End Stage Renal Disease

- As the population ages and the incidence of diabetes rises, chronic kidney disease (CKD) and end-stage renal disease (ESRD) are becoming increasingly common diagnoses in the United States.
- The National Center for Health Statistics lists CKD as the ninth leading cause of death, accounting for 1.7% of all deaths in the United States.
- In 2005, data from the U.S. Renal Data System (USRDS) showed that more than 106,000 new patients began therapy for ESRD, while the dialysis population reached 341,000 and the transplant population reached 143,693.

Disclosures

Grant Support

• BSN Jobst

Consultant for

• Covidien, WL Gore, Cook
KDOQI Guidelines

- In 1997, the National Kidney Foundation–Kidney Dialysis Outcomes Quality Initiative (NKF-KDOQI) published clinical practice guidelines
  - an effort to increase the placement of autogenous arteriovenous (AV) access and prolong the use of such access by detecting dysfunction before thrombosis occurs.

KDOQI Guidelines

- guidelines stress
  - early identification of pts with progressive kidney disease
  - id and protection of potential native access sites
  - development of a multifaceted quality assurance program
  - detect at-risk vascular access,
  - track complication rates,
  - implement procedures that maximize access longevity.

- guidelines recommended
  - autogenous AV accesses be constructed in at least 50% AV access
  - ultimately, 40% of patients have autogenous AV access

ESRD

- 2003 National Vascular Access Improvement Initiative established
  - CMS, ESRD Network, Institute for Healthcare Improvement
  - 2005, CMS established Fistula First Breakthrough Initiative (FFBI)
    - goal of increasing the placement of autogenous AV access to meet or exceed the NKF-KDOQI guidelines.
    - identified clinical and organizational changes that could be used
    - identified system changes that could be implemented at a national level
    - including reimbursement of autogenous AV access > prosthetic
    - reimbursement of preoperative vein mapping
    - national rate of autogenous access reached 40% prevalence by Aug 2005
    - June 2007 show a 47% prevalence of autogenous access

Timing of referral to AV access surgeon and timing of placement of permanent vascular access

- Patients with advanced CKD disease
  - (late stage 4, stage 4 CKD (GFR <25), or based on progression of renal disease)
  - who have elected hemodialysis as their choice of renal replacement therapy
  - should be referred to an access surgeon in order to evaluate and plan construction of AV access

- If upper extremity arterial and venous anatomy is adequate
  - autogenous AV access should be constructed as soon as possible
  - and undergo further interventions that may be needed to ensure that the access is ready to be used when dialysis is initiated.

- If a prosthetic access is to be constructed, this should be delayed until just before the need for dialysis.

Temporary Hemodialysis access

- Short-term dialysis catheters
  - Good for pts require acute dialysis < 3 wks
  - double-lumen, noncuffed, nontunneled
  - placed at the bedside
  - without fluoroscopic guidance.
Temporary Hemodialysis access

- Long-term dialysis catheters
  - double-lumen, cuffed, tunneled that are placed with fluoroscopic guidance and are intended to be used for weeks to months.
  - Over to higher blood flow and lower complication rates, access through the right internal jugular vein with the distal catheter tip in the right atrium is preferred, however, left internal jugular and femoral approaches are also suitable.

Complications of Hemodialysis Catheters

- More than half of long-term dialysis catheters need to be removed because of complications such as infection, malfunction, and central venous compromise.
  - Jefferys and colleagues followed 205 catheters placed in 93 patients over a 1-year period and found that the reason for removal was elective in only 47% of patients; removal was necessitated by catheter blockage in 31%, infection in 20%, and cracked catheters in 1% of patients.
  - Other disadvantages include the discomfort of an external device and lower blood-flow rates, leading to longer dialysis times or less effective dialysis.
  - Catheter thrombosis is seen in up to 25% of patients being dialyzed through long-term dialysis catheters.

Preoperative evaluation

- History of
  - peripheral intravenous lines
  - sites of central lines
  - pacemakers and defibrillators
  - previous access procedures
  - trauma or previous nonaccess surgery to the extremity
  - all co-morbid conditions
Preoperative evaluation

- Physical Exam
  - Brachial, radial, and ulnar arteries should be evaluated for compressibility and equality bilaterally.
  - Allen test should be performed to evaluate palmar arch patency. The superficial venous system should be evaluated with and without a venous pressure tourniquet in place, examining for distensibility and interruptions.

Venous evaluation

- Using venous duplex imaging, superficial veins should be examined for diameter, distensibility, and continuity.
  - The minimal acceptable diameter for use was reported to be 2 mm by Mendes and associates, who achieved a successful early maturation rate of 70%.
  - Using a minimal vein diameter of 2.5 mm, Silva and colleagues were able to achieve 63% autogenous access, with a 92% early maturation rate and an 83% 1-year patency rate.

Arterial evaluation

- If abnormality on clinical examination
  - Segmental pressures
  - Pulse volume recordings
  - Duplex ultrasound scanning
  - Arterial requirements
    - No pressure gradient should be noted between the bilateral upper extremities.
    - Arterial diameter should be greater than or equal to 2 mm throughout the extremity.
    - Patent palmar arch

Operative strategies to optimize the placement of autogenous arteriovenous accesses

• Upper Extremity
  • Nondominant arm
  • When access opportunities are equal in both extremities
  • Placed as far distally in the upper extremity as possible
  • Preserve proximal sites for future accesses
  • Lower extremity and body wall access sites last

• Autogenous AV accesses
  • Considered before prosthetic
  • Direct AV anastomosis, venous transpositions, and translocations
Postoperative follow up

- Access should be mature by 12 weeks
- If failing to mature:
  - Should be examined with duplex and/or venography
- Secondary procedures include:
  - Vein patches
  - Interposition vein grafts
  - Vein transposition to proximal arteries
  - Branch ligations
  - Vein superficialization
  - Arterial and venous angioplasties.

Long Term follow up

- Monthly determination of access flow by ultrasound dilution, conductance dilution, thermal dilution, or Doppler technique
- Access flow less than 600 mL/min or access flow less than 1000 mL/min that has decreased by 25% over 4 months should be evaluated with duplex ultrasound followed by fistulogram

Long Term follow up

- Static venous dialysis pressures
  - A graft-to-arterial ratio > 0.75
  - A graft-to-venous ratio < 0.5
  - Increase in venous or arterial segment > 0.25
  - Evaluated with duplex/fistulogram
- Measurements of dynamic venous pressures are a relatively poor marker of autogenous or prosthetic access function.


- Preop duplex US performed in 68% of pts, and venography in 32%
- Autogenous fistula creation rate increased from 61% to 73% in all patients
- And from 66% to 83% in pts undergoing a first access (P <.05).
- Mean maturation time for arteriovenous fistulas was 70 days.
- Functional maturation rate decreased from 73% to 57% (P <.05) after implementation of preoperative imaging and more aggressive vein use.
• 58 consecutive patients with diabetes mellitus after initial autogenous AV access was placed and demonstrated a
  • 70% nonmaturation rate and a 33% primary patency rate for autogenous radial-cephalic wrist direct AV access,
  • a 27% nonmaturation rate and a 78% primary patency rate for autogenous brachial-basilic upper arm transposed AV access,
  • and a 0% nonmaturation rate and a 79% primary patency rate for autogenous brachial-cephalic upper arm direct AV access.

Therefore, when selecting an AV access location in a patient with diabetes mellitus, the surgeon should consider upper arm autogenous AV access the primary choice.