Needling techniques for vascular access, a key to success

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UK Renal Association Guidelines

- **65%** of incident (new) patients commencing HD with a functioning AVF
- **85%** of prevalent (existing) patients – HD with functioning AVF
- Staph Aureus bacteremia rates < 2.5 /100 HD pts
- MRSA bacteremia < 1/100 HD pts over 2 years
- Pts with Access related complications treated by multi-disciplinary teams, local protocols

Nephrologist / access coordinator/ vasc surgeon/ radiologist

Association Clinical Practice Guidelines Jan 2011

THE RENAL ASSOCIATION
founded 1950

Mortality

- Patients with renal failure have a high mortality
- Cardiovascular disease is the main cause
- 35% at 5 years with the onset of HD
- Mortality worse for patients on dialysis with central venous catheters compared to AV fistulae

Conversion of vascular access type among incident hemodialysis patients: Bradbury et al AJKD 2009

Predictors of early mortality among incident US dialysis patients in the DOPPS Bradbury et al Clin Soc AM Nephrol 2007

Effects of starting hemodialysis with an AVF or CVC compared with PD Coentrao et al BMC Nephrology 2012

DOPPS study 2004

Central Venous Catheters

- Increased cardiovascular mortality
- Increased rate of hospital admissions
- Increased rate of bloodstream infections
- Increased costs compared to patients with AVF's

USRDS ESRD Report 2011, National Kidney Care Audit Vascular Access Report 2011

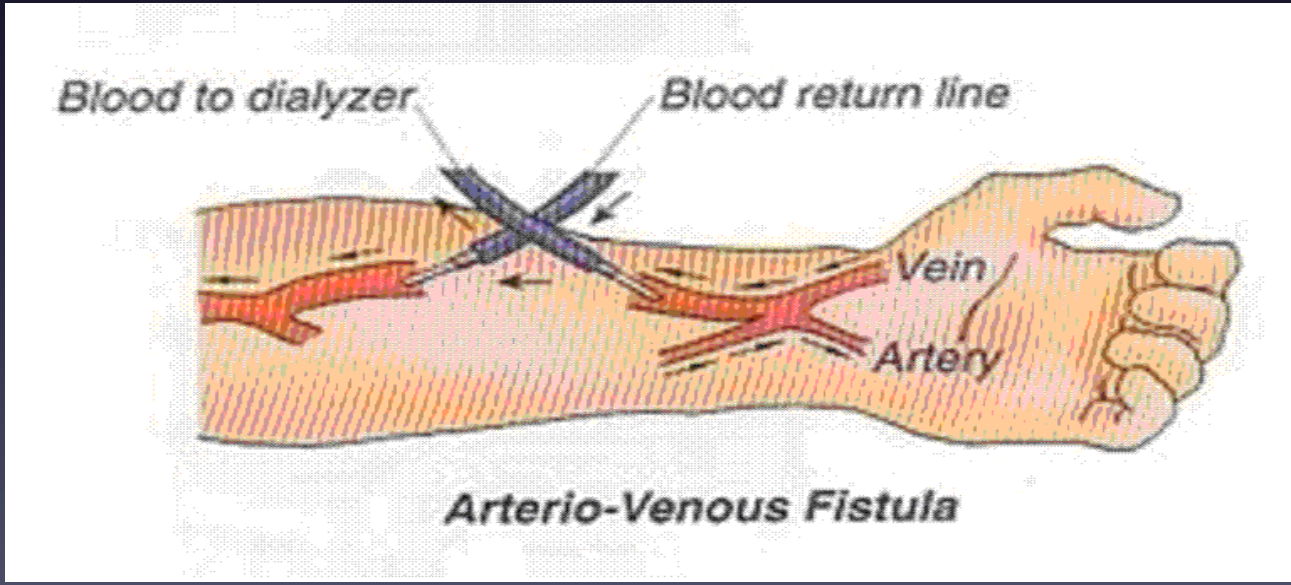
- Increased risk of death 32% *DOPPS Study 2004*

26% at 2 years HD

Outcomes of vascular access for hemodialysis – A systematic review and meta-analysis. Almasri et al JVS 2016

AV fistula

An AVF is formed by joining a artery to a vein



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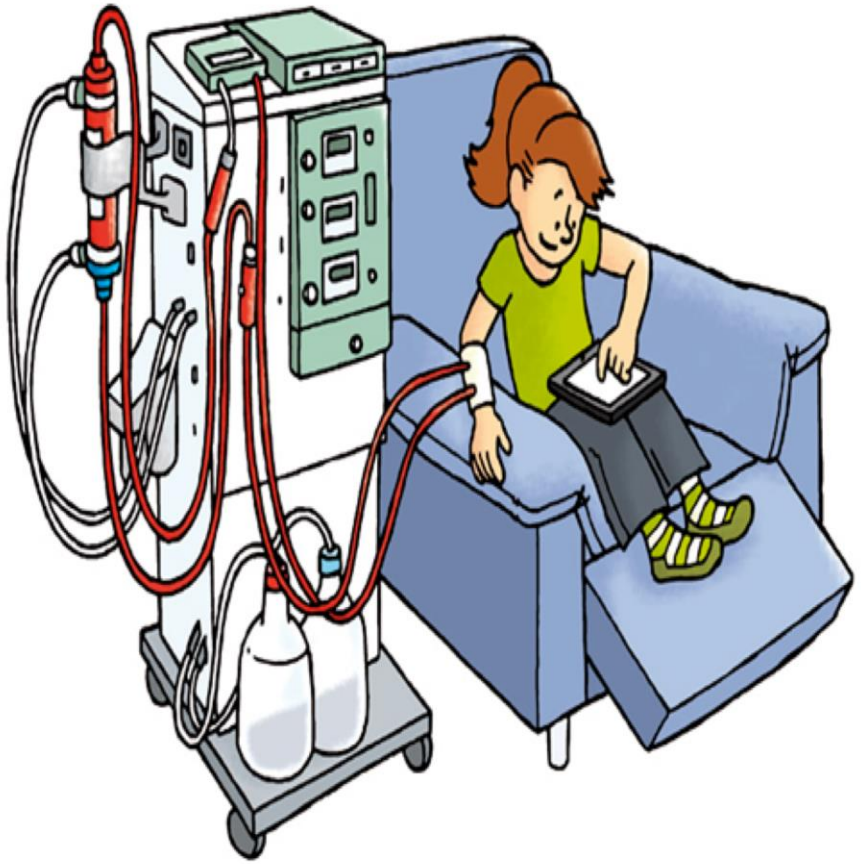
INFORMATION ABOUT A FISTULA



BENEFITS of having an Arterio-Venous fistula

- A fistula is created by using your own vein and artery without the need to use any artificial material
- It is the best form of access for haemodialysis
- Less risk of infection and clotting
- Provides a more efficient dialysis treatment
- Once the surgical wound has healed, there is no restriction in swimming and showering

COMPLICATIONS to watch out for

- **THROMBOSIS** - formation of blood clot inside the blood vessels obstructing/restricting blood flow through the circulatory system
- **STEAL Syndrome** – diversion of arterial supply caused by the fistula associated with tingling sensation +/-numbness and discoloration of fingers
- **STENOSIS** - is an abnormal narrowing in a blood vessel
- **ANEURYSM** - weakness in the wall of the blood vessel (lumpy appearance) or the blood vessel is damaged caused by poor needling techniques

NOTE:

It is very important for you to let the staff rotate needling sites on your fistula. This will help prolong the lifespan of your fistula and will help prevent formation of aneurysm.

Any concerns about your fistula please contact us on number below

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What is a FISTULA?

A fistula is an artery joined to a vein. This is done surgically under the skin either in the wrist or the elbow.

The artery takes blood flow away from the heart and the vein takes blood flow back to the heart. When the fistula has been made more blood will be flowing to your vein making it larger overtime.

It usually takes 6-8 weeks for the fistula to mature and to be ready to use for dialysis.

PROCESS of having a fistula:

Once you have decided to have haemodialysis as a form of renal replacement therapy you should start preserving (**not use for taking blood samples and doing blood pressure**) your non-dominant arm. This will give the surgeons better options on where to create a fistula.

Also, you will be scheduled for the following:

Pre-Operative Preparation:

- You will be referred to see a vascular surgeon with the vascular nurse in clinic for assessment and discussion of your operation
- Referral for an ultrasound scan (Doppler) of veins in your arm as necessary
- MRSA screening swabs for pre admission preparation as per hospital protocol
- You may be advised to exercise your hand/arm muscles by squeezing a rubber/stress ball
- Pre-operative assessment by the vascular nurse and a renal doctor which will include ECG and bloods. This will be done as soon as you have been booked for the operation

Post-Operative Care:

Here are some basic but very important tips on how to care and protect a fistula.

- Check for a **"thrill"** which is a buzzing sensation you feel upon placing your hand over the fistula area. This needs to be done every day.
- Check and observe your fistula and your fistula hand for any discoloration (*i.e* redness in area; blue fingers), change in temperature (*i.e* cold or warm to touch) and/or change in sensation (*i.e.* tingling sensation and numbness). If you are concerned with any of these contact the vascular nurses or the renal ward.
- The fistula arm should be elevated to help reduce the swelling.
- You may experience pain in discomfort after surgery. To help ease the pain you can take pain killers e.g. Paracetamol 1 gram.
- Your new fistula needs to be cleaned (change dressing) and assessed (listen for a "bruit") by the vascular nurse in the hospital 3 days after you had it done.
- Allow at least 2 weeks post-surgery before you may drive.
- Avoid leaning (*i.e.* sleeping) and applying pressure (*i.e.* bandages) on the fistula arm. Avoid wearing a watch or jewellery as this may restrict the flow on the fistula.
- Avoid heavy lifting with your fistula arm.
- Do not let anybody take blood samples on your fistula and blood pressure on your fistula arm.
- If possible, monitor your blood pressure at least once a week. If the top number (systolic) is below 100 drink about 2 cups of water and recheck again after an hour.

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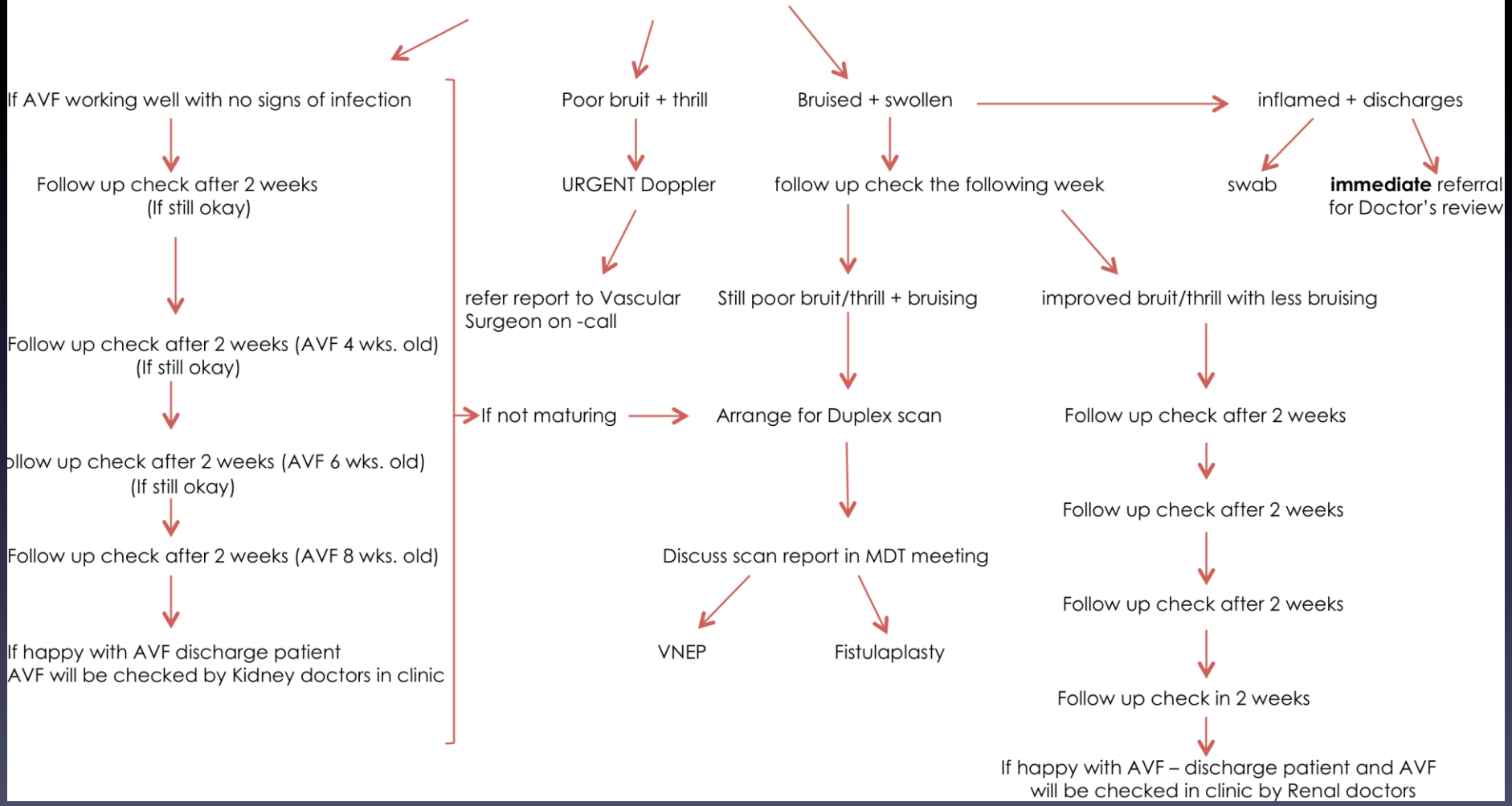
AVF CHECK

(From 3 days old post OP check to 8 week old check)



Recommended flow rate thresholds

Native AVF	PTFE Graft	(In mls / minute)
0 – 500	0 – 600	Critical flow level probably significant stenosis
500 – 800	600 - 1000	Lower flow threshold potential stenosis
800 – 2000	1000 – 2000	Adequate flow
>2000	>2000	Upper flow threshold potential cardiac overload

NKF-KDOQI guidelines 2006 updates

Rule of 6's

- AVF **6** weeks after creation
- Flow **>600** mls / min
- Should be **6** mm in diameter
- Should be < **6** mm from the skin surface

The National Kidney Foundation Kidney Disease Outcomes Quality Initiative

(NKF KDOQI) - Vascular Access Guidelines 2006

Problem Indicators

- Increase in venous pressure
- Changes in arterial pressure
- Prolonged bleeding
- Decrease in Kt/v or URR
- Change in thrill / bruit
- Abnormal transonic flow
- Signs of infection / inflammation
- Needling difficulties
- Aneurysmal change

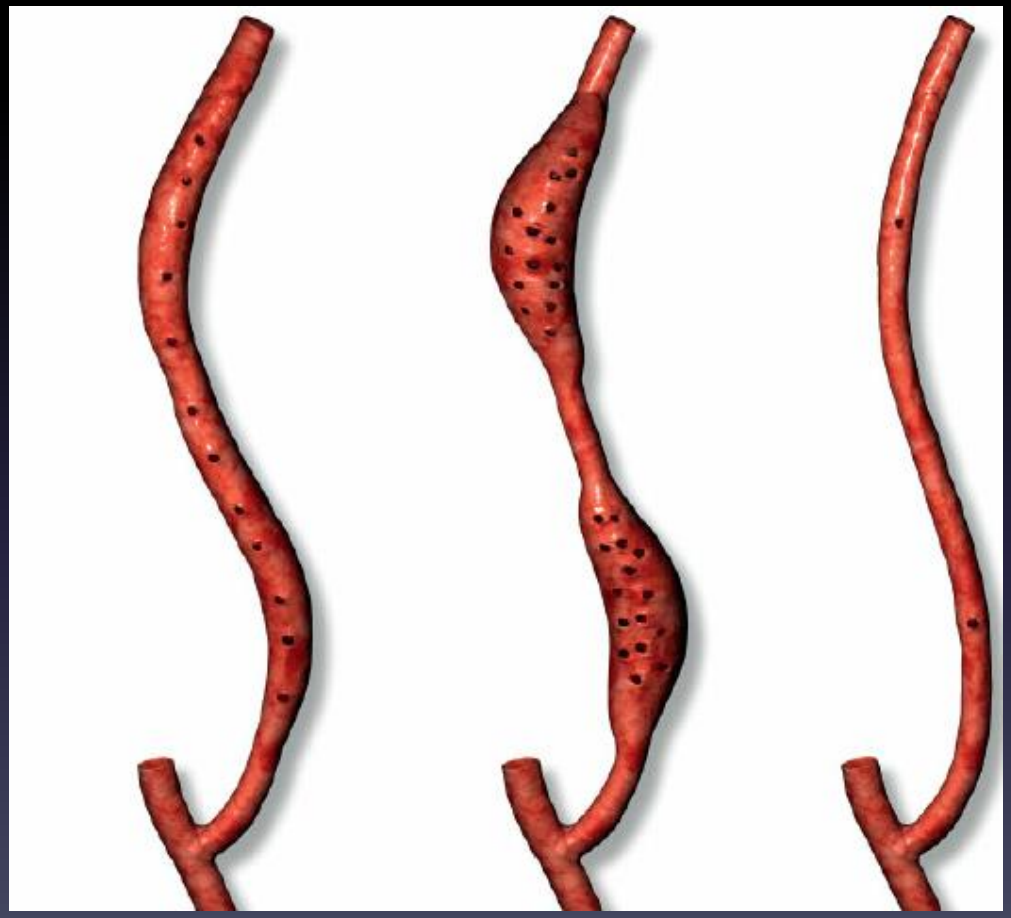
How and when to needle

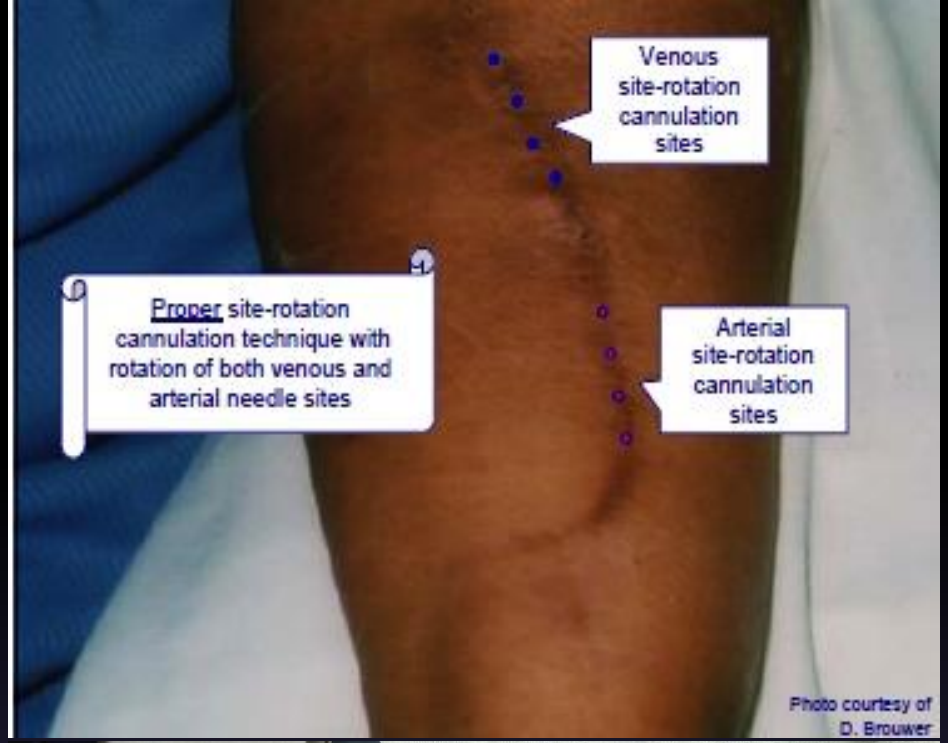
- A newly formed fistula cannot be needled until it is mature, usually 4-6 weeks after formation.
- Tourniquets should always be used when needling AVF's.
- Start to cannulate AVF using 25 degree bevel up
- Use Ultrasound to assist in difficult cannulation

Recommendation 34-37 Level B/C evidence. / 6.3.2.2 Ultrasound assisted cannulation
Vascular Access 2018: Clinical Practice Guidelines of the ESVS. Schmidli et al EJVES June 2018

Needling techniques

- Rope Ladder
- Area Puncture
- Button hole





Rope ladder technique

- Utilising the whole length of the AVF / AVG

- Moving needling site up or down the vessel by 2cm each HD session


FISTULA LEFT

Rope Ladder Technique

Advantages

- Utilises whole of AVF
- Encourages AVF maturation with dilation of the vessel over a long segment
- Prevents aneurysm formation
- Preserves life of AVF / AVG

Disadvantages

- Easily becomes Area Puncture
- Can take more time with less mature AVF
- Difficult with short brachial cephalic AVF due to limited vessel length

Plastic deformation of Cimino Fistula by repeated puncture Kronung G. Dial Transpl 1984

Button hole technique

- Constant site
- Tract created by the same needler - needling the same site over approx 6 sessions using a sharp needle.
- Subsequent needling once tract is created is by using a blunt needle

Button hole technique

Advantages

- Less painful
- Easier needling once tract created – ideal for self needling /home/daily
- Less / no aneurysm formation
- Prolongs life of AVF

Disadvantages

- Infection / Bacteraemia
- Bleeding from 'false' tract if sharp needles once tract formed
- NOT FOR USE WITH AVG

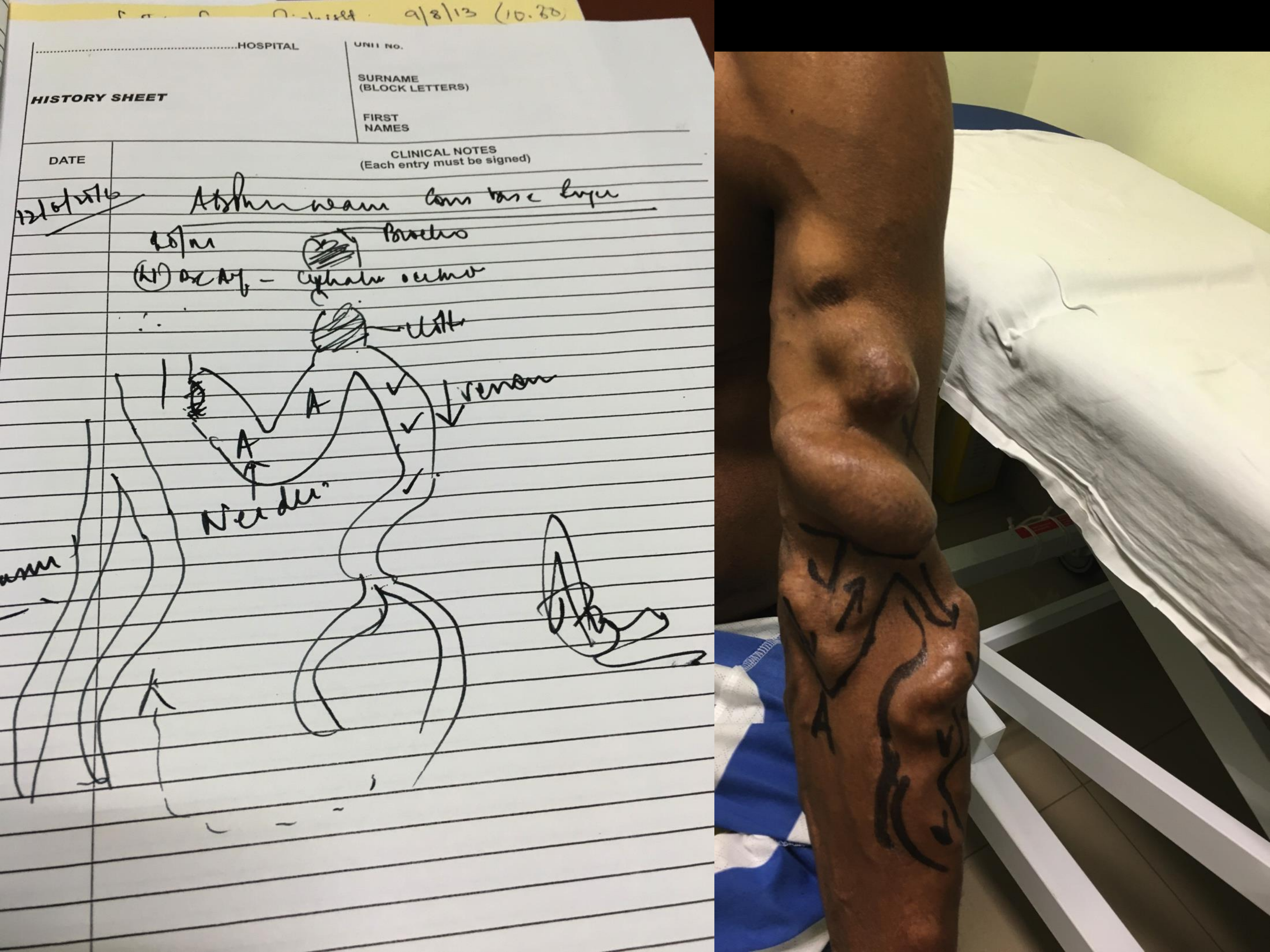
RCT of Button hole cannualtion for the prevention of fistula access complications Chow et al Jr Ren care 2011
RCT comparing Buttonhole with Ropeladder needling in conventional HD McCrae J et al Clin Jr Am Soc Nephrol 2012

Area puncture

- Causes aneurysms, pseudo-aneurysm and stenosis
- 'Difficult' AVF / AVG
- Easy?
- Patient preference
- Poor and yet commonest practice

Vascular Access management II AVF/AVG Cannulation. McCann M et al Jr Ren Care 2009


F-M
J-P
Q-W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(Each entry must be signed)

Literature review

The quality of the evidence is poor. RCT data are scant and contradictory.

Patient survival	No difference *(MacRae J AVF survival & needling AJKD 2014)*
Access survival	No difference *(MacRae J AVF survival & needling AJKD 2014)*
Thrombosis	No difference *(MacRae J AJKD 2014)*
Quality of life	No difference *(Chow J RCT buttonhole Jr Ren Care 2011)*
Pain	Less pain with buttonhole technique *(Chow J J Ren Care 2011)*
Infection	Rare compared to CVC, however 3 fold increase with buttonhole technique. *(Muir CA Buttonhole outcomes CJASN 2014)*
Haemostasis	Shorter time with buttonhole technique *(MacRae J CJASN 2012)*
Haematoma	Less common with buttonhole technique *(MacRae J RCT buttonhole vs ropeladder CJASN 2012)*
Aneurysm	Less common with buttonhole technique *(Vaux E AJKD 2013)*

Vascular Access 2018: Clinical Practice Guidelines of the ESVS. Schmidli et al EJVES June 2018

Conclusion

- AV fistulas should be cannulated by rope ladder or buttonhole, never area puncture.
- Choice - type and site of access, home versus in-centre haemodialysis and experience.
- AV grafts should be cannulated using rope ladder not button hole
- Short cannulation segment – button hole

Vascular Access 2018: Clinical Practice Guidelines of the ESVS. Schmidli et al EJVES June 2018

Kumwenda M - Clinical practice guideline - Vascular access for haemodialysis 6th Edition.

https://renal.org/wp-content/uploads/2017/06/vascular-access.pdf.

Future research

- Long term RCTs are needed comparing cannulation techniques.
- Such studies should measure pain and be adequately powered for infection, aneurysm, patency and quality of life scores.