Complete Summary

GUIDELINE TITLE

NKF-KDOQI clinical practice guidelines for vascular access: update 2006.

BIBLIOGRAPHIC SOURCE(S)

Vascular Access Work Group. Clinical practice guidelines for vascular access. Am J Kidney Dis 2006 Jul;48 Suppl 1:S248-73. PubMed

GUIDELINE STATUS

This is the current release of the guideline.

This guideline updates a previous version: NKF-K/DOQI clinical practice guidelines for vascular access: update 2000. Am J Kidney Dis 2001 Jan;37(1 Suppl 1):S137-81.

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
RECOMMENDATIONS
EVIDENCE SUPPORTING THE RECOMMENDATIONS
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
QUALIFYING STATEMENTS
IMPLEMENTATION OF THE GUIDELINE
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY
DISCLAIMER

SCOPE

DISEASE/CONDITION(S)

End-stage renal disease (ESRD)

GUIDELINE CATEGORY

Evaluation
Management
Treatment

CLINICAL SPECIALTY

Family Practice
Internal Medicine
Nephrology
Pediatrics

INTENDED USERS

Advanced Practice Nurses
Allied Health Personnel
Clinical Laboratory Personnel
Dietitians
Health Care Providers
Health Plans
Nurses
Patients
Physician Assistants
Physicians
Social Workers

GUIDELINE OBJECTIVE(S)

To update the 2000 Kidney Disease Outcomes Quality Initiative (KDOQI) Clinical Practice Guidelines on Vascular Access

TARGET POPULATION

Adult and pediatric patients with end-stage renal disease who receive hemodialysis treatment

INTERVENTIONS AND PRACTICES CONSIDERED

1. Patient education on modalities of kidney replacement therapy (KRT) and monitoring of accesses
2. Patient evaluation prior to placement of permanent hemodialysis (HD) access, including history and physical exam, duplex ultrasound, and central vein evaluation
3. Structured approach to selection of the type of hemodialysis access (fistula, graft, or peritoneal dialysis catheter)
4. Structured approach to selection of the location of hemodialysis access
    - Fistula: wrist, elbow, or transposed brachial basilica vein
    - Arteriovenous graft (AVG): forearm loop, upper arm, chest wall
    - Catheters and port catheter systems: right internal jugular vein or secondary locations
5. Placement of functional permanent access prior to initiation of dialysis therapy
6. Use of aseptic technique and appropriate cannulation methods of fistulae and grafts
7. Optimal timing of fistula and graft cannulation
8. Monitoring of fistula maturation
9. Use of infection control measures for all HD catheters
10. An organized monitoring/surveillance approach to detect access dysfunction
    - Physical examination
    - Surveillance of grafts and fistulae

- Referral for evaluation (diagnostic) and treatment

11. Timely evaluation and treatment of fistula complications
    - Assessment of persistent swelling, delays in maturation, inadequate blood flow, venous stenosis, thrombosis, aneurysm, ischemia, infection
    - Treatment of stenosis with percutaneous angioplasty (PTA) or surgical revision
    - Treatment of thrombosis with thrombectomy
    - Referral of patients with an arteriovenous fistula (AVF) with ischemia to a vascular access surgeon
    - Treatment of infections with antibiotics and, for extensive infection, resection of the infected graft material
12. Management and treatment of AVG complications
    - Assessment of extremity edema, risks for graft rupture, severe degenerative changes, pseudoaneurysm, stenosis, thrombosis, infection
    - Treatment of AVGs with severe degenerative changes or pseudoaneurysm with revision/repair
    - Treatment of stenosis without thrombosis with angioplasty or surgical revision
    - Treatment of thrombosis and associated stenosis with percutaneous thrombectomy with angioplasty or surgical thrombectomy with AVG revision
    - Treatment of infection with antibiotics, and for extensive infection, resection of the infected graft material
13. Evaluation of dysfunctional catheters and ports to facilitate prevention and early treatment
    - Treatment of dysfunctional catheters and ports with repositioning, thrombolytics, or catheter exchange with sheath disruption
    - Treatment infected HD catheter or port with antibiotic(s)
14. Use of continuous quality improvement (CQI) to monitor clinical outcome goals

MAJOR OUTCOMES CONSIDERED

- Vascular access-related morbidity
- Maturation and function of new arteriovenous fistula (AVF)
- Change in approach to access placement
- Infection rates
- Infection clearing rates
- Reinfection rates
- Infection-free time
- Access survival
- Maintenance of access patency/function
- Blood flow achieved
- Sensitivity and specificity of tests for periodic monitoring of access
- Re-establishment of patency/function in malfunctioning catheter
- Hospitalization
- Costs associated with the maintenance of access patency

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Primary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

Based on the draft guideline statements, the Work Group members agreed on topics that would be systematically reviewed and formulated questions defining predictors, interventions, comparators, and outcomes of interest. Search strategies were developed based on these questions and topics, in addition to the study designs and years of publications of interest to the Work Group (see Appendix 2 of the original guideline document). Articles of interest were identified through MEDLINE searches of English language literature of human studies in May through July 2004. Broad search terms were used to avoid missing potentially pertinent articles. The searches were supplemented by articles identified by Work Group members through June 2005.

Only full journal articles of original data were included. The searches were limited to studies published since January 1997 since earlier publications were reviewed in the previous Dialysis Outcomes Quality Initiatives (DOQI) guidelines. Editorials, letters, abstracts, and unpublished reports were not included. Selected review articles, however, were included for background material. No systematic process was followed to obtain review articles.

Abstracts and titles from the MEDLINE search results were prescreened by members of the Evidence Review Team for general relevance. A second round of screening was performed on the abstracts by Work Group members for relevance using predefined eligibility criteria, described below. Articles were retrieved by the Evidence Review Team and then rescreened by Work Group members and/or the Evidence Review Team. Eligible studies were extracted using standardized extraction forms. Domain experts made the final decisions regarding the eligibility of all articles.

Literature Yield

A total of 2,892 citations were screened, of which 388 were review articles. There were 112 articles (89 studies in adults, 13 in children, 10 review articles) that were potentially relevant. These articles were retrieved for full review. Of these, 58 articles were accepted for full data extraction by the Work Group members. Because of small sample sizes, articles in children were not formally data extracted but reviewed in detail by the 2 pediatric nephrologists on the Work Group and used to write the narrative summary in the pediatric section. Articles in adults were randomly assigned to individual Work Group members for data extraction. Five additional articles were added by Work Group experts and the Evidence Review Team. Finally, 24 studies answered questions pertinent to topics chosen for systematic listing in Summary Tables. See Table 4 of Appendix 1 in the original guideline document for more details.

Limitations of Approach

While the literature searches were intended to be comprehensive, they were not exhaustive. MEDLINE was the only database searched, and searches were limited to English language publications. Hand searches of journals were not performed,

and review articles and textbook chapters were not systematically searched. However, important studies known to the domain experts that were missed by the literature search were included in the review.

Because of resource limitations and other practical considerations, there were several deviations from the original protocol for several of the update topics. These primarily resulted in nephrologists in the Evidence Review Team, rather than Work Group members, performing the primary article screening and the data extraction for articles included in several Summary Tables. However, all articles that met criteria for all topics, all completed data extraction forms, and all Summary Tables were distributed to relevant Work Group members for critical review and incorporation into guidelines.

NUMBER OF SOURCE DOCUMENTS

24

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

The quality of evidence was not explicitly graded. It was implicitly assessed according to the criteria outlined in the table below, and considered: i) the methodological quality of the studies; ii) whether or not the studies were carried out in the target population (i.e., patients on dialysis, or in other populations) and iii) whether the studies examined health outcomes directly, or examined surrogate measures for those outcomes (e.g., blood flow instead of access survival.)

		Methodological Quality		
Outcome	Population	Well designed and analyzed (little, if any, potential bias)	Some problems in design and/or analysis (some potential bias)	Poorly designed and/or analyzed (large potential bias)
Health outcome(s)	Target population	Strong[a]	Moderately Strong[b]	Weak[h]
Health outcome(s)	Other than the target population	Moderately Strong[c]	Moderately Strong[d]	Weak[h]
Surrogate measure for health outcome(s)	Target population	Moderately Strong[e]	Weak[f]	Weak[h]
Surrogate measure for health outcome(s)	Other than the target population	Weak[g]	Weak[g]	Weak[g,h]
Definitions:				

		Methodological Quality
Strong: [a]Evidence includes results from well-designed, well-conducted study/studies in the target population that directly assess effects on health outcomes. **Moderately Strong**: [b]Evidence is sufficient to determine effects on health outcomes in the target population, but the strength of the evidence is limited by the number, quality, or consistency of the individual studies. [c]OR evidence is from a population other than the target population, but from well-designed, well-conducted studies; [d]OR evidence is from studies with some problems in design and/or analyses; [e]OR evidence is from well-designed, well-conducted studies or surrogate endpoints for efficacy and/or safety in the target population. **Weak**: [f]Evidence is insufficient to assess the effects on net health outcomes because it is from studies with some problems in design and/or analysis on surrogate endpoints for efficacy and/or safety in the target population; [g]OR the evidence is only for surrogate measures in a population other than the target population; [h]OR the evidence is from studies that are poorly designed and/or analyzed.		

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Generation of Data Extraction Forms

Data extraction forms were designed to capture information on various aspects of the primary articles. Forms for all topics included study setting and demographics, eligibility criteria, causes of kidney disease, numbers of subjects, study design, study funding source, dialysis characteristics, comorbid conditions, descriptions of relevant risk factors or interventions, description of outcomes, statistical methods, results, study quality (based on criteria appropriate for each study design, study applicability, and sections for comments and assessment of biases. Training of the Work Group members to extract data from primary articles occurred by emails and teleconferences. Work Group members were assigned the task of data extraction of articles.

Generation of Evidence Tables

The Evidence Review Team condensed the information from the data extraction forms into evidence tables, which summarized individual studies. These tables were created for the Work Group members to assist them with review of the evidence and are not included in the guidelines. All Work Group members received copies of all extracted articles and all evidence tables. During the development of the evidence tables, the Evidence Review Team checked the data extraction for accuracy and re-screened the accepted articles to verify that each of them met the initial screening criteria determined by the Work Group. If the criteria were not met, the article was rejected, in consultation with the Work Group.

Format for Summary Tables

Summary Tables describe the studies according to the following dimensions: study size and follow-up duration, applicability or generalizability, results, and methodological quality. Within each table, the studies are first grouped by outcome type. Data entered into Summary Tables were derived from the data extraction forms, evidence tables, and/or the articles by the Evidence Review Team. All Summary Tables were reviewed by the Work Group members.

Within each outcome, studies are ordered first by methodological quality (best to worst), then by applicability (most to least), and then by study size (largest to smallest). When relevant, outcome thresholds (e.g., of access flow measurement) are included. Results are presented by using the appropriate metric or summary symbols, as defined in the table footnotes.

Systematic Review Topics, Study Eligibility Criteria, and Studies Evaluated

The topics for each Update were selected by the respective Work Group members for systematic review (see Table 1-3 in Appendix 1 of the original guideline document). The eligibility criteria were defined by the Work Group members in conjunction with the Evidence Review Team.

Grading of Individual Studies

Study Size and Duration

The study (sample) size is used as a measure of the weight of the evidence. In general, large studies provide more precise estimates of prevalence and associations. In addition, large studies are more likely to be generalizable; however, large size alone, does not guarantee applicability. A study that enrolled a large number of selected patients may be less generalizable than several smaller studies that included a broad spectrum of patient populations. Similarly, longer duration studies may be of better quality and more applicable, depending on other factors.

Applicability

Applicability (also known as generalizability or external validity) addresses the issue of whether the study population is sufficiently broad so that the results can be generalized to the population of interest at large. The study population is typically defined primarily by the inclusion and exclusion criteria. The target population was defined to include patients with kidney failure, specifically those on dialysis. A designation for applicability was assigned to each article, according to a three-level scale. In making this assessment, sociodemographic characteristics were considered, as well as comorbid conditions and prior treatments. Applicability is graded in reference to the population of interest as defined in the clinical question. For example for the question of treatment of catheter-related infections the reference population is that of HD patients with infected cuffed tunneled hemodialysis (HD) catheters (see Appendix 1 of the original guideline document for details).

Results

The type of results available in each study is determined by the study design, the purpose of the study, and the question(s) being asked. The Work Group decided on the eligibility criteria and outcomes of interest (see Tables 1-3 in Appendix 1 of the original guideline document).

Diagnostic Test Studies

For studies of diagnostic tests, sensitivity and specificity data or area under the curve were included when reported. When necessary, sensitivity and specificity data were calculated from the reported data. Diagnostic tests were evaluated according to a hierarchy of diagnostic tests. Each test was assessed according to diagnostic technical capacity, accuracy, diagnostic and therapeutic impact, and patient outcome. This ultimately affected the overall strength of a recommendation regarding a diagnostic test.

Methodological Quality

Methodological quality (or internal validity) refers to the design, conduct, and reporting of the clinical study. Because studies with a variety of types of design were evaluated, a 3-level classification of study quality was devised (see Appendix 1 of the original guideline document for details).

Summarizing Reviews and Selected Original Articles

Work Group members had wide latitude in summarizing reviews and selected original articles for topics that were determined not to require a systemic review of the literature.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The Work Group sought to update the guidelines using an evidence-based approach. After topics and relevant clinical questions were identified for the updates, the available scientific literature on those topics was systematically searched and summarized.

Creation of Groups

The Kidney Disease Outcomes Quality Initiative (KDOQI) Advisory Board selected the Work Group Chairs and the Director of the Evidence Review Team then assembled groups to be responsible for the development of the updates. These Work Groups and the Evidence Review Team collaborated closely throughout the project.

The Work Groups consisted of domain experts, including individuals with expertise in nephrology, surgery, radiology, pediatrics, nursing and nutrition. For each guideline update, the first task of the Work Group members was to define the

overall topics and goals of the updates. They then further developed and refined each topic, literature search strategies, and data extraction forms. The Work Group members were the principal reviewers of the literature, and from their reviews and detailed data extractions, they summarized the available evidence and took the primary roles of writing the guidelines and rationale statements. Completed data extractions were posted on a National Kidney Foundation (NKF) website for direct access by Work Group members.

The Evidence Review Team consisted of nephrologists (one senior nephrologist and two nephrology fellows), methodologists, and research assistants from Tufts-New England Medical Center with expertise in systematic review of the medical literature. They instructed the Work Group members in all steps of systematic review and critical literature appraisal. The Evidence Review Team also coordinated the methodological and analytical process of the report, defined and standardized the methodology of performing literature searches, of data extraction, and of summarizing the evidence in summary tables. They organized abstract and article screening, created forms to extract relevant data from articles, organized Work Group member data extraction, and tabulated results. Throughout the project the Evidence Review Team led discussions on systematic review, literature searches, data extraction, assessment of quality and applicability of articles, evidence synthesis, and grading of the quality of the body of evidence and the strength of guideline recommendations.

Refinement of Update Topics and Development of Materials

The Work Group reviewed the 1995 DOQI Clinical Practice Guidelines and the 2000 KDOQI updates and decided which of the guideline recommendations required updates and which should remain unchanged. These assessments were based primarily on expert opinion regarding the currency of the previous guidelines and the likelihood of availability of new evidence. Preliminary literature searches were made to inform this process. To allow for timely review, it was determined that each set of guidelines would be able to have systematic reviews on only a limited number of topics. After literature review, the experts decided which recommendations would be supported by evidence or by opinion.

The Work Groups and Evidence Review Team developed: a) draft guideline statements; b) draft rationale statements that summarized the expected pertinent evidence; and c) data extraction forms containing the data elements to be retrieved from the primary articles. The topic refinement process began prior to literature retrieval and continued through the process of reviewing individual articles. Recommendations based on adequate evidence were categorized as Guidelines (CPGs), while opinion-based statements were categorized as Clinical Practice Recommendations (CPRs).

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Rating the Strength of Recommendations

After literature review, the experts decided which recommendations were supported by evidence and which were supported by consensus of Work Group opinion. Evidence-based guideline recommendations were graded as strong (A) or moderate (B). Recommendations based on weak evidence (C) and/or consensus of expert opinion were labeled as Clinical Practice Recommendations (CPRs). See "Rating Scheme for the Strength of the Recommendations" below.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

The strength of each guideline recommendation is based on the quality of the supporting evidence as well as additional considerations. Additional considerations, such as cost, feasibility, and incremental benefit were implicitly considered.

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

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

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.

Health outcomes are health-related events, conditions, or symptoms that can be perceived by individuals to have an important effect on their lives. Improving health outcomes implies that benefits outweigh any adverse effects.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review
Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

As was the case with the initial Guidelines, the current guideline updates were subjected to a three-stage review process. They were presented first to the National Kidney Foundation Dialysis Outcomes Quality Initiative (NKF-DOQI) Steering Committee and revised in response to the comments received. In the second stage, the Kidney Disease Outcomes Quality Initiative (K/DOQI) Advisory Board, along with other experts in the field, provided comments. After considering

these, the Work Groups produced a third draft of the guidelines. In the final stage, this draft was made available for public review and comment by all interested parties, including End-Stage Renal Disease (ESRD) Networks, professional and patient associations, dialysis providers, government agencies, product manufacturers, managed care groups, and individuals. The comments received were reviewed and, where appropriate, incorporated in the final version of the updated guideline.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Definitions for the strength of each guideline or recommendation (A, B, or CPR), based on the quality of the supporting evidence as well as additional considerations, are provided at the end of the "Major Recommendations" field.

Clinical Practice Guidelines for Vascular Access

Guideline 1. Patient Preparation for Permanent Hemodialysis Access

Appropriate planning allows for the initiation of dialysis therapy at the appropriate time with a permanent access in place at the start of dialysis therapy.

1.1 Patients with a glomerular filtration rate (GFR) less than 30 mL/min/1.73 m^2 (chronic kidney disease [CKD] stage 4) should be educated on all modalities of kidney replacement therapy (KRT) options, including transplantation, so that timely referral can be made for the appropriate modality and placement of a permanent dialysis access, if necessary. **[A]**

1.2 In patients with CKD stage 4 or 5, forearm and upper-arm veins suitable for placement of vascular access should not be used for venipuncture or for the placement of intravenous (IV) catheters, subclavian catheters, or peripherally inserted central catheter lines (PICCs). **[B]**

1.3 Patients should have a functional permanent access at the initiation of dialysis therapy.

1.3.1 A fistula should be placed at least 6 months before the anticipated start of hemodialysis (HD) treatments. This timing allows for access evaluation and additional time for revision to ensure a working fistula is available at initiation of dialysis therapy. **[B]**

1.3.2 A graft should, in most cases, be placed at least 3 to 6 weeks before the anticipated start of HD therapy. Some newer graft materials may be cannulated immediately after placement. **[B]**

1.3.3 A peritoneal dialysis (PD) catheter ideally should be placed at least 2 weeks before the anticipated start of dialysis treatments. A backup HD access does not need to be placed in most patients. A PD catheter may be used as a bridge for a fistula in "appropriate" patients. **[B]**

1.4 Evaluations that should be performed before placement of a permanent HD access include (see table below):

1.4.1 History and physical examination. **[B]**

1.4.2 Duplex ultrasound of the upper-extremity arteries and veins, **[B]**

1.4.3 Central vein evaluation in the appropriate patient known to have a previous catheter or pacemaker. **[A]**

Patient Evaluation Prior to Access Placement

Consideration	Relevance
Patient History	
History of previous CVC	Previous placement of a CVC is associated with central venous stenosis.
Dominant arm	To minimize negative impact on quality of life, use of the nondominant arm is preferred.
History of pacemaker use	There is a correlation between pacemaker use and central venous stenosis.
History of severe CHF	Accesses may alter hemodynamics and cardiac output.
History of arterial or venous peripheral catheter	Previous placement of an arterial or venous peripheral catheter may have damaged target vasculature.
History of diabetes mellitus	Diabetes mellitus is associated with damage to vasculature necessary for internal accesses.
History of anticoagulant therapy or any coagulation disorder	Abnormal coagulation may cause clotting or problems with hemostasis of accesses.
Presence of comorbid conditions, such as malignancy or coronary artery disease, that limit patient's life expectancy	Morbidity associated with placement and maintenance of certain accesses may not justify their use in some patients.
History of vascular access	Previously failed vascular accesses will limit available sites for accesses; the cause of a previous failure may influence planned access if the cause is still present.
History of heart valve disease or prosthesis	Rate of infection associated with specific access types should be considered.
History of previous arm, neck, or chest surgery/trauma	Vascular damage associated with previous surgery or trauma may limit viable access sites.
Anticipated kidney transplant form living donor	Catheter access may be sufficient.
Physical Examination	
Physical Examination of Arterial System	
Character of peripheral pulses, supplemented by hand-held Doppler evaluation when indicated	An adequate arterial system is needed for access; the quality of the arterial system will influence the choice of access site.
Results of Allen test	Abnormal arterial flow pattern to the hand may contraindicate the creation of a radial-cephalic

Consideration	Relevance
Patient History	
	fistula.
Bilateral upper extremity blood pressures	Pressures determine suitability of arterial access in upper extremities.
Physical Examination of the Venous System	
Evaluation for edema	Edema indicates venous outflow problems that may limit usefulness of the associated potential access site or extremity for access placement.
Assessment of arm size comparability	Differential arm size may indicate inadequate veins or venous obstruction which should influence choice of access site.
Examination for collateral veins	Collateral veins are indicative of venous obstruction.
Tourniquet venous palpitation with vein mapping	Palpitation and mapping allow selection of ideal veins for access.
Examination for evidence of previous central or peripheral venous catheterization	Use of CVCs is associated with central venous stenosis; previous placement of venous catheters may have damaged target vasculature necessary for access.
Examination for evidence of arm, chest, or neck surgery/trauma	Vascular damage associated with previous surgery or trauma may limit access sites.
Cardiovascular Evaluation	
Examination for evidence of heart failure	Accesses may alter cardiac output.

Definitions: CVC, central venous catheter; CHF, congestive heart failure

Guideline 2. Selection and Placement of Hemodialysis Access

A structured approach to the type and location of long-term HD accesses should help optimize access survival and minimize complications.

The access should be placed distally and in the upper extremities whenever possible. Options for fistula placement should be considered first, followed by prosthetic grafts if fistula placement is not possible. Catheters should be avoided for HD and used only when other options listed are not available.

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 fistula. **[A]**

2.1.1.3 A transposed brachial basilic vein fistula: **[B]**

2.1.2 Acceptable: Arteriovenous graft (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 arteriovenous (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. Magnetic resonance angioplasty (MRA) imaging of both arteries and veins is the diagnostic procedure of choice for evaluating central vessels for possible chest wall construction.

2.1.4 Patients should be considered for construction of a primary fistula after failure of every dialysis AV access. **[B]**

2.1.5 While this order of access preference is similar for pediatric patients, special considerations exist that should guide the choice of access for children receiving HD. Please refer to Clinical Practice Recommendation (CPR) 8 for specific recommendations.

2.1.6 In the patient receiving PD who is manifesting signs of modality failure, the decision to create a backup fistula should be individualized by periodically reassessing need. In individuals at high risk for failure (see the National Guideline Clearinghouse [NGC] summary of the PD Adequacy Guidelines), evaluation and construction should follow the procedures in CPG 1 for patients with CKD stage 4.

2.2 Fistulae:

2.2.1 Enhanced maturation of fistulae can be accomplished by selective obliteration of major venous side branches in the absence of a downstream stenosis. **[B]**

2.3 Dialysis AVGs:

2.3.1 The choice of synthetic or biological material should be based on the surgeon's experience and preference. The choice of synthetic or biological conduits should consider local experience, technical details, and cost. **[B]**

2.3.2 There is no convincing evidence to support tapered versus uniform tubes, externally supported versus unsupported grafts, thick- versus thin-walled configurations, or elastic versus nonelastic material. **[A]**

2.3.3 While the majority of past experience with prosthetic grafts has been with the use of polytetrafluoroethylene (PTFE), other prosthetics (e.g., polyurethane [PU]) and biological conduits (bovine) have been used recently with similar outcomes. **[B]**

2.3.4 Patients with swelling that does not respond to arm elevation or that persists beyond 2 weeks after dialysis AV access placement should receive an imaging study or other noncontrast study to evaluate central venous outflow (see CPG 1). **[B]**

2.4 Catheters and port catheter systems:

2.4.1 The preferred insertion site for tunneled cuffed venous dialysis catheters or port catheter systems is the right internal jugular vein. Other options include the right external jugular vein, left internal and external jugular veins, subclavian veins, femoral veins, and translumbar and transhepatic access to the inferior vena cava (IVC). Subclavian access should be used only when no other upper-extremity or chest-wall options are available. **[A]**

2.4.2 Ultrasound should be used in the placement of catheters. **[B]**

2.4.3 The position of the tip of any central catheter should be verified radiologically. **[B]**

Guideline 3. Cannulation of Fistulae and Grafts and Accession of Hemodialysis Catheters and Port Catheter Systems

The use of aseptic technique and appropriate cannulation methods, the timing of fistula and graft cannulation, and early evaluation of immature fistulae are all factors that may prevent morbidity and may prolong the survival of permanent dialysis accesses.

3.1 Aseptic techniques:

3.1.1 For all vascular accesses, aseptic technique should be used for all cannulation and catheter accession procedures. (See the following table) **[A]**

Skin Preparation Technique for Subcutaneous arteriovenous (AV) Access

• Locate, inspect, and palpate the needle cannulation sites prior to skin preparation. Repeat prep if the skin is touched by the patient or staff once the skin prep has been applied, but the cannulation not completed.

- Wash access site using an antibacterial soap or scrub and water.
- Cleanse the skin by applying 2% chlorhexidine gluconate/70% isopropyl alcohol or 70% alcohol and/or 10% povidone iodine as per manufacturer's instructions for use.

Notes:

- 2% chlorhexidine gluconate/70% isopropyl alcohol antiseptic has a rapid (30 s) and persistent (up to 48 hr) antimicrobial activity on the skin. Apply solution using back and forth friction scrub for 30 seconds. Allow area to dry. Do not blot the solution.
- Alcohol has a short bacteriostatic action time and should be applied in a rubbing motion for 1 minute immediately prior to needle cannulation.
- Povidone iodine needs to be applied for 2-3 minutes for its full bacteriostatic action to take effect and must be allowed to dry prior to needle cannulation.
- Clean gloves should be worn by the dialysis staff for cannulation. Gloves should be changed if contaminated at any time during the cannulation procedure.
- New, clean gloves should be worn by the dialysis staff for each patient with proper infection control measures followed between each patient.

3.2 Maturation and cannulation of fistulae:

3.2.1 A primary fistula should be mature, ready for cannulation with minimal risk for infiltration, and able to deliver the prescribed blood flow throughout the dialysis procedure. (See the following table.) **[B]**

Technique for Mature Arteriovenous Fistula (AVF) Cannulation

Technique	Rationale
After skin preparation, apply a tourniquet to increase the venous pressure, and pull skin taut in opposite direction of needle insertion. Avoid excessive pressure to the cannulation site to prevent flattening of the vessel. Stabilize but do not obliterate the vessel.	Compresses peripheral nerve endings between epidermis and dermis. Increases surface tension thereby facilitating smoother incision of skin with less surface area contacting cutting edge of needle. Enables better stabilization of graft or vessel to be cannulated.
For easily palpated vessel, use approximately 25 degree angle with the bevel up. Arterial needle placement can be in antegrade (up or in the direction of the blood flow) or retrograde (down or against the direction of blood flow). The venous needle should always be in the same direction as the blood flow.	Less steep angles increase risk of dragging cutting edge of needle along surface of vessel. Steeper angles increase risk of perforating underside (backwall) of vessel. Needle direction of the venous needle in the same direction as the blood flow will prevent excessive pressure at the needle site. The arterial needle in either direction will not increase the risk of recirculation as long as the

Technique	Rationale
	access blood flow is greater to the blood pump setting.
Once the vessel has been penetrated: • Advance the needle slowly with cutting edge facing top of vessel and do not rotate axis.	Any manipulation may traumatize the intima of the vessel. The use of a blackeye needle will eliminate the need to rotate the needle due to poor flows.
• Tape the needle at the same angle or one similar to the angle of insertion.	Pressing the needle shaft flat against the skin moves the needle tip from the desired position within the vessel lumen.
• Remove needle at same or angle similar to angle of insertion, and NEVER APPLY PRESSURE BEFORE NEEDLE IS COMPLETELY OUT.	Avoid trauma to any intima by dragging cutting edge along it. Avoid pressing cutting edge into intima when applying pressure for HD.

Definitions: HD, hemodialysis

3.2.2 Fistulae are more likely to be useable when they meet the Rule of 6s characteristics: flow greater than 600 mL/min, diameter at least 0.6 cm, no more than 0.6 cm deep, and discernible margins. **[B]**

3.2.3 Fistula hand-arm exercise should be performed. **[B]**

3.2.4 If a fistula fails to mature by 6 weeks, a fistulogram or other imaging study should be obtained to determine the cause of the problem. **[B]**

3.3 Cannulation of AVGs:

Grafts generally should not be cannulated for at least 2 weeks after placement and not until swelling has subsided so that palpation of the course of the graft can be performed. The composite PU graft should not be cannulated for at least 24 hours after placement and not until swelling has subsided so that palpation of the course of the graft can be performed. Rotation of cannulation sites is needed to avoid pseudoaneurysm formation. (See the following table.) **[B]**

Technique for AVG Cannulation

Technique	Rationale
After skin preparation, pull skin taut in opposite direction of needle insertion. Avoid excessive pressure to the cannulation site to stabilize and prevent flattening of the graft material.	Compress peripheral nerve endings between epidermis and dermis. Facilitates smoother incision of skin with less surface area contacting cutting edge of needle. Enables better stabilization of graft or vessel to be cannulated.
Use approximately 45 degree angle of insertion.	Less steep angles increase risk of dragging cutting edge of needle along surface of vessel.

Technique	Rationale
	Steeper angles increase risk of perforating underside of vessel.
Once the vessel has been penetrated, there are basically 2 methods employed in current practice:	
a. Advance the needle slowly with cutting edge facing top of vessel and do not rotate axis	a. Any manipulation may traumatize the intima of the vessel. This is the preferred method for routine AVG cannulation technique.
b. For a deep, hard to palpate AVG immediately rotate the axis of the needle 180 degrees and advance slowly with bevel cutting edge facing bottom of the vessel.	b. Rotating the axis avoids traumatizing the top of the intima and prevents the tip of the needle from entering the backside of the graft material. This should only be utilized when the graft backwall location is difficult to determine and the risk of continuing the needle advancement into the backwall is high.
Tape needle at the same angle or one similar to the angle of insertion.	Pressing the needle shaft flat against the skin moves the needle tip from the desired position within the vessel lumen.
Remove needle at same or angle similar to angle of insertion, and NEVER APPLY PRESSURE BEFORE NEEDLE IS COMPLETELY OUT.	Avoid trauma to any intima by dragging cutting edge along it. Avoid pressing cutting edge into intima when applying pressure for HD.

Definitions: AVG, arteriovenous graft; HD, hemodialysis

3.4 Dialysis catheters and port catheter systems:

Infection-control measures that should be used for all HD catheters and port catheter systems include the following:

3.4.1 The catheter exit site or port cannulation site should be examined for proper position of the catheter/port catheter system and absence of infection by experienced personnel at each HD session before opening and accessing the catheter/port catheter system. **[B]**

3.4.2 Changing the catheter exit-site dressing at each HD treatment, using either a transparent dressing or gauze and tape. **[A]**

3.4.3 Using aseptic technique to prevent contamination of the catheter or port catheter system, including the use of a surgical mask for staff and patient and clean gloves for all catheter or port catheter system connect, disconnect, and dressing procedures. **[A]**

Access Physical Examination

Exam Steps	Fistula (Normal)	AVG (Normal)	Stenosis or Poor Maturation (Abnormal)	Infection or Steal Syndrome (Abnormal)
Look	Well developed main venous outflow, not irregular/dilated areas or aneurysm formations, areas of straight vein that can be used for cannulation. Vessel partially collapses when arm is elevated above head.	Uniform size graft in a loop or straight configuration. No irregular areas or aneurysm formations with organized site rotation used for cannulation sites.	Fistula with poor maturation - multiple venous outflow veins (accessory veins), poorly defined cannulation areas. *Fistula*: Stenosis can occur in artery or any of the venous outflow veins. Look for a narrowing of the outflow vein or aneurysm formations. *Fistula or Graft*: Dilated neck veins or small surface collateral veins in the arm or neck above the vascular access.	*Infection*: Redness, swelling, broken skin, drainage, induration. *Steal Syndrome*: Hand of the access limb may appear discolored due to poor arterial blood flow to the hand. Check nail beds, fingers, and hand for skin color changes.
Listen with a stethoscope	Low pitch continuous diastolic and systolic	Low pitch continuous diastolic and systolic	High pitch discontinuous systolic only	*Steal Syndrome*: Fistula may have a very strong bruit.

Feel with your finger tips	Thrill at the arterial anastomosis and throughout the entire outflow vein that is easy to compress	Thrill strongest at the arterial anastomosis, but should be felt over entire graft and easy to compress	*Fistula*: Pulse at the site of a stenotic lesion Pulse has a water-hammer feel *Graft*: Thrill and/or pulse strong at the site of a stenotic lesion. Pulse has a water-hammer feel. A graft with a low intra-access blood flow feels mushy. Local area of the graft that feels mushy or irregular in shape can be a site of aneurysm formation.	*Infection*: Warm to touch, swelling *Steal Syndrome*: Feel bilateral limbs (hands and fingers) and compare for the access limb to be the same as the nonaccess limb. Compare temperature, grip strength and range of motion, and any complaints of pain. If the access limb has any major differences than the nonaccess limb, consider steal syndrome.

Definitions: AVG: Arteriovenous graft

Considerations for Accessing Catheters and Cleansing Catheter Exit Sites

Prepare procedure site using dialysis precautions.
Conduct procedures using aseptic technique (correct hand-washing, masks for patient and staff, "no-touch" technique, and disposable clean gloves).
Chlorhexidine 2% with 70% alcohol is the preferred solution for cleansing of long-term catheter sites.[a] For patients with sensitivities to chlorhexidine 2% with 70% alcohol, chlorhexidine aqueous[a] may be used instead. For patients with sensitivities to chlorhexidine aqueous, povidone solution[b] may be used.
Skin cleansing should include the following steps: • Apply solution/swab in a circular motion working from catheter exit site outwards. • Cover an area 10 cm in diameter. • Repeat this step twice. Do not rinse off or blot excess solution from skin. • Allow solution to dry completely before applying dressing.
To cleanse the connection between any CVC hub and cap use 2 swabs: • Grasp connection with 1 swab. • Use second swab to clean from catheter connection up catheter for 10 cm. • Cleanse hub connection site and cap vigorously with the first swab. Discard

swab. • Do not drop a connection site once it is cleaned.
To cleanse the section of the catheter that lies adjacent to the skin, gently swab the top and undersides of the catheter starting at the exit site and working outwards.

[a] Check catheter manufacturer's warnings about effect of disinfectants on catheter material.

[b] Use according to manufacturer's directions.

Definitions: CVC, central venous catheter

Guideline 4. Detection of Access Dysfunction: Monitoring, Surveillance, and Diagnostic Testing

Prospective surveillance of fistulae and grafts for hemodynamically significant stenosis, when combined with correction of the anatomic stenosis, may improve patency rates and may decrease the incidence of thrombosis.

The Work Group recommends an organized monitoring/surveillance approach with regular assessment of clinical parameters of the AV access and HD adequacy. Data from the clinical assessment and HD adequacy measurements should be collected and maintained for each patient's access and made available to all staff. The data should be tabulated and tracked within each HD center as part of a Quality Assurance (QA)/Continuous quality improvement (CQI) program.

4.1 Physical examination (monitoring):

Physical examination should be used to detect dysfunction in fistulae and grafts at least monthly by a qualified individual. **[B]**

4.2 Surveillance of grafts:

Techniques, not mutually exclusive, that may be used in surveillance for stenosis in grafts include:

4.2.1 Preferred:

4.2.1.1 Intra-access flow by using 1 of several methods that are outlined below using sequential measurements with trend analysis. **[A]**

Flow Methods in Dialysis Access

• Duplex Doppler Ultrasound (Quantitative color velocity imaging): [DDU] • Magnetic Resonance Angiography: [MRA] • Variable Flow Doppler Ultrasound (Specs USA): [VFDU] • Ultrasound dilution (Transonics): [UDT] • CritLine III (optodilution by ultrafiltration; HemaMetrics): [OABF] • CritLine III direct transcutaneous (HemaMetrics): [TQA]

- Glucose pump infusion technique: [GPT]
- Urea dilution: [UreaD]
- Differential conductivity (GAMBRO): [HDM]
- In line dialysance (Fresenius): [DD]

4.2.1.2 Directly measured or derived static venous dialysis pressure by 1 of several methods. **[A]** (Protocol provided in the table below for using transducers on HD machines to measure directly; criteria in the table below for derived methods.)

4.2.1.3 Duplex ultrasound. **[A]**

4.2.2 Acceptable:

4.2.2.1 Physical findings of persistent swelling of the arm, presence of collateral veins, prolonged bleeding after needle withdrawal, or altered characteristics of pulse or thrill in a graft. **[B]**

4.2.3 Unacceptable:

4.2.3.1 Unstandardized dynamic venous pressures (DVPs) should not be used. **[A]**

Static Intra-Access Pressure (IAP) Surveillance

a. Establish a baseline when the access has matured and shortly after the access is first used. Trend analysis is more useful than any single measurement.
b. Assure that the zero setting on the pressure transducers of the dialysis delivery system being used has been calibrated to be accurate within $\pm$5 mm Hg.
c. Measure the mean arterial blood pressure (MAP) in the arm contralateral to the access.
d. Enter the appropriate output or display screen where venous and arterial pressures can be visualized (this varies for each dialysis delivery system). If a gauge is used to display the pressures, the pressure can be read from the gauge.
e. Stop the blood pump and cross clamp the venous line just proximal to the venous drip chamber with a hemostat (this avoids having to stop ultrafiltration for the brief period needed for the measurement). On the arterial line, no hemostat is needed since the occlusive roller pump serves as a clamp.
f. Wait 30 seconds until the venous pressure is stable, then record the arterial and venous intra-access pressure (IAP) values. The arterial segment pressure can only be obtained if a pre-pump drip chamber is available and the dialysis system is capable of measuring absolute pressures greater than 40 mm Hg.
g. Unclamp the venous return line and restore the blood pump to its previous value.
h. Determine the height correction, (delta h) between the access and the drip chamber(s) either by direct measurement (A) or using a formula (B) based on the difference in height between the top of the drip chamber and the top of the arm rest of the dialysis chair (delta). Both measurements need to be in cm. Height corrections are not needed if the measurements in step 6 are

done with access level with the drip chamber

- Measure the height from the venous or arterial needle to the top of the blood in the venous drip chamber. The offset in Hg = height (cm) x 0.76
- Use the formula, offset in mm Hg = 3.6 + 0.35 x delta.

i. The same correction values can be used for both if the 2 drip chambers are at the same height. If the drip chambers are not at equal heights, the arterial and venous height offsets must be determined individually. In a given patient with a given access the height offsets need to be measured only once and then used until the access location is altered by construction of a new access.

j. Calculate the normalized arterial and venous segment static IAP ratio(s), P_{IA}/MAP

Arterial ratio = (arterial IAP + arterial height correction)/MAP

Venous ratio = (venous IAP + venous height correction)/MAP

Where P_{IA} is intra-access pressure

Criteria for Intervention

Access Pressure Ratio						
Degree of Stenosis	**Graft**			**Fistula**		
	Arterial Segment		**Venous Segment**	**Arterial Segment**		**Venous Segment**
<50% of diameter	0.35-0.74		0.15-0.49	0.13-0.43		0.08-0.34
>50% of diameter						
Venous outlet	>0.75	or	>0.5	>0.43	or	>0.35
Intra-access	≥0.65	**and**	<0.5	>0.43	**and**	≤0.35
Arterial inflow	<0.3		Clinical findings	<0.13 + clinical findings		Clinical findings

4.3 Surveillance in fistulae:

Techniques, not mutually exclusive, that may be used in surveillance for stenosis in arteriovenous fistulae (AVFs) include:

4.3.1 Preferred:

4.3.1.1 Direct flow measurements. **[A]**

4.3.1.2 Physical findings of persistent swelling of the arm, presence of collateral veins, prolonged bleeding after needle withdrawal, or altered characteristics of pulse or thrill in the outflow vein. **[B]**

4.3.1.3 Duplex ultrasound. **[A]**

4.3.2 Acceptable:

4.3.2.1 Recirculation using a non-urea-based dilutional method. **[B]**

4.3.2.2 Static pressures **[B]**, direct or derived. **[B]**

4.4 When to refer for evaluation (diagnosis) and treatment:

4.4.1 One should not respond to a single isolated abnormal value. With all techniques, prospective trend analysis of the test parameter has greater power to detect dysfunction than isolated values alone. **[A]**

4.4.2 Persistent abnormalities in any of the monitoring or surveillance parameters should prompt referral for access imaging. **[A]**

4.4.3 An access flow rate less than 600 mL/min in grafts and less than 400 to 500 mL/min in fistulae. **[A]**

4.4.4 A venous segment static pressure (mean pressures) ratio greater than 0.5 in grafts or fistulae. **[A]**

4.4.5 An arterial segment static pressure ratio greater than 0.75 in grafts. **[A]**

Access Flow Protocol Surveillance

Access flow measured by ultrasound dilution, conductance dilution, thermal dilution, Doppler or other technique should be performed monthly. The assessment of flow should be performed during the first 1.5 hour of the treatment to eliminate error caused by decreases in cardiac output or blood pressure related to ultrafiltration/hypotension. The mean value of 2 separate determinations (within 10% of each other) performed at a single treatment should be considered the access flow.

Graft
If access flow is <600 in a graft, the patient should be referred for fistulogram.
If access flow 1,000 mL/min that has decreased by more than 25% over 4 month, the patient should be referred for fistulogram.

Patient Education Basics

All patients should be taught how to:

a. Compress a bleeding access.
b. Wash skin over access with soap and water daily and before hemodialysis (HD).
c. Recognize signs and symptoms of infection.
d. Select proper methods for exercising fistula arm with some resistance to venous flow.
e. Palpate for thrill/pulse daily and after any episodes of hypertension, dizziness, or lightheadedness.
f. Listen for bruit with ear opposite access if they cannot palpate for any reason.

All patients should know how to:

a. Avoid carrying heavy items draped over the access arm or wearing occlusive clothing.
b. Avoid sleeping on the access arm.
c. Insist that staff rotate cannulation sites each treatment.
d. Ensure that staff are using proper techniques in preparing skin prior to cannulation and wearing masks for all access connections.
e. Report any signs and symptoms of infection or absence of bruit/thrill to dialysis personnel immediately.

Guideline 5. Treatment of Fistula Complications

Appropriate interventions for access dysfunction may result in an increased duration of survival of the AVF.

5.1 Problems developing in the early period after AVF construction (first 6 months) should be promptly addressed.

5.1.1 Persistent swelling of the hand or arm should be expeditiously evaluated and the underlying pathology should be corrected. **[B]**

5.1.2 A program should be in place to detect early access dysfunction, particularly delays in maturation. The patient should be evaluated no later than 6 weeks after access placement. **[B]**

Summary of Physical Examination

Inspection	Examine for erythema, swelling, gangrene, change of size of aneurysms over time.
Palpitation	Feel for intravascular pressure along the veins; examine for segmental differences in quality. Feel for elevated/low skin temperature; check the quality of pulsation along arteries and veins. Check for pain caused by finger pressure.
Auscultation	Check for the presence of typical low-frequency bruit with systolic and diastolic components. Examine for abnormal high-frequency bruit produced by turbulence due to a stenosis.

5.2 Intervention:
Intervention on a fistula should be performed for the presence of:

5.2.1 Inadequate flow to support the prescribed dialysis blood flow. **[B]**

5.2.2 Hemodynamically significant venous stenosis. **[B]**

5.2.3 Aneurysm formation in a primary fistula. Postaneurysmal stenosis that drives aneurysm also should be corrected. The aneurysmal segment should not be cannulated. **[B]**

5.2.4 Ischemia in the access arm. **[B]**

5.3 Indications for preemptive percutaneous angioplasty (PTA):

A fistula with a greater than 50% stenosis in either the venous outflow or arterial inflow, in conjunction with clinical or physiological abnormalities, should be treated with PTA or surgical revision. **[B]**

5.3.1 Abnormalities include reduction in flow, increase in static pressures, access recirculation preempting adequate delivery of dialysis, or abnormal physical findings. **[B]**

5.4 Stenosis, as well as the clinical parameters used to detect it, should return to within acceptable limits following intervention. **[B]**

5.5 Thrombectomy of a fistula should be attempted as early as possible after thrombosis is detected, but can be successful even after several days. **[B]**

5.6 Access evaluation for ischemia:

5.6.1 Patients with an AVF should be assessed on a regular basis for possible ischemia. **[B]**

5.6.2 Patients with new findings of ischemia should be referred to a vascular access surgeon emergently. **[B]**

5.7 Infection:

Infections of primary AVFs are rare and should be treated as subacute bacterial endocarditis with 6 weeks of antibiotic therapy. Fistula surgical excision should be performed in cases of septic emboli. **[B]**

Guideline 6. Treatment of Arteriovenous Graft Complications

Appropriate management and treatment of AVG complications may improve the function and longevity of the vascular access.

6.1 Extremity edema:

Patients with extremity edema that persists beyond 2 weeks after graft placement should undergo an imaging study (including dilute iodinated contrast) to evaluate patency of the central veins. The preferred treatment for central vein stenosis is PTA. Stent placement should be considered in the following situations:

6.1.1 Acute elastic recoil of the vein (>50% stenosis) after angioplasty. **[B]**

6.1.2 The stenosis recurs within a 3-month period. **[B]**

6.2 Indicators of risk for graft rupture:

Any of the following changes in the integrity of the overlying skin should be evaluated urgently:

6.2.1 Poor eschar formation. **[B]**

6.2.2 Evidence of spontaneous bleeding. **[B]**

6.2.3 Rapid expansion in the size of a pseudoaneurysm. **[B]**

6.2.4 Severe degenerative changes in the graft material. **[B]**

6.3 Indications for revision/repair:

6.3.1 AVGs with severe degenerative changes or pseudoaneurysm formation should be repaired in the following situations:

6.3.1.1 The number of cannulation sites are limited by the presence of a large (or multiple) pseudoaneurysm(s). **[B]**

6.3.1.2 The pseudoaneurysm threatens the viability of the overlying skin. **[B]**

6.3.1.3 The pseudoaneurysm is symptomatic (pain, throbbing). **[B]**

6.3.1.4 There is evidence of infection. **[B]**

6.3.2 Cannulation of the access through a pseudoaneurysm must be avoided if at all possible and particularly so if the pseudoaneurysm is increasing in size. **[B]**

6.4 Treatment of stenosis without thrombosis:
Stenoses that are associated with AVGs should be treated with angioplasty or surgical revision if the lesion causes a greater than 50% decrease in the luminal diameter and is associated with the following clinical/physiological abnormalities:

6.4.1 Abnormal physical findings. **[B]**

6.4.2 Decreasing intragraft blood flow (<600 mL/min). **[B]**

6.4.3 Elevated static pressure within the graft. **[B]**

6.5 Outcomes after treatment of stenosis without thrombosis:
After angioplasty or surgical revision of a stenosis, each institution should monitor the primary patency of the AVG. Reasonable goals are as follow:

6.5.1 Angioplasty:

6.5.1.1 The treated lesion should have less than 30% residual stenosis and the clinical/physiological parameters used to detect the stenosis should return to acceptable limits after the intervention. **[B]**

6.5.1.2 A primary patency of 50% at 6 months. **[B]**

6.5.2 Surgical revision:

6.5.2.1 The clinical/physiological parameters used to detect the stenosis should return to acceptable limits after the intervention. **[B]**

6.5.2.2 A primary patency of 50% at 1 year. **[B]**

6.6 If angioplasty of the same lesion is required more than 2 times within a 3-month period, the patient should be considered for surgical revision if the patient is a good surgical candidate.

6.6.1 If angioplasty fails, stents may be useful in the following situations:

6.6.1.1 Surgically inaccessible lesion. **[B]**

6.6.1.2 Contraindication to surgery. **[B]**

6.6.1.3 Angioplasty-induced vascular rupture. **[B]**

6.7 Treatment of thrombosis and associated stenosis:

Each institution should determine which procedure, percutaneous thrombectomy with angioplasty or surgical thrombectomy with AVG revision, is preferable based upon expediency and physician expertise at that center.

6.7.1 Treatment of AVG thrombosis should be performed urgently to minimize the need for a temporary HD catheter. **[B]**

6.7.2 Treatment of AVG thrombosis can be performed by using either percutaneous or surgical techniques. Local or regional anesthesia should be used for the majority of patients. **[B]**

6.7.3 The thrombectomy procedure can be performed in either an outpatient or inpatient environment. **[B]**

6.7.4 Ideally, the AVG and native veins should be evaluated by using intraprocedural imaging. **[B]**

6.7.5 Stenoses should be corrected by using angioplasty or surgical revision. **[B]**

6.7.6 Methods for monitoring or surveillance of AVG abnormalities that are used to screen for venous stenosis should return to normal after intervention. **[B]**

6.8 Outcomes after treatment of AVG thrombosis:

After percutaneous or surgical thrombectomy, each institution should monitor the outcome of treatment on the basis of AVG patency. Reasonable goals are as follows:

6.8.1 A clinical success rate of 85%; clinical success is defined as the ability to use the AVG for at least 1 HD treatment. **[B]**

6.8.2 After percutaneous thrombectomy, primary patency should be 40% at 3 months. **[B]**

6.8.3 After surgical thrombectomy, primary patency should be 50% at 6 months and 40% at 1 year. **[B]**

6.9 Treatment of AVG infection:
Superficial infection of an AVG should be treated as follows:

6.9.1 Initial antibiotic treatment should cover both gram-negative and gram-positive microorganisms. **[B]**

6.9.1.1 Subsequent antibiotic therapy should be based upon culture results.

6.9.1.2 Incision and drainage may be beneficial.

6.9.2 Extensive infection of an AVG should be treated with appropriate antibiotic therapy and resection of the infected graft material. **[B]**

Guideline 7. Prevention and Treatment of Catheter and Port Complications

Catheters and ports are essential tools for providing urgent and, in some cases, long-term vascular access. Prevention and early treatment of complications should greatly reduce associated morbidity and mortality.

7.1 Catheters and ports should be evaluated when they become dysfunctional. Dysfunction is defined as failure to attain and maintain an extracorporeal blood flow of 300 mL/min or greater at a prepump arterial pressure more negative than –250 mm Hg. **[B]**

Signs of CVC Dysfunction: Assessment Phase

Blood pump flow rates <300 mL/min
Arterial pressure increases (< -250 mm Hg)
Venous pressure increases (>250 mm Hg)
Conductance decreases (<1.2): the ratio of blood pump flow to the absolute value of prepump pressure
URR progressively <65% or (Kt/V <1.2)
Unable to aspirate blood freely (late manifestation)
Frequent pressure alarms - not responsive to patient repositioning or catheter flushing
Trend analysis of changes in access flow is the best predictor of access patency and risk for thrombosis.

Definitions: CVC; central venous catheter; URR, urea reduction ratio; Kt/V, $(K_{urea} \times T_d)/V_{urea}$, where K_{urea} is the effective (delivered) dialyzer urea clearance in milliliters per minute integrated over the entire dialysis, T_d is the time in minutes measured from beginning to end of dialysis, and V_{urea} is the patient's volume of urea distribution in milliliters

Causes of Early Catheter Dysfunction

Mechanical

Kinks (angulation in tunnel) Misplaced sutures Catheter migration Drug precipitation (some antibody locks or IV IgG) Patient position Catheter integrity Holes Cracks

Definitions: IV IgG, intravenous Immunoglobulin G

Available Thrombolytics

Streptokinase • Highly antigenic • Low fibrin affinity Urokinase • Available for PE treatment • No longer manufactured (11/2004) Reteplase • Used in treatment of AMI • Must be aliquoted and frozen Ateplase, tPA • High fibrin specificity • FDA approved • Available in single dose vials • No antigenicity

7.2 The exception is pediatric or smaller adult catheters that are not designed to have flows in excess of 300 mL/min. **[B]**

7.3 Methods that should be used to treat a dysfunctional or nonfunctional catheter or port include:

7.3.1 Repositioning of a malpositioned catheter. **[B]**

7.3.2 Thrombolytics, using either an intraluminal lytic, intradialytic lock protocol, or an intracatheter thrombolytic infusion or interdialytic lock. **[B]**

7.3.3 Catheter exchange with sheath disruption, when appropriate. **[B]**

7.4 Treatment of an infected HD catheter or port should be based on the type and extent of infection.

7.4.1 All catheter-related infections, except for catheter exit-site infections, should be addressed by initiating parenteral treatment with an antibiotic(s) appropriate for the organism(s) suspected. **[A]**

7.4.2 Definitive antibiotic therapy should be based on the organism(s) isolated. **[A]**

7.4.3 Catheters should be exchanged as soon as possible and within 72 hours of initiating antibiotic therapy in most instances, and such exchange does not require a negative blood culture result before the exchange. **[B]** Follow-up cultures are needed 1 week after cessation of antibiotic therapy (standard practice).

7.4.4 Port pocket infections should be treated with systemic antibiotics and irrigation, in conjunction with the manufacturers' recommendations. **[B]**

Guideline 8. Clinical Outcome Goals

8.1 Goals of access placement:

8.1.1 Each center should establish a database and CQI process to track the types of accesses created and complication rates for these accesses.

8.1.2 The goals for permanent HD access placement should include:

8.1.2.1 Prevalent functional AVF placement rate of greater than 65% of patients. **[B]**

8.1.2.2 Cuffed catheter for permanent dialysis access (e.g., not as a bridge) in less than 10% of patients. Long-term catheter access is defined as the use of a dialysis catheter for more than 3 months in the absence of a maturing permanent access - graft or fistula. **[B]**

8.2 The *primary* access failure rates of HD accesses in the following locations and configurations should not be more than the following:

8.2.1 Forearm straight grafts: 15%. **[B]**

8.2.2 Forearm loop grafts: 10%. **[B]**

8.2.3 Upper-arm grafts: 5%. **[B]**

8.2.4 Tunneled catheters with blood flow less than 300 mL/min: 5%. **[B]**

8.3 Access complications and performance:

8.3.1 Fistula complications/performance should be as follows:

8.3.1.1 Fistula thrombosis: fewer than 0.25 episodes/patient-year at risk. **[B]**

8.3.1.2 Fistula infection: less than 1% during the use-life of the access. **[B]**

8.3.1.3 Fistula patency greater than 3.0 years (by life-table analysis). **[B]**

8.3.2 Graft complications/performance should be as follows:

8.3.2.1 Graft thrombosis: fewer than 0.5 thrombotic episodes/patient-year at risk. **[B]**

8.3.2.2 Graft infection: less than 10% during the use-life of the access. **[B]**

8.3.2.3 Graft patency greater than 2 years (by life-table analysis). **[B]**

8.3.2.4 Graft patency after PTA: longer than 4 months. **[B]**

8.3.3 Catheter complications/performance should be as follows:

8.3.3.1 Tunneled catheter-related infection less than 10% at 3 months and less than 50% at 1 year. **[B]**

8.3.3.2 The cumulative incidence of the following insertion complications should not exceed 1% of all catheter placements: **[B]**

- Pneumothorax requiring a chest tube
- Symptomatic air embolism
- Hemothorax
- Hemomediastinum
- Hematoma requiring evacuation

8.3.4 Cumulative patency rate of tunneled cuffed catheters (TCCs): Not specified. **[B]**

8.4 Efficacy of corrective intervention:

The rate of certain milestones after correction of thrombosis or stenosis should be as follows:

8.4.1 AVF patency after PTA: greater than 50% unassisted patency at 6 months (and <30% residual stenosis postprocedure or lack of resolution of physical findings postprocedure); AVF patency following surgery: greater than 50% unassisted patency at 1 year. **[B]**

8.4.2 AVG patency after PTA: please refer to CPG 6.5.1

AVG patency after surgery: please refer to CPG 6.5.2

AVG after either PTA or surgery: greater than 90% with postprocedure restoration of blood flow and greater than 85% postprocedure ability to complete 1 dialysis treatment. Please refer to CPG 6.8. **[B]**

8.4.3 Surgical correction is set to a higher standard because of the use of venous capital. **[B]**

Clinical Practice Recommendations for Vascular Access

Clinical Practice Recommendations for Guideline 1: Patient Preparation for Permanent Hemodialysis Access

Factors that may be helpful in preparing the patient for placement of a permanent HD access include the following:

1.1 The veins of the dorsum of the hand should be the preferred site for IV cannulation.

1.2 Sites for venipuncture should be rotated if arm veins need to be used.

1.3 Patients with CKD stage 5 should be educated on the risks and benefits associated with catheters and strongly encouraged to allow the evaluation for and creation of a fistula for long-term access when appropriate. Such discussions with the patient should be initiated months before the anticipated start of dialysis therapy.

1.4 Alternative imaging studies for central veins include Duplex Doppler ultrasound (DDU) and magnetic resonance imaging/magnetic resonance angioography (MRA).

Clinical Practice Recommendations for Guideline 2: Selection and Placement of Hemodialysis Access

Recommendations for fistulae:

2.1 When a new native fistula is infiltrated (i.e., presence of hematoma with associated induration and edema), it should be rested until the swelling is resolved.

Clinical Practice Recommendations for Guideline 3: Cannulation of Fistulae and Grafts and Accession of Dialysis Catheters and Ports

3.1 Cannulation skill:

Staff should be appropriately trained and observed for technical mastery before cannulating any AV access. Only those with said technical mastery should be allowed to cannulate a new fistula. A protocol for minimizing vessel damage should be used for cannulation failure. Recannulation should be attempted only when the cannulation site is healed and the vessel is assessed to be normal and

appropriate for cannulation. Heparin management should be reviewed on a case-by-case basis to minimize postdialysis bleeding.

3.2 Self-cannulation:

Patients who are capable and whose access is suitably positioned should be encouraged to self-cannulate. The preferred cannulation technique is the buttonhole.

3.3 Buttonhole:

Patients with fistula access should be considered for buttonhole (constant-site) cannulation. (See protocol in CPG 3.)

3.4 Elevation of arm for swelling:

The AVG access arm should be elevated as much as possible until swelling subsides, which may take as long as 3 to 6 weeks. Increase in symptoms requires urgent evaluation.

Clinical Practice Recommendations for Guideline 4: Detection of Access Dysfunction: Monitoring, Surveillance, and Diagnostic Testing

4.1 Monitoring the access:

4.1.1 Access patency should be ensured before each treatment before any attempts to cannulate the access.

4.1.2 All caregivers, including fellows in training, should learn and master the methods for examining a vascular access.

4.1.3 Access characteristics, such as pulsatility and presence of thrill, as well as flow and pressure, should be recorded and tracked in a medical record and be available to all caregivers of the vascular access team (VAT).

4.2 Frequency of measurement is dependent on the method used:

4.2.1 It is not clear that access flow measurements performed at a monthly frequency provide sufficient data stability to make decisions. Until additional studies are performed to determine the optimal frequency, more frequent measurements are recommended.

4.2.2 Static pressure measurements require less technology and should be made more frequently than flow measurements. Direct measurements of static pressure ratios should be made every 2 weeks. Less-direct measurements should be made weekly. Dynamic pressures, if used (see CPG 4.2.3), should be measured with each dialysis treatment, but derivation of a static pressure should be attempted, rather than using the raw numbers.

4.2.3 Measurement of recirculation is not recommended as a surveillance technique in grafts.

4.3 Frequency of measurement for access complications:

4.3.1 Thrombosis in fistulae develops more slowly than in grafts. Flow measurements performed at a monthly frequency appear to be adequate. Until additional studies are performed to determine the optimal frequency, less frequent measurements are not recommended.

4.3.2 Because static pressure measurements are inherently less accurate in detecting access stenosis in fistulae, the frequency should not be less than in grafts. Direct measurements of static pressure ratios should be made every 2 weeks. Less-direct measurements should be made weekly. Dynamic pressures should be measured with each dialysis. Increased recirculation can indicate reduced effective blood pump flow, resulting in inadequate dialysis.

4.4 Diagnostic testing:

4.4.1 Characteristics of access (see CPR 4.1), as well as blood pump flow and pressure performance, should be recorded and tracked in medical records.

4.4.2 Data should be analyzed at least monthly to evaluate access dysfunction.

4.4.3 After intervention, the surveillance parameter should be restored to normal.

4.4.4 Data should be analyzed to improve success rates and ensure that interventions are appropriately assessed. For example, PTA and surgical revision rates, recurrence rates, and number of procedures per patient year should be systematically analyzed in a CQI process.

4.4.5 A multidisciplinary team should be involved.

4.4.6 Preemptive correction of hemodynamically significant stenoses should remain the standard of care.

Clinical Practice Recommendations for Guideline 5: Treatment of Fistula Complications

5.1 If a new fistula access has vein margins that are difficult to discern on physical examination and cannulation frequently is associated with aspiration of clot, the patient should be referred for access marking by means of DDU to define the center of the vessel and depth of the fistula. A diagram of these findings should be sent to the dialysis unit.

5.1.1 The patient should be taught to examine his or her access daily, while at home, for thrombosis.

Clinical Practice Recommendations for Guideline 7: Prevention and Treatment of Catheter and Port Complications

7.1 Treatment of catheter dysfunction:

Catheter dysfunction should be treated when a dialyzer blood flow of 300 mL/min is not being attained in a catheter previously able to deliver greater than 350 mL/min at a prepump pressure of –250 torr.

7.1.1 A dysfunctional catheter (blood flow <300 mL/min) for 2 consecutive treatments should be treated in the HD unit by using an intraluminal interdialytic thrombolytic lock protocol between 2 dialysis treatments (i.e., 35 to 69 hours).

7.2 Radiological evaluation:

Any dysfunction that cannot be managed in the dialysis unit should be sent for radiographic study to diagnose dysfunction and document the condition of the vessel.

7.2.1 Catheter imaging with contrast infusion can identify other correctable problems (e.g., residual lumen thrombus, external fibrin catheter sheath, malpositioned catheter tip). Appropriate interventions may follow, such as:

7.2.1.1 Repositioning of the catheter.

7.2.1.2 Angioplasty of a vessel.

7.2.1.3 Replacement of a malpositioned catheter over guide wire.

7.2.1.4 Higher-dose lytic infusion for occlusive thrombus (e.g., right atrial) or fibrin sheath

7.3 Choice of thrombolytic and use of other modalities:

7.3.1 A special brush is used to remove thrombus from the lumens of a conventional catheter by using a protocol specific to this procedure.

7.4 Treatment of infection:

7.4.1 Catheter exit-site infections, in the absence of a tunnel infection, should be treated with topical and/or oral antibiotics, ensuring proper local exit-site care. In general, it should not be necessary to remove the catheter.

7.4.2 If a patient with bacteremia is afebrile within 48 hours and is clinically stable, catheter salvage might be considered by using an interdialytic antibiotic lock solution and 3 weeks of parenteral antibiotics in appropriate situations. A follow-up blood culture 1 week after completion of the course of antibiotics should be performed. (see Table 24 in the original guideline document)

7.4.3 Antibiotic lock with antibiotic to which the organism is sensitive is indicated when follow-up cultures indicate reinfection with the same organism in a patient with limited catheter sites.

7.4.4 Short-term catheters should be removed when infected. There is no conclusive evidence to support a rationale for scheduled replacement except for those in the femoral area.

Clinical Practice Recommendation 8: Vascular Access in Pediatric Patients

8.1 Choice of access type:

8.1.1 Permanent access in the form of a fistula or graft is the preferred form of vascular access for most pediatric patients on maintenance HD therapy.

8.1.2 Circumstances in which a central venous catheter (CVC) may be acceptable for pediatric long-term access include lack of local surgical expertise to place permanent vascular access in small children, patient size too small to support a permanent vascular access, bridging HD for PD training or PD catheter removal for peritonitis, and expectation of expeditious kidney transplantation.

8.1.3 If surgical expertise to place permanent access does not exist in the patient's pediatric setting, efforts should be made to consult vascular access expertise among local adult-oriented surgeons to either supervise or place permanent vascular access in children.

8.1.4 Programs should evaluate their patients' expected waiting times on their local deceased-donor kidney transplant waiting lists. Serious consideration should be given to placing permanent vascular access in children greater than 20 kg in size who are expected to wait more than 1 year for a kidney transplant.

Semipermanent HD Catheter and Patient Size Guideline

Patient Size (kg)	Catheter Options
<10 kg	Made on a case by case basis
10-20 kg	8 French dual lumen
20-25 kg	7 French twin catheter
20-40 kg	10 French dual lumen 10 French split catheter 10 French twin catheter
>40 kg	10 French twin catheter 11.5 or 12.5 French dual lumen

8.2 Stenosis surveillance:

An AVG stenosis surveillance protocol should be established to detect venous anastomosis stenosis and direct patients for surgical revision or PTA.

8.3 Catheter sizes, anatomic sites, and configurations:

8.3.1 Catheter sizes should be matched to patient sizes with the goal of minimizing intraluminal trauma and obstruction to blood flow while allowing sufficient blood flow for adequate HD.

8.3.2 External cuffed access should be placed in the internal jugular with the distal tip placed in the right atrium.

8.3.3 The blood flow rate (BFR) of an external access should be minimally 3 to 5 mL/kg/min and should be adequate to deliver the prescribed HD dose.

Definitions:

Rating the Strength of Guideline Recommendations

The strength of each guideline recommendation is based on the quality of the supporting evidence as well as additional considerations. Additional considerations, such as cost, feasibility, and incremental benefit were implicitly considered.

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

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

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.

Health outcomes are health-related events, conditions, or symptoms that can be perceived by individuals to have an important effect on their lives. Improving health outcomes implies that benefits outweigh any adverse effects.

Rating the Quality of Evidence

The quality of evidence was not explicitly graded. It was implicitly assessed according to the criteria outlined in the table below, and considered: i) the methodological quality of the studies; ii) whether or not the studies were carried out in the target population (i.e., patients on dialysis, or in other populations) and iii) whether the studies examined health outcomes directly, or examined surrogate measures for those outcomes (e.g., blood flow instead of access survival.)

		Methodological Quality		
Outcome	Population	Well designed and analyzed (little, if any, potential bias)	Some problems in design and/or analysis (some potential bias)	Poorly designed and/or analyzed (large potential bias)
Health outcome(s)	Target population	Strong[a]	Moderately Strong[b]	Weak[h]
Health outcome(s)	Other than the target population	Moderately Strong[c]	Moderately Strong[d]	Weak[h]
Surrogate measure for	Target population	Moderately Strong[e]	Weak[f]	Weak[h]

		Methodological Quality		
health outcome(s)				
Surrogate measure for health outcome(s)	Other than the target population	Weak[g]	Weak[g]	Weak[g,h]

Definitions:

Strong: [a]Evidence includes results from well-designed, well-conducted study/studies in the target population that directly assess effects on health outcomes.

Moderately Strong: [b]Evidence is sufficient to determine effects on health outcomes in the target population, but the strength of the evidence is limited by the number, quality, or consistency of the individual studies. [c]OR evidence is from a population other than the target population, but from well-designed, well-conducted studies; [d]OR evidence is from studies with some problems in design and/or analyses; [e]OR evidence is from well-designed, well-conducted studies or surrogate endpoints for efficacy and/or safety in the target population.

Weak: [f]Evidence is insufficient to assess the effects on net health outcomes because it is from studies with some problems in design and/or analysis on surrogate endpoints for efficacy and/or safety in the target population; [g]OR the evidence is only for surrogate measures in a population other than the target population; [h]OR the evidence is from studies that are poorly designed and/or analyzed.

CLINICAL ALGORITHM(S)

An algorithm is provided in the original guideline document, "Pediatric progress from chronic kidney disease (CKD) stages 1 to 5 and kidney replacement therapy (KRT)/access."

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for each recommendation (see "Major Recommendations").

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

- Early identification of patients with progressive renal failure for identification and protection of potential access sites
- Reduced morbidity related to vascular access
- Enhanced long-term access function
- Reduced infection rates
- Improved infection clearing rates
- Reduced rates of hospitalization

- Reduced costs associated with the maintenance of access patency
- Early detection and treatment of access dysfunction

POTENTIAL HARMS

Complications of vascular access placement and maintenance (for example, infection, stenosis, thrombosis, aneurysm, and limb ischemia).

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- These Clinical Practice Guidelines (CPGs) and Clinical Practice Recommendations (CPRs) are based upon the best information available at the time of publication. They are designed to provide information and assist decision making. They are not intended to define a standard of care, and should not be construed one. Neither should they be interpreted as prescribing an exclusive course of management.
- Variations in practice will inevitably and appropriately occur when clinicians take into account the needs of individual patients, available resources, and limitations unique to an institution or type of practice. (See "Limitations" sections in the original guideline document for a more detailed explanation specific to each guideline.) Every healthcare professional making use of these CPGs and CPRs is responsible for evaluating the appropriateness of applying them in the setting of any particular clinical situation. The recommendations for research contained within this document are general and do not imply a specific protocol.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

Implementation is an integral component of the Kidney Disease Outcomes Quality Initiative process, and accounts for the success of its past guidelines. The Kidney Learning System (KLS) component of the National Kidney Foundation is developing implementation tools that will be essential to the success of these guidelines.

IMPLEMENTATION TOOLS

Clinical Algorithm
Foreign Language Translations
Patient Resources
Pocket Guide/Reference Cards
Quick Reference Guides/Physician Guides
Resources
Wall Poster

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Vascular Access Work Group. Clinical practice guidelines for vascular access. Am J Kidney Dis 2006 Jul;48 Suppl 1:S248-73. PubMed

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Not applicable: The guideline was not adapted from another source.

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The National Kidney Foundation makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the Work Group.

Specifically, all members of the Work Group are required to complete, sign, and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest. All affiliations are published in their entirety at the end of this publication in the Biographical Sketch section of the Work Group members.

- Dr. Besarab has received research funds, grants or contracts from Abbott Laboratories, Advanced Magnetics, Affymaz, American Regent Inc. Amgen, Inc., Baxter, Genentech, Hoffman-La Roche, Rockwell International, Transonic Systems Inc., VascAlert, and Watson Pharmaceuticals.
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GUIDELINE AVAILABILITY

Electronic copies: Available from the National Kidney Foundation (NKF) Web site.

Print copies: Available from the National Kidney Foundation (NKF), 30 East 33rd St., New York, NY 10016. These guidelines are also available on CD-ROM from NKF.

AVAILABILITY OF COMPANION DOCUMENTS

The following are available:

- Action on access: principles of catheter use for hemodialysis (wall chart)
- Hemodialysis catheters: best practice for early identification and management of dysfunction
- Hemodialysis catheters: preventing and managing dysfunction (laminated guide)
- Hemodialysis vascular access overview: fistula and graft use (wall chart)
- Infection prevention and control: best practices for hemodialysis vascular access (laminated guide)
- Dialysis care package
- Dialysis care clinical practice guidelines and recommendations (CD-ROM)
- KDOQI in the dialysis center: a quick reference guide
- CKD: a guide to select NKF-KDOQI guidelines and recommendations 2006

These materials are available by contacting: National Kidney Foundation 30 East 33rd Street, New York, NY 10016 (phone: 212.889.2210 or 800.622.9010 or fax: 212.686.8916), or through the National Kidney Foundation Web site.

PATIENT RESOURCES

The following are available:

- Hemodialysis catheters: how to keep yours working well (also available in Spanish)
- Vascular access: what you need to know (also available in Spanish)

These patient education materials are available by contacting: National Kidney Foundation 30 East 33rd Street, New York, NY 10016 (phone: 212.889.2210 or 800.622.9010 or fax: 212.686.8916), or through the National Kidney Foundation Web site.

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NGC STATUS

This summary was completed by ECRI on September 1, 2001. The information was verified by the guideline developer as of November 19, 2001. The updated information was verified by the guideline developer on July 20, 2007.

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