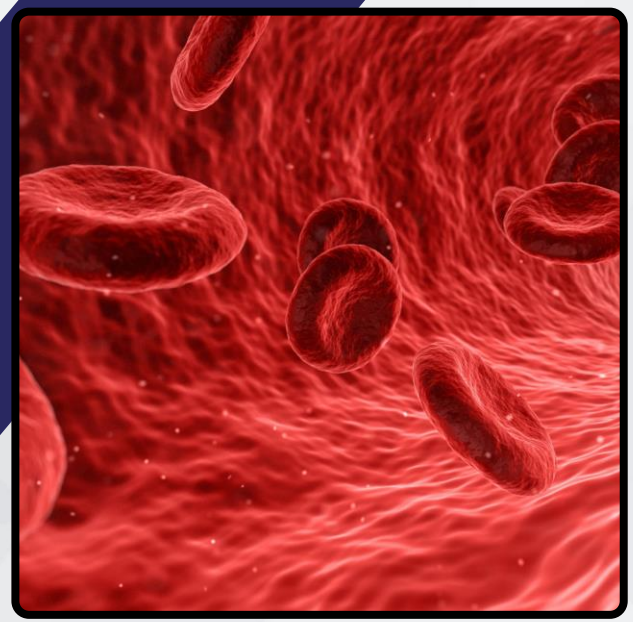
彰化基督教醫院
CHANGHUA CHRISTIAN MEDICAL FOUNDATION
CHANGHUA CHRISTIAN HOSPITAL

血管通路-

腎臟科團隊可以做甚麼?



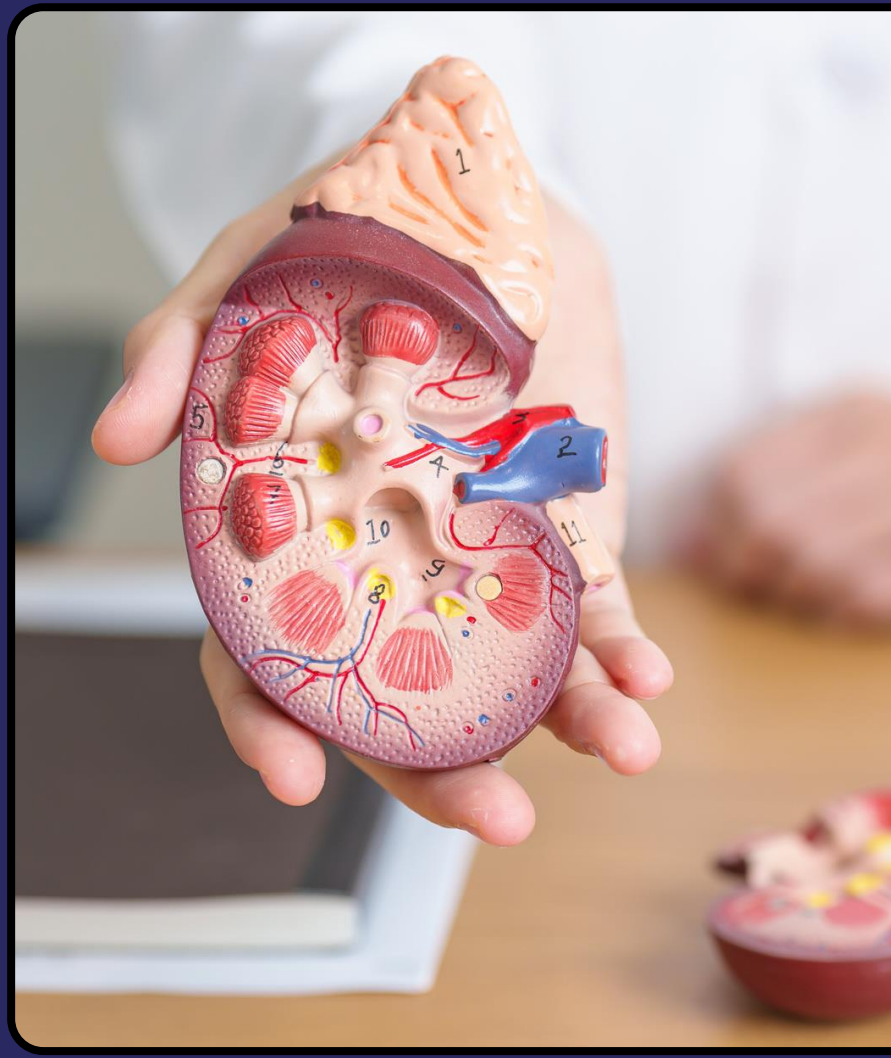
彰化基督教醫院

腎臟科 蔡俊傑醫師

素材來源：Canva

Patient profile

- Chart number :3940 OOO
- Name : 李O義
- Sex :male
- Age : 66 y/o
- Admission : 2018/09/14 first admission for post transplantation care
- Hight :157cm
- Weight :63.2kg
- Social history : smoking(-)alcohol(-), tobacco(-)
- Job : retired Businessman



素材來源：Canva

Underlying disease

1.ESRD under regular hemodialysis via right Hickmen(2017/09/06~) on QW2,4,6, post renal transplant on 2018-08-30

2.Right Internal carotid artery total occlusion& Left Internal carotid artery stenosis s/p stenting on 2018-4-12

3. Type 2 diabetes mellitus

4.CAD-3VD with m-RCA lesion, d-RCA CTO, and OM lesion s/p successful percutaneous coronary intervention with POBA plus drug eluting balloon for middle, distal RCA, and OM on 2018-02-02

5.HBV related liver cirrhosis s/p liver transplantation in 2010

6Hypertension

Attending Doctor	1520566 李中毅		
Anesthetist	1520470 謝安凱	Date	2018-01-22
Anesthesia	General		

Preoperative Diagnosis

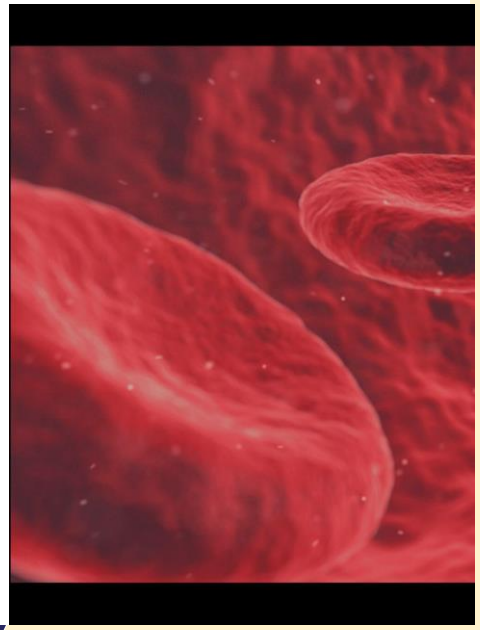
End stage renal disease

Operation Method

1. open Thrombectomy of AV fistiula , left upperarm
2. PTA to stenotic lesion of AV fistula
3. PTA to A junction of AV fistula , left

Postoperation Diagnosis

1. AV fistula occlusion , left upperarm
2. Immatured AV fistula , left upperarm
3. A-junction of AV fistula stenosis, left upperarm



素材來源：Canva

2021 Active problem

- Post kidney transplantation with BK nephroapthy (BKV (serum)1/18: 187954; BKV urine 1/22:>15554000), and CKD stage V
- Interstitial pneumonitis with Severe diffusion impairment (lung function test on 2020.12.29) under steroid usage
- Urinary bladder urothelial carcinoma, stage cT1N0M0 s/p(status post)Transurethral resection of bladder tumor (laser) on 2020-07-07 and Mitonco 30mg bladder irrigation on 2020-07-08, suspect recurrent on 2021.01.18, post TURBT on 2021.01.21
- Type 2 diabetes mellitus

- 2021.1.13-2021.02.10

Uremic encephalopathy

--> post Hickman insertion on 2021.01.26 and initiate HD since 2021.01.27

- 2021.03.01: stop HD and create Right radiocephalic vein AVF
- 2021.03.22: remove permcath
- 2021.04.12-2021.05.01

  Uuremic encephalopathy with seizure

  -->Restart HD

  -->Replace permcath on left IJV

- 2021.06

  Poor function of Permcath (紅藍端互換）

  AVF : poor thrill

- 2021.06.28: PTA

  Focal stenosis was identified over distal cephalic vein area, which causing contrast stagnant and poor distal enhancement. After 5 -mm balloon dilation, the stenosis released, the contrast wash out fast with good distal enhancment. Right innominate vein CTO --> fail to PTA

- 2021.07.27:
  try puncture of AVF(V), Permcath (A)

- 2021.08.17:
  infiltration over puncture site;
  HD from Permcath
- 2021. 8.31:
  Try shunt again
- 2021.09.06: refuse PTA in CVS clinic

- 2021.09.14: one puncture (V): high vein pressure
- 2021.10.05: try 2 puncture
- 2021.10.19:easily echymosis, hand swelling and decreased thrill
  (use Permcath again)

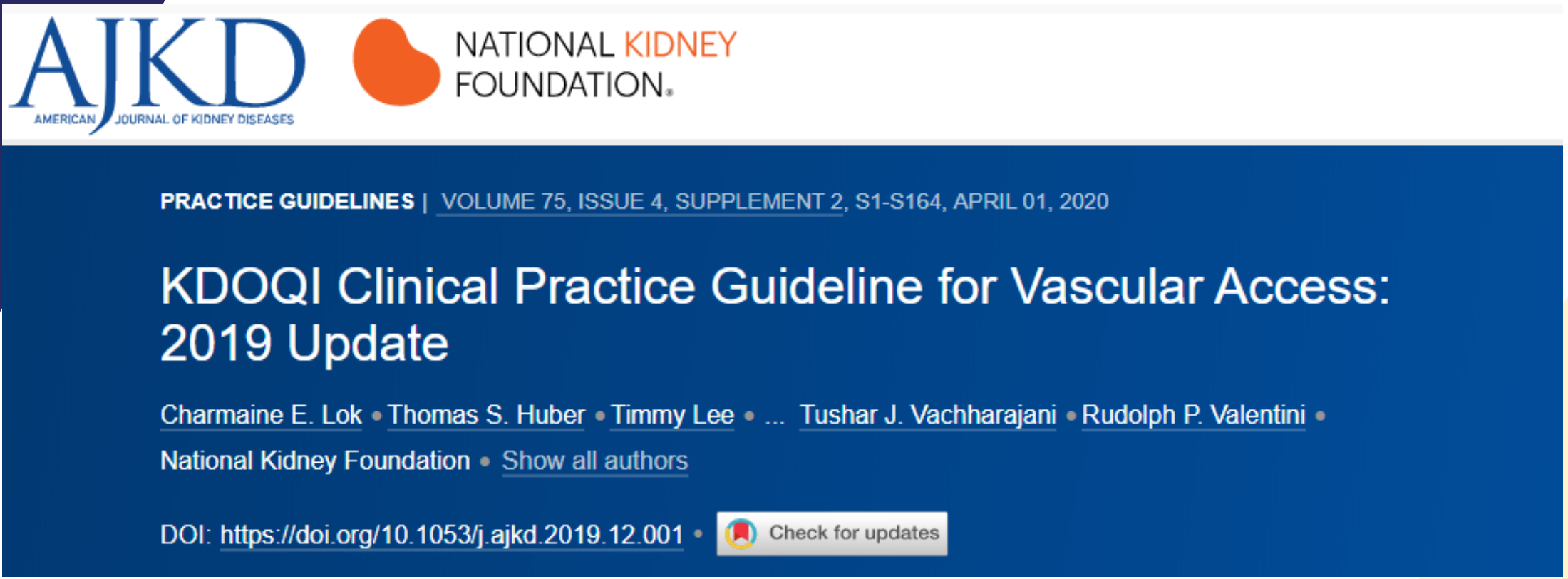
- 2021.11.19: One puncture of AVF (V); Permcath (resistant when draw blood)

- 2021.11.25:
  ESRD, right wrist radio-cephalic AVF dysfunction (right innominate vein CTO)

下一步?

- 瘻管建立選擇
  - 時機
  - AVF VS AVG VS CVC
  - Succession Plan (下一個通路)
- 外科醫師瘻管建立考慮因素
- 瘻管建立後
  - 衛教病患運動
  - 教導病患評估瘻管併發症
  - 洗腎室上針

- 瘻管建立選擇
  - 時機
  - AVF VS AVG VS CVC
  - Succession Plan (下一個通路)
- 外科醫師瘻管建立考慮因素
- 瘻管建立後
  - 衛教病患運動
  - 教導病患評估瘻管併發症
  - 洗腎室上針


AJKD
AMERICAN JOURNAL OF KIDNEY DISEASES
NATIONAL KIDNEY FOUNDATION.
PRACTICE GUIDELINES | VOLUME 75, ISSUE 4, SUPPLEMENT 2, S1-S164, APRIL 01, 2020
KDOQI Clinical Practice Guideline for Vascular Access: 2019 Update
Charmaine E. Lok • Thomas S. Huber • Timmy Lee • ... Tushar J. Vachharajani • Rudolph P. Valentini •
National Kidney Foundation • Show all authors
DOI: https://doi.org/10.1053/j.ajkd.2019.12.001 •
Check for updates

VASCULAR ACCESS

Endstage Kidney Disease (ESKD) Life-Plan

NATIONAL KIDNEY FOUNDATION®

Establish an ESKD Life-Plan if your patient has any of the following:

CPG 1.1

- Progressive CKD
- eGFR 15-20 ml/min/1.73m^2

or

- Already on hemodialysis
- Already on peritoneal dialysis
- Already has a kidney transplant

This individualized patient ESKD Life-Plan should be regularly reviewed, updated and documented in the patient's medical record

ESKD Life-Plan Review and Update

Who does it?

- Members of the health care team and patient

When is it done?

- Once a year (and more frequently as clinically indicated)

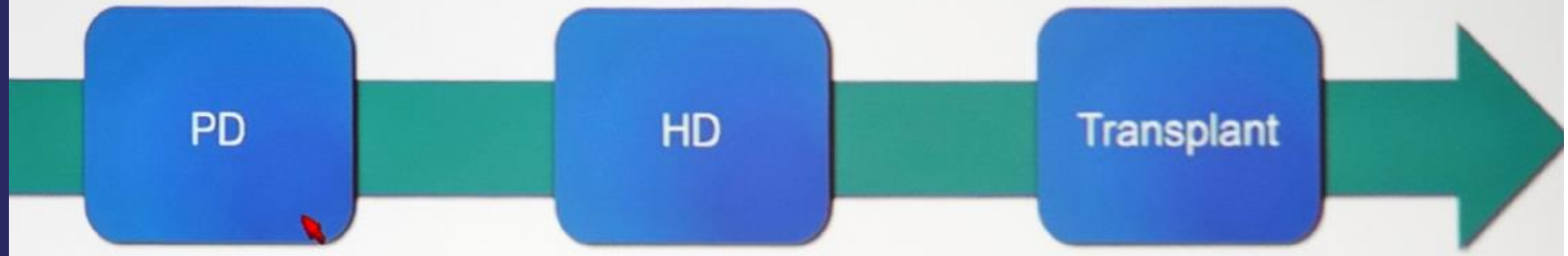
CPG 1.2

Patient's Vascular Access should be reviewed quarterly to determine:

- Function of vascular access
- Complications and risks of complications
- Future dialysis access options

CPG 1.3

A key CONCEPT: ESKD Life-Plan



ESKD is part of the CKD continuum

Within ESKD, a patient is anticipated to have a continuum of therapies to help optimize their life - their ESKD Life-Plan

ESKD Life-Plan

Date Completed:_____

Patient Name: 56 yo M, right handed, ESRD due to HTN, PVD, GFR 15 ml/min, limited social support and lives in social support housing

Addressograph

Primary Nephrologist: _____ Phone: _____

Primary Interventionalist: _____ Phone: _____

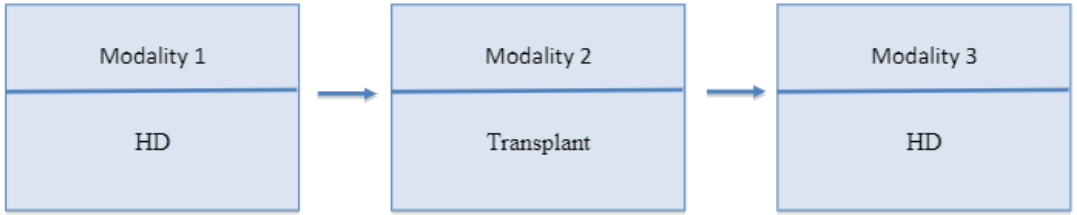
Primary Surgeon: _____ Phone: _____

Primary Care Practitioner: _____ Phone: _____

Emergency Contact: _____ Phone: _____

Key Notes: _____

Language(s) Spoken: _____ Translator required: _____



Access Strategy	Access Strategy	Access Strategy
1. Radio-cephalic AVF (L)*	1. Preserve HD current vascular access	*Note: Would be re-evaluated during time with transplant*
2. Forearm loop graft (L)	2. Protect peripheral and central veins	Goal: to re-start HD with a functioning AV access
3. Brachiocephalic AVF (L)	3. Re-evaluate once receives transplant	
*Deceased donor transplant list	4. Evaluation for AV-access if transplant failing	

I gave input into my ESKD Life-Plan, understand it and agree to it.

I have discussed the RRT options and associated dialysis access strategies with the patient and answered their questions to their satisfaction and understanding

_____
Patient signature

_____
Health care professional signature

This is an annual update: ☐ Yes ☐ No

Has the ESKD Life-Plan changed since the last review: ☐ Yes ☐ No

If YES, the ESKD Life-Plan has changed, fill out a new ESKD Life-Plan document


Update prior messages
FISTULA FIRST
CATHETERS LAST

How?.....P-L-A-N

- **P**atient
- **L**ife-Plan

1

Patient First

What is the Patient's ESKD Life-Plan?

How?.....P-L-A-N

- Access
- Needs

2

What is the Patient's Access Creation Plan

How?.....P-L-A-N

- Access
- Needs

3

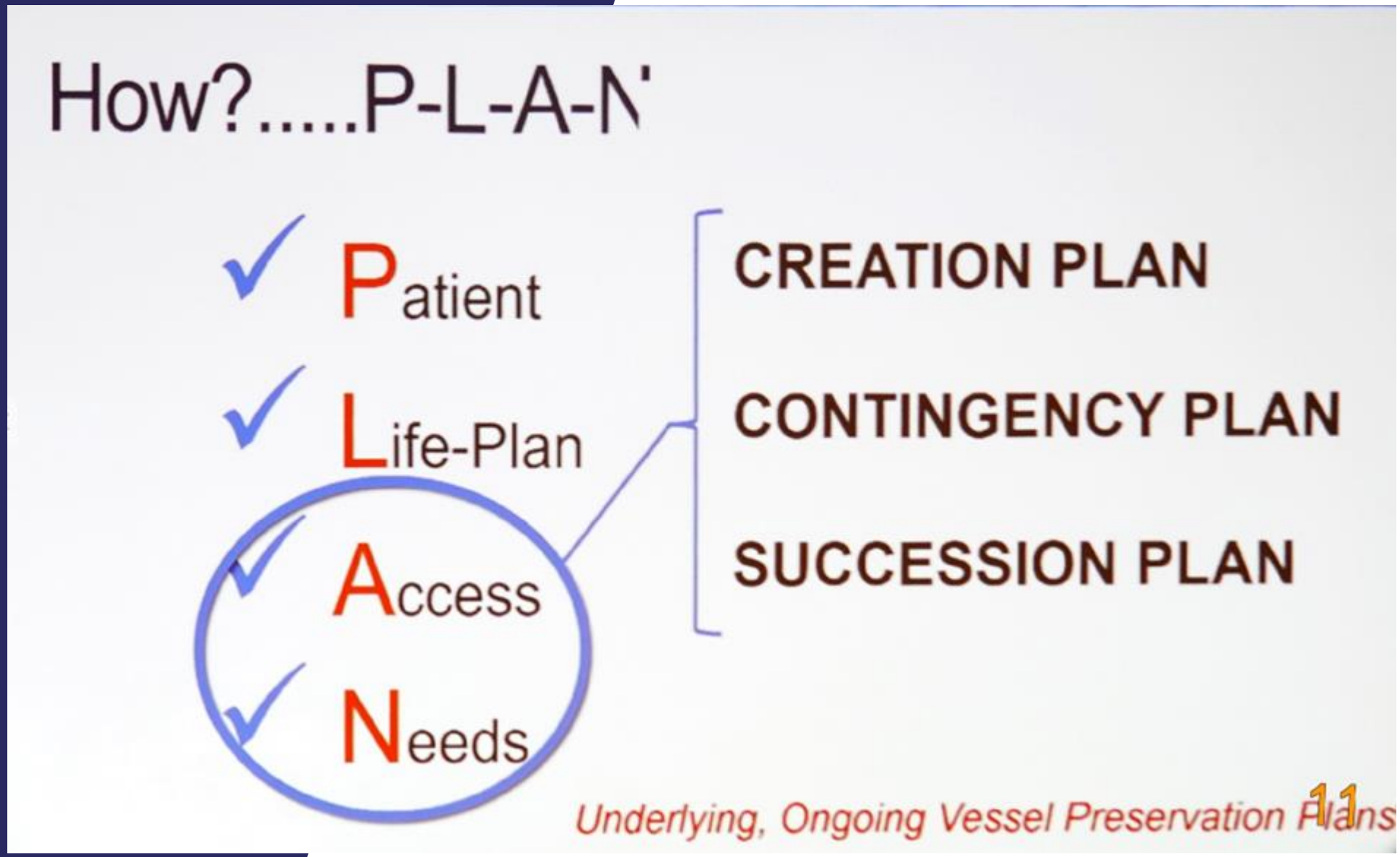
What is the Patient's
Access Contingency Plan

How?.....P-L-A-N

- Access
- Needs

4

What is the Patient's Access Succession Plan


How?.....P-L-A-N
Patient
Life-Plan
Access
Needs
CREATION PLAN
CONTINGENCY PLAN
SUCCESSION PLAN
Underlying, Ongoing Vessel Preservation Plans
11

Initial steps to achieving a functional access

- For starters…. Save the veins
  - Avoid phlebotomy at antecubital space
  - Avoid PICC lines
  - Avoid unnecessary blood tests

ASN KIDNEY WEEK

Prior Dialysis Access (Vascular access or PD catheter)	1	2	3
Date of Creation/ insertion			
List associated complications, if any			

Current Access:

- ☐ None
- ☐ Right
- ☐ AV Fistula
- ☐ Yes
- ☐ Left
- ☐ AV Graft
- ☐ Tunneled CVC
- ☐ Other:

Reason for Referral

Creation of Fistula or Graft

- ☐ Expected hemodialysis start ≤ 6 months
- ☐ Expected hemodialysis start > 6 months
- ☐ Other: on dialysis

Existing Fistula and Graft

- ☐ Maturation failure requiring revision
- ☐ Anticipated aneurysm rupture
- ☐ Severe limb threatening ischemia from steal syndrome
- ☐ Thrombosis of graft/fistula
- ☐ Infected graft/fistula
- ☐ Other: Click or tap here to enter text.

Other Information

- ☐ Patient expected to self-cannulate
- ☐ Right-handed
- ☐ Left-handed
- ☐ Patient is on anticoagulation/ antiplatelet agents
- ☐ Others: Click or tap here to enter text.

Comments:

☐ Other: Click or tap here to enter text.

- 瘻管建立選擇
  - 時機
  - AVF VS AVG VS CVC
  - Succession Plan (下一個通路)
- 外科醫師瘻管建立考慮因素
- 瘻管建立後
  - 衛教病患運動
  - 教導病患評估瘻管併發症
  - 洗腎室上針

VASCULAR ACCESS

What the Surgeon Needs to Know: New AV access creation and follow-up

NATIONAL KIDNEY FOUNDATION®

New AV Access Creation & Follow up: Best Practices for Surgeons

Initial Office Visit Checklist

☐ **Obtain information to guide vascular access procedure selection**

- Review referral, including ESKD Life-Plan
- History (include: timing, co-morbidities, body mass index [BMI], patient preference)
- Physical Examination
- Vessel mapping to assess arteries and veins of select patients with risk factors (see Table 7.2)

CPG 1, 6

☐ **Choose the most appropriate vascular access procedure for that patient based on his/her specific clinical situation**

- Consider using the My Vascular Access mobile app to guide choice (www.myvascularaccess.com)
- Consider other evaluation tools

CPG 2.4, 7.1-7.5

☐ **Select a primary access that considers secondary access options. The secondary procedure will be included in the patient's "ESKD Life-Plan" and will be the backup procedure should the primary AV access fail. During follow-up of the primary AV access, the care team will also evaluate the secondary option to decide if it is still appropriate.**

CPG 1.1

Table 7.2. Examples of Risk Factors For Which Vessel Mapping May Be Beneficial

Clinical Problem	Risk Factors
Fistula failure	Elderly age, female, comorbidities (eg, peripheral vascular disease, coronary artery disease), small pediatric patients
Peripheral vessel damage	Ipsilateral: PICC insertion, other iatrogenic (eg, venipuncture), self-inflicted (eg, IVDU), disease states (eg, vasculitis), radial artery harvesting for CABG
Central venous stenosis	Multiple CVCs; prolonged CVC duration; cardiac implantable electronic device; PICC; surgery or trauma to neck, chest, upper extremity
Limitations to physical examination	Morbid obesity, suboptimal conditions (eg, patient dehydrated or vasoconstricted), poor skin integrity, patient refusal

Note: When central venous stenosis is suspected, ultrasound has low sensitivity for detecting central vein stenosis, and venogram should be performed when possible to confirm and locate lesions.
Abbreviations: CABG, coronary artery bypass graft; CVC, central venous catheter; IVDU, intravenous drug use; PICC, peripherally inserted catheter central.

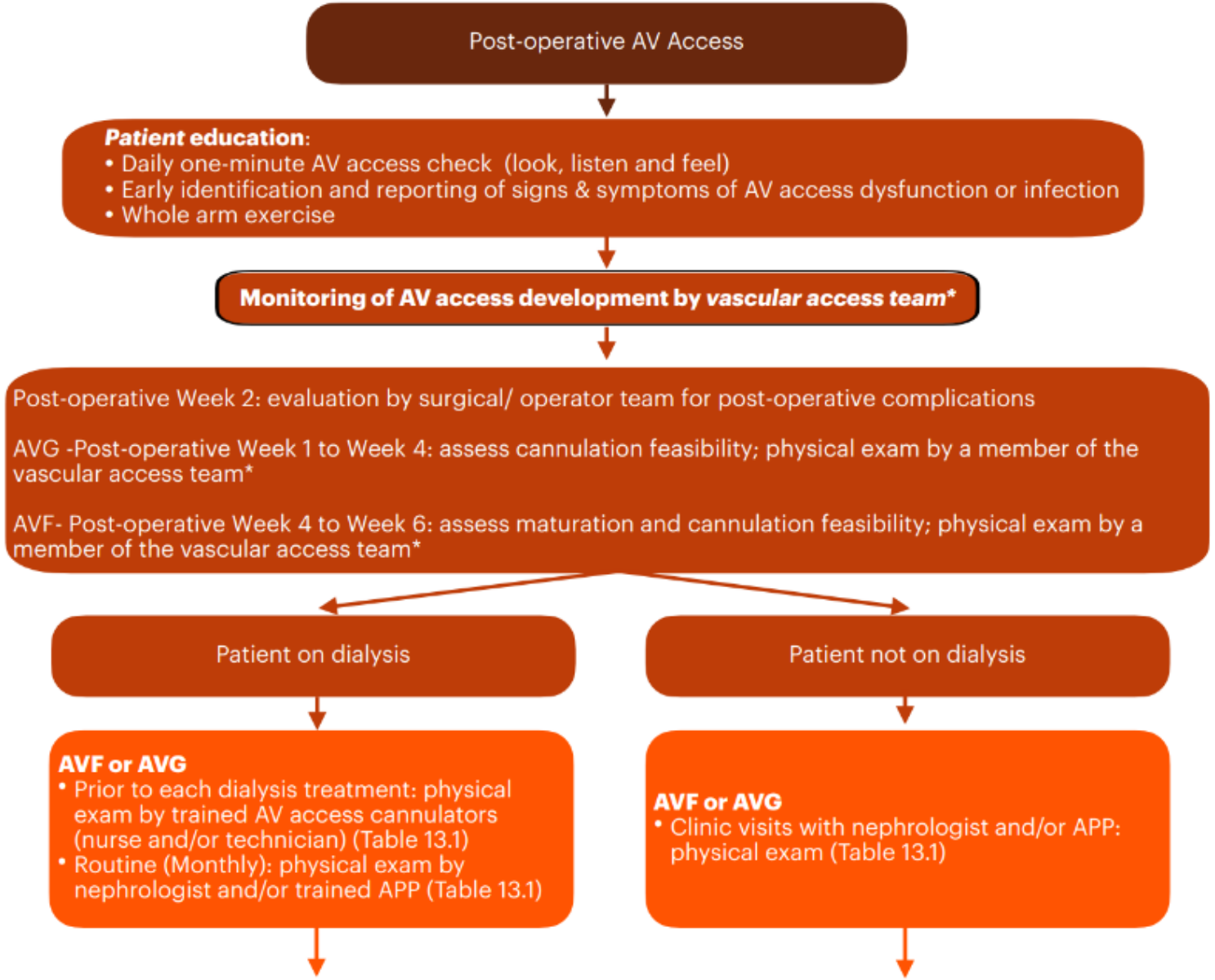
Risk Factors for Vascular Access Failure (Select all that apply)

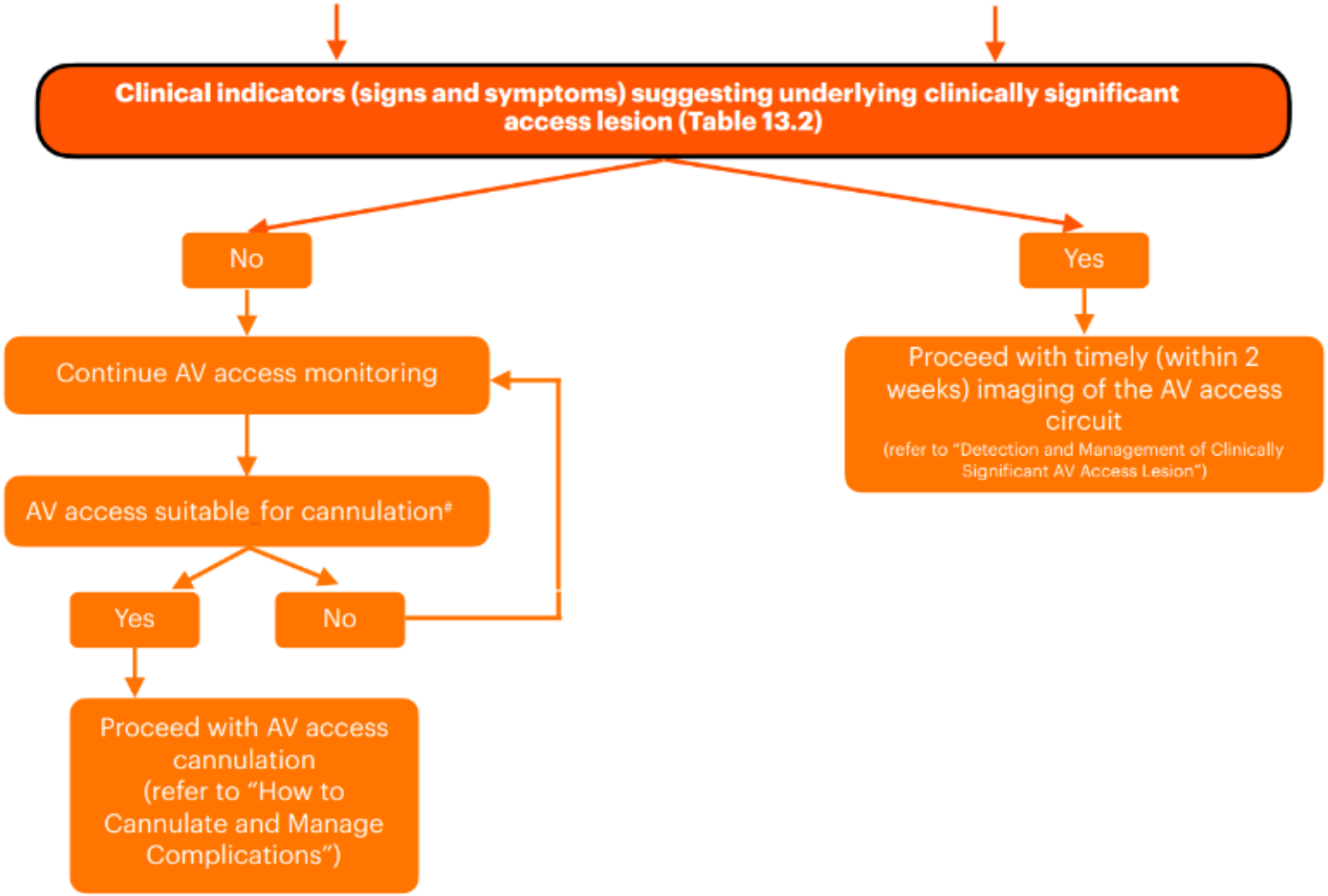
- ☐ Peripheral vascular disease
- ☐ Coronary artery disease
- ☐ Diabetes
- ☐ Medical history of CHF or known LV dysfunction
- ☐ BMI > 30
- ☐ Age > 65 years old
- ☐ Previous catheter use, pacemaker or other risk factors for central venous stenosis
- ☐ Previous failed fistula or graft
- ☐ Other: Click or tap here to enter text.

NATIONAL KIDNEY FOUNDATION®

Flow Diagram 10

CPG 10, 13





*Vascular access team members: nephrologist, interventionalist, surgeon/operator, vascular access coordinator.
#AV access suitable for cannulation when there is: absent or mild local erythema, absent or mild local edema; AVF with well-developed vein as assessed by an experienced cannulator; appropriate bruit (AVG) and thrill (AVF). For AVF, expect maturation and cannulation feasibility during post-operative Week 4 to Week 6. For AVG, expect cannulation feasibility during post-operative Week 1 to Week 4, depending on graft material.

Perioperative Evaluation Checklist

- [ ] **All AV access – identify and manage any infection risks**

CPG 8.1

- [ ] **For AV Grafts consider oral fish oil supplementation to enhance early AV graft patency**
  - provide info on dose (EPA 400 and DHA 200 /capsule; 4 capsules/day)

CPG 14.6

Postoperative Evaluation Checklist

- [ ] **Initial 2 weeks – follow-up and assess for complications**
  - Infection
  - Persistent pain
  - Limb swelling
  - Nerve dysfunction
  - Symptomatic steal
  - AV access patency

CPG 1.1, 10.1, 15.10

- [ ] **4-6 weeks (AV fistula only) – Evaluate AV fistula for maturation**
  - If the AV fistula is not matured, develop a follow-up timetable and intervention plan with the goal of achieving a functional access.
  - In considering the intervention plan for the primary AV access, consider impact on secondary AV access options.

- 瘻管建立選擇
  - 時機
  - AVF VS AVG VS CVC
  - Succession Plan (下一個通路)
- 外科醫師瘻管建立考慮因素
- 瘻管建立後
  - **衛教病患運動**
  - 教導病患評估瘻管併發症
  - 洗腎室上針

J Vasc Access 2013; 14 (3): 239-244
DOI: 10.5301/jva.5000123

ORIGINAL ARTICLE

Assessment of effects of upper extremity exercise with arm tourniquet on maturity of arteriovenous fistula in hemodialysis patients

Fereshteh Salimi[1], Gilda Majd Nassiri[1], Maryam Moradi[2], Amir Keshavarzian[3], Ziba Farajzadegan[4], Mohammad Saleki[5], Azimeh Nikpoor[6], Massoomeh Ghane[6]

[1]Department of Vascular Surgery, Isfahan University of Medical Sciences, Isfahan - Iran

ABSTRACT

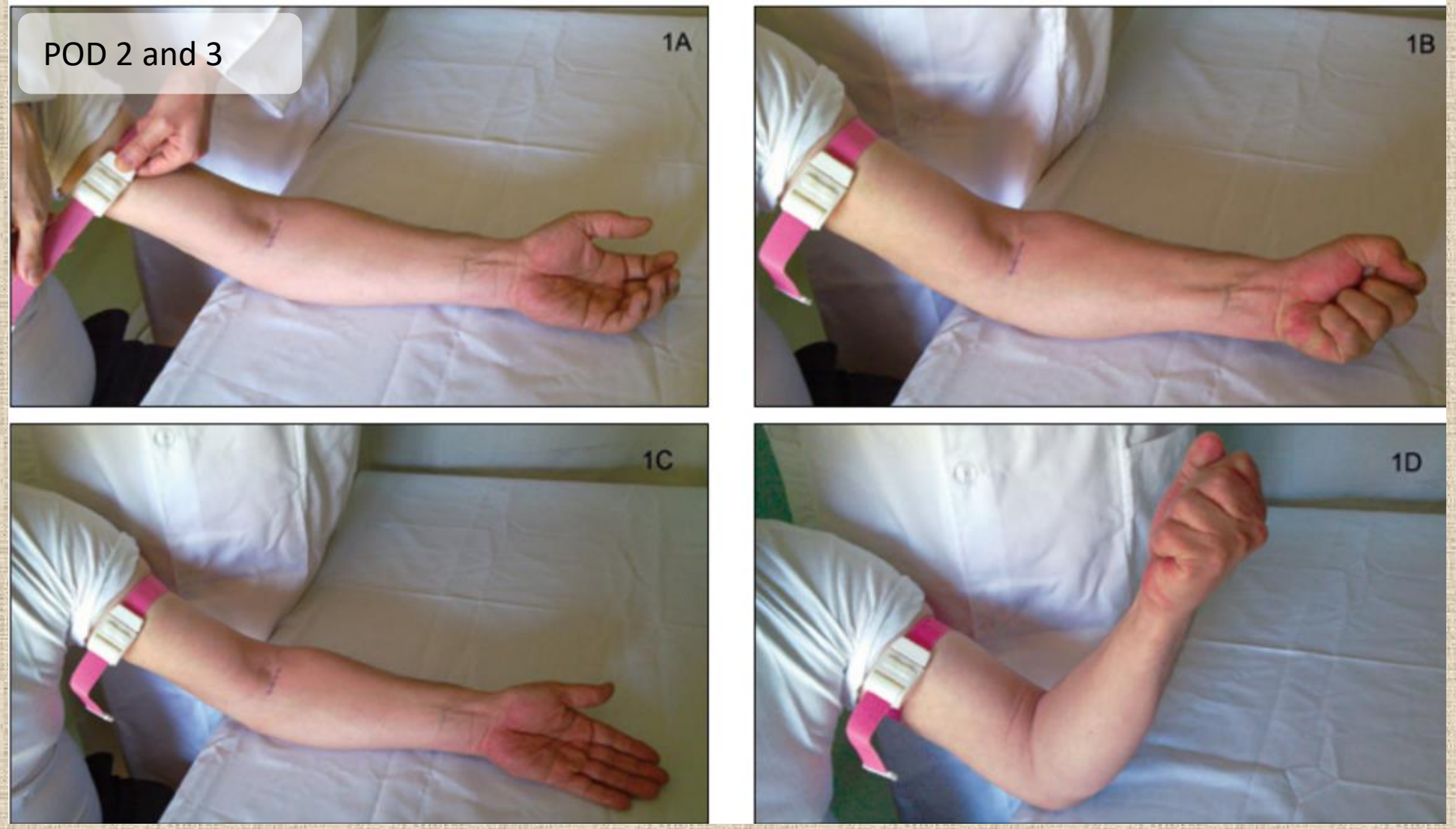
Objective: **This study was designed to investigate the effects of hand exercise using a tourniquet on arteriovenous fistula (AVF) maturity in patients with end stage renal disease.**

Methods: **Fifty patients were randomly allocated to 2 groups with 25 patients. After creating an AVF, in the control group, patients were asked to start doing simple hand exercise- opening and closing the fingers. In the second groups, patients underwent a structured isometric exercise program. The pre exercise and post exercise ultrasound examination were performed in the first 24 hours and 2 weeks after the operation respectively. Patients were also clinically evaluated at the end of the study.**

Results: **Post exercise ultrasound showed significant difference in the draining vein diameter, vein wall thickness, vein area and blood flow rate (BFR) (p-value: 0.009, 0.04, 0.02 and 0.02 respectively). The number of patients who had clinically mature AVFs in the case group was significantly more than the control group (13 vs. 5; p-value: 0.008).**

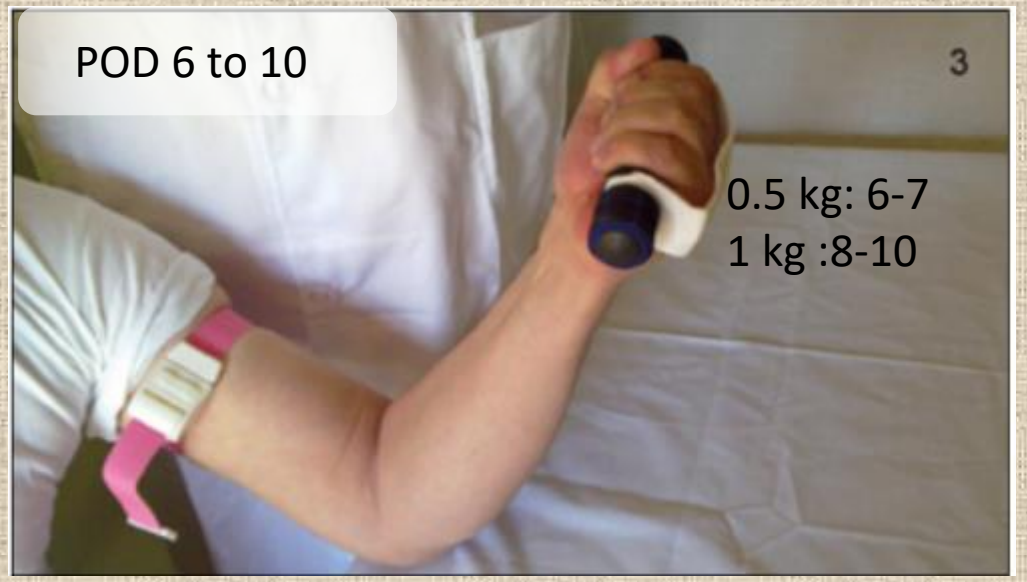
Conclusion: **We conclude that hand exercise using arm tourniquet affects most sonographic parameters which are associated with AVF maturity, and could be beneficial for acceleration of AVF clinical maturation.**

POD 2~ : exercise programme four times a day (morning, noon, afternoon and night)



POD 4 and 5

POD 6 to 10



POD 11 to 13

TABLE II - COMPARISON OF PRE AND POST-EXERCISE ULTRASONOGRAPHIC CHARACTERISTICS BETWEEN TWO GROUPS

Parameter	Assessment time	Case	Control	P-value
Draining vein diameter (mm)	Pre-exercise	5.36±1.02	5.10±1.17	0.39
	Post-exercise	7.68±1.23	6.73±1.21	0.009
Vein wall thickness (mm)	Pre-exercise	0.28±0.05	0.31±0.07	0.10
	Post-exercise	0.53±0.10	0.47±0.10	0.04
Skin-vein distance (mm)	Pre-exercise	4.54±1.22	4.24±1.39	0.42
	Post-exercise	2.59±0.77	2.44±0.89	0.52
Vein area (mm)	Pre-exercise	0.24±0.09	0.21±0.09	0.28
	Post-exercise	0.47±0.13	0.39±0.12	0.02
BFR (mL/min)	Pre-exercise	439.80±181.81	411.44±187.01	0.58
	Post-exercise	870.32±246	727.92±167.09	0.02

- 瘻管建立選擇
  - 時機
  - AVF VS AVG VS CVC
  - Succession Plan (下一個通路)
- 外科醫師瘻管建立考慮因素
- 瘻管建立後
  - 衛教病患運動
  - **教導病患評估瘻管併發症**
  - 洗腎室上針

It only takes a minute to save your lifeline.

Look

Listen

Feel

ESRD NCC NATIONAL COORDINATING CENTER

www.esrdncc.org

arteriovenous FISTULAFIRST AVF — The first choice for hemodialysis

Look

The skin over your access is all one color and looks like the skin around it.

GO

Looking good!

There is redness, swelling or drainage. There are skin bulges with shiny, bleeding, or peeling skin.

STOP

Contact your dialysis care team if you notice any "stop" signs!

ESRD NCC NATIONAL COORDINATING CENTER

arteriovenous FISTULAFIRST AVF — The first choice for hemodialysis

Listen

When you place your access next to your ear, you hear a sound. And it sounds the same as the last time you checked it.

You place your access next to your ear and hear no sound. Or it sounds different than it did the last time you checked it.

Sounding good!

Contact your dialysis care team if you notice any "stop" signs!

ESRD NCC NATIONAL COORDINATING CENTER

arteriovenous FISTULA FIRST AVF — The first choice for hemodialysis

Feel

Thrill: a vibration or buzz in the full length of the access.

Pulse: slight beating like a heartbeat. Fingers placed lightly on the access should move slightly.

Pulsatile: The beat is stronger than a normal pulse. Fingers placed lightly on the access will rise and fall with each beat.

GO

Good to go!

STOP

Contact your dialysis care team if you notice any "stop" signs!

ESRD NCC NATIONAL COORDINATING CENTER

www.esrdncc.org

This material was prepared by the End-Stage Renal Disease Network Coordinating Center (NCC), under contract with the Centers for Medicare & Medicaid Services (CMS), an agency of the U.S. Department of Health and Human Services. The contents presented do not necessarily reflect CMS policy nor imply endorsement by the U.S. Government. Pub. No. FL-ESRD NCC-7N52TA-08132020-08

arteriovenous FISTULA FIRST
AVF — The first choice for hemodialysis

VASCULAR ACCESS

Detection and Management of Clinically Significant AV Access Lesion (Stenosis/Thrombosis)

NATIONAL KIDNEY FOUNDATION®

Key Messages: Clinically Significant Stenosis

- Clinically significant stenosis can be detected by monitoring (abnormalities found on physical exam and/or during dialysis without additional special equipment)
- Confirm by imaging that the reduction in lumen size is >=50% to the adjacent non-stenosed vessel
- Primary treatment is typically endovascular (e.g. angioplasty [PTA])
- Surgical treatment should be considered in situations where endovascular therapy is unlikely to be successful
- As much as possible, avoid endovascular or surgical treatments that may adversely impact cannulation zone or future vascular access options, according to the patient's ESKD Life-Plan

NATIONAL KIDNEY FOUNDATION®

Detect & Confirm a Clinically Significant Lesion

Check if Yes:

A) During physical examination or check

- ☐ **Ipsilateral extremity edema**
- ☐ **Alterations in the pulse, with a weak or resistant pulse, difficult to compress, in the area of stenosis**
- ☐ **Abnormal thrill (weak and/or discontinuous) with only a systolic component in the region of stenosis**
- ☐ **Abnormal bruit (high pitched with a systolic component in the area of stenosis)**
- ☐ **Failure of the fistula to collapse when the arm is elevated (outflow stenosis) and lack of pulse augmentation (inflow stenosis)**
- ☐ **Excessive collapse of the venous segment upon arm elevation**

OR

B) During dialysis

- ☐ **New difficulty with cannulation when previously not a problem**
- ☐ **Aspiration of clots**
- ☐ **Inability to achieve the target dialysis blood flow**

Detect & Confirm a Clinically Significant Lesion – cont.

- ☐ **Prolonged bleeding beyond usual for that patient from the needle puncture sites for 3 consecutive dialysis sessions**
- ☐ **Unexplained (>0.2 units) decrease in the delivered dialysis dose (Kt/V) on a constant dialysis prescription without prolongation of dialysis duration**

OR

C) Other causes have been eliminated

- ☐ **If any of the above has been checked as "yes", other causes of the abnormality besides the vascular access has been ruled out**

If any items from "A" or "B" AND "C" have been checked off, then there is likely a clinically significant lesions.

Next steps:

Confirm by imaging that if the lesion is a stenosis that the reduction in lumen size is >=50% to the adjacent non-stenosed vessel.

影像確定病兆管徑已狹窄>50%

- 瘻管建立選擇
  - 時機
  - AVF VS AVG VS CVC
  - Succession Plan (下一個通路)
- 外科醫師瘻管建立考慮因素
- 瘻管建立後
  - 衛教病患運動
  - 教導病患評估瘻管併發症
  - **洗腎室上針**

VASCULAR ACCESS

Cannulation –
How to Cannulate & Manage Complications

NATIONAL KIDNEY FOUNDATION®

Cannulation Methods

繩梯式打法

Rope Ladder

區塊式打法

Area Puncture

扣眼式打法

Buttonhole

NATIONAL KIDNEY FOUNDATION®

Table 11.a.
Cannulation Methods and Recommendations

Cannulation Method	Vascular Access Type	Description of Arterial/Venous Needle Locations	Recommendations KDOQI 2019 VA Guidelines
Rope Ladder	• AV fistula – surgical or endovascular • AV graft (synthetic or biological)	Cannulation site is moved up and down the cannulation zone to allow full site rotation	11.2 Considered the Best Practice method for routine AV fistula or AV graft cannulation
Area Puncture	• AV fistula – surgical or endovascular • AV graft (synthetic or biological)	Limited segment of the cannulation zone is used for repeated cannulation	**Not Recommended** as a cannulation method
Buttonhole	• AV fistula – surgical or endovascular	Exact same cannulation site and angle is utilized to create a tissue tunnel track with a sharp needle then converted to a dull needle	11.3-11.5 Use only under **special circumstances** given the associated increased risks of infection and related adverse consequences **Special Circumstances:** very short segment cannulation zones, enlarging anuerysms (see Table 11.1) **Recommend** 2 arterial and 2 venous buttonhole sites to allow rotation

NATIONAL KIDNEY FOUNDATION®

Table 11.b.
Cannulation Skills and Recommendations

Cannulator & Skill Set	Recommendations KDOQI 2019 VA Guidelines
Skilled cannulators with established high rates of success should perform initial cannulations	11.6
Have structured training and supervision of dialysis technicians and nurses before and during initial cannulation attempts and have regular training updates to maintain cannulation competency	11.7
Support & educate eligible patients on self-cannulation of their AV fistula or AV graft	11.8 (also CMS Conditions of Coverage V-tag 456)

NATIONAL KIDNEY FOUNDATION®

Table 11.c.
Practical Applications for Cannulation
Nephrologist Order Required for Cannulation

Should Include	Description
Cannulation Method	Rope Ladder unless special circumstances to utilize buttonhole cannulation (include the justification for the buttonhole method so if the justification changes in the future the cannulation method is reassessed). Consider adding no Area Puncture to the order.
Needle Type	Plastic cannula, sharp needle, dull buttonhole needle
Needle Length	3/5" short needle, 1" needle or 1 ¼" needle
Needle Angle	If vessel depth is measured with a cannulation map, the angle of entry can be calculated. Can also include needle insertion direction Arterial/Venous (antegrade or retrograde) as indicated
Needle Gauge	17, 16, 15, 14 gauge (may limit a maximum needle gauge)
Blood Flow Rate to Correspond to the Needle Gauge	No recommendations listed in the 2019 Guidelines See "Matching needle gauge to the prescribed bloodflow rate (BFR)"
May cannulate & Needle Advancement	Initial Cannulation Protocol/Algorithm (typically facility or provider specific) No recommendations listed in the 2019 Guidelines
Any procedure adaptations for self-cannulation	Modifications to the taping procedure, needle insert and needle removal procedure

NATIONAL KIDNEY FOUNDATION®

Table 11.d.
Matching Needle Gauge to the Prescribed Blood Flow Rate (BFR)

Smaller needle gauge requires lower blood flow rates (BFRs)
General needle gauge guidelines and maximum BFR with the pre–pump arterial pressure (AP) ≤ –200 to –250 mm Hg • 17-gauge needle = 200–250 BFR • 16-gauge needle = 250–350 BFR • 15-gauge needle = 350–450 BFR • 14-gauge needle = > 450 BFR
Must monitor pre–pump AP to prevent excessive negative pressure from the blood pump drawing on the vascular access. Pre–pump AP should be ≤ –250 mm Hg for all needle gauges and BFRs

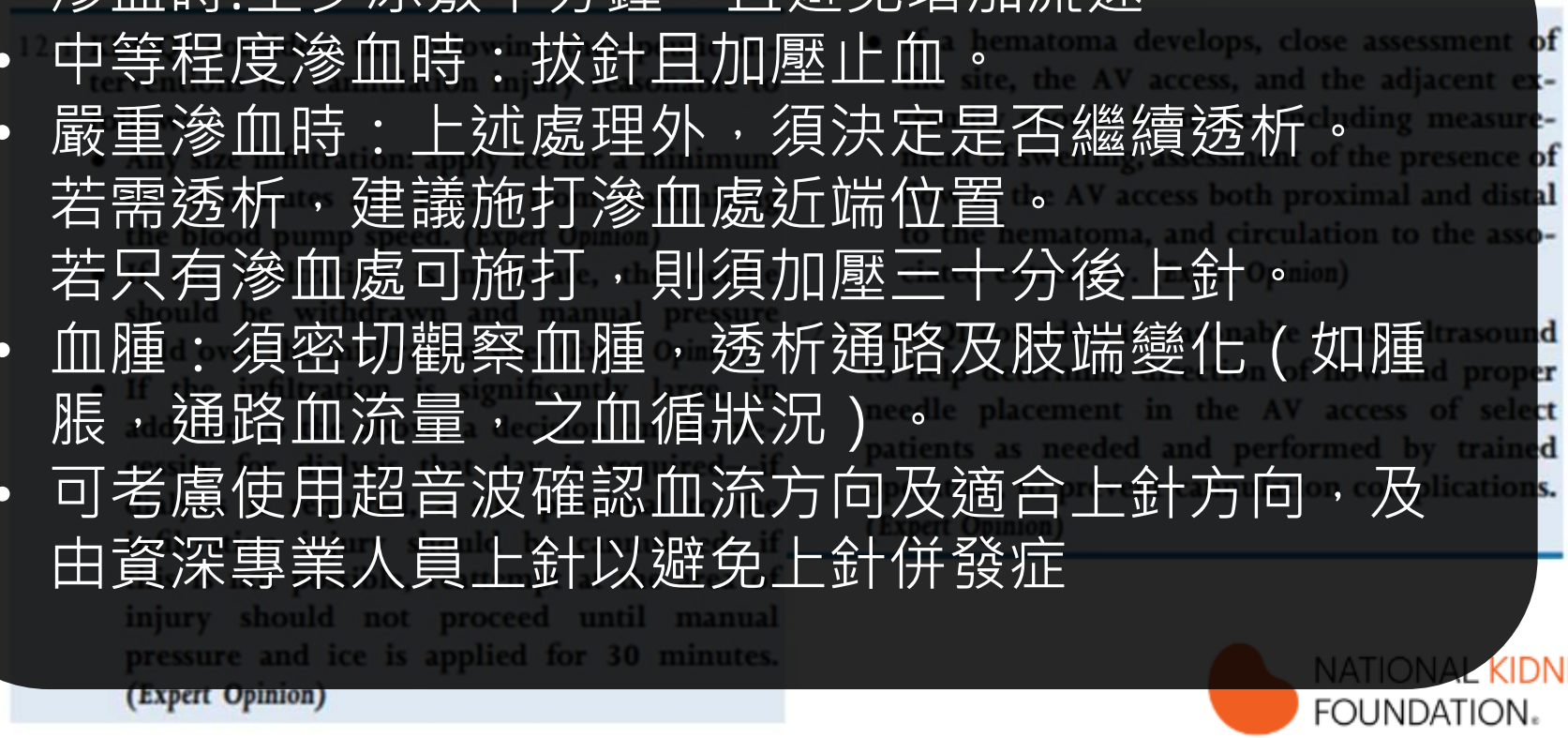
* Follow your unit-specific nursing policy and procedure for specific needle gauge and maximum BFR.

NATIONAL KIDNEY FOUNDATION®

Gomes LK, POCUS J. 2022 Feb 1;7(Kidney):105-109.

Cannulation Complications

- 滲血時:至少冰敷十分鐘，且避免增加流速。
- 中等程度滲血時：拔針且加壓止血。
- 嚴重滲血時：上述處理外，須決定是否繼續透析。
  若需透析，建議施打滲血處近端位置。
  若只有滲血處可施打，則須加壓三十分後上針。
- 血腫：須密切觀察血腫，透析通路及肢端變化（如腫脹，通路血流量，之血循狀況）。
- 可考慮使用超音波確認血流方向及適合上針方向，及由資深專業人員上針以避免上針併發症



NATIONAL KIDNEY FOUNDATION.

First cannulation program

Cannulation of New Fistula Policy and Procedure - Sample

Purpose:
To successfully cannulate new arteriovenous fistulas and to prevent infiltration.

Policy:
Newly created primary AV fistulas shall be allowed to develop for at least 8-12 weeks prior to cannulation. Initial attempts to perform dialysis via new fistulas shall proceed with caution. Without exception, fistulas shall not be progressed faster than these guidelines ***without MD order***. All patient care personnel are responsible for implementing this policy.

Procedure:

1. Obtain order from vascular surgeon or nephrologist to begin cannulation of fistula 8 to 12 weeks after creation. **All new fistulas should be examined by surgeon, nephrologist and designated staff member before cannulation is initiated**.
2. Only staff identified as demonstrating best cannulation practice techniques should be assigned to cannulate NEWLY developing fistulas.
3. **ALWAYS USE A TOURNIQUET**, even with well-developed fistulas. **NO EXCEPTIONS!**
4. Explain procedure to patient.
5. Educate patient on:
   - Checking the access daily for a thrill and for signs and symptoms of infection.
   - Performing fistula exercises to promote maturation process.
   - Understanding that hematoma could occur most likely during the first two weeks of using the access.
   - For infiltrations, provide written materials about icing, elevation, and heat application.

It is ***IMPORTANT*** that prior to any AVF cannulation, everyone knows…

- What ***TYPE*** of AVF has been placed;
- The ***DIRECTION*** of blood flow for a specific access site (check with surgeon to confirm direction of flow and obtain a diagram showing direction of flow for patient chart); and
- If a reverse flow AVF [such as a proximal radial artery (PRA) AVF] has been created, blood flow direction dictates ***PLACEMENT*** of the arterial and venous needles.

Week One

- Check with charge nurse for heparinization changes. Heparin prime and hourly should be decreased by half of the ordered dose for the first week to prevent bleeding into the surrounding tissue. It may be necessary to initiate saline flushes during this week of

第一周

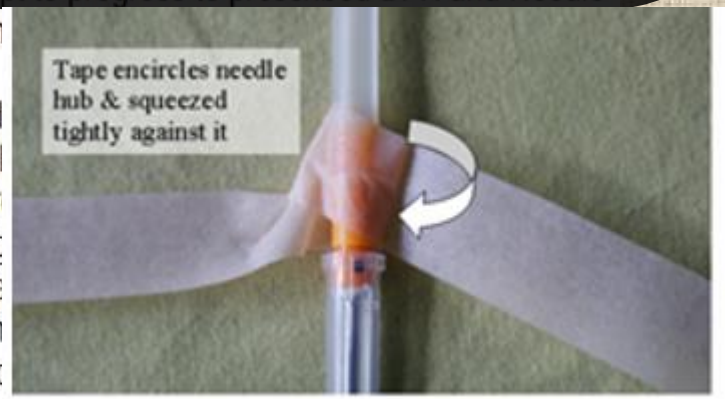
- 第一周減半抗凝血劑量以避免滲血。
- 使用17號針及血流200-250 ml/min。需遠離吻合處3.8-5公分處打針，以25度下針。
- 有percath時:以AVF/AVG當A端，permcath當V端。
- 穩定蝶翼，及以chevron method方式固定管路。
- 衛教病人避免移動打針肢體，避免滲血。
- 以同角度移除針，且未完全移除針前不加壓。加壓十分鐘且不可中途停止加壓觀察出血。
- 只能在確認無血及其他上針問題下，調升血流速。
- 有任何上針及流速狀況須回報charge。

Week Two

Week Three

- Either repeat procedure for Week 2, or may attempt to progress to prescribed BFR and Needle gauge. When increasing BFR, recommend match below,
- Regular Blood Flow AVF's: Recommended need arterial anastomosis), venous antegrade (toward t
- Reverse Blood Flow AVF's: If both needles ar needle should be placed downstream (i.e., retrog direction of the venous blood flow. If you use the toward the heart, so the needle would be upstrean

(These policies may vary based on policies and pr



Week One

- Check with charge nurse for heparinization changes. Heparin prime and hourly should be decreased by half of the ordered dose for the first week to prevent bleeding into the surrounding tissue. It may be necessary to initiate saline flushes during this week of decreased heparin.
- If no other access present, use two 17 gauge needles. **ALWAYS** stay at least 1.5-2" from the anastomosis.
- If catheter present, use 17-gauge needle as the arterial, and use catheter for venous return.
- Using a 25° angle, cannulate the fistula.
- Remove needles at the same angle as the angle of insertion. Never apply pressure before the needle is completely out. Apply pressure for 10 minutes, without peeking – no exceptions.

第二周

- 若第一周可能成功上針。第二周使用16號針且更換下針處。
- 血流率建議: 300 ml/min

Week Two

- If the first week is successful, cannulate with 16 gauge needles, rotating cannulation sites.
- Blood flow rate recommended: 300 ml/min.

Week Three

第三周

- 繼續第二周使用針或考慮加大針及血流率。
- 常規AVF (regular flow AVF):

- arterial anastomosis), venous antegrade (toward the venous anastomosis).
- Reverse Blood Flow AVF's: If both needles are to be placed in the forearm, the venous needle should be placed downstream (i.e., retrograde) toward the hand, because that is the direction of the venous blood flow. If you use the upper arm for venous return, the flow goes toward the heart, so the needle would be upstream (i.e., antegrade) toward the shoulder.

(These policies may vary based on policies and procedures of specific Provider)

Infiltration instructions

If the fistula infiltrates, let it "rest" for one week and then go back to smaller gauge needles. Notify nephrologist.

If the fistula infiltrates a second time, wait another two weeks and then go back to smaller gauge needles. Notify nephrologist.

If the fistula infiltrates a third time, notify surgeon and nephrologist.

Catheter removal instructions

The patient's **catheter is not to be removed** until the patient has had SIX CONSECUTIVE SUCCESSFUL arterial/venous needle cannulations at the prescribed BFR and needle gauge.

RECOMMENDED: It is important to match needle gauge to blood flow rate.

BLOOD FLOW RATE	RECOMMENDED NEEDLE GAUGE
<300 ml/min	17 gauge
300 – 350 ml/min	16 gauge
>350-450 ml/min	15 gauge
> 450 ml/min	14 gauge

Note: These are minimum recommended gauges for the stated BFR settings. Larger needles, when feasible, will reduce (make less negative) pre-pump arterial pressure and increase delivered blood flow .

Take home massage

GOALS AND TARGETS	
AV Access (Fistula or Graft) Target	
2	All AV access (Fistula or Graft) Intervention goal = "1-2-3" interventions as follows: 1. For each 1 AV access creation 2. There should be ≤2 interventions to facilitate AV access use 3. There should be ≤3 interventions to maintain AV access use per year *Access use refers to successful use of AV access with 2-needle cannulation to achieve prescribed dialysis.*
Central Venous Catheter Target	
3	All CVC, regardless if the CVC is cuffed or not, tunneled or not, "final CVC" or not: Infection goal = Catheter-related bloodstream infection rate of <1.5/1000 catheter days

KDOQI Clinical Practice Guideline for Vascular Access: 2019 Update

Prior Dialysis Access (Vascular access or PD catheter)	1	2	3
Date of Creation/ insertion			
List associated complications, if any			

Current Access:

- ☐ None
- ☐ Right
- ☐ AV Fistula
- ☐ Yes
- ☐ Left
- ☐ AV Graft
- ☐ Tunneled CVC
- ☐ Other:

Reason for Referral

Creation of Fistula or Graft	**Existing Fistula and Graft**
☐ Expected hemodialysis start ≤ 6 months ☐ Expected hemodialysis start > 6 months ☐ Other: on dialysis	☐ Maturation failure requiring revision ☐ Anticipated aneurysm rupture ☐ Severe limb threatening ischemia from steal syndrome ☐ Thrombosis of graft/fistula ☐ Infected graft/fistula ☐ Other: Click or tap here to enter text.
Other Information ☐ Patient expected to self-cannulate ☐ Right-handed ☐ Left-handed ☐ Patient is on anticoagulation/ antiplatelet agents ☐ Others: Click or tap here to enter text.	**Comments:**

It only takes a minute to save your lifeline.

Look

Listen

Feel

ESRD NCC NATIONAL COORDINATING CENTER

www.esrdncc.org

arteriovenous FISTULA FIRST
AVF — The first choice for hemodialysis

Line of CCH CVS

陳映澄醫師

李宗勳醫師

謝永堃醫師

案例一：蕭先生

基本資料 | 醫囑執行單 | 檢驗

血液透析記錄表

醫囑檔 | 上次記錄 | 下次記錄 | 透析歷程

姓名 [redacted]　病歷 [redacted]　透析日期：2025-02-05 (三) 中午

病人來源：門診 (門診床號 _____)　保險別：健保　出生日期：1963-09-23　本次透析數第 次　床號：A-09

透析時間：開始 12:59　結束 15:35
透析前血壓：坐 163 / 69 脈搏 70
透析後血壓：坐 160 / 88 脈搏 88

【Background】
儀器類型：Fresenius4008B/A-09/034933
透析液流量：500 ml/mim　透析器種類：FX100
透析液：Ca2.5/K2.0

Heparin：400 iu/ml， Priming 2000
初劑量 0 iu， 維持量 iu 其他
Innohep：Priming 0， 初劑量 500 iu
備註：Coronary atherosclerosis with LAD muscle bridge c/w type 2 MI on 2024-11-12

【Situation】
體溫：35.9 ℃
開始體重 (kg)：81.3 - (0) = **81.3**
前次畢體重 (kg)：**79.15**
標準體重 (kg)：
應脫水 (kg)：+ (0) =
暫設脫水 (kg)：**1.0**
結束體重 (kg)：81.4 - (0) = **81.4**
實際脫水 (kg)：**-0.1**
檢討：

時間	血壓	脈搏	血液流速	靜脈壓	膜上壓	傳導濃度	透析溫度	UF速率	UF量	肝素注射餘量	生理鹽水	人工腎臟狀態	備註	護理人員	警報處置
13:00	/		260	111	71	14.2	36.8	0.375	0.01				呼吸:16	謝惠美	
13:00	138/74	68	260	123	61	14.2	36.7	0.375	0.015					謝惠美	
13:31	134/66	69	260	126	64	14.2	36.9	0.375	0.206					謝惠美	
14:02	138/65	71	260	129	61	14.2	36.8	0.375	0.4					謝惠美	
14:25	153/88	76	0	18	45	14.2	36.8	0.375	0.539				收血休息	謝惠美	
14:53	156/81	78	0	57	36	12.7	36.6	0.375	0.539				重新上機	謝惠美	謝惠美 15:21
15:19	137/92	86	201	117	60	14.1	36.8	0.18	0.616				交班者	謝惠美	
15:35	142/86	89	198	114	64	14.2	36.9	0.18	0.66				接班者，呼吸:18次/分	陳慧萱	

透析後處置
人工腎臟：-
透析管路腔室血塊：無
傷口止血情形：良好　處理：
護理人員：

醫療紀錄及處置

時間	狀況	處置	分類	記錄人
14:20	1/20 intra-dialytic ledt hand sever paon (3.4.指脹痛) --> 1/24 shunt s/p PTA. 目前又疼痛	apap 1 tab PRN	醫囑	蔡俊傑
14:20	home BP: 130-145mmHg	【複】Exforge 5mg/80mg/ tab 1 tab BID+【25mg/ tab】【大劑量】Carvedilol Tab. 0.5 tab BID + Doxazosin Mesylate 4mg/tab 1 tab BID	醫囑	蔡俊傑

【Assessment】
血管通路：左 / 前臂 / Fistula
開始使用日期：

透析護理紀錄

時間	項目	D	A	R	T	記錄人
12:59	血液透析照護需求	■ 上次透析後無不適。	■ 執行安全透析程序。■ 注意血壓變化，依血壓調整脫水量並評估是否須調整乾體重。			謝惠美
14:25	血液透析照護需求	■ 病人主訴左前臂Fistula透析時手掌非常脹痛。	■ 予暫停血液透析透析休息一下，開口服止痛藥服用。			謝惠美
14:53	血液透析照護需求		■ 予重新上機。			謝惠美
15:35	血液透析照護需求			■ 病人左手手指疼痛難耐，要求提早收血，告知專科護理師王碧琳，今透析2小時。		陳慧萱
15:50	血液透析照護需求			■ 病人左手指疼痛情形較改善，家屬陪伴步行離開病室。		陳慧萱

【Recommendation】
透析前處置
病人活動方式：
護理人員：

- NCV
  - Interpretation:
  - The NCV suggests bilateral median and ulnar neuropathies, demyelinating type. Sensorimotor polyneuropathy is also considered.

2025.04.07

- Left radiocephalic AVF banding with Goretex vascular graft

案例二：陳先生

2025.03.08

- Right brachio=cephalic AVF thrombosis
- Open thrombecctomy
- PTA to R. cephalic arch and R. innomiante v.

2025.05.22

- Post OP Dx:right brachio-cephalic AVF acute occlusion, stenosis site at cephalic arch s/p open thrombectomy + PTA with 8,9mm balloon + stenting with 8mm*10cm viabahn