guided vessel mapping and scheduling patients for vascular access Planning and scheduling for corrective interventions such as surgery and angioplasties Educating patients regarding follow up, fistula care, and thrill assessment Screening for fistula complications, stenosis, and complications Scheduling post-op follow-up Doppler assessment prior of dialysis start Maintaining records of access-related procedures and complications and preparing monthly audits 	<ul style="list-style-type: none"> Increased the number of AVF from 511 to 713 (39%) Reduced the number of follow-up visits to surgeons from an average of 4–0.25 visits/patient Increased the salvage procedures from 44 to 161 (272%) Increased the primary and secondary patency rates to 86% and 92% 	It does not define the training provided to the vascular access coordinator and the gain of experience required

access, and cannulation problems and surveillance methods in complex accesses by direct flow assessment.

The coordinator must have good communication skills in order to develop an interdisciplinary practice with other professionals (nephrologist, nephrologist nurse, nurse, and vascular surgeon) with the purpose of making the best decision for the patient vascular access. Such decisions can lead to maintain monitoring and surveillance or enable the identification of the appropriate moment for intervention. Another important issue is passing the information and

decision concerning the indication or change of vascular access cannulation sites.^{11,16}

The coordinator plays an important role in the education and training of the entire dialysis team.¹² He should promote and provide the vascular access nurse manager with continuing education, especially on cannulation techniques, physical examination, surveillance, and ability to refer patients to the coordinator.

The vascular access coordinator needs specific training on ultrasonography and decision-making related to the vascular access.

Therefore, courses of vascular access ultrasound and development of decision-making skills are the key. Preferably, the vascular access coordinator should be trained in a clinical setting under the supervision of a senior vascular access coordinator, not less than 200 h. We defined this number of hours, considering that all education and training are necessary, mainly ultrasound course, with the respective learning curve, to develop decision-making capacity for vascular access, as well as an autonomous decision. We believe it is important to implement and then evaluate. It is important to develop studies that can validate or increase more information about the aspect to be included in the training model.

Literature reviews selects the nurse as the most suitable professional to take this position. From our point of view, the nurse should be the professional with better knowledge, good communication skills, motivation, decision-making ability, and a full bond with the institution. We believe the nurse can be a good choice for

this job, always in articulation with the nephrologist. Preferably, the vascular access coordinator should be full-time in the dialysis unit, and may perform other activities (supervision, management support), depending on the size and number of patients in the dialysis unit.

2.3 | Vascular access consultant

The third level is the vascular access consultant whose main role is advising and supporting the coordinator. He can raise questions and may need to discuss decisions occasionally. This counseling and discussion/reflection process enables the coordinator to develop his decision-making ability.

The vascular access consultant is supposed to promote scientific publication, organize and update scientific evidence, and promote the development of research projects with the coordinator. Furthermore, he must have experience in scientific publishing, and it is suggested a Master or PhD degree related to the vascular access.

2.4 | Articulation of the 3Level_M

The articulation between the vascular access coordinator and the manager nurse is very important for the success of 3Level_M. Definition of the information flow and the process of monitoring and referring patients is a key factor. Communication between the coordinator and the vascular access center or the vascular surgeon is essential to understand what was been previously done, providing directions to the vascular access manager nurse. A representative flowchart of the 3Level_M dynamic shown in Figure 2.

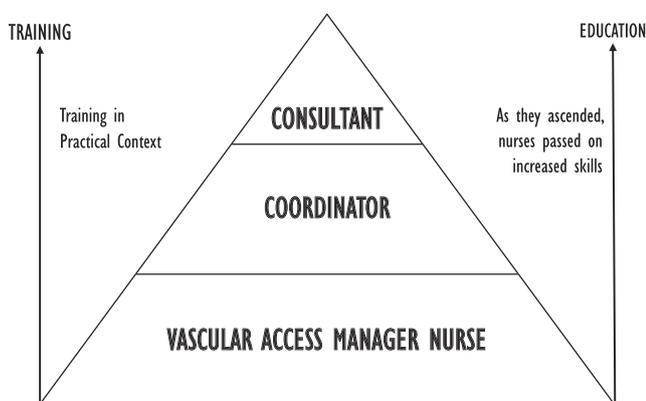


FIGURE 1 The 3Level_M for vascular access management.

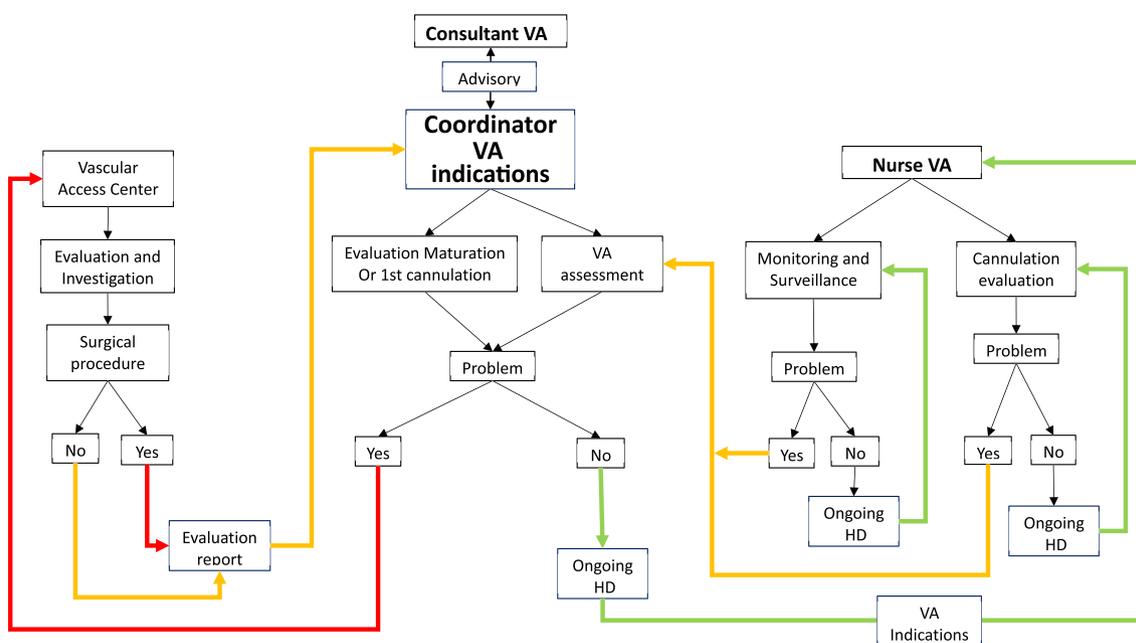


FIGURE 2 Flowchart of the 3Level_M for vascular access management.

2.5 | Barriers and challenges of the 3Level_M

Preparing nurses to manage the vascular access can be a challenge for the dialysis units. Nurses will need practical training in a clinical context, and it can be a barrier in some dialysis units due to the high turnover. It is important to design a theoretical-practical training program tailored to the needs, which can also provide monitoring and surveillance skills of the vascular access.

The time required to train a vascular access coordinator on decision-making can be another hurdle. We believe that internship centers designed to develop the ability to make decisions is also a key factor even though such centers can be a big challenge for the nephrology community.

3 | CONCLUSION

We introduced a new approach to access management by the vascular access coordinator. The 3Level_M for vascular access management is focused on three levels with specific skills for each one and different decision degrees. We think that the 3Level_M can bring benefits to dialysis units and especially to patients. In some institutions, it may not be possible to implement it in its entirety. Our approach can contribute to the continuous improvement of nephrological care, based in the three-level skill's model, and the articulation between all intervenient in this process: nurses, nephrologists, vascular surgeons, and vascular access center. The 3Level_M can contribute to the continuous improvement of care provided to end-stage renal disease patients.

CONFLICT OF INTEREST STATEMENT

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