Chapter 4: Vascular Access

- 80.3% of patients were using a catheter at hemodialysis initiation in 2014, which has changed little since 2005 (Figure 4.1).
- At 90 days after initiation of dialysis, 68.3% of hemodialysis patients were still using a catheter in 2014 (Figure 4.7.a).
- AV fistula use at hemodialysis initiation rose from 12% to 16.9% over the period 2005-2014 (Figure 4.1).
- The percentage of patients at hemodialysis initiation using an AV fistula or with a maturing AV fistula increased from 28.9% to 33.8%, over the same period (Figure 4.1).
- The percentage of patients using an AV fistula exclusively at the end of one year on hemodialysis was 65%, up from 17% at initiation (Figure 4.7.a).
- The proportion of patients with an AV graft for vascular access was 3% at hemodialysis initiation, and 15% at 1 year after initiation (Figure 4.7.a).
- At 1 year after hemodialysis initiation, 80% of patients were using either an AV fistula or AV graft without the presence of a catheter (Figure 4.7.a).
- By December 2014, 63.4 % of prevalent dialysis patients were using an AV fistula (Figure 4.6).
- In 2014, 33.8% of AV fistulas placed failed to be in use following placement, with a median of 114 days to first AV fistula use (Table 4.7).
- The percent of AV fistula that successfully matured was higher with younger age; similarly, the median time to first AV fistula use was somewhat shorter with younger age (Table 4.7).

Introduction

Clinical practice guidelines recommend an autogenous arteriovenous (AV) fistula as the preferred vascular access for hemodialysis (National Kidney Foundation, 2006). A recent systematic review of 62 cohort studies with 586,337 patients evaluated the association between type of vascular access and risk of mortality, infection, and major cardiovascular events. While recognizing the risk of selection bias inherent in observational studies, it concluded that central venous catheters (hereafter, catheter[s]) were associated with the highest risk of death, infection, and cardiovascular events, compared with other types of vascular access, and that patients who had a usable AV fistula were at the lowest risks for these events (Ravani et al., 2013).

The international Dialysis Outcomes and Practice Patterns Study (DOPPS) highlighted the fact that U.S. dialysis practices with respect to vascular access lagged behind other industrialized countries of the world (Pisoni et al., 2002; Goodkin et al., 2010; Robinson et al., 2010). In large part, these international comparisons served as impetus for implementation of the Fistula First Breakthrough Initiative (FFBI) by the Centers for Medicare & Medicaid (CMS) (Vassalotti et al., 2012). A steady increase in AV fistula placement efforts followed in the United States over the next decade, such that the proportion of prevalent hemodialysis patients using an AV fistula rose from 32% in 2003 to 63% by 2014.

A robust debate continues as to whether an AV fistula should remain the access of first choice in every dialysis patient. Although an AV fistula continues to

be considered the optimal type of vascular access in many patients owing to its potential for durability and lower risk of infection and intervention to ensure patency, the focus has shifted somewhat toward creating the most appropriate access for the individual patient, based upon the clinical situation, patient characteristics, life expectancy, patient preference, and other factors. Whether this approach will indeed prove superior can only be determined by further detailed, prospective studies, and/or clinical trials.

A landmark clinical trial where maturation of an AV fistula was a secondary outcome, revealed the high prevalence of failure of newly placed fistulas ever coming to use (Dember et al., 2008). This topic is of great interest to the nephrology community (Riella, et al., 2013) and led to the NIDDK funded Hemodialysis Fistula Maturation Study (Dember et al., 2014) designed to study this phenomenon further. Between primary surgical failures and maturation failures, 33.8% of AV fistula placements in the United States are unsuccessful (Table 4.7). The many potential factors underlying this phenomenon need to be rigorously evaluated so that primary surgical success rates and subsequent optimal maturation of the AV fistula can be ensured. In this regard, greater emphasis on AV fistula placement during surgical training may need to be prioritized in the United States (Saran et al., 2008; Goodkin et al., 2010). A number of other factors, including patient motivation for access placement, timeliness of referral for nephrology care and vascular access placement, likely impact successful AV fistula placement—suggesting that a systematic, multilevel approach is required for ensuring optimal vascular access for every hemodialysis patient (Huber, 2015).

Interventional nephrology has gained prominence in the United States over the last decade or so, introducing a new class of specialists involved with vascular access procedures to a field previously dominated primarily by surgeons and interventional radiologists trained in vascular access procedures. The impact of this phenomenon on patient outcomes has yet to be systematically studied. In addition, technological advances, such as bioengineered vessels, continue to be studied, and have the potential to influence future vascular access practice and patient outcomes.

All of the above considerations make it imperative to comprehensively and carefully track vascular access placements, related practices, and outcomes. In addition to patient characteristics, other factors such as technological advances, improved surgical and medical treatments, use of specific medications, payment reform and bundling, and improved pre-dialysis care can impact vascular access practice patterns and outcomes. Despite the emphasis on improving AV fistula success rates, at the time of their initial dialysis, 80% of patients are still using a catheter. Well-coordinated pre-dialysis care during the critical transition period to ESRD may be the key to future improvements in this suboptimal practice pattern.

This chapter describes patterns of vascular access use among incident and prevalent dialysis patients by patient characteristics and geographic region over the last decade. In addition, we explore variation in time-to-first-use of AV fistula after placement as a surrogate of AV fistula maturation across the country. Additional information describing vascular access use by dialysis providers is provided in *Chapter 10: Dialysis Providers* in Volume 2 of this Annual Data Report.

Methods

This chapter uses data from the Centers for Medicare & Medicaid Services (CMS). Details of the data source are described in the Data Sources section of the ESRD Analytical Methods chapter.

See the section on Chapter 4 in the ESRD Analytical Methods chapter for an explanation of analytical methods used to generate the study cohorts, figures, and tables in this chapter.

Vascular Access Use at Initiation of Hemodialysis

A total of 80.3% of patients were using a catheter at hemodialysis initiation in 2014, which has changed little since 2005. Figure 4.1 shows that, in 2014, 61.6% of hemodialysis patients incident to ESRD had neither an AV fistula nor AV graft in place (or maturing) at their first outpatient hemodialysis session. This peaked at 65.4% in 2008, and has been relatively stable near 60% since around 2012. Over the last seven