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Review Article

Role of interventional nephrology in the multidisciplinary approach to hemodialysis vascular access care



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ABSTRACT

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Dialysis vascular access planning, creation, and management is of critical importance to the dialysis patient population. It requires a multidisciplinary approach involving patients and their families, dialysis facility staff, the nephrologist, the surgeon, and the interventionalist. With the emergence of interventional nephrology as a subspecialty of nephrology, the nephrologist is increasingly providing both the nephrology and interventional aspects of care, and in some areas, the surgical functions as well. Most of these interventional nephrologists work in freestanding outpatient dialysis access centers (DACs). Large clinical studies published over the past 10 years demonstrate that the interventional nephrologist can manage the problems associated with dialysis access dysfunction effectively, safely, and economically. A recently published study based upon United States Medicare claims data in which a DAC patient group ($n = 27,613$) and a hospital outpatient department patient group (HOPD group; $n = 27,613$) were compared using propensity score matching techniques showed that patients treated in the DACs had significantly better clinical outcomes ($P < 0.001$). This included fewer vascular access-related infections (0.18 vs. 0.29), fewer septicemia-related hospitalizations (0.15 vs. 0.18), and a lower mortality rate (47.9% vs. 53.5%).

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Introduction

Hemodialysis is the perfect example of bioengineering being applied to a medical problem to preserve the life of the patient with an otherwise fatal disease. Unfortunately, the interface between the mechanism and the patient, the vascular access, is defective. It is a problem that contributes significantly to the morbidity and mortality associated with the process and the leading cause of hospitalization in the end-stage renal disease (ESRD) patient population [1]. Dialysis

vascular access planning, creation, and management are critical in allowing realization of the ESRD patient's longevity potential. This process is best carried out using a multidisciplinary approach which involves the patient and his/her family, the nephrologist, the dialysis facility personnel, the surgeon, and the interventionalist.

For healthcare professionals, regardless of their specialty, to perform their function in this process in the most optimal fashion, they should possess three critical characteristics [2]. First, they must understand the dialysis process and the dialysis patient. Dialysis patients are unique and have unique problems. Access planning, creation, and management must be individualized. A single algorithm will not serve all cases. Individualization is possible only through understanding of the patient and the process.

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Second, the healthcare professional must have a thorough in-depth knowledge of dialysis vascular access. This must include the types of access that are available, the individual characteristics of each, and the appropriate application of each. This must include a knowledge of what not to do and what to do in individual cases.

Third, they must have skill and expertise in the procedures that they are to perform whether this be the cannulation of an arteriovenous access, the surgical creation of the access, or a maintenance procedure performed because of malfunction.

The nephrologist must play a leadership role in the multidisciplinary team overseeing dialysis vascular access. First and foremost, the nephrologist caring for the patient on chronic dialysis therapy has a responsibility to be an advocate for that patient. To perform this function adequately and effectively, it is essential that the physician become knowledgeable in the area of vascular access, develop a vascular access strategy, and oversee its operation. Delegation of this facet of dialysis patient care to other specialists is less than optimum. The physician who knows the most about the patient, is an expert in hemodialysis, and has the deepest understanding of how the vascular access impacts all other facets of the patient's care must also be the leader in managing the vascular access.

It is possible for the nephrologist to play an active role in all of the three activities associated with dialysis vascular access—planning, creation, or management—and in some areas, they do. An increasing number of nephrologists have found that the best way to fulfill their obligation to the patient is interventional nephrology (IN). Historically, dialysis vascular access planning, creation, and maintenance have not been done well in many parts of the world [3–7]. Because of this, nephrologists have been becoming increasingly involved over the past 2 decades. This is especially true for dialysis access maintenance procedures. This has given rise to a new subspecialty of nephrology referred to as IN.

Interventional nephrology

In practice, although some would want to broaden the definition, the term interventional nephrology has come to be defined as

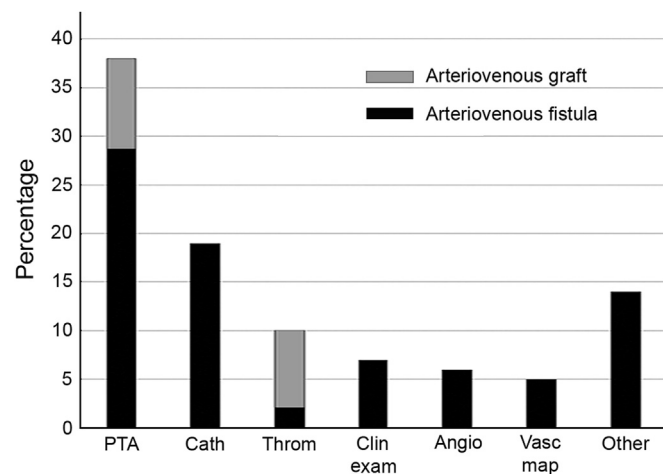


Figure 1. Case distribution for IN facility. This is based on 100,000 procedures performed in 75 facilities for the year 2014. Angio, angiogram; Cath, catheter-based procedures; Clin exam, clinical examination; IN, interventional nephrology; Other, miscellaneous procedures; PTA, percutaneous transluminal angioplasty; Throm, thrombectomy; Vasc map, vascular mapping.

that branch of nephrology that deals with the establishment and maintenance of dialysis access, particularly arteriovenous access. A tabulation of the variety of procedures performed in a typical group of facilities is shown in Fig. 1. In the United States, most interventional nephrologists work in freestanding dialysis access centers (DACs), which are designed, equipped, staffed, and supplied specifically for dialysis vascular access management procedures. Their primary goal is to provide an efficient and economical alternative for managing access dysfunction away from the hospital setting. Their efficiency allows for a patient with a thrombosed vascular access to receive therapy and return to the dialysis clinic within a matter of hours, thus avoiding missed treatments.

The growth of IN has been almost exponential since its beginning. All of the reasons for this growth are not obvious; however, there are several advantages that relate to improved patient care that have become apparent in dialysis programs in which an interventional nephrologist is involved. The first of these is expeditious management of dialysis access dysfunction. Typically, dialysis access procedures have been given low priority by consultants performing the required procedures. As a result, patients require hospitalization and temporary dialysis catheters frequently [1]. With the advent of IN, these have become outpatient cases associated with a quickly realized, marked decrease in dialysis patient hospitalization and missed dialysis treatments [8].

A second advantage is individualized patient care. The nephrologist trained as an interventionalist can provide the required individualized care, and a prospective approach to the planning for future dialysis vascular access can be provided only by someone who understands the dialysis patient, the dialysis treatment, and vascular access issues.

An additional advantage relates to the opportunity for research and innovation that is offered by involvement in the management of the dialysis patient's vascular access. Many dialysis vascular access principles are opinion based. This problem is of obvious paramount importance to the nephrologist providing care to these patients. The nephrologist who is well versed in the basic principles of dialysis vascular access and has the ability to manage these problems independently is in an advantageous position to conduct meaningful research and innovation in this area.

Table 1. Success rates for dialysis access procedures for interventional nephrologists

Procedure	2004		2014	
	No.	Success rate (%)	No.	Success rate (%)
TDC-Place	1,765	98.24	4,038	97.89
TDC-Ex	2,262	98.36	8,851	99.29
AVF-PTA	1,561	96.58	32,392	99.40
AVG-PTA	3,560	98.06	12,418	99.56
AVF-T	228	78.10	2,613	87.94
AVG-T	4,671	93.08	8,447	94.08
Combined	14,067	96.18	68,759	98.24

AVF, arteriovenous fistula; AVG, arteriovenous graft; Ex, exchange; Place, placement; PTA, percutaneous transluminal angioplasty; T, thrombectomy; TDC, tunneled dialysis catheter.

From "Effectiveness and safety of dialysis vascular access procedures performed by interventional nephrologists," by G.A. Beathard, T. Litchfield, Physician Operators Forum of RMS Lifeline, Inc., 2004, *Kidney Int*, 66, p. 1622–1632. Reprinted with permission.

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