

AV Fistula Maturation, Cannulation, and Protection

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Objectives

- The learner will be able to:
 - Define AV fistula maturation
 - Describe the nephrology caregivers role in maintaining AV fistulas
 - Describe the components of an AV fistula physical assessment
 - Summarize tips suggested for successful cannulation
 - Discuss rationale for vascular access surveillance

What are the KDOQI guideline %s for fistula prevalence

- The 2006 update for the KDOQI guidelines say that >65% of prevalent patients should have a functional AV fistula
- The Clinical Performance Measures (CPM) defines a working fistula as one that can be used for a dialysis treatment with 2 needles

The Fistula First Breakthrough Initiative (FFBI) says that the target % for prevalent working fistulas is $\geq 66\%$ of all access!

How the Vascular Access Team can increase % of working fistulas especially the nurses' role in fistula maintenance.

Fistula First Breakthrough Initiative

The Fistula First Breakthrough Initiative (FFBI) is working on both the nephrology, surgical and interventional barriers to fistula creation and preservation with the physicians!

How well are we doing with the staff and patient education with fistula protection, maturation, and cannulation?

Is cannulation the overlooked variable?

We all know that fistulas ARE the best access because they have fewer complications once established!

However, if we don't get a handle on effective, consistent assessment & cannulation, we will continue to struggle to establish and maintain AVFs!

Types of Fistulas

- Simple (radiocephalic & brachiocephalic)
- Vein transposition (BVT & CVT)
- 2 step - simple then transposition*
- Superficialization of veins by surgical removal of tissue between skin and vein

Post-surgical assessment – every* treatment!

- Overall appearance: edema, hyperemia (redness), bruising, functional abilities
- Skin: incisions (?presence of stitches, staples or drainage), appearance of outflow vein
- Pulses – distal to fistula
- Digits; temperature, capillary refill
- Thrill and bruit along the outflow vein

Arterio-venous fistulas

- basic care
 - maturation exercises (2 weeks postop)
 - protecting the access (from day 1)
 - no IV sticks in that arm
 - no BP cuff (which is why you check at every treatment)
 - no tight clothing or jewelry that “binds”
 - Teach patient to not “sleep” on his fistula arm
 - holds own needle sites (after cannulation begins)
 - removes pressure dressings ASAP
 - ongoing physical assessment, flow and pressure monitoring

Arterio-venous fistulae

- complications
 - inadequate maturation
 - repeated infiltration
 - steal syndrome or nerve damage
 - stenosis
 - thrombosis
 - infection
 - aneurysms/one site-it is
 - high flow vein hypertrophy

Fistula Maturation

- Exercises - might help*, shouldn't hurt but patients should not be told that exercising **WILL** make the vein larger and **WILL** prevent early failure – research is limited
- If I can hear bruit to the elbow with an RC AVF or shoulder in a BC fistula at 2 weeks postop - it's a good sign that the vein will develop (but not guaranteed)

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

Fistula Maturation

- Veins not large enough to cannulate at 6* weeks should be referred to surgeon or interventionalist - there may be collaterals that can be tied off or a fistulogram* may detect stenosis that could be plastied for better flow
- The fistula itself may need to be revised surgically or recreated more proximally on the artery
- Is the artery integrity and cardiac output adequate to expand vein?

Rule of Three 6s for the Vein

- 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

Maturation Time

- How long should you wait till cannulation attempt?
 - in Europe they say 4 weeks that there are no more complications than waiting 8-12 weeks
 - in the US the general wisdom is 8-12 weeks
- Shouldn't it depend on the individual patient's vein development, alternative access situation, and the cannulation expertise of the staff?*

Physical Assessment

- Before EVERY cannulation regardless of AVF age!
- inspection
 - general development
 - skin condition
 - ? aneurysms
 - ? hyperpulsatility (look for collapse of outflow vein with arm elevation)
- palpation
 - thrill or pulsation
- auscultation - quality and amplitude of bruit

Does Cannulation Affect Outcomes?

- One-site-itis leads to aneurysm formation that may require ligation of the fistula outflow vein
- Should a clotted access be stuck to make sure?
- Infiltrations - should they be considered a fact of access life? Compartment syndrome?
- Should an outflow vein be cannulated if recently severely infiltrated?
- Access Infections - do bacteria get a free ride from the careless cannulator?

The Marginal Outflow Vein

- Use a small, single needle initially
- Aggressively treat infiltrations
- Conservatively recannulate
- Get ultrasound mapping for depth and size
- Get fistulagram if generalized swelling occurs*
- Refer back to surgeon for revision options

Patient Preparation

- Cannulation will be more successful, more of the time if you have a relaxed, confident patient:
 - Pain is minimized with relaxation of the muscles
 - ? Local anesthesia using
 - Lidocaine/prilocaine cream
 - Ethyl chloride
 - Lidocaineis a must for the fearful patient until such time as the pain is diminished with trust and scar tissue

Patient Preparation

.....“You know you have to be careful not to make them mad or get a reputation for being a trouble maker – then they might stick you or infiltrate your vessel on purpose. You know that’s happened. I know cases where that’s happened – where technicians have done that.”

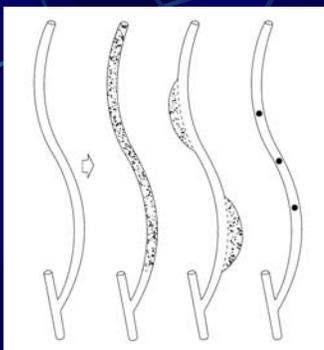
Curtin & Mapes (2001) Health Care Management Strategies of Long-term Dialysis Survivors P389 *NNJ*, 28(4)

Cannulation Techniques

- Rope ladder technique to assure rotation of sites and prevent one-siteitis for grafts and fistulas

OR

- Button Hole technique for fistulas



Use of a single needle at first

- Select your best cannulator
- Choose a 17 gauge needle
- Use for arterial – return to catheter
- To prevent prolonged bleeding or large infiltration
 - Flush and heparin lock the side of catheter not being used early in treatment - ?locking strength
 - Reduce loading dose
 - Turn off heparin at least 1 hour prior to takeoff

Button Hole Technique

- Is the “repeated cannulation into the exact same puncture site, and a scar tissue tunnel tract develops. The scar tissue tunnel tract allows the needle to pass through to the (outflow) vessel of the fistula following the same path each time.”

Patt Petersen, Medisystems

Button Hole Technique

- Cannulation less painful
- Quick and easy cannulation
- Infiltrations and reneedling virtually eliminated
- Infection rate not significantly higher than multi-site cannulation

Twardowski, D&T,1995

For more information on the
buttonhole go to:
<http://www.medisystems.com/hemodialysis/buttonhole/>

Cannulation Controversies

- Tourniquet in the mature fistula?
- Wet stick or dry stick? (infection vs clotting in the needle)
- To clamp or not to clamp
- Who are the cannulators?

Who is the Cannulator?

- Will just anyone do?
- Would you let that person stick you or yours?
- What training should you look for?
- Is there a role for dedicated cannulators*?
- Has the time for self-cannulation arrived?

Variability of Staff Experience

- High staff turnover with many new staff having NO cannulation experience!
- Do technical staff being trained to cannulate have a basic understanding of anatomy & physiology?
- Many staff trained to cannulate PTFE try to cannulate outflow veins with same technique
- Are cannulation challenges assigned to appropriate expertise?

Self-Cannulation

- These patients tell me
 - they are not masochists - they choose to self-cannulate because it is the lesser evil
 - they never hurt themselves (can you tickle yourself?)
 - they rarely miss (infiltrate)
- Teaching tip: show the patient how to stick himself with a small (21g or less) butterfly the first time on a non-dialysis day in a non-threatening atmosphere & location

Lesley's cannulation tips

- carefully inspect, feel, and listen to access
- thoughtfully choose BOTH needle sites before inserting - take your time
 - which side/end is arterial*?
 - where was the previous cannulation site?
 - is there room above to insert again should it not work?
 - where will the tip of the needle be?
 - how deep is the vessel?
 - ? needs local - lidocaine versus Emla cream

Lesley's cannulation tips cont.

- Remember
 - take your time
 - vein and graft walls have different composition
 - ALWAYS use a tourniquet for a fistula
 - use a tourniquet for a "mushy" graft
 - fistulas not as tough as PTFE - be gentle!
 - if at first you don't succeed - get expert help
 - stick unto others as you would have them stick you

Lesley's cannulation tips cont.

- Remember
 - needles don't bend - accesses do
 - rotate sites (unless there are buttonholes)
 - listen to your patient - he's seen the best and the worst and knows his access best
 - flip needles ONLY if flow is poor
 - tape needles securely not tightly
 - take your time

Patient quote

"How is it that they have enough time to stick me 2 or 3 times when they miss - but don't have enough time to do it right the first time?"

Post-Dialysis Access Assessment

- Should mirror pre-dialysis for patency and condition noting any significant changes from the pre-dialysis assessment (therefore should be done by the same caregiver if at all possible)
 - presence of hematoma
 - presence of pain
 - length of time to hemostasis (noting any anticoagulation influences)
 - character of thrill and bruit

Ultrasound Assessment

- Direction of flow
- Can detect stenosis
- Size of vessel
- Depth of access – get serial depths
- Request a ‘map’ and possible marking of skin over vessel
- Get a Site-rite for your unit!

Vascular Access Monitoring

- Effective
 - must get done
 - must minimize false positives - cost & inconvenience
 - must minimize false negatives - loss of access
- Affordable
- User friendly - see #1
- Rational - what are we looking for?

Prospective identification of stenoses

- Flow studies trends
- Static venous pressure (VPO) trends
- Venous dialysis pressure (VDP) trends
- Other signs and symptoms of access pathology
 - recirculation and/or decreased URR
 - difficulty cannulating and pain in the access
 - changes in thrill and bruit
 - prolonged bleeding post-dialysis
 - arm swelling & prominent collaterals
 - sudden appearance of aneurysms

Mechanical Surveillance

- Flow monitoring
 - Static venous pressures
 - Dynamic venous pressures
 - Prepump arterial pressures
 - Blood volume processed (BVP)
 - Online clearance monitoring
- All to prospectively identify stenoses!*

Best Practice Access Monitoring

- second generation K/DOQI guidelines (#10)
- clinical performance measures (CPMs)
- keep using your own assessment skills - don't get machine-reading dependent - *remember to*
 - Use all your senses for assessment and then use your memory to compare and contrast the condition of the access to previous assessments
 - *Listen to what your patient says!*

“Abnormal physical examination findings were the most common sole indication of graft dysfunction.”

Safa et al., *Radiology* 1996; 199:653-657

“when the extremity is elevated the vein will collapse at least partially – with upstream stenosis, the AVF becomes very pulsatile and firm”

Beathard, *Seminars in Dialysis*, 1998, 4:231-236

“By examining the entire length of the AVF, the site of the stenosis can be identified – at this point the pulse diminishes as does the caliber of the vessel.”

Beathard, *Seminars in Dialysis*, 1998, 4:231-236

Do's and Don't's

- DO remember that it's always about the patient!
- DON'T subject that patient to anything you wouldn't let someone do to you!

The Big Push is to
Create

but

The Challenge is to
Maintain!