

Vascular Access in Hemodialysis: the 2006 KDOQI Guidelines Update

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**Thanks to the SEKC for the
gracious invitation and honor
to present the KDOQI and
Surgical Aspects of:
IMPROVING ARTERIAL
VENOUS FISTULA RATES
THROUGH AN INTEGRATED
VASCULAR ACCESS PROGRAM**

Learning Objectives

- The Learner will be able to:
 1. Provide an overview of the history and purpose of the KDOQI guidelines
 2. Review post-operative methods to maximize maturation of AV Fistulae
 3. Describe how stenosis formation occurs within the access, and identify ways that it can be prevented

Q1. The KDOQI guidelines should be interpreted as:

- A. strict protocols for clinical practice in the care of all ESRD patients
- B. recognized standards of clinical care for ESRD patients
- C. evidence-based statements to guide caregivers in clinical management of CKD patients
- D. measures that will be used for pay for performance
- E. all of the above

Overview of the NKF-DOQI Guidelines

- In the early 1990s, the National Kidney Foundation recognized significant differences in ESRD care across the nation and around the world. Much of this care was less than optimal. Multi-disciplinary workgroups were selected to review the literature, build consenses of optimal clinical practice and create guidelines in four categories of ESRD:
 - Vascular Access
 - Peritoneal Dialysis
 - Adequacy of Dialysis and
 - Anemia

Overview of the KDOQI Guidelines

- The Vascular Access Multi-Disciplinary Workgroup started the process in 1995 with the first publication in 1997 of the Dialysis Outcome Quality Initiative Vascular Access Guidelines
- These were first reviewed and revised in 2000 and were published in 2001 as the Kidney Disease Outcomes Quality Initiative for Vascular Access with substantive changes in the Monitoring Section only

Overview of KDOQI Guidelines

- In the interim, new guidelines have been written for:

Nutrition

Bone Disease Management

Chronic Kidney Disease

Cardiovascular Disease

- The latest revision of the original Vascular Access guidelines have been published as a supplement to the July 2006 AJKD and in book form and can be viewed at

http://www.kidney.org/PROFESSIONALS/kdoqi/guideline_upHD_PD_VA/index.htm.

Overview of the KDOQI Guidelines

- The format is different and the rationale is an exhaustive explication of the Work Group's decisions re the Guidelines and Recommendations
- Four areas of the Vascular Access Guidelines were intensively reviewed and revised with the remainder updated.

Mission Given - Limited Revision:

- **Select Areas of Most importance**
 1. **Role of vein imaging (mapping) in fostering the AV fistula initiative.**
 2. **Catheter infection: Treatment and prevention**
 3. **Catheter dysfunction: role of thrombolytics**
 4. **Role of surveillance**

Mission Given - Limited Revision:

- **Update the literature on the other Guidelines**
- **Differentiate Guidelines from Recommendations**
- **Propose Research Topics**
- **Simplify: previous KDOQI for vascular access had 38 separate guidelines with subheadings.**

Major Changes to VA-KDOQI 2006

- The Previous 38 CPG were condensed into
 - 7 major topics for adults (old GPG 1-28)
 - 1 section of clinical outcome goals (old 29-38)
 - 1 section for pediatrics (new)
- Recommendations (*CPR*) are now separate from the guidelines (to emphasize the importance of the evidence base)

Major Changes to VA-KDOQI 2006

- Each major topic has multiple specific areas for further research studies:
 - Most research suggestions relate to the recommendations under each topic.
 - Goal is to gather evidence so that a guideline or recommendation can be promoted or demoted (for example – access surveillance).

The evidence

2892+112 +5 = 3009 articles screened



59 sent for data extraction



More than half rejected



24 incorporated into evidence tables

VA 3009/58/24; HD 2749/87/23; PD 2600/101/27

Q2. To be considered as a source for evidence, research articles had to graded upon:

- A. study size and duration
- B. applicability to the areas of review
- C. results (hard outcome or surrogate)
- D. methodological quality (bias avoidance)
- E. all of the above

Vascular Access - KDOQI 2006

CPG 5. Treatment of Autologous Fistula
Complications

CPG 6. Treatment of AV Graft Complications

CPG 7. Prevention and Treatment of
Catheters/ports Complications

CPG 8 Clinical Outcome Goals

CPR 8 Clinical Practice Recommendations for
Vascular Access in Pediatric Patients

Major Differences from the 2000 Guidelines

- Clearer differentiation of guidelines from recommendations based on the strength of the evidence
- Proposals for further research studies relating to specific issues for each section – goal is to increase the evidence base of guidelines and especially recommendations
- Emphasis on the importance of the physical exam: teach better practices to staff and patients

Major Differences from 2000 Guidelines

- Calls for earlier identification of/and motivation of the patient to receive a permanent access prior to the need for dialysis (those patients receiving health care)
- Emphasis on educating patients, staff, health care systems; establishing Vascular Access Teams (VAT) for shared responsibility
- Data collection on access care and use of CQI.

Major Focus Areas

- Pre-op venous imaging/mapping for planning AVF construction
 - CPG 1.3 Patients should have a *functional permanent* access at the initiation of dialysis (criteria given)

Major Focus Areas

- Monitoring and surveillance of accesses to prevent dysfunction/thrombosis

CPG 4.1 *Physical examination should be used to detect dysfunction in fistulae and grafts at least monthly by a qualified individual. (B)*

Physical Examination (of the access): Inspection, palpation, and auscultation of the access. (KDOQI glossary)

Major Focus Areas

- Treatment/prevention of tunneled catheter related bacteremia

— CPG 7.4.1 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 prior to the exchange. (B+)

Major Focus Areas

- Treatment/prevention of tunneled catheter related bacteremia
 - CPR7.5.3 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. (Opinion)

Major Focus Areas

- Management of the dysfunctional tunneled catheter
 - CPG 7.3.2 Use of thrombolytics
- Surveillance of accesses to prevent dysfunction/ thrombosis
 - CPG 4.1 Physical examination should be used to detect dysfunction in fistulae and grafts at least monthly by a qualified individual. (B)
 - CPG4.2.3.1 Unstandardized dynamic venous pressures (DVP) should not be used as a surveillance technique. (A)

Patient Preparation for Long-Term Hemodialysis Access - CPG1

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

CPG 1: Preparation & Evaluation

- 1.1 Patients with a GFR of < 30 ml/min/1.73m² (CKD stage IV) should be educated on all modalities of renal replacement therapy including transplantation options so that timely referral can be made for the appropriate modality and placement of a permanent dialysis access if necessary. (A)

Q3. Vein preservation for access includes:

- A. all patients diagnosed with CKD
- B. all peripheral arm and central vessels
- C. blood draws and IV placements should be from or in the backs of the hands
- D. patient education, early and often
- E. all of the above

CPG 1: Preparation & Evaluation

1.2 In patients with Stage IV or V CKD, forearm and upper arm veins suitable for placement of vascular access should not be used for venipuncture or for the placement of intravenous catheters, subclavian catheters or PICC lines. (B)

CPG 1: Preparation & Evaluation

1.3 Patients should have a functioning permanent access at the initiation of dialysis

1.3.3 A peritoneal dialysis (PD) catheter should be ideally placed at least 2 weeks prior to the anticipated start of dialysis treatments. A back-up HD access does not need to be placed in most patients. A PD catheter may be used as a bridge for fistula in “appropriate” patients. (B-)

1.4 Evaluations that should be performed prior to placement of a permanent HD access

CPG2-Selection of Access Type and Site

A structured approach to the type and location of long-term HD accesses should help to optimize access survival and minimize complications. The access should be placed distally and in the upper extremities whenever possible. Options for fistula creation should be considered first, followed by prosthetic grafts, if fistula creation is not possible. Catheters should be avoided for hemodialysis and used only when other options are **not** available.

CPG 2. Selection of Access

2.1 The order of preference for placement of fistulae in patients with kidney failure who choose HD as their initial mode of RRT should be:

2.1.1 Preferred: fistula. (B+)

2.1.1.1 A wrist (radial-cephalic) primary fistula. (A)

2.1.1.2 An elbow (brachial-cephalic) primary fistula. (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 etc.

CPG 2. Selection of Access

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)

Although there are no studies reporting on the safety of patients with NCCs going home while awaiting placement at a dialysis center, the Work Group believes that the risk of infection, inadvertent removal, hemorrhage, air embolism, and patient comfort mandates that patient safety come first. Therefore, a patient with an NCC should not be discharged. A short-term catheter can be converted to a TCC if there is no evidence of active infection.

CPG 2. Selection of Access

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 Grafts

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

CPG 2. Selection of Access

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; the left internal and external jugular veins; subclavian veins; femoral veins; and translumbar and transhepatic access to the 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 catheters should be verified radiologically. (B)

CPG3. Accession of HD 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 long-term dialysis accesses.*

CPG 3. Cannulation & Access Care

- 3.1 Aseptic technique should be used for all cannulation and catheter accession procedures. (A)
- 3.2 Maturation - Fistula hand-arm exercise (B)
If a fistula has not matured, a fistulogram or other imaging study should be obtained to determine the cause of the problem. (B+).

Exercise should both enlarge the vein by increasing flow and build the muscle below to make the vein more prominent

Rule of 6s for the Fistula Maturation

- Greater than 600mL per min flow
 - Greater than 6 mms in diameter
 - Less than 6mms below skin surface
- AND
- All fistulae should be thoroughly examined *no later* than 6 weeks post op
 - Is there at least 6 cms of vein to cannulate?

CPG 3. Cannulation & Access Care

3.3 Cannulation of AV grafts: tutorial, use of the buttonhole

3.4 Infection control measures that should be used for all hemodialysis catheters and port catheter systems: 4 specific statements relating to examination, dressings, aseptic technique, prevention including Antimicrobial Locking Solutions.

Q4. The Purpose of Monitoring and Surveillance is to:

- A. fill out the CPM forms correctly
- B. to prospectively identify stenoses in the access
- C. collect CQI data on flow rates
- D. save staff time by eliminating physical exam
- E. all of the above

CPG 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.

CPG 4. Access Dysfunction Surveillance/Monitoring

- 4.1. Physical examination should be used to detect dysfunction in fistulae and grafts at least monthly by a qualified individual. (B)
- 4.2. Techniques, not mutually exclusive, that should be used in surveillance for stenosis in grafts include: flow, static pressure, DUS.

CPG 4. Access Dysfunction Surveillance/Monitoring

- 4.3 Surveillance in fistulae: flow and duplex ultrasound preferred
- 4.4. Criteria for referral for elective intervention

Recirculation and dynamic venous pressure not recommended

CPG 4. Surveillance & Monitoring

- 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 (B).

CPG 4. Surveillance & Monitoring

4.4.2 *Persistent abnormalities in any of the monitoring or surveillance parameters* should prompt referral for access angiography. (B)

4.4.3 An access flow rate <600- 800 ml/min in graft and < 400-500 in fistulae (B)

CPG 4. Surveillance & Monitoring

4.4 When to refer for evaluation (diagnosis) and treatment

4.4.4 A venous segment static pressure (mean pressures) ratio > 0.5 in grafts or fistulae (B)

4.4.5 An arterial segment static pressure greater than 0.75 in grafts. (B)

4.4.6 Ratio of dialyzer (blood pump) flow to pre-pump pressure < 1.2 in fistulae and 1.6 in grafts when using 15 g needles. (B-)

CPG5. Treatment of Fistula Complications

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

5.1 Problems developing within the first 6 months should be promptly addressed [3]

5.1.3. 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. (B)

CPG5. Treatment of Fistula Complications

5.2 Reasons for elective intervention (flow inadequacy, stenosis, aneurysm, ischemia)

5.3 A fistula with a greater than 50% stenosis in either the venous outflow or arterial inflow, in conjunction with clinical or physiologic abnormalities, should be treated with percutaneous transluminal angioplasty or surgical revision. (B)

CPG 5. Treatment of Fistula Complications

- 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 an 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: how, frequency, and when. [2]

CPG 6. Treatment of AVG Complications

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

- 6.1. Extremity Edema in Access Limb. (2)
- 6.2. Indicators of Graft Rupture. (4)
- 6.3. Indications for revision/repair. (4)
- 6.4. Criteria for Action on Stenoses w/o Thrombosis. (3)

CPG 6. Treatment of AVG Complications

- 6.5. Outcomes Following Treatment of Stenosis without Thrombosis: degree of residual, change in hemodynamics or physiology, patency post intervention (surgery vs PTAS)
- 6.6 PTA failures and use of stents.
- 6.7 Treatment of Thrombosis and Associated Stenosis.
- 6.8 Outcomes Following Treatment of AV Graft Thrombosis.
- 6.9. Treatment AV Graft Infection.

Q5 Which statement about catheters is true?

- A. prevention and early treatment of complications should greatly reduce associated morbidity and mortality.
- B. catheter dysfunction is a BFR consistently less than 300mLs/min in the average adult
- C. strict aseptic technique should always be used when accessing a catheter
- D. all of the above

CPG 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.

CPG 7 Prevention and Treatment of Catheter and Port Complications

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 ≥ 300 mL/min at a prepump arterial pressure more negative than -250 mm Hg. (B)

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

CPG 7 Prevention and Treatment of Catheter and Port Complications

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)

CPG7 Prevention and Treatment of Catheter and Port Complications

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)

CPG7 Prevention and Treatment of Catheter and Port Complications

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 prior to 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)

CPG 8 - Clinical Outcome Goals:

8.1 Goals for Access Placement.

8.1.1 Each center should establish a database and CQI process to track the types of accesses created and the complication rates for these accesses (cannot accomplish without a VAT)

8.1.2 The goals for incident hemodialysis access placement should include:

fistula >65%, catheters <10%.

8.2. The primary access failure rates of hemodialysis accesses (grafts and catheters)

CPG8 Clinical Outcome Goals

- 8.3. Access complications/performance: relating to thrombosis rates, infection rates overall survival**
- 8.4. Efficacy of Interventions: Secondary patency following PTA or surgery w and w/o thrombosis.**

Clinical Practice Recommendations for Vascular Access in Pediatric Patients

- 8.1. Choice of Access [4]**
 - 8.1.1 Permanent access in the form of a fistula or graft is the preferred form of pediatric vascular access for maintenance hemodialysis for most pediatric patients (B).**

Clinical Practice Recommendations for Vascular Access in Pediatric Patients

- 8.1.2 Circumstances in which a central venous catheter may be acceptable for pediatric chronic 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 and expectation of expeditious renal 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.

Clinical Practice Recommendations for Vascular Access in Pediatric Patients

8.1. Choice of Access

- 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 placing permanent vascular access in children >20 kg in size who are expected to wait more than 1 year for a kidney transplant. (CPR)

Clinical Practice Recommendations for Vascular Access in Pediatric Patients

9.2 Stenosis surveillance:

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

Clinical Practice Recommendations for Vascular Access in Pediatric Patients

9.3 Catheter sizes, anatomical sites and configurations:

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. (CPR)

9.3.2 External cuffed access should be placed in the internal jugular with the distal tip placed in the right atrium. (C)

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

**It's always about
the Patient!**

**Thanks!
– email me at
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CPR [recommendations] 1-4

CPR 1: use of veins on dorsum of hand, patient education during CKD, imaging other than DDU.

CPR 2: what to do when a new native fistula is infiltrated, role of fistula-hand exercises prior to construction

CPR 3: cannulation skills, self cannulation, buttonhole, managing extremity edema

CPR 4: monitoring, frequency of surveillance, diagnostic testing (what to record, how often, where, review process, by whom [VAT])

CPR [recommendations] 5-9

CPR 5:

when to “mark the fistula” that is difficult to cannulate
teaching patients to monitor their own fistula patency

CPR 7: catheter dysfunction/catheter maintenance

radiologic evaluation and intervention; sheath stripping
choice and use of thrombolytics,

- catheter maintenance in the patient with limited access options
- use of endoluminal brushes
- Managing infection: when to use adjunctive antibiotics for salvage; use of prophylactic AMLs

Research:

3. Cannulation and Access Care.

- Additional studies on disinfectants, role of antibiotic locks and which patients may benefit most from CVC salvage.
- Risk benefit outcomes as well as long term antibiotic susceptibility studies to detect resistance with ABLs
- Does the bevel up cannulation method decrease access complications? RCT
- Can increased remuneration for expert cannulators lead to better access outcomes?

Research:

7. Catheters

With modern catheters, what is the value of the conductance (BFR/arterial pre pump pressure) in predicting catheter dysfunction?

- The ideal catheter diameter is not established. Are there com increased complications associated with larger diameter catheters?
- Comparison of lytic treatments

Research:

7 Catheters (cont)

Comparison of lytic treatments

Defining the natural history of catheter/port related complications in the central veins using central venograms

- Studies to determine the association between infection and fibrin sheaths in catheters.
- Antibiotic locks: optimal use?

9. Pediatrics (infinite number of questions)