The role of the nephrologist in the management of vascular access

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Introduction

The Dialysis Outcomes and Practice Patterns Study (DOPPS) associated the preferred application of autogenous arteriovenous fistulas (AVFs), as currently applied in Europe and Japan, with a decrease in therapeutic costs [1]. The 1-year probability of failure for a prosthetic vascular access (VA) is almost twice that of autogenous AVFs [1]. Reduced primary patency increases hospitalizations, use of central vein catheters (CVCs), invasive and surgical procedures and thus costs. Preparation and maintenance costs are greater for grafts and CVCs [2]. The worldwide increase in dialysis patients with multiple comorbidities enhances the need for VA, but efficient application is hampered as the system mostly relies on isolated professionals with often limited experience, instead of experts working in teams. Centres cannot match the demand and/or do not comply with the guidelines [3]. As a consequence, many patients start dialysis on a CVC [4], while many AVFs (30–60%) fail or do not mature [5], suggesting an incorrect selection of patients [6], resulting from failures in management and training.

Training of nephrologists in VA

Almost 50 years ago, Quinton and Scribner made possible the arteriovenous shunt with an ‘artifact’, thus inaugurating the era of repeated use of VAs for haemodialysis (HD) and allowing this experimental treatment to become routine practice [7]. But it is as if these pioneers had opened Pandora’s box: despite having positive outcomes, a series of new problems materialized.

The policy concerning VA impacts not only on the costs incurred by the health care systems but also on the morbidity and mortality of patients [8]. At a time in which we must decide the allocation of increasingly limited resources, it is the responsibility of scientific societies and institutions to shoulder the problem and invest in training. But which model to adopt? We suggest the creation of large reference centres: in general, it is estimated that a reference centre is needed for every 500 patients on dialysis [9], where they can undergo a wide variety of procedures related to VA, including endovascular procedures. There, the high number of procedures will allow the maintenance and improvement of skills, thus favouring the dissemination of guidelines and better communication among nephrologists and other involved professionals [9,10]. This requires mutual cooperation in order to build a team that is able to meet any VA request [9]. Centres focusing on access care should prioritize practical training, teaching and tutoring to improve skills. Training must be based on effective teaching: learning occurs through the demonstration of an act done properly to illustrate the process rather than by reviewing them. Also, written instructions should be communicative and not empty procedures for the end user [11]. Thus, the proposed reference centres should be complementary to the guidelines or recommendations. The latter offers a theoretical background to the proposed education centres where nephrologists can practice their skills and practical procedures are taught. It can be hypothesized that the training of nephrologists could achieve two goals: to create VAs by themselves, as is the case in many Divisions of Nephrology in Italy and in some other countries [12] and the ability to act in specific circumstances based on decision trees. It has been clearly shown that enhanced training in VA creation predicts AVF placement and patency in HD patients, as shown by the results of a 47-item questionnaire conducted in 12 DOPPS countries and sent to surgeons involved in VA placement and nephrologists [12]. In Italy, nephrologists performed the majority of access interventions (85%); in contrast, vascular surgeons were the primary surgeons for accesses in facilities in Germany (57%), Spain (92%) and Canada (81%) [12]. The majority of respondents from Italy (85%) and Germany (57%) indicated a high degree of emphasis on VA during surgical training compared with 20% of US respondents [12]. It is important to underline that guidelines cannot substitute detailed teaching in the field of VA [13]. A training programme for nephrologists in the field of VAs might include:

(i) VA education

(a) Candidate dialysis patients should be examined thoroughly when planning their VA; (b) clinical problems in prevalent HD patients such as needling difficulties, reduced access flow rates, arm oedema and steal syndromes must be
checked on a regular basis; with this aim, proficiency in Doppler ultrasound must be encouraged and/or implemented among nephrologists; physical examination techniques must be demonstrated and whenever possible correlated with vascular radiographic images and (c) access blood flow screening must be encouraged and/or implemented, even though a recent systematic review has shown that the evidence in favour of this frequently used tool is weak [14].

(ii) VA planning

The National Kidney Foundation Dialysis Outcomes Quality Initiative (K/DOQI) recommends that future end-stage renal disease patients, as well as prevalent dialysis patients, should be evaluated by history and physical examination to determine the most suitable type and location of VA [15]. When clinical evaluation reveals a potential problem known to be associated with vascular impairment, diagnostic evaluation by phlebography and/or vascular ultrasound must be recommended to detect underlying defects in vascular structure and flow [9].

(iii) Vascular mapping

Vascular mapping is essential prior to any vascular procedure. It is irrelevant who makes the preoperative access evaluation, if the physician performing the evaluation is skilled and has the opportunity to perform enough procedures to develop and maintain his/her competence and if the necessary information is transmitted to the physician constructing the access. In an ideal setting, the evaluator and the ‘surgeon’ are the same individual, but this is not mandatory as long as the information is shared [9].

(iv) Interventions

Insertion and/or correction of VAs should be a key part of the training programme: while other medical subspecialties, such as cardiology and neurology have developed a broad range of sophisticated interventional procedures, many training nephrologists are not taught how to place a CVC, a peritoneal catheter and even to perform a kidney biopsy. When the nephrologist assumes the role of ‘surgeon of the VA’, the absolute prerequisites are: a day-surgery operating room in which Doppler ultrasound and radiocopy devices must be available; an anaesthetist should be alerted for complicated interventions; if the estimated workload of the reference centre is that of 500 patients on dialysis [9], a team of three nephrologists would be required with two programmed surgical sessions a week and access to an operating room in case of emergent interventions; each surgical session requires the presence of two of the three nephrologists; consequently, all of them are involved in the other daily activities of the Division of Nephrology in the other days of the week; the training of VA surgery is performed by experienced nephrologists and, if necessary, by vascular surgeons. Finally, it must be acknowledged that complex VAs, which are nowadays more and more frequent, may require inevitably the intervention of the vascular surgeon.

If a training programme which includes a direct surgical experience cannot be implemented for whatever reasons, trainees should, in any case, be actively involved in a large number of procedures, such as placement of AVFs, arteriovenous grafts, tunnelled CVCs, performance of percutaneous balloon angioplasty and thrombectomy procedures for access thrombosis, etc.

Role of nephrologists in the management of VA

Historically, nephrologists took the lead in the development and clinical application of innovations in VA. However, surgeons and radiologists have become the clinicians who perform most VA-related procedure and, perhaps by default, have become the clinicians who have taken most of the decisions regarding access planning and placement. However, it is becoming more and more clear that nephrologists also in this context are able to assume leadership roles, thus providing excellent levels of effectiveness, efficiency and safety [9]. Moreover, the number of scientific publications on VA published in nephrology journals over the past decade indicates that nephrologists are also playing a more active role in performing interventions to combat access predicaments [16]. Thus, we believe that if it may not be conceivable to generalize the proposal of encompassing the role of the nephrologist as surgeon of the VA, as for example, in our Division [17], it should be mandatory that nephrologists take on the role of coordinator of the VA team. In fact, the problems associated with the management of a VA, though important, go beyond the technical details represented by the performance of the anastomosis. More generally, they are related to the choice of the VA, its planning and timing and surgical strategies in relation to the characteristics of the patient and to the management of complications [18]. They are related also to the need for careful clinical and instrumental monitoring [19,20]. Finally, problems related to complications cause the hospitalization of dialysis patients which has a high impact on morbidity and mortality.

Several guidelines, recommendations and position statements have been published in recent years [15,21–26]: they give diagnostic algorithms and pathways in order to optimize the management of VA, increasing the level of awareness of nephrologists in this important area of nephrology. The choice of the type of VA has clinical and economic implications. The construction of a VA by a US nephrologist is a rare exception because of political barriers, training and logistics [27]. In the US, VAs are usually performed by the transplant surgeon or the vascular surgeon. However, it was in this country that the need for a paradigm shift in the management of VA was first felt, creating interesting experiences such as those on Interventional Nephrology or the creation of centres devoted to the care of VA, the Vascular Access Centre, with very bright results [28–30].

Although, as Konner wrote, there is not a European model for the management of VA [13], it is the current opinion that countries where greater involvement of nephrologists or where there is a strong integration between the professional subjects, get better outcomes. In recent years, the nephrology community has taken the responsibility to build a solid background of knowledge around the issue of VAs that goes beyond the strict competence of its discipline and sees increasing involvement of other professionals, starting from vascular surgeon, interventional radiologist and last but not least, the dialysis nurse. A team should pursue the goals of quality and safety in relation to international standards and guidelines but must also
be capable of a strong integration and able to respond promptly and appropriately to all patient needs. The team should also pursue research objectives and use increasingly advanced technologies. In this context of multidisciplinary work ARCH project laid the groundwork for the creation of a computerized model that, through easily measurable parameters based on readily available in vivo imaging techniques, allows the prediction for a single patient of outcomes associated with VA, such as the maturation or the complications of the VA [31].

Conclusions

Adequate VA is essential for efficient dialysis. The nephrology community should be aware that: (i) the VA issue imposes a major financial burden to the health care systems and can be associated with increased morbidity and mortality [8,32]; (ii) the increasing incidence and prevalence of the worldwide HD population will determine the growing demand for VA [3,4]; (iii) if it may not be conceivable to generalize the proposal of encompassing the role of the nephrologist as surgeon of the VA, as is frequently the case in Italy, nephrologists should be able to play a leading and coordinating role of the VA team because they bear the ultimate responsibility for the outcomes of their patients. We suggest the creation of nephrology unit-based large reference centres for VA, one for every 500 HD patients. The high number of procedures will allow the improvement of skills by adequate training and teaching.

Conflict of interest statement. None declared.

References

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