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Dialysis Vascular Access Training: A Nicaraguan Experience

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Nicaragua is experiencing a rapid growth of patients who are undergoing chronic hemodialysis because of the high incidence of Mesoamerican nephropathy in the Pacific Coast region.

The Pan-American Health Organization recently published a special report about an epidemic of chronic kidney disease (CKD) unrelated to diabetes, hypertension, and other known causes that devastates the Pacific Coasts of Nicaragua, El Salvador, Costa Rica, and Guatemala and has caused high rates of morbidity and mortality among young male agricultural workers.[1] The Pan-American Health Organization recommends "chronic kidney disease of nontraditional origin" (CKDnt) as the name for the disease and proposes that the existing epidemiologic evidence is sufficient to consider CKDnt in Mesoamerica an occupational disease driven by work-related heat stress.[1]

Nicaragua (Figure 1), with a population of 6,527,691 and a 2019 gross domestic product of $36.153 million, has a prevalence of kidney replacement therapy of 520 patients per million population, accounting for 70% on hemodialysis, 28% on peritoneal dialysis, and 2% with a functioning kidney transplant allograft.[2]

The epidemiologic profile identifies the end-stage kidney disease population as young men with long life expectancies and with well-preserved vasculature. Hemodialysis remains the mainstay kidney replacement therapy because the kidney transplantation rate remains low at 2 patients per million population per year, primarily because of the absence of a deceased donor transplant program.[2] The creation and maintenance of dialysis vascular access is therefore of prime importance for long-term KRT.

In Nicaragua, a policy to sustain hemodialysis services has resulted in the adoption of a vascular access–focused strategy to make treatment viable and cost effective.

Incorporating a vascular access care plan as an integral part of hemodialysis service from its conception remains imperative. The incident patients should never be left dependent on a central venous catheter. The consequences of prolonged exposure to a central venous catheter leads to complications such as infection and central vein stenosis. These complications are frequent and require complex, expensive, and recurrent interventions that ultimately shorten life expectancy. The best practice remains avoiding long-term catheter use.

Unplanned vascular access management can lead to a regrettable picture of "Venus de Milo syndrome": a young patient with a reasonably long life expectancy, truncated by the inability to provide dialysis therapy as a result of vascular exhaustion from poorly preserved peripheral and central veins. On the other hand, an early and strategized approach toward vascular access creation has led to a high prevalence of native arteriovenous fistula (AVF). A single-center experience at Baptist Hospital Hemodialysis Center, Vascular Access Registry, found that 85% of patients had a functioning AVF, which is higher than the international average of 65% in the United States and 60% to 80% in Europe.[3] A younger population in Nicaragua, with relatively well-preserved vasculature, clearly offers an advantage over the Western population that is older and that has multiple comorbidities.

Despite the high prevalence of CKD in Nicaragua, the workforce available to treat CKD is limited

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Figure 1. Nicaragua (blue) and the cultural region of Mesoamerica (thick red line).

compared with the average number of nephrologists and vascular surgeons in Latin America (4 vs. 18 nephrologists per million population[2]) and vascular surgeons around 1.5 per million population.

Globally, various specialists (vascular surgeons, general surgeons, transplant surgeons, interventional radiologists, cardiothoracic surgeons, and nephrologists as a nonsurgical specialty) are involved in the construction of vascular access for hemodialysis. It seems reasonable to state that dedication to vascular access surgery is more important than specialty of the proceduralist. Globally, formal education and certification in vascular access surgery is often the exception than the rule. The years of surgical training are less important compared with the number and complexity of procedures performed per year.[4]

The Interventional Nephrology Working Group of the International Society of Nephrology identified a shortage of personnel skilled in creating and managing dialysis access as a critical challenge. It also recognized the need to equip the kidney care community with appropriate skills and delineated the minimum standards needed to practice in resource-limited countries without compromising the safety and quality of care.[5] Initiatives with a focus on building a modular training program to provide trainees with a reproducible level of exposure and competency have been published.[6]

Nicaraguan Experience

The International Society of Nephrology Educational Ambassador visits in 2017 with follow-up hands-on workshops focused on building the awareness and importance of vessel preservation, creating a long-term access, and minimizing the use of central venous catheters. However, without a formal surgical training program the impact into clinical practice was slow.[7] Herein, we describe our experience implementing a pilot surgical training program with a structured curriculum. In July 2020, a hemodialysis facility treating 1500 patients initiated a plan to train 2 general surgeons in native AVF surgery. Considering the importance of this service for patients with end-stage kidney disease, their clinic and their demographic profile, the scarcity of a specialized workforce, and the dramatic potential benefit of timely vascular access creation for patients, we agreed to undertake the initiative. We estimated that mastery on native AVF creation in this population will meet vascular access demand for ≥70% of patients while delegating complex procedures to vascular surgeons equipped with advanced skills.

Training Plan

A modular plan was designed to provide didactic, clinical, and surgical training over a 2-month period (Table 1). Spanish Vascular Access Guidelines[8] was assigned as fundamental reading material. Additional reading material was provided from the e-curriculum and webinars available on the International Society of Nephrology Academy website (academy.theisn.org), Atlas of Dialysis Vascular

Table 1. Modular training plan

Didactic training
Spanish Vascular Access Guidelines
ISN Academy: modules and e-curriculum (academy.theisn.org)
ISN Educational Ambassador visit
Vascular access–focused workshops
Review of key publications
Clinical assessment
Preoperative physical assessment skills
Physical assessment skills postsurgery for arteriovenous fistula maturation
Surgical training
First month: trainee as an assistant
3 cases/day
Second month: trainee as a primary surgeon
3 cases/day

ISN, International Society of Nephrology.

Access,[9] and other key scientific publications. The preoperative evaluation of patients was developed by trainees supervised by a mentor with clinical and ultrasonography assessment. One to 3 surgical procedures per day were performed 3 times a week. In the first month, procedures were performed by the mentor as primary surgeon and trainee as an assistant. In the second month, roles were reversed, with trainees as the primary surgeons supervised by the mentor. A total of 28 native AVFs were created on 27 patients (average age 48.6 years, 92% men [n = 25]). The AVF location was radiocephalic (n = 18, 66%), brachiocephalic (n = 8, 29%), and a single 2-stage basilic vein transposition. All surgical procedures were performed under local anesthesia supplemented with intravenous conscious sedation. The basilic vein transposition was performed under brachial plexus blockade. All procedures were performed in an outpatient center. The primary maturation failure rate was 7%. After successfully completing the training, 2 surgeons were integrated into the vascular access service and in 5 months they have created 280 AVFs.

Future Plans

In emerging economies, especially those affected by CKDnt, the opportunity to provide optimal CKD care remains challenging. Ongoing efforts focused on prevention, early detection, and treatment need to remain a primary objective. For patients, improvement in health care plans, the availability of peritoneal dialysis, and deceased donor kidney transplantation remain critical. Quality improvement of hemodialysis vascular access service may be seen as a minor issue in the overall delivery of CKD care, but in practice it translates into important outcomes on quality of life, life expectancy, and the burden of health care costs to society.

Factors that are commonly found to negatively affect the quality of vascular access care are a lack of surgical skills/training, a reimbursement system for establishing or maintaining vascular access, a lack of training/education of allied health professionals,[10] a lack of technology for specialized vascular procedures, and the high cost of devices. Our early experience with implementing a structured training plan using available online resources, interactions with global experts, and support from the International Society of Nephrology has been encouraging. Future goals include expanding this pilot model to other centers and engaging the Nicaraguan Nephrology Society (an affiliate society of the International Society of Nephrology) in creating an advocacy group to influence health care policy changes.

DISCLOSURE

All the authors declared no competing interests.

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