**National Quality Forum—Evidence (subcriterion 1a)**

**Measure Number** (*if previously endorsed*)**:** 0256

**Measure Title**: Minimizing Use of Catheters as Chronic Dialysis Access

**IF the measure is a component in a composite performance measure, provide the title of the Composite Measure here:** Click here to enter composite measure #/ title

**Date of Submission**: 2/27/2014

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| **Instructions**  *For composite performance measures:*  *A separate evidence form is required for each component measure unless several components were studied together.*  *If a component measure is submitted as an individual performance measure, attach the evidence form to the individual measure submission.*   * Respond to all questions as instructed with answers immediately following the question. All information needed to demonstrate meeting the evidence subcriterion (1a) must be in this form. An appendix of *supplemental* materials may be submitted, but there is no guarantee it will be reviewed. * If you are unable to check a box, please highlight or shade the box for your response. * Maximum of 10 pages (*incudes questions/instructions*; minimum font size 11 pt; do not change margins). ***Contact NQF staff if more pages are needed.*** * Contact NQF staff regarding questions. Check for resources at [Submitting Standards webpage](http://www.qualityforum.org/Measuring_Performance/Submitting_Standards.aspx). |

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| **Note: The information provided in this form is intended to aid the Steering Committee and other stakeholders in understanding to what degree the evidence for this measure meets NQF’s evaluation criteria.**   1a. Evidence to Support the Measure Focus The measure focus is evidence-based, demonstrated as follows:   * Health outcome: [**3**](#Note3) a rationale supports the relationship of the health outcome to processes or structures of care. Applies to patient-reported outcomes (PRO), including health-related quality of life/functional status, symptom/symptom burden, experience with care, health-related behavior. * Intermediate clinical outcome: a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence [**4**](#Note4)that the measured intermediate clinical outcome leads to a desired health outcome. * Process: [**5**](#Note5) a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence [**4**](#Note4) that the measured process leads to a desired health outcome. * Structure: a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence [**4**](#Note4) that the measured structure leads to a desired health outcome. * Efficiency: [**6**](#Note6) evidence not required for the resource use component.   **Notes**  **3.** Generally, rare event outcomes do not provide adequate information for improvement or discrimination; however, serious reportable events that are compared to zero are appropriate outcomes for public reporting and quality improvement.  **4.** The preferred systems for grading the evidence are the U.S. Preventive Services Task Force (USPSTF) [grading definitions](http://www.uspreventiveservicestaskforce.org/uspstf/grades.htm) and [methods](http://www.uspreventiveservicestaskforce.org/methods.htm), or Grading of Recommendations, Assessment, Development and Evaluation [(GRADE) guidelines](http://www.gradeworkinggroup.org/publications/index.htm).  **5.** Clinical care processes typically include multiple steps: assess → identify problem/potential problem → choose/plan intervention (with patient input) → provide intervention → evaluate impact on health status. If the measure focus is one step in such a multistep process, the step with the strongest evidence for the link to the desired outcome should be selected as the focus of measurement. Note: A measure focused only on collecting PROM data is not a PRO-PM.  **6.** Measures of efficiency combine the concepts of resource use and quality (see NQF’s [Measurement Framework: Evaluating Efficiency Across Episodes of Care](http://www.qualityforum.org/Publications/2010/01/Measurement_Framework__Evaluating_Efficiency_Across_Patient-Focused_Episodes_of_Care.aspx); [AQA Principles of Efficiency Measures](http://www.aqaalliance.org/files/PrinciplesofEfficiencyMeasurementApril2006.doc)). |

**1a.1.This is a measure of**: (*should be consistent with type of measure entered in De.1*)

Outcome

Health outcome: Click here to name the health outcome

Patient-reported outcome (PRO): Click here to name the PRO

*PROs include HRQoL/functional status, symptom/symptom burden, experience with care, health-related behaviors*

Intermediate clinical outcome (*e.g., lab value*): Catheter rate

Process: Click here to name the process

Structure: Click here to name the structure

Other: Click here to name what is being measured

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**HEALTH OUTCOME/PRO PERFORMANCE MEASURE**  *If not a health outcome or PRO, skip to* [*1a.3*](#Section1a3)

**1a.2.** **Briefly state or diagram the path between the health outcome (or PRO) and the healthcare structures, processes, interventions, or services that influence it.**

N/A

**1a.2.1.** **State the rationale supporting the relationship between the health outcome (or PRO) to at least one healthcare structure, process, intervention, or service (*i.e., influence on outcome/PRO*).**

N/A

*Note: For health outcome/PRO performance measures, no further information is required; however, you may provide evidence for any of the structures, processes, interventions, or service identified above.*

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**intermediate outcome, PROCESS, or STRUCTURE PERFORMANCE measure**

**1a.3.****Briefly state or diagram the path between structure, process, intermediate outcome, and health outcomes**. Include all the steps between the measure focus and the health outcome.

The measure focus is the process of measuring catheter use at facilities. The process leads to improvement Measure Catheter Rate --> Assess value --> Identify problems --> Decrease Catheter Rate --> Impact on mortality

**1a.3.1.** **What is the source of the systematic review of the body of evidence that supports the performance measure?**

Clinical Practice Guideline recommendation – ***complete sections*** [***1a.4***](#Section1a4)***, and*** [***1a.7***](#Section1a7)

US Preventive Services Task Force Recommendation – ***complete sections*** [***1a.5***](#Section1a5) ***and*** [***1a.7***](#Section1a7)

Other systematic review and grading of the body of evidence (*e.g., Cochrane Collaboration, AHRQ Evidence Practice Center*) – ***complete sections*** [***1a.6***](#Section1a6) ***and*** [***1a.7***](#Section1a7)

Other – ***complete section*** [***1a.8***](#Section1a8)

*Please complete the sections indicated above for the source of evidence. You may skip the sections that do not apply.*

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**1a.4. CLINICAL PRACTICE GUIDELINE RECOMMENDATION**

**1a.4.1.** **Guideline citation** (*including date*) and **URL for guideline** (*if available online*):

National Kidney Foundation: DOQI Clinical Practice Guidelines for Vascular Access. Update 2006.

<http://www.kidney.org/professionals/KDOQI/guidelines_commentaries>

**1a.4.2.** **Identify guideline recommendation number and/or page number** and **quote verbatim, the specific guideline recommendation**.

2.1 The order of preference for placement of fistulae in patients with kidney

failure who choose HD as their initial mode of KRT should be (in descending

order of preference):

2.1.1 Preferred: Fistulae. (B)

2.1.1.1 A wrist (radiocephalic) primary fistula. (A)

2.1.1.2 An elbow (brachiocephalic) primary fistua. (A)

2.1.1.3 A transposed brachial basilic vein fistula: (B)

2.1.2 Acceptable: AVG of synthetic or biological material, such as: (B)

2.1.2.1 A forearm loop graft, preferable to a straight configuration.

2.1.2.2 Upper-arm graft.

2.1.2.3 Chest wall or “necklace” prosthetic graft or lower extremity

fistula or graft; all upper-arm sites should be

exhausted.

2.1.3 Avoid if possible: Long-term catheters. (B)

2.1.3.1 Short-term catheters should be used for acute dialysis and

for a limited duration in hospitalized patients. Noncuffed

femoral catheters should be used in bed-bound patients

only. (B)

2.1.3.2 Long-term catheters or dialysis port catheter systems

should be used in conjunction with a plan for permanent

access. Catheters capable of rapid flow rates are preferred.

Catheter choice should be based on local experience, goals

for use, and cost. (B)

2.1.3.3 Long-term catheters should not be placed on the same

side as a maturing AV access, if possible. (B)

Special attention should be paid to consideration of avoiding

femoral catheter access in HD patients who are current

or future kidney transplant candidates. MRA imaging of

both arteries and veins is the diagnostic procedure of

choice for evaluating central vessels for possible chest

wall construction.

**1a.4.3.** **Grade assigned to the quoted recommendation with definition of the grade:**

See ratings above for each guideline. The guidelines have been assigned either an “A” or “B” rating, defined as:

Grade A: It is strongly recommended that clinicians routinely follow the guideline for eligible patients. There is strong evidence that the practice improves health outcomes.

Grade B: It is recommended that clinicians routinely follow the guideline for eligible patients. There is moderately strong evidence that the practice improves health outcomes.

**1a.4.4. Provide all other grades and associated definitions for recommendations in the grading system.** (*Note: If separate grades for the strength of the evidence, report them in section 1a.7.*)

The rating system defined in the KDOQI Guidelines was used to grade the strength of the Guideline recommendation. KDOQI defined grades as follows:

Grade A: It is strongly recommended that clinicians routinely follow the guideline for eligible patients. There is strong evidence that the practice improves health outcomes.

Grade B: It is recommended that clinicians routinely follow the guideline for eligible patients. There is moderately strong evidence that the practice improves health outcomes.

Grade CPR: It is recommended that clinicians consider following the guideline for eligible patients. This recommendation is based on either weak evidence or on the opinions of the Work Group and reviewers that the practice might improve health outcomes.

**1a.4.5. Citation and URL for methodology for grading recommendations** (*if different from 1a.4.1*)**:**

National Kidney Foundation: DOQI Clinical Practice Guidelines for Hemodialysis Adequacy. Appendix 1.

Methods for Evaluating Evidence. Update 2006.

<http://www.kidney.org/professionals/KDOQI/guidelines_commentaries>

**1a.4.6. If guideline is evidence-based (rather than expert opinion), are the details of the quantity, quality, and consistency of the body of evidence available (e.g., evidence tables)?**

Yes **→ *complete section*** [***1a.7***](#Section1a7)

No **→ *report on another systematic review of the evidence in sections*** [***1a.6***](#Section1a6) ***and*** [***1a.7***](#Section1a7)***; if another review does not exist, provide what is known from the guideline review of evidence in*** [***1a.7***](#Section1a7)

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**1a.5.** **UNITED STATES PREVENTIVE SERVICES TASK FORCE RECOMMENDATION**

**1a.5.1.** **Recommendation citation** (*including date*) and **URL for recommendation** (*if available online*):

N/A

**1a.5.2.** **Identify recommendation number and/or page number** and **quote verbatim, the specific recommendation**.

N/A

**1a.5.3.** **Grade assigned to the quoted recommendation with definition of the grade**:

N/A

**1a.5.4. Provide all other grades and associated definitions for recommendations in the grading system.** (*Note: the* *grading system for the evidence should be reported in section 1a.7.*)

N/A

**1a.5.5. Citation and URL for methodology for grading recommendations** (*if different from 1a.5.1*)**:**

***Complete section*** [***1a.7***](#Section1a7)

N/A

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**1a.6. OTHER SYSTEMATIC REVIEW OF THE BODY OF EVIDENCE**

**1a.6.1.** **Citation** (*including date*) and **URL** (*if available online*):

N/A

**1a.6.2.** **Citation and** **URL for methodology for evidence review and grading** (*if different from 1a.6.1*)**:**

***Complete section*** [***1a.7***](#Section1a7)

N/A

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**1a.7. FINDINGS FROM SYSTEMATIC REVIEW OF BODY OF THE EVIDENCE supporting the measure**

*If more than one systematic review of the evidence is identified above, you may choose to summarize the one (or more) for which the best information is available to provide a summary of the quantity, quality, and consistency of the body of evidence. Be sure to identify which review is the basis of the responses in this section and if more than one, provide a separate response for each review.*

**1a.7.1.** **What was the specific structure, treatment, intervention, service, or intermediate outcome addressed in the evidence review?**

N/A

**1a.7.2.** **Grade assigned for the quality of the quoted evidence with definition of the grade**:

N/A

**1a.7.3. Provide all other grades and associated definitions for strength of the evidence in the grading system.**

N/A

**1a.7.4.** **What is the time period covered by the body of evidence? (*provide the date range, e.g., 1990-2010*). Date range**: Click here to enter date range

N/A

**QUANTITY AND QUALITY OF BODY OF EVIDENCE**

**1a.7.5.****How many and what type of study designs are included in the body of evidence**? (*e.g., 3 randomized controlled trials and 1 observational study*)

N/A

**1a.7.6.** **What is the overall quality of evidence across studies in the body of evidence**? (*discuss the certainty or confidence in the estimates of effect particularly in relation to study factors such as design flaws, imprecision due to small numbers, indirectness of studies to the measure focus or target population*)

N/A

**ESTIMATES OF BENEFIT AND CONSISTENCY ACROSS STUDIES IN BODY OF EVIDENCE**

**1a.7.7.** **What are the estimates of benefit—magnitude and direction of effect on outcome(s) across studies in the body of evidence**? (*e.g., ranges of percentages or odds ratios for improvement/ decline across studies, results of meta-analysis, and statistical significance*)

N/A

**1a.7.8.** **What harms were studied and how do they affect the net benefit (benefits over harms)?**

N/A

**UPDATE TO THE SYSTEMATIC REVIEW(S) OF THE BODY OF EVIDENCE**

**1a.7.9.** **If new studies have been conducted since the systematic review of the body of evidence, provide for each new study: 1) citation, 2) description, 3) results, 4) impact on conclusions of systematic review**.

N/A

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**1a.8 OTHER SOURCE OF EVIDENCE**

*If source of evidence is NOT from a clinical practice guideline, USPSTF, or systematic review, please describe the evidence on which you are basing the performance measure.*

**1a.8.1** **What process was used to identify the evidence?**

A large body of literature exists showing strong associations between central venous catheter use in hemodialysis patients with poorer survival and greater morbidity [1-40]. The prevalence of numerous patient comorbidity indicators was similar in facilities with high versus low catheter use. Lower mortality has been observed with reduction in catheter use and an increase in fistula use in facility- and patient-level access use studies [7, 10, 13, 40, 41]. Furthermore, much of the 30-40% higher case-mix adjusted mortality rate for US hemodialysis patients compared to those in several European countries appears to be explained by differences in vascular access use between these two regions [2].

A literature search was conducted in May 2014 to supplement the list of references from 2011. This search resulted in an additional 9 articles added to the reference list (#42-50).

**1a.8.2.** **Provide the citation and summary for each piece of evidence.**

1. Dhingra RK, Young EW, Hulbert-Shearon TE, Leavey SF, Port FK. Type of vascular access and mortality in U.S. hemodialysis patients. Kidney Int 2001; 60:1443-1451.

BACKGROUND:

Vascular access (VA) complications account for 16 to 25% of hospital admissions. This study tested the hypothesis that the type of VA in use is correlated with overall mortality and cause-specific mortality.

METHODS:

Data were analyzed from the U.S. Renal Data System Dialysis Morbidity and Mortality Study Wave 1, a random sample of 5507 patients, prevalent on hemodialysis as of December 31, 1993. The relative mortality risk during a two-year observation was analyzed by Cox-regression methods with adjustments for demographic and comorbid conditions. Using similar methods, cause-specific analyses also were performed for death caused by infection and cardiac causes.

RESULTS:

In diabetic mellitus (DM) patients with end-stage renal disease, the associated relative mortality risk was higher for those with arteriovenous graft (AVG; RR = 1.41, P < 0.003) and central venous catheter (CVC; RR = 1.54, P < 0.002) as compared with arteriovenous fistula (AVF). In non-DM patients, those with CVC had a higher associated mortality (RR = 1.70, P < 0.001), as did to a lesser degree those with AVG (RR = 1.08, P = 0.35) when compared with AVF. Cause-specific analyses found higher infection-related deaths for CVC (RR = 2.30, P < 0.06) and AVG (RR = 2.47, P < 0.02) compared with AVF in DM; in non-DM, risk was higher also for CVC (RR = 1.83, P < 0.04) and AVG (RR = 1.27, P < 0.33). In contrast to our hypothesis that AV shunting increases cardiac risk, deaths caused by cardiac causes were higher in CVC than AVF for both DM (RR = 1.47, P < 0.05) and non-DM (RR = 1.34, P < 0.05) patients.

CONCLUSION:

This case-mix adjusted analysis suggests that CVC and AVG are correlated with increased mortality risk when compared with AVF, both overall and by major causes of death.

1. Pisoni RL, Arrington CJ, Albert JM, Ethier J, Kimata N, Krishnan M, et al. Facility hemodialysis vascular access use and mortality in countries participating in DOPPS: an instrumental variable analysis. Am J Kidney Dis 2009; 53:475-491.

BACKGROUND:

Previously, the Dialysis Outcomes and Practice Patterns Study (DOPPS) has shown large international variations in vascular access practice. Greater mortality risks have been seen for hemodialysis (HD) patients dialyzing with a catheter or graft versus a native arteriovenous fistula (AVF). To further understand the relationship between vascular access practice and outcomes, we have applied practice-based analyses (using an instrumental variable approach) to decrease the treatment-by-indication bias of prior patient-level analyses.

STUDY DESIGN:

A prospective observational study of HD practices.

SETTING & PARTICIPANTS:

Data collected from 1996 to 2004 from 28,196 HD patients from more than 300 dialysis units participating in the DOPPS in 12 countries.

PREDICTOR OR FACTOR:

Patient-level or case-mix-adjusted facility-level vascular access use. OUTCOMES/MEASUREMENTS: Mortality and hospitalization risks.

RESULTS:

After adjusting for demographics, comorbid conditions, and laboratory values, greater mortality risk was seen for patients using a catheter (relative risk, 1.32; 95% confidence interval, 1.22 to 1.42; P < 0.001) or graft (relative risk, 1.15; 95% confidence interval, 1.06 to 1.25; P < 0.001) versus an AVF. Every 20% greater case-mix-adjusted catheter use within a facility was associated with 20% greater mortality risk (versus facility AVF use, P < 0.001); and every 20% greater facility graft use was associated with 9% greater mortality risk (P < 0.001). Greater facility catheter and graft use were both associated with greater all-cause and infection-related hospitalization. Catheter and graft use were greater in the United States than in Japan and many European countries. More than half the 36% to 43% greater case-mix-adjusted mortality risk for HD patients in the United States versus the 5 European countries from the DOPPS I and II was attributable to differences in vascular access practice, even after adjusting for other HD practices. Vascular access practice differences accounted for nearly 30% of the greater US mortality compared with Japan.

LIMITATIONS:

Possible existence of unmeasured facility- and patient-level confounders that could impact the relationship of vascular access use with outcomes.

CONCLUSIONS:  
Facility-based analyses diminish treatment-by-indication bias and suggest that less catheter and graft use improves patient survival.

1. Polkinghorne KR, McDonald SP, Atkins RC, Kerr PG. Vascular access and all-cause mortality: a propensity score analysis. J Am Soc Nephrol 2004; 15:477-486.  
   Abstract:

The native arteriovenous fistula (AVF) is the preferred vascular access because of its longevity and its lower rates of infection and intervention. Recent studies suggest that the AVF may offer a survival advantage. Because these data were derived from observational studies, they are prone to potential bias. The use of propensity scores offers an additional method to reduce bias resulting from nonrandomized treatment assignment. Adult (age 18 yr or more) patients who commenced hemodialysis in Australia and New Zealand on April 1, 1999, until March 31, 2002, were studied by using the Australian and New Zealand Dialysis and Transplant Association (ANZDATA) Registry. Cox regression was used to determine the effect of access type on total mortality. Propensity scores were calculated and used both as a controlling variable in the multivariable model and to construct matched cohorts. The catheter analysis was stratified by dialysis duration at entry to ANZDATA to satisfy the proportional-hazard assumption. There were 612 deaths in 3749 patients (median follow-up, 1.07 yr). After adjustment for confounding factors and propensity scores, catheter use was predictive of mortality. Patients with arteriovenous grafts (AVG) also had a significantly increased risk of death. Effect estimates were also consistent in the smaller propensity score-matched cohorts. Both AVG and catheter use in incident hemodialysis patients are associated with significant excess of total mortality. Reducing catheter use and increasing the proportion of patients commencing hemodialysis with a mature AVF remain important clinical objectives.

1. Pastan S, Soucie JM, McClellan WM. Vascular access and increased risk of death among hemodialysis patients. Kidney Int 2002; 62:620-626.

BACKGROUND:

Hemodialysis with a venous catheter increases the risk of infection. The extent to which venous catheters are associated with an increased risk of death among hemodialysis patients has not been extensively studied.

METHODS:

We conducted a retrospective cohort study of 7497 prevalent hemodialysis patients to assess the association between dialysis with a venous catheter and risk of death due to all causes and to infection.

RESULTS:

A tunneled cuffed catheter was used for access in 12% of the patients and non-cuffed, not tunneled catheter in 2%. Younger age (P = 0.0005), black race (P = 0.0022), female gender (P = 0.0004), short duration since starting dialysis (P = 0.0003) and impaired functional status (P = 0.0001) were independently associated with increased use of catheter access. The proportion of patients who died was higher among those who were dialyzed with a non-cuffed (16.8%) or cuffed (15.2%) catheter compared to those dialyzed with either a graft (9.1%) or a fistula (7.3%; P < 0.001). The proportion of deaths due to infection was higher among patients dialyzed with a catheter (3.4%) compared to those dialyzed with either a graft (1.2%) or a fistula (0.8%; P < 0.001). The adjusted odds ratio (95% CI) for all-cause and infection-related death among patients dialyzed with a catheter was 1.4 (1.1, 1.9) and 3.0 (1.4, 6.6), respectively, compared to those with an arteriovenous (AV) fistula.

CONCLUSION:  
Venous catheters are associated with an increased risk of all-cause and infection-related mortality among hemodialysis patients.

1. Combe C, Pisoni RL, Port FK, Young EW, Canaud B, Mapes DL, et al. [Dialysis Outcomes and Practice Patterns Study: data on the use of central venous catheters in chronic hemodialysis]. Nephrologie 2001; 22:379-384.

Abstract:

Central venous catheters are widely used as vascular accesses for chronic haemodialysis. Different factors may lead to catheter use, whether clinical such as emergency dialysis, or related to practices specific to each dialysis unit or country. The Dialysis Outcomes and Practice Patterns Study is an observational study of more than 10,000 representative patients treated by haemodialysis followed over a two-year period in the United States, Japan, and in five European countries (France, Germany, Italy, Spain, United Kingdom). DOPPS data from the United States and Europe about catheters are reported in this paper. Catheter use is less frequent in Europe than in the US, both in incident and prevalent patients, and in patients who have been seen by a nephrologist in the pre-dialysis period. Tunneled and untunneled catheters are each associated with a significantly higher frequency of access infection compared to native arteriovenous fistulae and grafts. Patients with important comorbidities such as diabetes, cardiovascular diseases, malnutrition or dementia are more likely to be dialysed with tunneled catheters. Furthermore, patients initiating hemodialysis with a tunneled catheter display higher mortality risk compared to patients starting hemodialysis with a permanent access. In summary, DOPPS data indicate that central venous catheters are used for chronic haemodialysis in patients with a high level of morbidity, and that their utilisation is associated to an additional risk, particularly of infection, and to a lower survival for tunneled catheters. Appropriate care should limit the utilisation of central venous catheters to clinically undisputable indications.

1. Xue JL, Dahl D, Ebben JP, Collins AJ. The association of initial hemodialysis access type with mortality outcomes in elderly Medicare ESRD patients. Am J Kidney Dis 2003; 42:1013-1019.

BACKGROUND:

Dialysis access is critical for therapy delivery. Few studies have linked type of dialysis access to patient survival in the elderly population.

METHODS:

We included 1995 to 1997 incidence Medicare hemodialysis patients (N = 66,595) who were 67 years and older at dialysis therapy initiation. Medicare Physician/Supplier claims were used to determine initial access type: simple fistula, autologous vein graft, synthetic graft, and hemodialysis catheter. We used International Classification of Diseases, Ninth Revision, Clinical Modification, codes to determine vascular access placement for renal failure. A Cox regression analysis assessed risk for death within 1 year, with explanatory variables of incidence year, age, sex, race, diabetes, initial access type, body mass index, days from first access placement date to initial dialysis date, and serum albumin, creatinine, and blood urea nitrogen levels.

RESULTS:

One-year crude death rates were 24.9%, 27.2%, 28.1%, and 41.5% for patients with simple fistulae, autologous vein grafts, synthetic grafts, and hemodialysis catheters, respectively. Patients with simple fistulae (the reference) had the lowest (P < 0.0001) likelihood of death compared with those with synthetic grafts (hazard ratio [HR], 1.160; 95% confidence interval [CI], 1.084 to 1.241) or catheters (HR, 1.696; 95% CI, 1.593 to 1.806). No difference (P > 0.09) in mortality risk was detected between simple fistulae and autologous vein grafts or between autologous vein grafts and synthetic grafts.

CONCLUSION:  
In the US Medicare dialysis population, type of initial hemodialysis access was associated with 1-year mortality. Mortality risks were (in ascending order) fistulae, grafts, and catheters.

1. Allon M, Daugirdas J, Depner TA, Greene T, Ornt D, Schwab SJ. Effect of change in vascular access on patient mortality in hemodialysis patients. Am J Kidney Dis 2006; 47:469-477.

BACKGROUND:

Hemodialysis patients using a catheter have a greater mortality risk than those using an arteriovenous (AV) access (fistula or graft). However, catheter-dependent patients also differ from those with an AV access in several clinical features, and these differences may themselves contribute to their excess mortality.

METHODS:

The current study evaluates whether a change in vascular access affects risk for mortality in patients enrolled in the Hemodialysis Study. Time-dependent Cox regression was used to relate mortality risk to current type of access and change in access type during the preceding 1 year.

RESULTS:

Compared with patients who dialyzed using an AV access at both the beginning and end of the preceding 1-year interval, relative risks for mortality were 3.43 (95% confidence interval [CI], 2.42 to 4.86) in patients who dialyzed with a catheter at both times; 2.38 (95% CI, 1.76 to 3.23) in patients switching from an AV access to a catheter, and 1.37 (95% CI, 0.81 to 2.32) in patients switching from a catheter to an AV access. Change from AV access to a catheter was associated with an antecedent decrease in serum albumin level (odds ratio, 1.25; 95% CI, 1.09 to 1.45 per 0.5 g/dL; P = 0.002), weight loss (odds ratio, 1.14; 95% CI, 1.06 to 1.22 per 2 kg; P < 0.001), and decreases in equilibrated normalized protein catabolic rate (odds ratio, 2.22; 95% CI, 1.41 to 3.57 per 0.25 g/kg/d; P < 0.001) and non-access-related hospitalization (odds ratio, 1.19; 95% CI, 1.06 to 1.32 per 1 additional hospitalization over 4 months; P = 0.002). Change from a catheter to AV access was predicted by only the antecedent non-access-related hospitalization rate (odds ratio, 0.93; 95% CI, 0.87 to 0.97 per 1 additional hospitalization over 4 months; P < 0.001).

CONCLUSION:  
Change from a catheter to AV access is associated with a substantial decrease in mortality risk.

1. Astor BC, Eustace JA, Powe NR, Klag MJ, Fink NE, Coresh J. Type of vascular access and survival among incident hemodialysis patients: the Choices for Healthy Outcomes in Caring for ESRD (CHOICE) Study. J Am Soc Nephrol 2005; 16:1449-1455.

Abstract:

Arteriovenous fistulae (AVF) have advantages over arteriovenous grafts (AVG) and central venous catheters (CVC), but whether AVF are associated independently with better survival is unclear. Recent studies showing such a survival benefit did not include early access experience or account for changes in access type over time and did not include data on some important confounders. Reported here are survival rates stratified by the type of access in use up to 3 yr after initiation of hemodialysis among 616 incident patients who were enrolled in the Choices for Healthy Outcomes in Caring for ESRD (CHOICE) Study. A total of 1084 accesses (185 AVF, 296 AVG, 603 CVC) were used for a total of 1381 person-years. At initiation, 409 (66%) patients were using a CVC, 122 (20%) were using an AVG, and 85 (14%) were using an AVF. After 6 mo, 34% were using a CVC, 40% were using an AVG, and 26% were using an AVF. Annual mortality rates were 11.7% for AVF, 14.2% for AVG, and 16.1% for CVC. Adjusted relative hazards (RH) of death compared with AVF were 1.5 (95% confidence interval, 1.0 to 2.2) for CVC and 1.2 (0.8 to 1.8) for AVG. The increased hazards associated with CVC, as compared with AVF, were stronger in men (n = 334; RH = 2.0; P = 0.01) than women (n = 282; RH = 1.0 for CVC; P = 0.92). These results strongly support existing clinical practice guidelines and suggest that the use of venous catheters should be minimized to reduce the frequency of access complications and to improve patient survival, especially among male hemodialysis patients.

1. Lacson E, Jr., Wang W, Hakim RM, Teng M, Lazarus JM. Associates of mortality and hospitalization in hemodialysis: potentially actionable laboratory variables and vascular access. Am J Kidney Dis 2009; 53:79- 90.

BACKGROUND:

To determine the most significant potentially actionable clinical variables associated with mortality and hospitalization risk in hemodialysis (HD) patients.

STUDY DESIGN:

Cohort study.

SETTING & PARTICIPANTS:

Adult maintenance HD patients in the Fresenius Medical Care, North America database as of January 1, 2004, with baseline information from October 1, 2003, to December 31, 2003, comprising approximately 26% of the US HD population.

PREDICTORS:

Case-mix (age, sex, race, diabetes, vintage, and body surface area), vascular access, and laboratory (albumin, equilibrated Kt/V, hemoglobin, calcium, phosphorus, creatinine, bicarbonate, biointact parathyroid hormone, transferrin saturation, and white blood cell count) variables.

OUTCOMES:

1-year mortality and hospitalization risk from January 1 to December 31, 2004.

MEASUREMENTS:

Cox proportional hazards models for death and hospitalization.

RESULTS:

The cohort (N = 78,420) had a mean age of 61.4 +/- 15.0 years, 47% were women, 49% were white, 41% were black race (10% defined as "other"), and 52% had diabetes. The top 5 actionable variables were the same for mortality and hospitalization. Final case-mix plus laboratory-adjusted hazard ratios for these top 5 actionable variables indicate 177% increased risk of death and 67% increased risk of hospitalization per 1-g/dL decrease in albumin level, 39% and 45% greater risk with catheters compared with fistulas, 18% and 9% greater risk per 1-mg/dL greater phosphorus level, 11% and 9% lower risk per 1-g/dL greater hemoglobin level, and 5% and 2% greater risk per 0.1-unit decrease in equilibrated Kt/V, respectively (all P < 0.0001).

LIMITATIONS:

Observational cross-sectional study with limited comorbidity adjustment (for diabetes).

CONCLUSION:  
The same variables are associated with both mortality and hospitalization in HD patients. The top 5 potentially actionable variables are readily identifiable, with albumin level and catheter use the most prominent, and all 5 are appropriate targets for improvement.

1. Lacson E, Jr., Wang W, Lazarus JM, Hakim RM. Change in vascular access and mortality in maintenance hemodialysis patients. Am J Kidney Dis 2009; 54:912-921.

BACKGROUND:

We hypothesized that a change from central venous catheters to a fistula or graft would improve short-term mortality risk in maintenance hemodialysis patients.

DESIGN:

Prospective observational study.

SETTING & PARTICIPANTS:

All maintenance in-center hemodialysis patients treated in Fresenius Medical Care, North America legacy facilities alive on January 1, 2007 with baseline laboratory data from December 2006.

PREDICTOR:

Access type (fistula, catheter, or graft), determined on December 31, 2006, and monthly thereafter. Conversion from a catheter to a fistula or graft during the 4-month period from January 1 to April 30, 2007.

OUTCOME:

Mortality was tracked from May 1, 2007, to December 31, 2007. Standard and time-dependent Cox models were used to determine hazard risks (HRs) of death with and without adjustment for case-mix and laboratory values.

RESULTS:

At baseline, 79,545 patients had 43% fistulas, 29% catheters, and 27% grafts. Mean age was 62 +/- 15 years, 54% were men, 51% were white, and 53% had diabetes. Compared with fistulas, unadjusted HRs of death were higher for grafts (1.22) and catheters (1.76; P < 0.001). In adjusted models, overall risk for grafts was decreased to 1.05 (95% limits, 1.003-1.100; P < 0.05) and approached that for fistulas consistently across multiple strata. Compared with patients who continued using a catheter, those who converted to either a graft or fistula had an HR of 0.69, whereas those who converted from a graft or fistula to a catheter had increased HRs to 2.12 (both P < 0.001). Similar trends were observed in the subset of incident patients (vintage < 90 days at study onset).

LIMITATIONS:

Observational design with residual confounding from unmeasured patient, facility, and treatment-related factors.

CONCLUSIONS:  
Catheters have the worst associated mortality risk. Changing from a catheter to a fistula or graft is associated with significantly improved survival. The risk for grafts approached that of fistulas, providing an alternative to prolonged catheter exposure and potentially less hazardous "bridge" toward a fistula.

1. Lacson E, Jr., Wang W, Lazarus JM, Hakim RM. Hemodialysis facility-based quality-of-care indicators and facility-specific patient outcomes. Am J Kidney Dis 2009; 54:490-497.

BACKGROUND:

We evaluated whether incremental achievement of up to 8 facility quality goals was associated with improvement in facility-specific mortality and hospitalization rates.

STUDY DESIGN:

Prospective observational study.

SETTING & PARTICIPANTS:

1,085 Fresenius Medical Care, North America facilities providing hemodialysis (HD) for 25 or more patients during January 2006.

MEASUREMENTS:

The facility average for the period up to December 31, 2006, was used to determine achievement of each goal for equilibrated Kt/V, missed HD treatments, hemoglobin level, bicarbonate level, albumin level, phosphorus level, fistulae, and HD catheters. Linear regression models were used to relate facility-wide achievement of goals with facility-specific hospital days and standardized mortality ratios.

RESULTS:

Most facilities (64%) achieved 2 to 4 of 8 goals, with only 8% meeting more than 5 quality goals. Achieving more than 5 goals averaged 3.5 fewer hospital days/patient-year and 20% lower standardized mortality ratios (all P < 0.001). The incremental number of goals met also was associated with improvement in facility mortality (P < 0.001) and hospital days (P < 0.001). Catheter and albumin level goals were achieved least (6% and 9% of facilities, respectively), but they had the best outcomes. Facilities achieving more than 5 goals had older patients (64.0 versus 61.5 years; P < 0.001), fewer African American patients (16% versus 38%; P < 0.001), and fewer women (44% versus 46%; P = 0.003) compared with the average.

LIMITATIONS:

Observational design with residual confounding from unmeasured patient-, facility-, and treatment-related factors.

CONCLUSIONS:  
Achieving more facility quality goals was significantly associated with better facility-based measurements of patient outcomes. Although these results do not establish a causal relationship, findings agree with the present practice of monitoring facility performance for continuous quality improvement.

1. Lacson E, Jr., Lazarus JM, Himmelfarb J, Ikizler TA, Hakim RM. Balancing Fistula First with Catheters Last. Am J Kidney Dis 2007; 50:379-395.

Abstract:

The success of Fistula First nationwide has been accompanied by an unplanned increase in hemodialysis catheters. Complications related to prolonged hemodialysis catheter use include increased morbidity, mortality, and cost. We hypothesize that the national focus on increasing fistulas may have inadvertently diverted attention away from initiatives to decrease dependence on hemodialysis catheters. Based on a synthesis of guidelines, reviews, published evidence, and the authors' opinions, we propose that the national vascular access initiative be revised to have a dual goal of Fistula First and "Catheters Last." These goals are not mutually exclusive, but rather complementary. We recommend a systematic refocus on interventions that not only increase fistulas, but help avoid extended catheter use. Clearly, the ideal practice for hemodialysis vascular access remains early placement of fistulas with enough maturation time such that they can be used for initiating long-term hemodialysis therapy when the need arises. To effect this change, a reimbursement policy covering the costs associated with permanent access placement before the need for dialysis is essential. Individualized patient management strategies may consider such innovative approaches as initiating patients on peritoneal dialysis therapy or using nonautogenous grafts as bridge accesses in lieu of catheters. For patients who are dialyzing using catheters, immediate active planning for permanent access placement and removal of the catheter is necessary. In the same vein as Fistula First, the renal community should once again be galvanized in working together toward controlling the catheter epidemic in our dialysis population.

1. Bradbury BD, Chen F, Furniss A, Pisoni RL, Keen M, Mapes D, et al. Conversion of vascular access type among incident hemodialysis patients: description and association with mortality. Am J Kidney Dis 2009; 53:804-814.

BACKGROUND:

Limited data exist describing vascular access conversions during the first year on dialysis therapy or the effect of converting to and from a catheter on subsequent mortality risk.

STUDY DESIGN:

Retrospective cohort study.

SETTING & PARTICIPANTS:

We studied a random sample of incident US hemodialysis patients (initiated long-term dialysis < 30 days before study entry) in the Dialysis Outcomes and Practice Patterns Study (DOPPS; 1996-2004).

PREDICTORS:

At dialysis therapy initiation, we assessed vascular access type in use (arteriovenous fistula [AVF], arteriovenous graft [AVG], or catheter) and other patient characteristics. We characterized changes in vascular access type (conversions) by using regularly collected functional status information.

OUTCOME & MEASUREMENTS:

We assessed time to all-cause mortality. We first described conversions, then used time-dependent Cox regression to estimate mortality hazard ratios (HRs) for conversions from a catheter to a permanent vascular access (versus no conversion) and conversions from a permanent vascular access to a catheter (versus no conversion).

RESULTS:

The study included 4,532 patients; 69.2% were dialyzing with a catheter; 17.6%, with an AVG; and 13.1%, with an AVF. In patients initiating therapy with an AVF or AVG, 22% experienced a conversion (failure), and median times to first failure were 62 and 84 days, respectively. In catheter patients, 59% converted to an AVF/AVG (predominantly AVG [57%]); median times to first conversion were 92 and 66 days, respectively. Conversion to a permanent access was associated with an adjusted mortality HR of 0.69 (95% confidence interval, 0.55 to 0.85). The effect was similar for conversion to an AVF or AVG, and these persisted across demographic groups and facilities with different conversion practices. Conversion from a permanent vascular access to a catheter was associated with an adjusted mortality HR of 1.81 (95% confidence interval, 1.22 to 2.68).

LIMITATIONS:

Potential for residual confounding because of unmeasured factors influencing decision to convert.

CONCLUSION:  
Vascular access conversions are common in incident patients. Continued efforts to increase early nephrologist referral and permanent vascular access placement may help decrease mortality risk in incident dialysis patients.

1. Collins AJ, Foley RN, Gilbertson DT, Chen SC. The state of chronic kidney disease, ESRD, and morbidity and mortality in the first year of dialysis. Clin J Am Soc Nephrol 2009; 4 Suppl 1:S5-11.

Abstract:

This review examines trends in the ESRD program, assessing progress in preventive care, hospitalizations, and mortality since 1989, the year of the Dallas Morbidity and Mortality Conference. The number of prevalent dialysis patients nearly tripled, to 366,000 in 2007 from 123,000 in 1989. Prevalent population mortality rates declined in the mid-1980s but did not change overall through the 1990s; rates declined for patients on dialysis for less than 5 yr but increased for patients on dialysis for longer than 5 yr. Death rates throughout the prevalent population have subsequently declined since 2000. In the incident dialysis population, death rates after the first year have declined, but first-year rates have remained flat since 1996; rates peak in months 2 and 3, then decline to the level of the first month by 12 mo. Infectious hospitalization rates in the prevalent population increased 40% in the last 10 yr. For incident patients, infectious hospitalizations increased almost 100% over 10 yr, vascular access hospitalizations by 200%, and cardiovascular hospitalizations by 30%. Use of dialysis catheters is high; 82% of patients start dialysis with a catheter. Poor planning for dialysis initiation may contribute to catheter use and the associated high infectious hospitalization rate, limiting potential for improved patient survival during the first year. Public health programs, including the new Medicare chronic kidney disease education benefit, are needed to promote better care of patients who may need dialysis to reduce the high morbidity and mortality in the first year.

1. Goncalves EA, Andreoli MC, Watanabe R, Freitas MC, Pedrosa AC, Manfredi SR, et al. Effect of temporary catheter and late referral on hospitalization and mortality during the first year of hemodialysis treatment. Artif Organs 2004; 28:1043-1049.

Abstract:

Late referral (LR) to dialysis therapy has been associated with poor outcomes in people with end-stage renal disease. This had been ascribed to the frequent use of temporary vascular catheters (TVCs) in LR patients. The effects of LR and TVC on the outcomes of an incident hemodialysis population (n = 101) were investigated. There was a higher incidence of vascular access infection, longer period of hospitalization, and lower survival in TVC and LR groups, compared with arteriovenous fistula and early referral (ER) groups, respectively. Late referral patients had higher number of hospitalizations than ER patients. In univariate analysis, LR (hazard ratio [HR] 10.8, P = 0.02) and albumin (HR 0.23, P < 0.0001) were associated with mortality. Late referral and body mass index were associated with the increased risk of hospitalization in univariate analysis. In multivariate analysis, LR was the only risk factor associated with hospitalization (HR 3.51, P = 0.002). In conclusion, LR was associated with increased risk of mortality and increased risk of hospitalization independently of the presence of a TVC.

1. Hakim RM. Reducing early mortality in hemodialysis patients. Curr Opin Nephrol Hypertens 2008; 17:595-599.

PURPOSE OF REVIEW:

There is increasing recognition of the high morbidity and mortality rate that is associated with initiation of chronic dialysis. The present review examines the recent literature that has addressed this topic.

RECENT FINDINGS:

Active interventions to reduce this high morbidity and mortality in the first year on dialysis have been few and infrequent. A recent publication has documented that a broad range of intervention early in the patient's life on dialysis can successfully impact such outcomes. There is also increased recognition that the type of access (catheter, graft, and fistula) with which the patient initiates dialysis has a strong influence on subsequent outcomes.

SUMMARY:  
The outcome of patients during the first year of dialysis is influenced not only by their comorbidities but also by the quality of care received shortly prior to the initiation of dialysis as well as the level of care they receive once they initiate chronic dialysis.

1. Hakim RM, Himmelfarb J. Hemodialysis access failure: a call to action--revisited. Kidney Int 2009; 76:1040-1048.

Abstract:

Eighty-two percent (82%) of patients initiating hemodialysis in the United States in 2006 did so with a catheter as the functioning access. Even in patients who have been followed by nephrologists for 6 months or more, 74% of patients initiated dialysis with a catheter. This is a multifactoral problem that requires attention and solutions from all stakeholders, including the nephrologist, the vascular surgeon, the hospital, and the insurance industry, as well as the patient and family. We propose a series of specific proposals that include a process for the timely referral and timely placement of a permanent access based on the patient's estimated or measured glomerular filtration rate (GFR), and a 'pay-for-performance' measure for vascular surgeons and nephrologists who admit patients with functional permanent accesses; such pay for performance would place a higher value for patients who are admitted with a functional arteriovenous (AV) fistula than for patients who are admitted with an AV graft. We also propose that hospitals develop a less permissive process for placement of PICC (peripherally inserted central catheters) lines in patients with GFR <60 ml/min and to consider surgery for access placement as 'urgent'. Finally, a more proactive educational process for patients and their families, including an 'informed non-consent' for patients who defer placement of a permanent access needs to be considered. The morbidity, mortality, and health-care costs associated with prolonged catheter use mandate urgent attention to this problem.

1. Higuera F, Rosenthal VD, Duarte P, Ruiz J, Franco G, Safdar N. The effect of process control on the incidence of central venous catheter-associated bloodstream infections and mortality in intensive care units in Mexico. Crit Care Med 2005; 33:2022-2027.

PURPOSE:

To ascertain the effect of an infection control program including process control on intensive care unit (ICU) rates of intravascular device (IVD)-associated bloodstream infection (BSI).

SETTING:

Two level III adult ICUs in one public university hospital in Mexico: one medical surgical ICU and one neurosurgical ICU. POPULATION STUDY: All adult patients admitted to study units who had a central venous catheter (CVC) in place for at least 24 hrs.

METHODS:

A prospective before/after trial in which rates of IVD-associated BSI are determined during a period of active surveillance without process control (phase 1) were compared with rates of IVD-associated BSI after implementing an infection control program applying process control (phase 2).

RESULTS:

Six hundred five IVD-days were accumulated in phase 1, and 2824 IVD-days were accumulated during phase 2. Compliance with CVC site care and hand hygiene improved significantly from baseline during the study period: placing a gauze dressing over the catheter insertion site (99.24% vs. 86.69%, respectively; relative risk [RR] = 1.14; 95% confidence interval [CI] = 1.07-1.22; p = .0000), proper use of gauze for vascular catheter insertion site (97.87% vs. 84.21%, respectively; RR = 1.16; 95% CI = 1.09-1.24; p = .0000), documentation of the duration of the administration set of the vascular catheter (93.85% vs. 40.69%, respectively; RR = 2.34; 95% CI = 2.14-2.56; p = .0000), and hand hygiene before contact with the patient (84.9% vs. 62%, respectively; RR = 1.37; 95% CI = 1.21-1.51; p = .0000). Overall rates of IVD-associated BSI were lowered significantly from baseline rates after implementation of process control (19.5 vs. 46.3 BSIs per 1000 IVD-days, respectively; RR = 0.42; 95% CI = 0.27-0.66; p = .0001). Overall rates of crude unadjusted mortality were lowered significantly from baseline rates (48.5% vs. 32.8% per 100 discharges, respectively; RR = 0.68; 95% CI = 0.50-0.31; p = .01).

CONCLUSION:  
Implementation of an infection control program utilizing education, process control, and performance feedback was associated with significant reductions in rates of IVD-associated BSI and mortality.

1. Hung AM, Ikizler TA. Hemodialysis central venous catheters as a source of inflammation and its implications. Semin Dial 2008; 21:401-404.

### Abstract:

The mortality rate for end-stage renal disease patients is six times higher than in the general population. Hemodialysis central venous catheter (CVC) utilization has increased by 50% between 1998 and 2004 and data from the United States Renal Data System suggest that 81% of the patients initiate hemodialysis through a CVC. There is evidence that the two observations are linked in both an obvious way (catheter-related sepsis) as well as in a less obvious manner-chronic inflammation. Inflammation is highly prevalent in chronic hemodialysis (CHD) patients and is consistently associated with poor outcomes. Some of the most important consequences of inflammation in CHD include, but are not limited to, cardiovascular disease, uremic protein-energy wasting, erythropoietin hyporesponsiveness, and increased hospitalization and death rates. Use of CVC has been long suspected to play a role in the inflammatory response in CHD patients. Recent studies have shown that the presence of CVCs is associated with higher levels of C-reactive protein (CRP), lower serum albumin values, and lower hemoglobin values. Furthermore, there are data showing that CRP levels decrease following CVC removal. Accordingly, avoidance of CVC represents an effective strategy to limit the inflammatory response in CHD patients and potentially prevent its devastating consequences.

1. Inrig JK, Reed SD, Szczech LA, Engemann JJ, Friedman JY, Corey GR, et al. Relationship between clinical outcomes and vascular access type among hemodialysis patients with Staphylococcus aureus bacteremia. Clin J Am Soc Nephrol 2006; 1:518-524.

Abstract:

The association between hemodialysis vascular access type, costs, and outcome of Staphylococcus aureus bacteremia (SAB) among patients with ESRD remains incompletely characterized. This study was undertaken to compare resource utilization, costs, and clinical outcomes among SAB-infected patients with ESRD by hemodialysis access type. Adjusted comparisons of costs and outcomes were based on multivariable linear regression and multivariable logistic regression models, respectively. A total of 143 hospitalized hemodialysis-dependent patients had SAB at Duke University Medical Center between July 1996 and August 2001. A total of 111 (77.6%) patients were hospitalized as a result of suspected bacteremia; 32 (22.4%) were hospitalized for other reasons. Of the 111 patients, 59.5% (n = 66) had catheters as their primary access type, 36% (n = 40) had arteriovenous (AV) grafts, and 4.5% (n = 5) had AV fistulas. Patients with fistulas were excluded from analyses because of small numbers. Patients with catheters were more likely to be white, had shorter dialysis vintage, and had higher Acute Physiology and Chronic Health Evaluation II scores compared with patients with grafts. Unadjusted 12-wk mortality did not significantly differ between patients with catheters compared with patients with grafts (22.7 versus 10.0%; P = 0.098); neither did 12-wk costs differ by access type ($22,944 +/- 18,278 versus $23,969 +/- 13,731, catheter versus graft; P > 0.05). In adjusted analyses, there was no difference in 12-wk mortality (odds ratio 1.63; 95% confidence interval 0.29 to 9.02; catheter versus graft) or 12-wk costs (means ratio 0.84; 95% confidence interval 0.60 to 1.17; catheter versus graft) among SAB-infected patients with ESRD on the basis of hemodialysis access type. Twelve-week mortality and costs that are associated with an episode of SAB are high in hemodialysis patients, regardless of vascular access type. Efforts should focus on the prevention of SAB in this high-risk group.

1. Inrig, J.K., et al., Mortality by dialysis modality among patients who have end-stage renal disease and are awaiting renal transplantation. Clin J Am Soc Nephrol, 2006. 1(4): p. 774-9.

Abstract:

Comparing outcomes related to dialysis modality is complicated by selection bias introduced by patients and physicians. To address the impact of selection bias, this study compared mortality by initial dialysis modality among patients who had ESRD and were placed on the transplant waiting list. This study was a historical prospective cohort of 12,568 patients in the United States who initiated dialysis between May 1, 1995, and October 31, 1998, and were placed on the transplant waiting list before dialysis initiation. Two-year mortality was compared using Kaplan-Meier curves and Cox proportional hazards models that analyzed patients primarily using an intention-to-treat approach and separately censored patients on a modality switch. At 2 yr, the unadjusted mortality rate was 6.6% among peritoneal dialysis (PD) patients compared with 6.9% among hemodialysis (HD) patients (hazard ratio [HR] 1.01; 95% confidence interval [CI] 0.82 to 1.23). After controlling for differences in baseline characteristics, comorbidities, and laboratory variables, the selection of PD versus HD remained associated with a similar 2-yr mortality risk (HR 1.03; 95% CI 0.83 to 1.28). In separate models, 2-yr mortality associated with PD versus HD was significant among patients with body mass index (BMI) > or = 26 kg/m2 (HR 1.37; 95% CI 1.01 to 1.83) but not among patients with BMI < 26 kg/m2 (HR 0.81; 95% CI 0.61 to 1.07). Results were similar after censoring on a modality switch. In conclusion, although choice of initial dialysis modality seems to be associated with equivalent outcomes among patients who have ESRD and are placed on the transplant waiting list, patients with BMI > or = 26 kg/m2 have increased 2-yr mortality associated with the selection of PD versus HD. Because the interpretation of observational data is highly affected by residual confounding and selection bias, further efforts should focus on the formation and testing of hypotheses to improve dialysis delivery.

1. Lee, T., J. Barker, and M. Allon, Tunneled catheters in hemodialysis patients: reasons and subsequent outcomes. Am J Kidney Dis, 2005. 46(3): p. 501-8.

BACKGROUND:

Reducing the use of tunneled catheters in hemodialysis patients requires concerted efforts to convert them to a usable permanent vascular access. The goal of this study is to evaluate the reasons for tunneled catheter use in our prevalent hemodialysis population and the success in converting them to a permanent vascular access.

METHODS:

We identified all catheter-dependent hemodialysis patients at our center on a single date. These patients were followed up prospectively during a 1-year period to evaluate access procedures and conversion to permanent access use.

RESULTS:

Of 458 prevalent hemodialysis patients, 108 patients (23.6%) were dialyzing through cuffed tunneled catheters: 18.5% had no further options for creation of a permanent vascular access, 28.7% had an immature access, 43.5% had access placement pending, and 9.2% had repeatedly refused access surgery. For 78 catheter-dependent patients (excluding patients with no access options and those who refused permanent access surgery), the likelihood of using a permanent access was 53% by 6 months and 80% by 1 year. In patients with an immature access, 50% were using a permanent access at 3 months, and 80%, at 6 months. Of patients with access surgery pending, 45% had access surgery performed within 3 months, and 70%, at 6 months. Finally, of all patients, the likelihood of catheter-related bacteremia was 48% at 6 months. On multivariable analysis, only duration of catheter dependence predicted subsequent use of a permanent access (hazard ratio, 3.11; 95% confidence interval, 1.70 to 5.68; P = 0.0002) for catheter dependence less than versus greater than 6 months.

CONCLUSION:  
Almost one quarter of our hemodialysis population is catheter dependent. Despite concerted efforts, there remain very long delays in achieving a usable permanent access, attributable to delays in both surgical access placement and access maturation. In the interim, this patient population developed a high frequency of catheter-related bacteremia.

1. Lorenzo, V., et al., Predialysis nephrologic care and a functioning arteriovenous fistula at entry are associated with better survival in incident hemodialysis patients: an observational cohort study. Am J Kidney Dis, 2004. 43(6): p. 999-1007.

BACKGROUND:

Late nephrologist referral may adversely affect outcome in patients initiating maintenance hemodialysis therapy, mostly with temporary catheters that may further increase morbidity and mortality. Our aim was to evaluate the influence of 2 variables on mortality: presentation mode (planned versus unplanned) and type of access (arteriovenous fistula [AVF] versus temporary catheter) at entry.

METHODS:

This was a 3-center, 5-year, prospective, observational, cohort study of 538 incident patients. Measurements included presentation mode, type of access, renal function and biochemical test results at entry, and stratification of risk groups. Main outcome measures were mortality and hospitalization.

RESULTS:

Of 281 planned patients (52%), 73% initiated therapy with an AVF. Of 257 unplanned patients (48%), 70% initiated therapy with a catheter (P < 0.001). Multivariate Cox analysis showed that unplanned presentation (hazard ratio [HR], 1.73; 95% confidence interval [CI], 1.23 to 2.44) and initiation of therapy with catheter (HR, 1.75; 95% CI, 1.25 to 2.46) were independently associated with greater mortality and similar HRs after adjusting for confounders. At 12 months, the number of deaths was 3 times higher in both the unplanned versus planned groups and catheter versus AVF groups. The joint effect of unplanned dialysis initiation and catheter use had an additive impact on mortality (HR, 2.89; 95% CI, 1.97 to 4.22). Greater hematocrit (HR, 1.04; 95% CI, 1.01 to 1.09) and albumin level (HR, 1.79; 95% CI, 1.37 to 2.33) showed an independent association with survival, underscoring the benefits of predialysis care. Using Poisson regression, all-cause hospitalization (incidence rate ratio, 1.56; 95% CI, 1.36 to 1.79; P < 0.001) and infection-related (incidence rate ratio, 2.62; 95% CI, 1.91 to 3.59; P < 0.001) and vascular access-related (incidence rate ratio, 1.49; 95% CI, 1.15 to 1.94; P < 0.003) admissions were higher in unplanned patients initiating therapy with a catheter than in planned patients initiating therapy with an AVF, after adjusting for confounders.

CONCLUSION:  
Unplanned dialysis initiation and temporary catheter were independently associated with greater mortality rates in incident patients. The combined influence of both variables was associated with greater morbidity and mortality than either variable alone.

1. Mendelssohn, D.C., et al., A practice-related risk score (PRS): a DOPPS-derived aggregate quality index for haemodialysis facilities. Nephrol Dial Transplant, 2008. 23(10): p. 3227-33.

BACKGROUND:

The Dialysis Outcomes and Practice Patterns Study (DOPPS) database was used to develop and validate a practice-related risk score (PRS) based on modifiable practices to help facilities assess potential areas for improving patient care.

METHODS:

Relative risks (RRs) from a multivariable Cox mortality model, based on observational haemodialysis (HD) patient data from DOPPS I (1996-2001, seven countries), were used. The four practices were the percent of patients with Kt/V > or =1.2, haemoglobin > or =11 g/dl (110 g/l), albumin > or =4.0 g/dl (40g/l) and catheter use, and were significantly related to mortality when modelled together. DOPPS II data (2002-2004, 12 countries) were used to evaluate the relationship between PRS and mortality risk using Cox regression.

RESULTS:

For facilities in DOPPS I and II, changes in PRS over time were significantly correlated with changes in the standardized mortality ratio (SMR). The PRS ranged from 1.0 to 2.1. Overall, the adjusted RR of death was 1.05 per 0.1 points higher PRS (P < 0.0001). For facilities in both DOPPS I and II (N = 119), a 0.2 decrease in PRS was associated with a 0.19 decrease in SMR (P = 0.005). On average, facilities that improved PRS practices showed significantly reduced mortality over the same time frame.

CONCLUSIONS:  
The PRS assesses modifiable HD practices that are linked to improved patient survival. Further refinements might lead to improvements in the PRS and will address regional variations in the PRS/mortality relationship.

1. Port, F.K., et al., DOPPS estimates of patient life years attributable to modifiable hemodialysis practices in the United States. Blood Purif, 2004. 22(1): p. 175-80.

Abstract:

Data from the Dialysis Outcomes and Practice Patterns Study (DOPPS) allow estimation of the percentage of patients outside published hemodialysis guidelines and their associated mortality risk. We estimated the number of life years that could be gained from adherence to four of these guidelines and two other modifiable practices, i.e. dialysis dose, phosphate control, improved anemia, partial correction of serum albumin, reduced interdialytic weight gain and less use of catheters for vascular access. We extrapolated DOPPS data on these practices and guidelines to the US hemodialysis population for a 5-year projected period. Of the practices we examined, the highest relative risk of mortality was associated with having albumin <3.5 g/dl (relative risk=1.38, p<0.0001); 20.5% of the patients in the study fell outside the target range. The adjusted sum of the patient years attributable to all six practice patterns was 143,617; a more conservative estimate, modeling life years potentially gained by bringing half of all patients outside targets within them, is 69,367. The magnitude of potential savings in life years should encourage greater adherence to guidelines and practices that are significantly associated with better survival.

1. Moist, L.M., et al., Increased hemodialysis catheter use in Canada and associated mortality risk: data from the Canadian Organ Replacement Registry 2001-2004. Clin J Am Soc Nephrol, 2008. 3(6): p. 1726- 32.

BACKGROUND AND OBJECTIVES:

The 1999 Canadian vascular access guidelines recommend the fistula as the access of choice. The study describes the trends in hemodialysis access use, variation among provinces, and the association with mortality from 2001 to 2004.

DESIGN, SETTING, PARTICIPANTS AND MEASUREMENTS:

An observational study of adult patients registered in Canadian Organ Replacement Registry on hemodialysis. Access trends were examined among incident and prevalent hemodialysis patients adjusted for age, sex, body mass index, late referral, race, smoking status, province, etiology of end-stage renal disease, and comorbidities. Cox proportional hazard regression analysis was used to analyze risk for death for patients followed to December 31, 2005.

RESULTS:

From 2001 to 2004, incident catheter use increased from 76.8% to 79.1%, fistulas decreased from 21.6% to 18.6%, and grafts remained between 2.1% to 2.6%. Prevalent catheter use increased from 41.8% to 51.7%, and fistulas and grafts decreased from 46.8% to 41.6% and 11.4% to 6.7%, respectively. There was significant variation in incident and prevalent fistulae use among the provinces. Adjustment for differences in patient characteristics did not change these trends. Incident catheter use was associated with a 6 times greater risk of death compared with fistula or graft use combined.

CONCLUSIONS:  
In Canada there has been a decrease in fistulae and grafts with a subsequent increase in catheters that is not explained by changes in patient characteristics. Vascular access use varied by province, suggesting differences in practice patterns. Because incident catheter use was associated with increased mortality, urgent measures are needed to develop strategies to decrease catheter use.

1. Mokrzycki, M.H., et al., Tunnelled haemodialysis catheter bacteraemia: risk factors for bacteraemia recurrence, infectious complications and mortality. Nephrol Dial Transplant, 2006. 21(4): p. 1024-31.

BACKGROUND:

Infection is a serious complication of tunnelled cuffed catheter (TCC) use and is associated with high complication and mortality rates. Although attempts at TCC salvage after bacteraemia have been associated with high rates of recurrent bacteraemia, there have been no large studies in which multivariate analysis has been performed to control for confounding factors such as infecting organisms, diabetes, etc.

METHODS:

A prospective observational study was performed in chronic HD patients dialyzing with a TCC at seven outpatient HD centers. All patients diagnosed with TCC bacteraemia were observed for 3 months following initial presentation and outcomes were recorded.

RESULTS:

During the 2.5 year study period, 226 patients had an episode of TCC bacteraemia that met inclusion criteria, and 3 month follow-up data were available in 219 episodes. Treatment failure, defined as recurrent TCC bacteraemia with the same organism or death from sepsis, occurred in 26 patients (12%). Infectious complications (such as endocarditis, osteomyelitis, etc.) occurred in 16 patients (7%), bacteraemia with a different organism occurred in 19 patients (9%), and death from sepsis occurred in eight patients (4%). Significant predictors of treatment failure (by univariate analysis) were TCC salvage, and infection with Staphylococcus aureus, (OR = 4.2, P = 0.002; and OR = 3.3, P = 0.02, respectively). TCC salvage, when used in episodes of S. aureus bacteraemia, was associated with an 8-fold higher risk of treatment failure (P = 0.001). The presence of an abnormal TCC exit site was associated with a significantly higher rate of death from sepsis, (OR = 7, P = 0.001). Outcomes (treatment failure and infectious complications) did not differ among bacteraemic episodes where the TCC was exchanged over a guidewire compared to those in which the TCC was immediately removed followed by delayed reinsertion. In the multivariate analysis, adjusted for potential confounding covariates, the only significant predictors of treatment failure after an episode of TCC bacteraemia were TCC salvage (OR = 5.4, P = 0.003), and S. aureus (OR = 4.2, P = 0.002). In a multivariate analysis, controlling for TCC management, the only variable that was significantly associated with the development of an infectious complication was infection with S. aureus (OR = 3.5, P = 0.02).

CONCLUSIONS:  
We have shown, using multivariate analysis and adjusting for potential confounding factors, that the use of TCC salvage and S. aureus are independent risk factors for treatment failure after an episode of TCC bacteraemia, and that S. aureus is an independent risk factor for developing an infectious complication. An infected-appearing TCC exit site is associated with a higher mortality rate. Episodes of TCC bacteraemia treated using TCC salvage are associated with the highest treatment failure rates. TCC guidewire exchange can be an acceptable practice, unless severe exit site or tunnel infection is present.

1. Oliver, M.J., et al., Late creation of vascular access for hemodialysis and increased risk of sepsis. J Am Soc Nephrol, 2004. 15 (7): p. 1936-42.

Abstract:

The creation of fistulas or grafts before starting dialysis is recommended, but whether it reduces major adverse events is largely unknown. The objective of this study was to determine if early access creation was associated with a reduced risk of hospitalization from sepsis and mortality. Fistulas or grafts created at least 4 mo before starting hemodialysis were defined as Early creations (n = 1240), and accesses created between 4 mo and 1 mo before starting hemodialysis were defined as Just Prior creations (n = 997). Accesses created within 1 mo of starting dialysis or after were defined as Late creations (reference group, n = 3687). Hemodialysis catheter use was defined as insertion, removal, or manipulation of a catheter before the occurrence of sepsis. Eighty percent of accesses were fistulas. Early access creation was associated with a relative risk (RR) of sepsis of 0.57 (95% CI, 0.41 to 0.79) compared with Late access creation. Catheter use increased the risk of sepsis by 1.41 (95% CI, 1.14 to 1.81). The risk of sepsis with Early creation decreased to 0.48 (95% CI, 0.35 to 0.65) if catheter use was not adjusted. Early access creation was associated with lower mortality (RR 0.76; 95% CI 0.58 to 1.00), but this association became nonsignificant if catheter use and sepsis were adjusted. Catheter use and sepsis independently increased mortality. This study demonstrates that fistula creation at least 4 mo before starting chronic hemodialysis is associated the lowest risk of sepsis and death, primarily by reducing the use of hemodialysis catheters.

1. Ribot, S., S.W. Siddiqi, and C. Chen, Right heart complications of dual lumen tunneled venous catheters in hemodialysis patients. Am J Med Sci, 2005. 330(4): p. 204-8.

Abstract:

Seven hemodialysis patients with infected right atrial thrombi and/or tricuspid valve endocarditis are reported. All cases were attributed to use of tunneled venous catheters. Staphylococcus aureus was the preponderant organism isolated on blood culture. Therapeutic measures included antibiotics, catheter exchange, and surgery. One patient died with pulmonary embolism, and the remainder survived the infectious episodes. Experimental evidence further confirms the relationship of venous catheters placed in or proximate to the right atrium as the cause for the reported infected thrombotic and tricuspid valve complications. Measures to reduce the incidence of right heart complications must begin with recognition of the need for a surgically created arterial venous dialysis access placed early in the course of kidney disease. There is no entirely satisfactory method for prevention of venous catheter--induced endocarditis.

1. Sands, J.J., Increasing AV fistulae and decreasing dialysis catheters: two aspects of improving patient outcomes. Blood Purif, 2007. 25(1): p. 99-102.

Abstract:

Maximizing arteriovenous (AV) fistula prevalence and minimizing catheter use have become the dominant issues in hemodialysis vascular access management and offer the promise of improved patient outcomes with decreased overall expenditures. Recent efforts have increased AV fistula prevalence in the US to 42.9% with regional rates as high as 59.5% and with complementary declines in AV grafts. This should decrease access procedures but may not fully realize the potential reductions in mortality and cost possible if combined with catheter reduction. Successful catheter reduction requires similar approaches to those utilized in the Fistula First Program. Educating patients, the use of clearly defined protocols and updating payment systems to include chronic kidney disease care are crucial to continued progress. Expansion of the Fistula First Program to include a focus on decreasing catheter prevalence and complications should be considered as a requirement in the push toward the breakthrough targets of 66% AV fistula prevalence.

1. Sands, J.J., Vascular access: the past, present and future. Blood Purif, 2009. 27(1): p. 22-7.

Abstract:

Over the past 40 years, improvements in vascular access management have enhanced patient outcomes and decreased an epidemic of access failure. Arteriovenous fistulae are again the access of choice and new percutaneous therapies and outpatient access centers have revolutionized the therapeutic approach to access failure. Evidence-based guidelines, supported by national and international outcome data have helped rationalize vascular access care. Current challenges and, in particular, the increased use of catheters with resultant increases in patient morbidity and mortality must be rapidly addressed to protect patients and decrease the unacceptably high rates of catheter-related infection. Future technologies will continue to improve vascular access management. Our ability to utilize these new approaches to benefit patients will depend on appropriate application, continued development of standardized delivery systems utilizing outcome measures and payment systems that support and incent outcome improvement.

1. Sikaneta, T., et al., The Toronto Western Hospital catheter: one center´s experience and review of the literature. Int J Artif Organs, 2006. 29(1): p. 59-63.

Abstract:

Background: We report our centers experience with the Toronto Western Hospital (TWH) catheter, and discuss our catheter survival and complication rates. Methods: Retrospective chart review of patients receiving peritoneal dialysis therapy via a TWH catheter. Catheter complication rates of peritonitis, exit site infection, obstruction, leak, and malfunction were assessed. A catheter was considered failed if removed because of exit site infection, obstruction, or malfunction. All other catheters, even if removed for other reasons, were considered censured. Survival was defined as the period from insertion to failure or censure date, and reported using Kaplan Meier analysis. Results: 192 patients with a total of 208 TWH catheters (4,845.3 catheter months) were analyzed. Our overall 1- and 3-year catheter survival rates were identical at 0.9182. Our catheter complication rates (expressed as number of catheter months per event) were 31.3 for peritonitis, 42.9 for exit site infection, 72.3 for obstruction, 538.4 for malfunction, and 969.1 for catheter leak. Our findings were similar to those reported in the literature for TWH and other peritoneal catheters.

1. Suresh, V., et al., Bacterial meningitis--complication from a dialysis catheter. Clin Nephrol, 2006. 65(6): p. 457-9.

Abstract:

Various infective complications associated with dialysis catheter infection have been reported in the literature previously. We report a case of a hemodialysis patient presented with confusion and dysarthria secondary to Staphylococcus aureus septicemia and meningitis originating from a tunneled catheter used for providing dialysis. Blood cultures from the periphery, central venous catheter and culture of the line tip grew methicillin-sensitive Staphylococcus aureus. Lumbar puncture after CT brain confirmed Staphylococcus aureus. He was treated with high dose of an appropriate parenteral antibiotic and also removal of the infected line. In spite of optimal treatment, he died 15 days following his admission. The ideal option will be to use a definitive access like a fistula or AV graft, but in practice a significant proportion of hemodialysis patients is dialyzed with temporary or tunneled catheters all over the world, and infection poses a serious threat to dialysis patients resulting in significant mortality and morbidity. In patients with dialysis catheter-related sepsis, removal of the infected catheters and appropriate antibiotic treatment will prevent serious metastatic complications. Planning definitive access well ahead in chronic kidney disease patients and minimizing the use of temporary access is the only way forward.

1. Thomson, P.C., et al., Vascular access in haemodialysis patients: a modifiable risk factor for bacteraemia and death. QJM, 2007. 100(7): p. 415-22.

BACKGROUND:

Bacteraemia and the development of sepsis syndrome is second only to cardiovascular disease as the leading cause of death in patients on renal replacement therapy.

AIM:

To determine the contributions of laboratory and clinical variables to the risk of bacteraemia and death in haemodialysis patients.

DESIGN:

Retrospective analysis.

METHODS:

We analysed all patients receiving haemodialysis in our renal unit at the beginning of January 2004 (n=263), recording clinical and laboratory variables for each patient at study entry. Bacteraemia and mortality were recorded for the subsequent 18-month period. Multivariate analysis using a Cox proportional hazards model was used to test for independent associations between variables and outcomes.

RESULTS:

During the study period, 45 patients (17.1%) developed bacteraemia and 65 (24.7%) died. Under multivariate analysis, use of dialysis catheters at study entry was a major factor in the development of bacteraemia and death with hazard ratios (HR) of 5.4 (p<0.001) and 2.8 (p=0.012), respectively, for tunnelled central venous catheters vs. arteriovenous fistulas (AVFs) and 3.1 (p=0.01) and 3.4 (p=0.001), respectively, for non-tunnelled central venous catheters vs. AVFs. Elevated CRP at study entry was independently associated with bacteraemia (HR 1.5 per unit log-CRP, p=0.006). Low serum albumin (HR 0.92, p=0.005) was independently associated with death.

DISCUSSION:  
Use of synthetic vascular access catheters and heightened inflammatory state both have strong independent associations with subsequent bacteraemia and death. Bacteraemia surveillance strategies should be developed, with consideration of vascular access type and baseline inflammatory state as key components.

1. Siempos, II, et al., Impact of catheter-related bloodstream infections on the mortality of critically ill patients: a meta-analysis. Crit Care Med, 2009. 37(7): p. 2283-9.

OBJECTIVE:

There is controversy on whether catheter-related bloodstream infections (CR-BSI) affect the mortality of critically ill patients.

DESIGN:

Meta-analysis of comparative studies that reported on mortality of intensive care unit (ICU) adult patients with and without CR-BSI.

METHODS:

PubMed, Current Contents, and reference lists of retrieved publications were searched with no language or time restrictions. Heterogeneity was assessed by means of I-statistic and chi-square test. Publication bias was detected by the funnel plot method using Egger's test. Pooled odds ratios (OR) and 95% confidence intervals (CI) were calculated by implementing both the Mantel-Haenszel fixed effect and the DerSimonian-Laird random effects model.

RESULTS:

Eight studies, involving 2,540 ICU patients, were included. Heterogeneity was detected (I = 0.67, 95% CI 0.32-0.85, p = 0.003). Publication bias was not found (Egger's test, p = 0.28). All-cause in-hospital mortality was higher in ICU patients with CR-BSI than in those without CR-BSI (fixed effect model: OR = 1.81, 95% CI 1.44-2.28; random effects model: OR = 1.96, 95% CI 1.25-3.09). This was also the case for the subgroup analysis of the studies that were matched for severity of illness (fixed effect model: OR = 1.65, 95% CI 1.28-2.13; random effects model: OR = 1.70, 95% CI 1.00-2.90).

CONCLUSION:  
Presence, as opposed to absence, of CR-BSI is associated with higher mortality in critically ill adult patients. This finding seems to justify and may enhance efforts to prevent CR-BSI in such patients.

1. Wasse, H., Catheter-related mortality among ESRD patients. Semin Dial, 2008. 21(6): p. 547-9.

Abstract:

Hemodialysis access-related complications remain one of the most important sources of morbidity and cost among persons with end-stage renal disease, with total annual costs exceeding $1 billion annually. In this context, the creation and maintenance of an effective hemodialysis vascular access is essential for safe and adequate hemodialysis therapy. Multiple reports have documented the type of vascular access used for dialysis and associated risk of infection and mortality. Undoubtedly, the central venous catheter (CVC) is associated with the greatest risk of infection-related and all-cause mortality compared with the autogenous arteriovenous fistula (AVF) or synthetic graft (AVG). The AVF has the lowest risk of infection, longer patency rates, greater quality of life, and lower all-cause mortality compared with the AVG or CVC. It is for these reasons that the National Kidney Foundation’s Kidney Disease Outcome Quality Initiative Clinical Practice Guidelines for Vascular Access recommend the early placement and use of the AVF among at least 50% of incident hemodialysis patients. This report presents catheter-related mortality and calls for heightened awareness of catheter-related complications.

1. Wasse, H., R.A. Speckman, and W.M. McClellan, Arteriovenous fistula use is associated with lowercardiovascular mortality compared with catheter use among ESRD patients. Semin Dial, 2008. 21(5): p. 483-9. 38) Weijmer, M.C., M.G. Vervloet, and P.M. ter Wee, Prospective follow-up of a novel design haemodialysis catheter; lower infection rates and improved survival. Nephrol Dial Transplant, 2008. 23(3): p. 977-83.

Abstract:

The arteriovenous fistula (AVF) is the recommended form of dialysis vascular access, however, limited studies suggest that AVF creation may result in increased cardiovascular stress and remodeling. To explore the contribution of vascular access type to cardiovascular-related (CV) mortality, we analyzed USRDS Clinical Performance Measures data comprising 4854 patients that initiated dialysis between October 1, 1999-December 31, 2004. CV mortality included death from acute myocardial infarction, atherosclerotic heart disease, cardiomyopathy, arrhythmia, cardiac arrest or stroke. Risk of cardiovascular mortality during a 4-year observation was analyzed by Cox-regression methods with adjustments for demographic and co-morbid conditions. AVF use was strongly associated with lower all-cause and CV mortality. After adjustment for covariates, AVF use 90 days after dialysis initiation remained significantly associated with lower cardiovascular mortality [hazard ratio (HR) 0.69, p = 0.0004] compared with catheter use. These findings suggest that vascular access type influences cause-specific mortality beyond that of infection, and support existing guidelines recommending the use of an AVF early in the course of chronic end-stage renal disease therapy.

1. Weijmer, M.C., M.G. Vervloet, and P.M. ter Wee, Prospective follow-up of a novel design haemodialysis catheter; lower infection rates and improved survival. Nephrol Dial Transplant, 2008. 23(3): p. 977-83.

BACKGROUND:  
Untunnelled straight jugular catheters (USC) are uncomfortable for patients and cannot be well fixated. This could be a reason for the high incidence of catheter-related complications.

METHODS:  
We prospectively analysed the outcome of a novel designed untunnelled precurved catheter (UPC) with better fixation properties and compared it with the outcome of USC. The outcome was also related to data on tunnelled cuffed catheters (TCC).

RESULTS:  
The outcome of USC was documented over a 32-month period. Thereafter, we switched to an UPC. The same catheter care protocol was used and not changed over time. A total of 104 USC and 65 UPC were inserted. Compared to USC, less UPC had to be removed for a complication (53 versus 15%; P < 0.001) and less periods of catheter-related bacteraemia were observed in UPC compared to USC [0 versus 5.6 per 1000 catheter days (cd); P < 0.01]. Removal for flow problems was similar. Compared to 64 TCC, inserted in the same period, UPC had more flow problems. Other outcomes and complication rates were similar. Complication rates for TCC inserted before and after the switch from USC to UPC were similar.

CONCLUSIONS:  
UPC have better patency rates and a lower risk for bacteraemia and exit-site infection compared to USC.

1. Taylor, G.D., et al., Central venous catheters as a source of hemodialysis-related bacteremia. Infect Control Hosp Epidemiol, 1998. 19(9): p. 643-6.

OBJECTIVE:

To describe investigations into an increase in hemodialysis-related bacteremia that occurred in our hospital in the first 6 months of 1996.

SETTING:

Hemodialysis unit in a tertiary-care medical center.

METHODS:

Prospective surveillance for hemodialysis bacteremia has been performed for several years. Cases that occurred in 1995 were compared to cases in the first 6 months of 1996. Unit data on dialysis runs and method of dialysis access were used to calculate rates. Nested polymerase chain reaction (PCR) was used to type 18 Staphylococcus aureus isolates from 1996. A case-control study comparing 80 randomly selected hemodialysis patients from 1995 and 1996 was performed to examine infection risk factors.

RESULTS:

The hemodialysis bacteremia rate was 1.2 per 1,000 runs in 1995 and 2.8 per 1,000 in the first 6 months of 1996 (P=.0009). The 25 cases in 1995 and 32 in the first half of 1996 were similar in age, gender, means of vascular access, and microbial etiology. Central venous catheter (CVC) access accounted for >90% of cases in both time periods. S aureus was the most common microbial etiology (53% of the 1996 cases). PCR typing of S aureus isolates from 1996 demonstrated five different strains, the most common having six isolates. The use of CVCs as a means of vascular access abruptly increased in the unit in January 1996, from <30% of dialysis runs in 1995 to >40% in 1996 (P<.001), associated with structural changes in healthcare delivery in the region resulting in delays in performing surgical procedures, such as creation of vascular grafts and fistulae.

CONCLUSION:  
A marked increase in hemodialysis bacteremia occurred in 1996, associated with increased reliance on CVCs for vascular access in hemodialysis patients during a period of healthcare restructuring.

1. Wasse, H., et al., Predictors of delayed transition from central venous catheter use to permanent vascular access among ESRD patients. Am J Kidney Dis, 2007. 49(2): p. 276-83.

Background

Early arteriovenous fistula (AVF) creation is necessary to curb the use of central venous catheters (CVCs) and reduce their complications. We sought to examine patient characteristics that may influence persistent CVC use 90 days after dialysis therapy initiation among patients using a CVC.

Methods

Data from the 1999 to 2003 Clinical Performance Measures Project was linked to the Centers for Medicare & Medicaid Services Medical Evidence (2728) form.

Results

Most patients (59.4%) starting dialysis with a CVC failed to transition to permanent access within 90 days, whereas 25.4% received a graft and only 15.2% received an AVF. Older patients (>75 years) were more than 2-fold more likely to remain CVC dependent at 90 days (P = 0.0.001) compared with those younger than 50 years. In addition, race and sex were highly predictive of CVC dependence at 90 days; black females, white females, and black males were 75% (P < 0.001), 61% (P < 0.001), and 35% (P = 0.023) more likely than white males to maintain CVC use, whereas patients with ischemic heart disease and peripheral vascular disease were 35% (P = 0.023) and 39% (P = 0.007) more likely to remain CVC dependent at 90 days, respectively.

Conclusion  
Prolonged CVC dependence is more likely to occur among patients of older age, females, blacks, and those with cardiovascular comorbidity, suggesting inadequate or late access referral or greater primary access failure. Our findings suggest possible missed opportunities for early conversion of patients to permanent vascular access that may vary by race and sex.

1. Wolfe, R.A., et al., Decreases in catheter use are associated with decreases in mortality for dialysis facilities during 2000-03. J Am Soc Nephrol Dial Transplant, 2005. 16: p. 95A.

1. Al-Jaishi, AA. Patency rates of the arteriovenous fistula for hemodialysis: a systematic review and meta-analysis. Am J Kidney Dis. 2014 Mar;63(3):464-78. doi: 10.1053/j.ajkd.2013.08.023. Epub 2013 Oct 30.

BACKGROUND:

Advantages of the arteriovenous fistula (AVF), including long patency and few complications, were ascertained more than 2 decades ago and may not apply to the contemporary dialysis population.

STUDY DESIGN:

Systematic review and meta-analysis. Estimates were pooled using a random-effects model and sources of heterogeneity were explored using metaregression.

SETTING & POPULATION:

Patients treated with long-term hemodialysis using an AVF.

SELECTION CRITERIA FOR STUDIES:

English-language studies indexed in MEDLINE between 2000 and 2012 using prospectively collected data on 100 or more AVFs.

PREDICTOR:

Age, AVF location, and study location.

OUTCOMES:

Outcomes of interest were primary AVF failure and primary and secondary patency at 1 and 2 years.

RESULTS:

7,011 citations were screened and 46 articles met eligibility criteria (62 unique cohorts; n = 12,383). The rate of primary failure was 23% (95% CI, 18%-28%; 37 cohorts; 7,393 AVFs). When primary failures were included, the primary patency rate was 60% (95% CI, 56%-64%; 13 studies; 21 cohorts; 4,111 AVFs) at 1 year and 51% (95% CI, 44%-58%; 7 studies; 12 cohorts; 2,694 AVFs) at 2 years. The secondary patency rate was 71% (95% CI, 64%-78%; 10 studies; 11 cohorts; 3,558 AVFs) at 1 year and 64% (95% CI, 56%-73%; 6 studies; 11 cohorts; 1,939 AVFs) at 2 years. In metaregression, there was a significant decrease in primary patency rate in studies that started recruitment in more recent years.

LIMITATIONS:

Low quality of studies, variable clinical settings, and variable definitions of primary AVF failure.

CONCLUSIONS:  
In recent years, AVFs had a high rate of primary failure and low to moderate primary and secondary patency rates. Consideration of these outcomes is required when choosing a patient's preferred access type.

1. Ravani, P. Associations between hemodialysis access type and clinical outcomes: a systematic review.J Am Soc Nephrol. 2013 Feb;24(3):465-73. doi: 10.1681/ASN.2012070643. Epub 2013 Feb 21.

Abstract

Clinical practice guidelines recommend an arteriovenous fistula as the preferred vascular access for hemodialysis, but quantitative associations between vascular access type and various clinical outcomes remain controversial. We performed a systematic review of cohort studies to evaluate the associations between type of vascular access (arteriovenous fistula, arteriovenous graft, and central venous catheter) and risk for death, infection, and major cardiovascular events. We searched MEDLINE, EMBASE, and article reference lists and extracted data describing study design, participants, vascular access type, clinical outcomes, and risk for bias. We identified 3965 citations, of which 67 (62 cohort studies comprising 586,337 participants) met our inclusion criteria. In a random effects meta-analysis, compared with persons with fistulas, those individuals using catheters had higher risks for all-cause mortality (risk ratio=1.53, 95% CI=1.41-1.67), fatal infections (2.12, 1.79-2.52), and cardiovascular events (1.38, 1.24-1.54). Similarly, compared with persons with grafts, those individuals using catheters had higher risks for mortality (1.38, 1.25-1.52), fatal infections (1.49, 1.15-1.93), and cardiovascular events (1.26, 1.11-1.43). Compared with persons with fistulas, those individuals with grafts had increased all-cause mortality (1.18, 1.09-1.27) and fatal infection (1.36, 1.17-1.58), but we did not detect a difference in the risk for cardiovascular events (1.07, 0.95-1.21). The risk for bias, especially selection bias, was high. In conclusion, persons using catheters for hemodialysis seem to have the highest risks for death, infections, and cardiovascular events compared with other vascular access types, and patients with usable fistulas have the lowest risk.

1. Ocak, G. Type of arteriovenous vascular access and association with patency and mortality. BMC Nephrology 2013, 14:79

Background  
There are only a few risk factors known for primary patency loss in patients with an arteriovenous graft or fistula. Furthermore, a limited number of studies have investigated the association between arteriovenous access modality and primary patency loss and mortality. The aim of this study was to investigate risk factors for patency loss and to investigate the association between graft versus fistula use and outcomes (patency loss and mortality).

Methods

We prospectively followed 919 incident hemodialysis patients and calculated hazard ratios (HRs) for putative risk factors of primary patency loss using Cox regression. Furthermore, HRs were calculated to study the association between graft versus fistula use and two-year primary patency loss and two-year mortality.

Results

Cardiovascular disease, prior catheter use, lowest tertile of albumin, highest tertile of hsCRP, and lowest tertile of fetuin-A were associated with primary patency loss in both patients with grafts and fistulas. Increased age, female sex, and diabetes mellitus were only associated with primary patency loss in patients with a fistula. We did not observe an association between primary patency loss and BMI, residual GFR, levels of calcium, phosphorus, and total cholesterol. Furthermore, graft use as compared with fistula use was associated with an 1.4-fold (95% CI 1.0-1.9) increased risk of primary patency loss and with an 1.5-fold(95% CI 1.0-2.2) increased mortality risk.

Conclusion  
Cardiovascular disease, prior catheter use, albumin, hsCRP, and fetuin-A are risk factors for patency loss. Graft use as compared with fistula use was associated with an increased risk of patency loss and mortality.

1. Moist, LM. Optimal hemodialysis vascular access in the elderly patient.Semin Dial. 2012 Nov-Dec;25(6):640-8. doi: 10.1111/sdi.12037.

Abstract:

The optimal vascular access for elderly patients remains a challenge due to the difficulty balancing the benefits and risks in a population with increased comorbidity and decreased survival. Age is commonly associated with failure to mature in fistula and decreased rates of primary and secondary patency in both fistula and grafts. In the elderly, at 1 and 2 years, primary patency rates range from 43% to 74% and from 29% to 67%, respectively. Secondary patency rates at 1 and 2 years range from 56% to 82% and 44% to 67%, respectively. Cumulative fistula survival is no better than grafts survival when primary failures are included. Several observational studies consistently demonstrate a lower adjusted mortality among those using a fistula compared with a catheter; however, catheter use in the elderly is increasing in most countries with the exception of Japan. Both guidelines and quality initiatives do not acknowledge the trade-offs involved in managing the elderly patients with multiple chronic conditions and limited life expectancy or the value that patients place on achieving these outcomes. The framework for choice of vascular access presented in this article considers: (1) likelihood of disease progression before death, (2) patient life expectancy, (3) risks and benefits by vascular access type, and (4) patient preference. Future studies evaluating the timing and type of vascular access with careful assessments of complications, functionality, cost benefit, and patients' preference will provide relevant information to individualize and optimize care to improve morbidity, mortality, and quality of life in the elderly patient.

1. Tamura, MK. Optimizing renal replacement therapy in older adults: a framework for making individualized decisions. Kidney Int. 2012 Aug;82(3):261-9. doi: 10.1038/ki.2011.384. Epub 2011 Nov 16.

Abstract:

It is often difficult to synthesize information about the risks and benefits of recommended management strategies in older patients with end-stage renal disease since they may have more comorbidity and lower life expectancy than patients described in clinical trials or practice guidelines. In this review, we outline a framework for individualizing end-stage renal disease management decisions in older patients. The framework considers three factors: life expectancy, the risks and benefits of competing treatment strategies, and patient preferences. We illustrate the use of this framework by applying it to three key end-stage renal disease decisions in older patients with varying life expectancy: choice of dialysis modality, choice of vascular access for hemodialysis, and referral for kidney transplantation. In several instances, this approach might provide support for treatment decisions that directly contradict available practice guidelines, illustrating circumstances when strict application of guidelines may be inappropriate for certain patients. By combining quantitative estimates of benefits and harms with qualitative assessments of patient preferences, clinicians may be better able to tailor treatment recommendations to individual older patients, thereby improving the overall quality of end-stage renal disease care.

1. Schmidt, RJ. Pursuing permanent hemodialysis vascular access in patients with a poor prognosis: juxtaposing potential benefit and harm. Am J Kidney Dis. 2012 Dec;60(6):1023-31. doi: 10.1053/j.ajkd.2012.07.020. Epub 2012 Sep 19.

Abstract:

For patients with end-stage renal disease requiring hemodialysis, the native arteriovenous fistula remains the gold standard of vascular access, with tunneled cuffed central venous catheters reserved for temporary use or as a last resort in patients for whom a permanent vascular access is not possible. It is expected that most patients receiving hemodialysis will be suitable for arteriovenous fistula placement, with suitable patients defined as those: (1) for whom long-term dialysis is expected to confer benefit, (2) with vascular anatomy amenable to arteriovenous fistula placement, and (3) with progressive irreversible kidney failure who are more likely to require dialysis than to die before reaching dialysis dependence. The present article reviews considerations for vascular access decision making, focusing on older patients and those with a poor prognosis, weighing the risks and benefits of arteriovenous fistulas, arteriovenous grafts, and central venous catheters and emphasizing that in the process of vascular access decision making for such patients, medical and ethical obligations to avoid central venous catheters must be balanced by the obligation to do no harm.

1. Allon M and Lok C. Dialysis fistula or graft: the role for randomized clinical trials. Clin J Am Soc Nephrol. 2010 Dec;5(12):2348-54. doi: 10.2215/CJN.06050710. Epub 2010 Oct 28.

Abstract:

The Fistula First Initiative has strongly encouraged nephrologists, vascular access surgeons, and dialysis units in the United States to make valiant efforts to increase fistula use in the hemodialysis population. Unfortunately, the rigid "fistula first" recommendations are not based on solid, current, evidence-based data and may be harmful to some hemodialysis patients by subjecting them to prolonged catheter dependence with its attendant risks of bacteremia and central vein stenosis. Once they are successfully cannulated for dialysis, fistulas last longer than grafts and require fewer interventions to maintain long-term patency for dialysis. However, fistulas have a much higher primary failure rate than grafts, require more interventions to achieve maturation, and entail longer catheter dependence, thereby leading to more catheter-related complications. Given the tradeoffs between fistulas and grafts, there is equipoise about their relative merits in patients with moderate to high risk of fistula nonmaturation. The time is right for definitive, large, multicenter randomized clinical trials to compare fistulas and grafts in various subsets of chronic kidney disease patients. Until the results of such clinical trials are known, the optimal vascular access for a given patients should be determined by the nephrologist and access surgeon by taking into account (1) whether dialysis has been initiated, (2) the patient's life expectancy, (3) whether the patient has had a previous failed vascular access, and (4) the likelihood of fistula nonmaturation. Careful clinical judgment should optimize vascular access outcomes and minimize prolonged catheter dependence among hemodialysis patients.

1. Lok, CE. Risk equation determining unsuccessful cannulation events and failure to maturation in arteriovenous fistulas (REDUCE FTM I). J Am Soc Nephrol. 2006 Nov;17(11):3204-12. Epub 2006 Sep 20.

Abstract:

Fistulas are the preferred permanent hemodialysis vascular access but a significant obstacle to increasing their prevalence is the fistula's high "failure to mature" (FTM) rate. This study aimed to (1) identify preoperative clinical characteristics that are predictive of fistula FTM and (2) use these predictive factors to develop and validate a scoring system to stratify the patient's risk for FTM. From a derivation set of 422 patients who had a first fistula created, a prediction rule was created using multivariate stepwise logistic regression. The model was internally validated using split-half cross-validation and bootstrapping techniques. A simple scoring system was derived and externally validated on 445 different, prospective patients who received a new fistula at five large North American dialysis centers. The clinical predictors that were associated with FTM were aged > or =65 yr (odds ratio [OR] 2.23; 95% confidence interval [CI] 1.25 to 3.96), peripheral vascular disease (OR 2.97; 95% CI 1.34 to 6.57), coronary artery disease (OR 2.83; 95% CI 1.60 to 5.00), and white race (OR 0.43; 95% CI 0.24 to 0.75). The resulting scoring system, which was externally validated in 445 patients, had four risk categories for fistula FTM: low (24%), moderate (34%), high (50%), and very high (69%; trend P < 0.0001). A preoperative, clinical prediction rule to determine fistulas that are likely to fail maturation was created and rigorously validated. It was found to be simple and easily reproducible and applied to predictive risk categories. These categories predicted risk of FTM to be 24, 34, 50, and 69% and are dependent on age, coronary artery disease, peripheral vascular disease, and race. The clinical utility of these risk categories in increasing rates of permanent accesses requires further clinical evaluation.

1. Lock, CE. Arteriovenous fistula outcomes in the era of the elderly dialysis population. Kidney Int. 2005 Jun;67(6):2462-9.

BACKGROUND:

The growth of patients > or =65 years on hemodialysis is increasing. Guidelines recommend arteriovenous fistula (AVF) access but their outcomes in elderly patients are controversial. This study compared the outcomes of AVF in patients <65 years old (65- group) versus those > or =65 years old (65+ group).

METHODS:

This retrospective analysis of prospectively collected data included 444 incident, first-time AVF created in a large dialysis center between January 1, 1995 and July 1, 2003. The primary outcome of AVF cumulative patency was evaluated using Kaplan-Meier survival analysis with log-rank test comparison. A Cox model determined factors associated with AVF loss.

RESULTS:

One hundred ninety-six patients (44%) were in the 65+ group. In total, there were 230 (52.2%) radiocephalic, 186 (42.2%) brachiocephalic, and 25 (5.6%) basilic vein transposed AVF. The one-year AVF cumulative survival was 75.1% (65+ group) and 79.7% (65- group); the five-year survival was 64.7% (65+ group) and 71.4% (65- group). The overall total procedure, angioplasty, thrombolysis, and revision rates per access-year were 0.83, 0.30, 0.66, and 0.16, respectively. The 65+ group had a relative risk of 1.7 of their AVF failing to mature compared with the 65- group. Multivariate analysis yielded these variables significant for AVF loss: male sex HR 0.63 (95% CI 0.44-0.91), coronary artery disease HR 2.1 (95% CI 1.5-3.0), and Caucasian ethnicity HR 0.63 (95% CI 0.44-0.91).

CONCLUSION:  
Age should not be a limiting factor when determining candidacy for AVF creation due to equivalent survival and procedural rates. Failure of fistula maturation is a primary concern to patients of all ages and demands further study.