CONFEZIONAMENTO FAV:
IL MAPPING PRE OPERATORIO



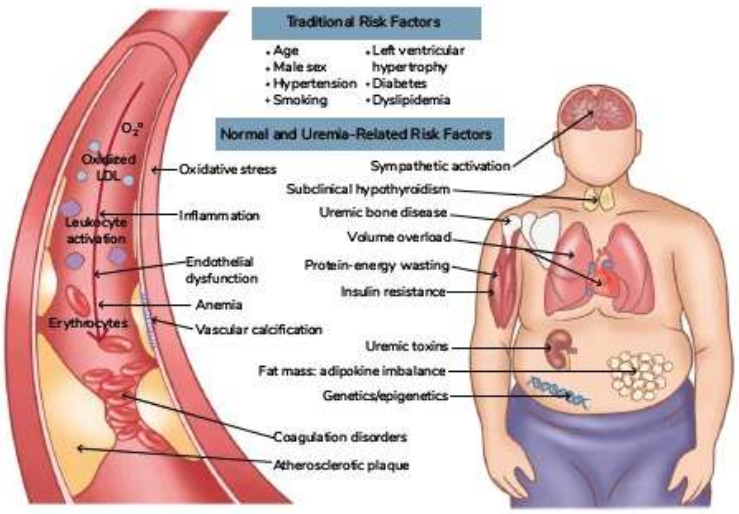
Fondazione IRCCS
San Gerardo dei Tintori

Sistema Socio Sanitario
Regione Lombardia



Dott.ssa Elena Ajello
Nefrologia e Dialisi

IL PAZIENTE UREMICO

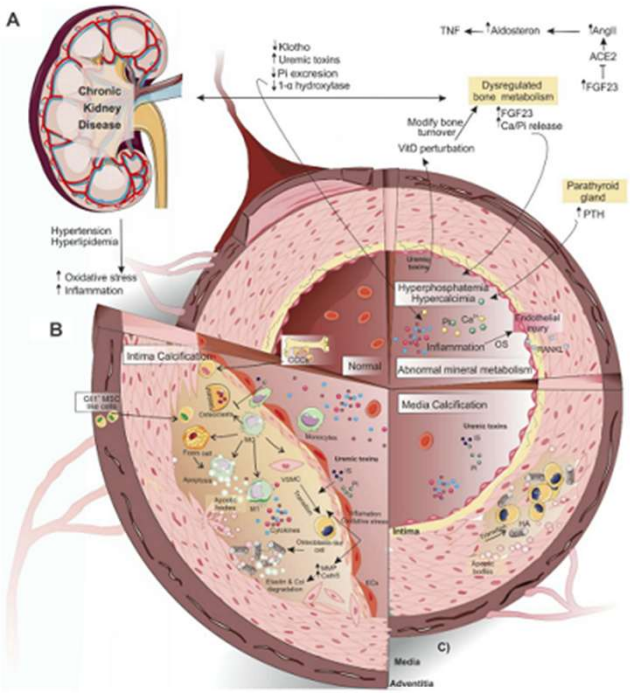


Nei pazienti con insufficienza renale cronica, i fattori di rischio tradizionali coesistono con fattori di rischio NON tradizionali ed il rischio cardiovascolare è aumentato in maniera proporzionale al rimodellamento vascolare (Vasculopatia Uremica).

Fattori di rischio NON tradizionali

Tossine uremiche, stress ossidativo, infiammazione, CKD-MBD

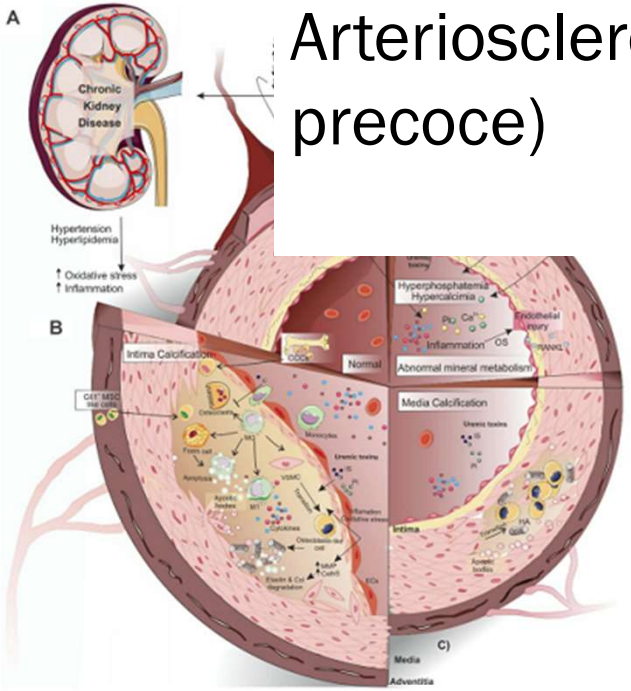
VASCULOPATIA UREMICA



- Calcificazione Vascolare Arteriosa
- Disfunzione Endoteliale
- Infiammazione Cronica e Stress Ossidativo
- Rimodellamento Strutturale (Iperplasia dell'Intima)

Vascular Health and Risk Management 2020:16 167–180, Vascular Calcification: An Important Understanding in Nephrology; Sepideh Zununi Vahed and

VASCULOPATIA UREMICA

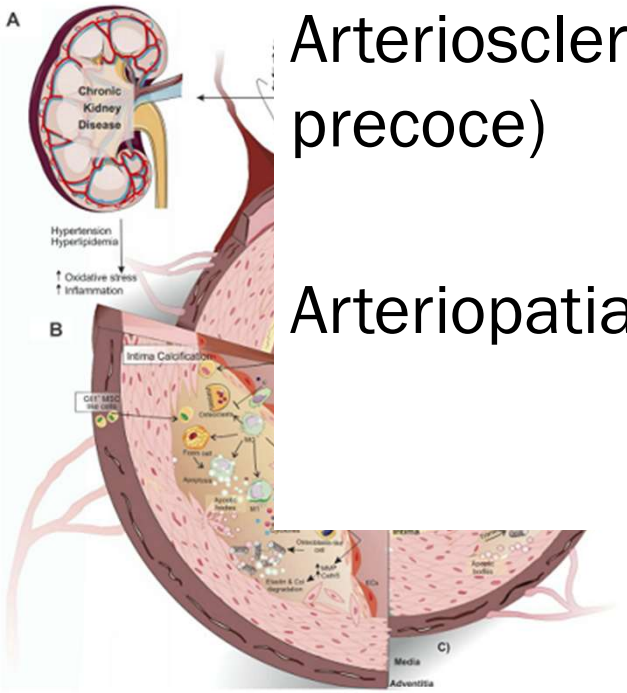


Arteriosclerosi accelerata (invecchiamento precoce)

l'Intima)

Vascular Health and Risk Management 2020:16 167–180, Vascular Calcification: An Important Understanding in Nephrology; Sepideh Zununi Vahed and

VASCULOPATIA UREMICA



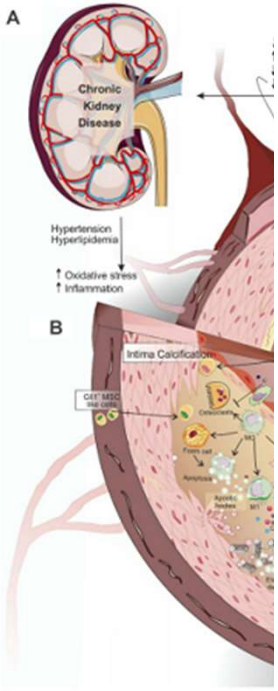
Arteriosclerosi accelerata (invecchiamento precoce)

l'Intima)

Arteriopatia uremica calcifica (calcifilassi)

Vascular Health and Risk Management 2020:16 167–180, Vascular Calcification: An Important Understanding in Nephrology; Sepideh Zununi Vahed and

VASCULOPATIA UREMICA



Arteriosclerosi accelerata (invecchiamento precoce)

l'Intima)

Arteriopatia uremica calcifica (calcifilassi)

Aumento del rischio cardiovascolare

Vascular Health and Risk Management 2020:16 167–180, Vascular Calcification: An Important Understanding in Nephrology; Sepiden Zununi Vahed and

PRESERVARE I VASI VENOSI

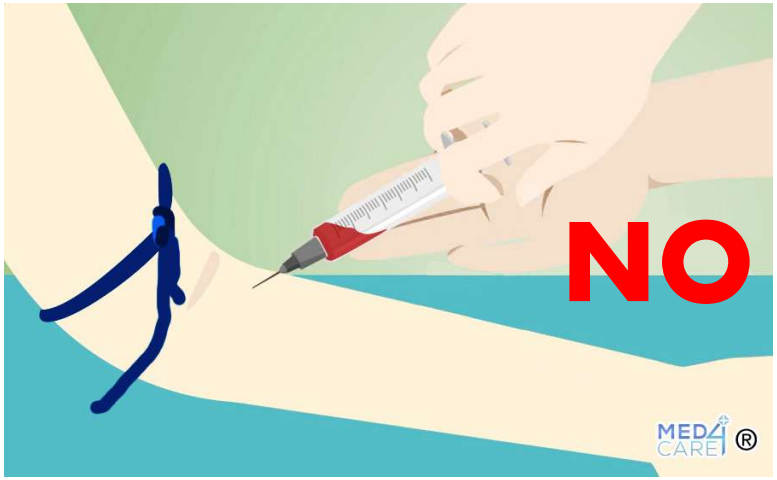
KDOQI
KIDNEY DISEASE OUTCOMES QUALITY INITIATIVE
National Kidney Foundation

. PRACTICE GUIDELINE FOR VASCULAR ACCESS: 2019 UPDATE

Statement: Vessel Preservation

6.10 KDOQI considers it reasonable to protect all central and peripheral arteries and veins from damage whenever possible, including the avoidance of peripherally inserted catheters and unnecessary venipunctures, for patients on dialysis or with CKD where dialysis access is expected in the future (CKD G3-G5). *(Expert Opinion)*

Note: Other scenarios where vessel (artery or vein) damage may occur that should be avoided include (1) radial artery access for coronary interventions and (2) venous cardiovascular implantable electronic devices; alternatives such as epicardial/leadless pacing should be considered whenever possible.





ESKD LIFE-PLAIN

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KDOQI CLINICAL PRACTICE GUIDELINE FOR VASCULAR ACCESS: 2019 UPDATE

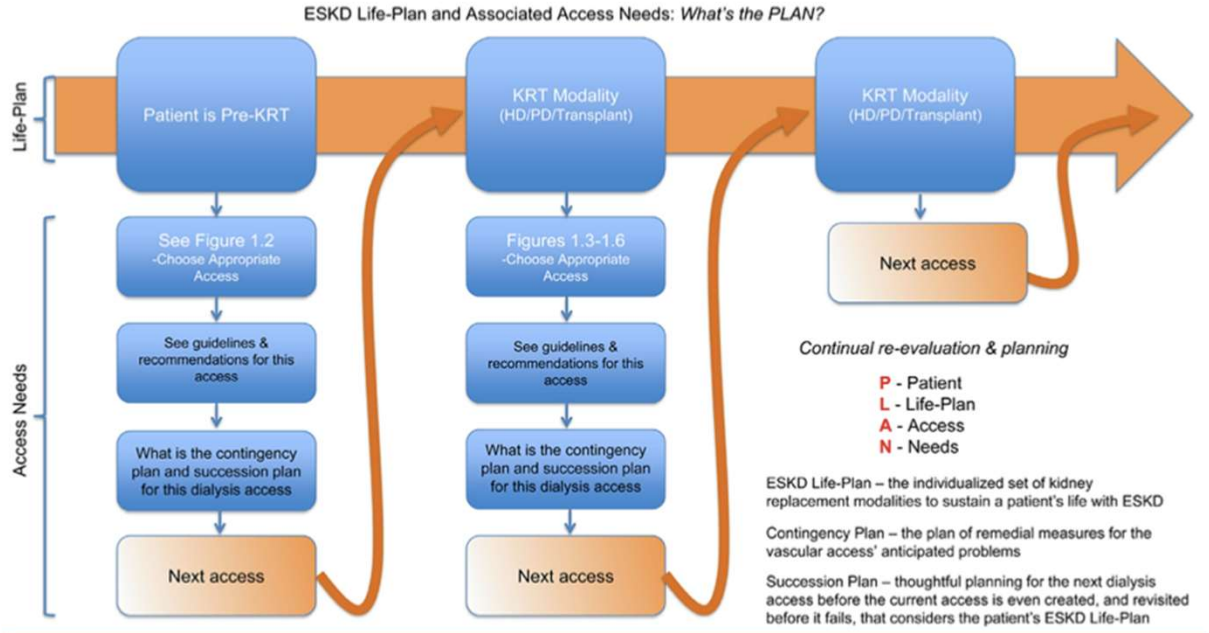


Figure 1.1. ESKD and Dialysis Access Life Plan: *What's the P-L-A-N?* Abbreviations: HD, hemodialysis; PD, peritoneal dialysis; KRT, kidney replacement therapy.

AFFIDARSI AL CASO NON È UN'OPZIONE, PAROLA D'ORDINE PIANIFICAZIONE

- Esame obiettivo
- Anamnesi dettagliata
- Terapia farmacologica
- Esame obiettivo arterioso
- Esame obiettivo venoso
- Studio ECOCOLORDOPPLER con prove funzionali

LINEE GUIDA

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KDOQI CLINICAL PRACTICE GUIDELINE FOR VASCULAR ACCESS: 2019 UPDATE

Guideline 7. Patient and Vessel Examinations: Prepratory Considerations

Statements: Patient Clinical Examination

7.1 KDOQI recommends that a physical examination focused on vascular anatomy be the basis for the initial assessment and planning of vascular access creation. *(Conditional Recommendation, Very Low Quality of Evidence)*

7.2 KDOQI considers it reasonable to have greater emphasis on and more training in preoperative clinical examination to assess patients and their vessels to determine the type and location of their vascular access. *(Expert Opinion)*

Statements: Vessel Mapping for Vascular Access

7.3 KDOQI suggests selective preoperative ultrasound in patients at high risk of AV access failure (Table 7.2) rather than routine vascular mapping in all patients. *(Conditional Recommendation, Low Quality of Evidence)*

7.4 KDOQI considers it reasonable to use various imaging studies as needed to evaluate the suitability of vessels for AV access creation, such as ultrasonography for peripheral vessels (including intraoperative ultrasound) and venography for suspected central vein occlusion, while considering the patient's clinical circumstances and residual kidney function. *(Expert Opinion)*

Statements: Optimal Vessel Size for Artery and Vein of AV Access Creation

7.5 KDOQI considers it reasonable that while there is no minimum-diameter threshold to create an AVF, arteries and veins of <2 mm in diameter should undergo careful evaluation for feasibility and quality to create a functioning AVF. *(Expert Opinion)*

7.6 KDOQI considers it reasonable to evaluate multiple characteristics of vessel quality for AVF creation (size, distensibility, flow, etc). *(Expert Opinion)*

ANAMNESI DETTAGLIATA

Arto dominante (meno limitante per il paziente)

CVC pregressi o PICC (stenosi centrali?)

PM o defibrillatori

Insufficienza cardiaca: coronarografia

Valvulopatie cardiache o protesi valvolari

TP anticoagulante o disordini della coagulazione

Diabete mellito

Rene policistico

Neoplasie (uso vasi venosi periferici o port)

Traumi pregressi arti superiori

Trapianto da vivente a breve



TERAPIA FARMACOLOGICA

Anticoagulati

Antiggreganti

Immunosoppressori

Terapia ipoglicemizzante

Steroidi

Antipertenisvi

Statine

Diuretici

Terapie ormonali

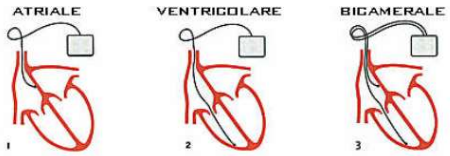
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Table 7.1. Focused Preoperative Physical Examination for Vascular Access Planning and Creation

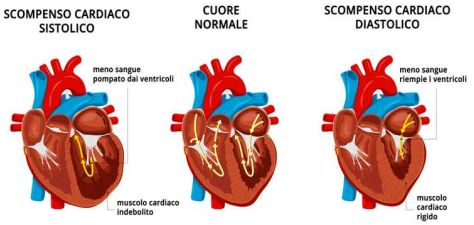
Consideration	Relevance
Cardiovascular evaluation Examination for evidence of heart failure	• Collateral veins are indicative of venous obstruction, as discussed. • Palpation augmented by tourniquet ± warm stimulus (eg, water) will inform venous characteristics (eg, distensibility). Selective venous mapping may be helpful (Guideline Statement 7.3 and Table 7.2) • Use of CVCs is associated with central venous stenosis; previous placement of venous catheters, pacemakers, etc may have damaged target vasculature necessary for vascular access (Guideline Statement 6.10). • Vascular damage associated with previous surgery or trauma may limit access sites (Guideline Statement 6.10). • Poor cardiac output or ejection fraction may affect success of AV access created (eg, low output may increase risk of maturation failure). • AV accesses may alter cardiac output.





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KIDNEY HEART CROSSTALK

ESAME OBIETTIVO ARTERIOSO

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Table 7.1. Focused Preoperative Physical Examination for Vascular Access Planning and Creation

Consideration	Relevance
Physical examination of arterial system Character of peripheral pulses Allen test Bilateral upper extremity blood pressures	• An adequate arterial system is needed for AV access; the quality of the arterial system will influence the choice of AV access site. • Abnormal arterial flow pattern to the hand may contraindicate the creation of a snuffbox or radiocephalic AVF.
Physical examination of venous system Evaluation for edema Assessment of arm sizes comparability Examination for collateral veins Evaluation of veins: Augmented palpation	• Equality or discrepancies of blood pressure values inform the suitability of arterial inflow and access in the upper extremities. • Edema indicates venous outflow problems that may limit usefulness of the associated potential vascular access site or extremity for vascular access placement.
Examination for evidence of prior central or peripheral venous catheterization Examination for evidence of arm, chest, or neck surgery/ trauma	• Differential arm size may indicate inadequate veins or venous obstruction that may influence success of AV access created and choice of vascular access site.

ESAME OBIETTIVO VENOSO

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ESAME OBIETTIVO VASCOLARE

ARTERIE

Polsi arteriosi:
0 non percepibile;
1 appena percepibile
2 palpabile
3 scoccante
4 visibile

Flusso:
- qualità
- quantità

PA bilaterale
<10 mm/Hg vn
>20 mm/Hg patologico

VENE

Torace nudo
Confronto D e S
Arto dominante
Trofismo cutaneo
Lesioni
Adipe
Cicatrici
Arrossamenti
Infezioni
Paresi
Mobilità
Asimmetrie
Edema
Circoli collaterali



K/DOQI 2006

1.4 Evaluations that should be performed before placement of a permanent HD access include (Table 1):

1.4.1 History and physical examination. (B)

1.4.2 Duplex ultrasound of the upper-extremity arteries and veins, (B)

1.4.3 Central vein evaluation in the appropriate patient known to have a previous catheter or pacemaker. (A)

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EBPG 2007

2. Pre-operative evaluation

Guideline 2.1. Clinical evaluation and non-invasive ultrasonography of upper extremity arteries and veins should be performed before vascular access creation (Evidence level II).

Guideline 2.2. Central vein imaging is indicated in patients with a history of previous central vein catheters (Evidence level IV).

K/DOQI 2006

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EBPG 2007

2. Pre-operative evaluation

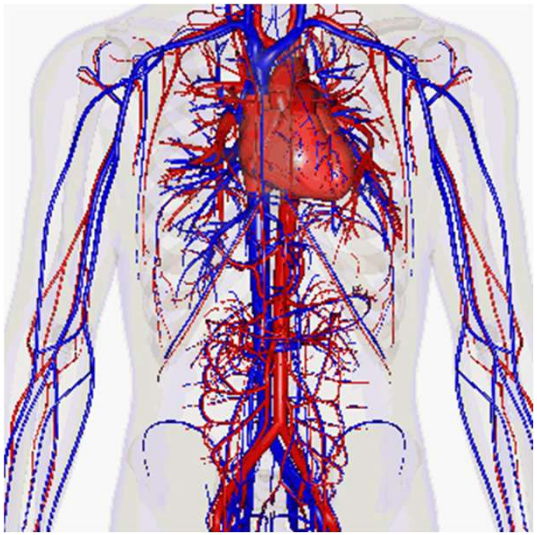
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Guideline 2.2. Central vein imaging is indicated in patients with a history of previous central vein catheters (Evidence level IV).



ECOCOLORDOPPLER: PARAMETRI STATICI E DINAMICI

Anatomia di arterie e vene
Decorso dei vasi
Valutazione dei diametri vascolari
Valutazione portata arteriosa
Valutazione presenza stenosi arteriose
Test iperemia reattiva
Valutazione comprimibilità e dilatazione venosa
Presenza di vasi collaterali venosi
Valutazione presenza di trombosi venose
Distanza tra vasi da utilizzare e profondità dei vasi



ECOCOLORDOPPLER: PARAMETRI STATICI E DINAMICI

Anatomia di art
Decorso dei va
Valutazione de
Valutazione po
Valutazione pre
Test iperemia r
Valutazione co
Presenza di va
Valutazione pre
Distanza tra va

AMBIENTE CONFORTEVOLE

BRACCIO ESTESO

POSIZIONE LIEVEMENTE DECLIVE

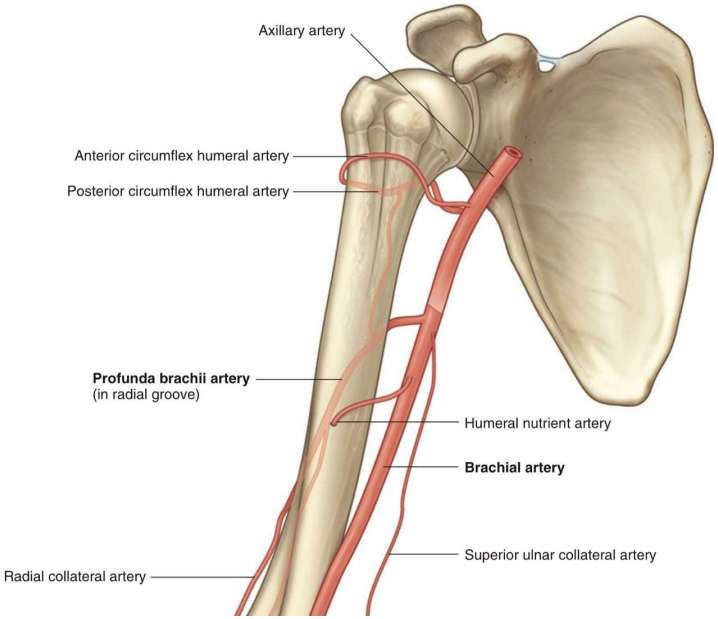
SONDA 10-20 MHz

- Scansioni longitudinali
- Scansioni trasversali





ARTERIA BRACHIALE



Arteria brachiale : decorre lungo il solco bicipitale mediale del braccio dal margine inferiore del muscolo grande pettorale fino alla piega del gomito nella fossa cubitale dove si divide nei suoi due rami: radiale e ulnare .

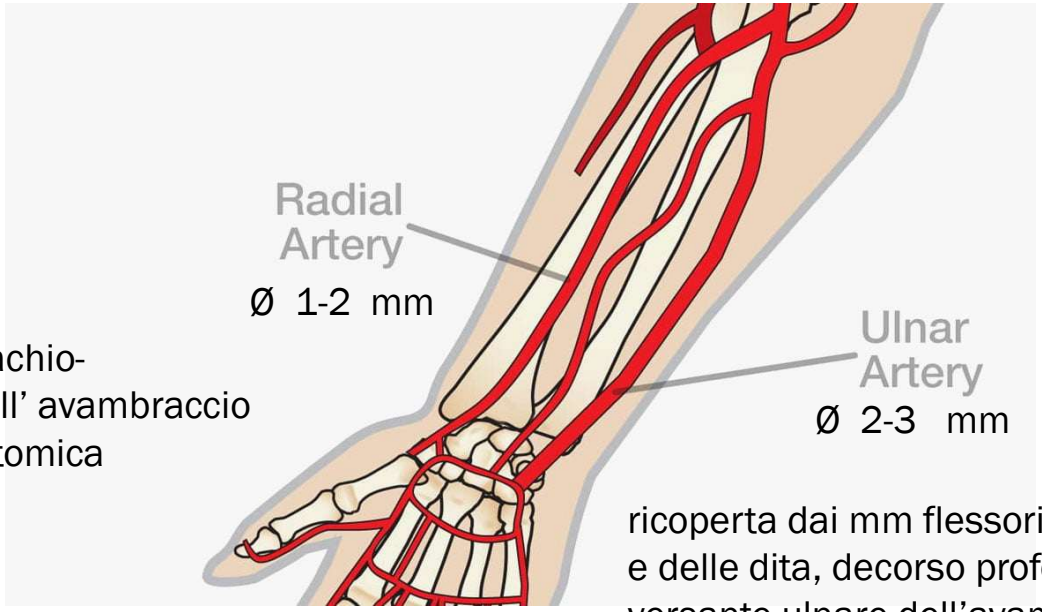
Diametri arteriosi (Ø 3-4 mm)
B MODE con zoom
M MODE per diametro in sistole e in diastole

Anomalie anatomiche (25%) o aneurismi
biforcazione alta : lunghi tempi di maturazione

Danno aterosclerotico di parete (diabetici)

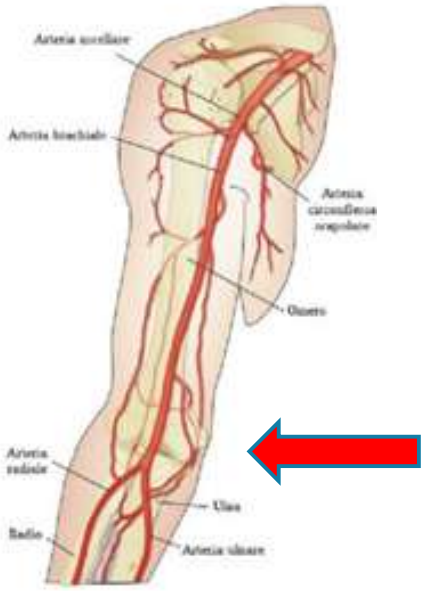
ARTERIA RADIALE E ULNARE

decorre fra il muscolo brachio-radiale e i mm flessori dell' avambraccio fino alla tabacchiera anatomica

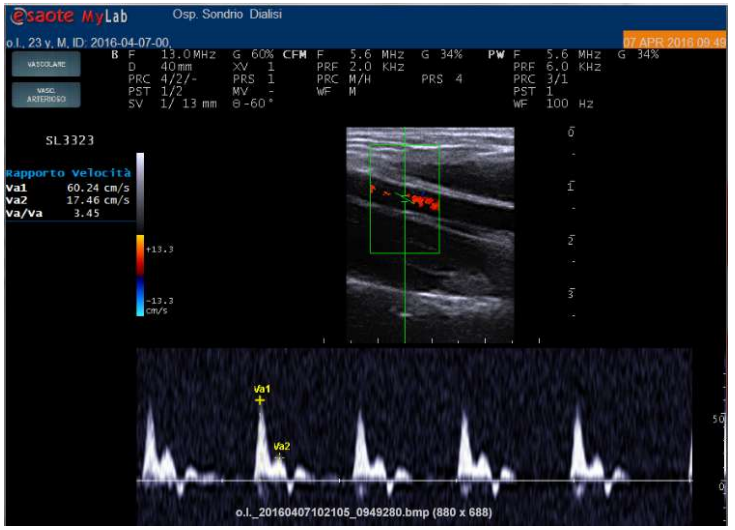


ricoperta dai mm flessori del carpo e delle dita, decorso profondo con decorso sul versante ulnare dell'avambraccio dopo aver dato origine alla arteria interossea poi si riduce di diametro

ARTERIA BRACHIALE





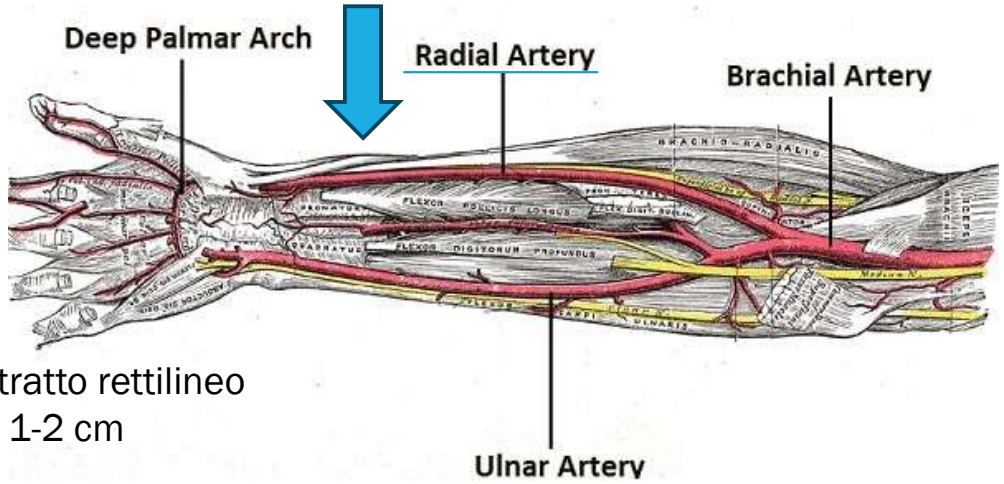


Diametro 3-4 mm
Velocità di picco > 60 cm/ sec

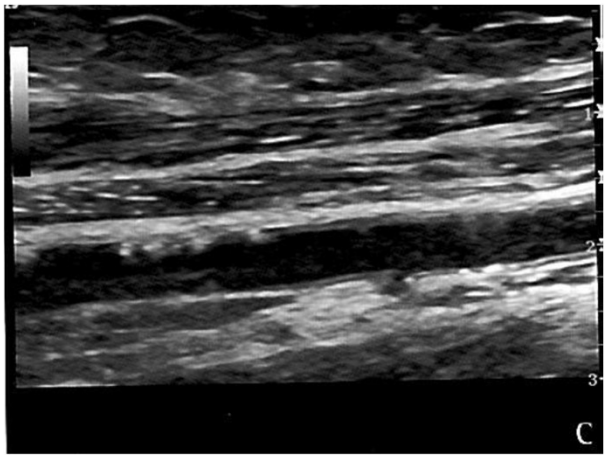
Portata in condizioni fisiologiche = 60 ml/min

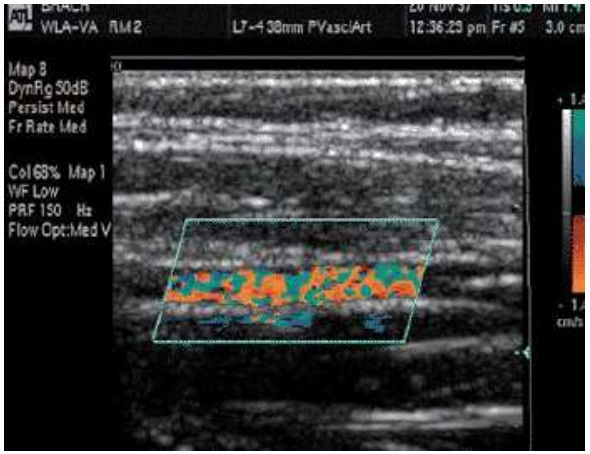
ARTERIA RADIALE

Diametro di 1-2 mm
Velocità di picco > 15 cm / sec
Portata in condizioni fisiologiche > 20-25 ml/min



La portata si misura in un tratto rettilineo
Dell'avambraccio distale a 1-2 cm
prossimalmente dal polso

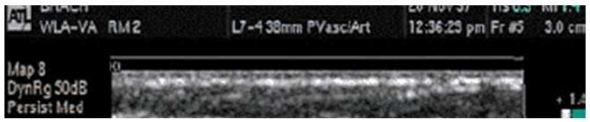




Calcificazioni parietali: Coni d'ombra (puntiformi o estese) longitudinale

Placche stenosanti : colore aliasing
doppler pulsato : flusso rallentato a monte
onde sistoliche ridotte
VPS raddoppio nel tratto stenotico





Distal AVF creation with marginal calcified radial artery: Multicentric experience of intraoperative intravascular lithotripsy

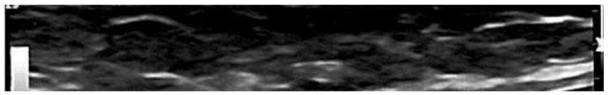
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Sage

Napoli Marcello[1], Taurisano Marco[2], Covella Patrizia[3], Ria Paolo[1], Barbarini Silvia[1], Cuna Simona[1] and De Pascalis Antonio[1]

ONLY

Calcificazioni parietali: Coni d'ombra (puntiformi o estese) longitudinale

Placche stenosanti : colore aliasing
doppler pulsato : flusso rallentato a monte
onde sistoliche ridotte
VPS raddoppio nel tratto stenotico



Distal AVF creation with marginal calcified radial artery: Multicentric experience of intraoperative intravascular lithotripsy

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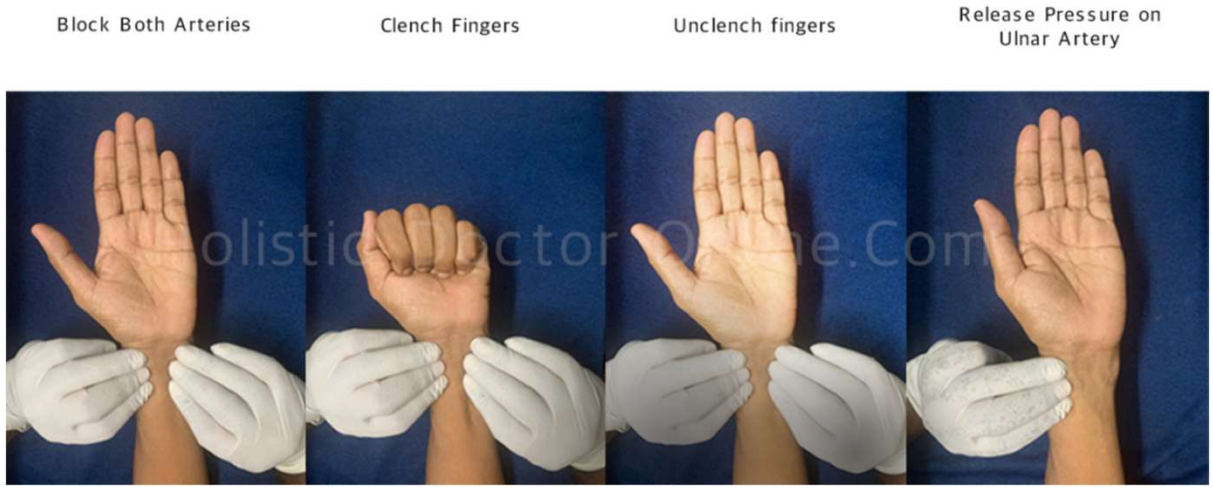


Figure 3. Rx image. This picture shows a stenotic, calcified radial artery before and after the IVL procedure.

Calcificazioni parietali: Coni d'ombra (puntiformi o estese) longitud

Placche stenosanti : colore aliasing
doppler pulsato : flusso rallentato a monte
onde sistoliche ridotte
VPS raddoppio nel tratto stenotico

Allen's Test



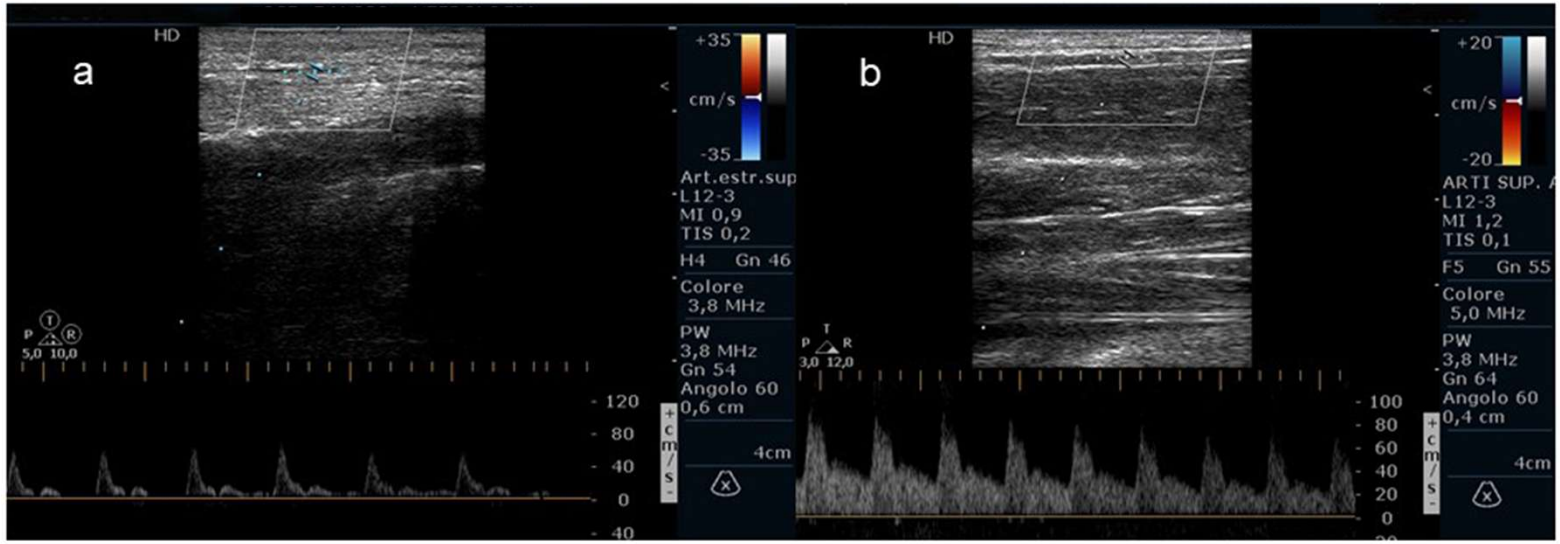
Valuta la pervietà funzionale delle **aa radiale ed ulnare** e stabilisce se **l'arcata palmare superficiale e profonda** sono pervie e ben funzionanti

- occlusione simultanea dell'arteria ulnare e radiale
- chiusura e apertura del pugno per espellere il sangue dalla mano per 30 sec
- riapertura della mano

Rilascio **a. ulnare** e riperfusione del palmo t < 5-7 sec ben funzionanti
t > 5-7 sec occlusione funzionale

Ripetere e rilascio **a. radiale** per determinarne la pervietà

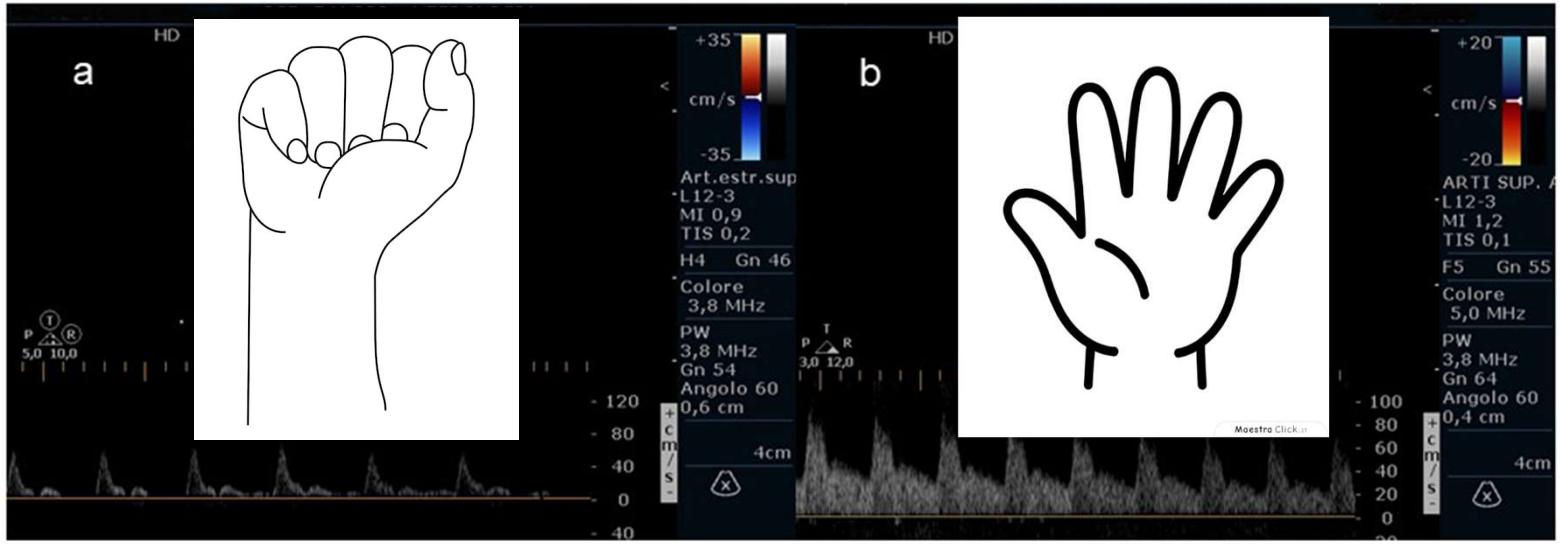
TEST DELL'IPEREMIA REATTIVA



Variazioni della traccia Doppler dell'arteria radiale durante il test dell'iperemia reattiva. (a) Fase di ischemia con traccia Doppler dopo che il pugno è stato chiuso per due minuti; (b) Fase di iperemia reattiva, conseguente all'apertura della mano. Il segnale velocitometrico da trifasico, tipico di arteria ad alta resistenza (a), assume i caratteri di un segnale bifasico (b), a bassa resistenza con fisiologico incremento del flusso ematico all'interno di un'arteria dopo un periodo di ischemia.

GIN GIUGNO 2020- Utilità della valutazione ecocolordoppler prima dell'allestimento di un accesso vascolare per emodialisi: esperienza di un singolo centro dialisi Marina Cornacchiari1 , et al

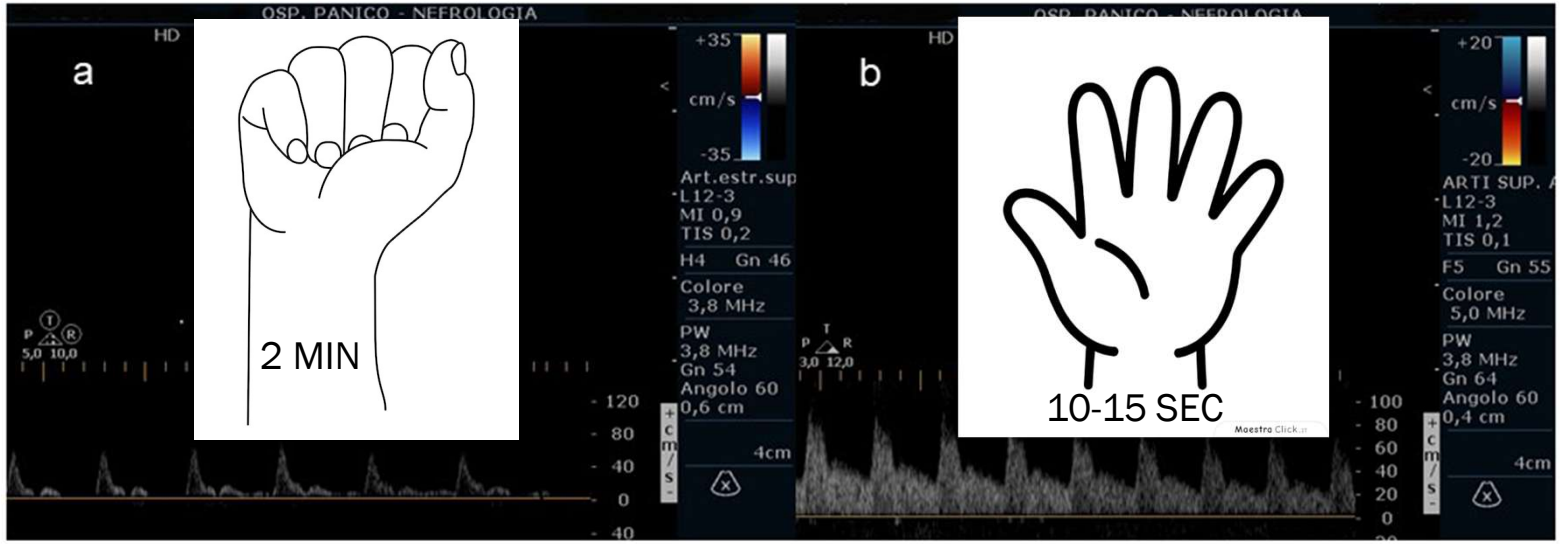
TEST DELL'IPEREMIA REATTIVA



Variazioni della traccia Doppler dell'arteria radiale durante il test dell'iperemia reattiva. (a) Fase di ischemia con traccia Doppler dopo che il pugno è stato chiuso per due minuti; (b) Fase di iperemia reattiva, conseguente all'apertura della mano. Il segnale velocitometrico da trifasico, tipico di arteria ad alta resistenza (a), assume i caratteri di un segnale bifasico (b), a bassa resistenza con fisiologico incremento del flusso ematico all'interno di un'arteria dopo un periodo di ischemia.

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TEST DELL'IPEREMIA REATTIVA



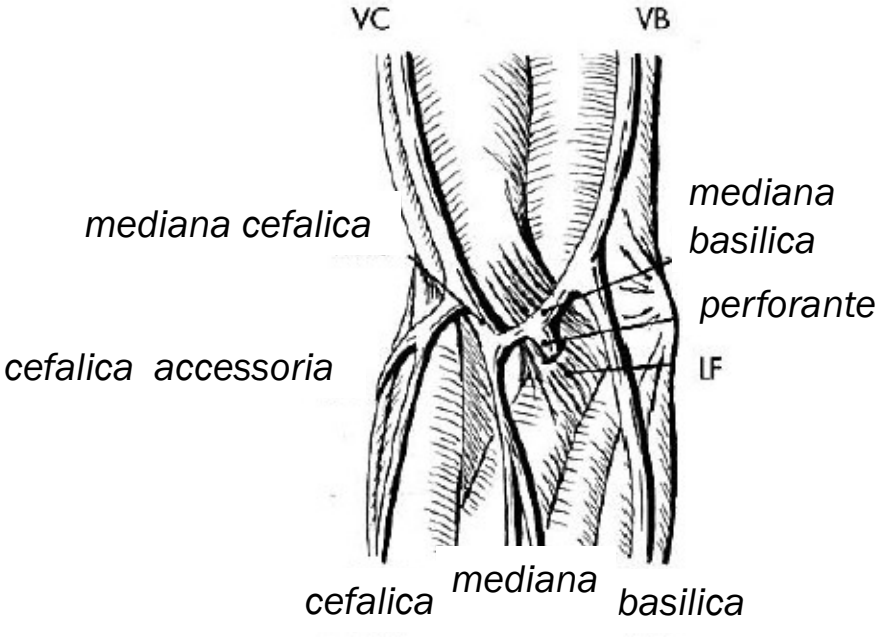
Indice di Resistenza post-ischemia:

•**Test Positivo (Normale/Buono):** L'IR crolla drasticamente **sotto lo 0.7** (o si riduce di oltre il 30% rispetto al basale). Significa che l'arteria è elastica e il letto vascolare è sano

•**Test Negativo (Patologico):** L'IR resta **superiore a 0.7**. Significa che l'arteria è rigida o calcifica e non riesce a dilatarsi; in questo caso il rischio di fallimento della futura fistola è elevato

LETTO VASCOLARE VENOSO SUPERFICIALE: COSA VALUTARE?

- Presenza di stenosi
- Diametro con e senza laccio emostatico
- Presenza di trombosi
- Profondità del vaso e distanza dall'arteria: utilizzabile?
- Anomalie anatomiche e studio della piega
- Doppler venoso : a bassa PRF e mi aiuto pompa della mano



DIAMETRO VENOSO

KDOQI
KIDNEY DISEASE OUTCOMES QUALITY INITIATIVE
National Kidney Foundation

KDOQI CLINICAL PRACTICE GUIDELINE FOR VASCULAR ACCESS: 2019 UPDATE

Nephrol Dial Transplant (2007) 22 [Suppl 2]: ii88–ii117
doi:10.1093/ndt/gfm021

EBPG on vascular access

Table 1. Vessel diameters for successful RCAVF creation

Author	Radial artery (mm)	Cephalic vein (mm)
Wong *et al.* [10]	1.6	1.6
Malovrh [12]	1.5	1.6
Silva *et al.* [3]	2.0	2.5
Ascher *et al.* [21]	–	2.5

Statements: Optimal Vessel Size of Artery and Vein for AV Access Creation

7.5 **KDOQI considers it reasonable that while there is no minimum diameter threshold to create an AVF, arteries and veins of <2 mm in diameter should undergo careful evaluation for feasibility and quality to create a functioning AVF. (Expert Opinion)**

7.6 **KDOQI considers it reasonable to evaluate multiple characteristics of vessel quality for AVF creation (size, distensibility, flow, etc). (Expert Opinion)**

Comparative Study > J Vasc Surg. 2024 Dec;80(6):1847-1853. doi: 10.1016/j.jvs.2024.08.026.
Epub 2024 Aug 23.

Vein distensibility is superior to vein diameter for predicting unassisted maturation of arteriovenous fistulae

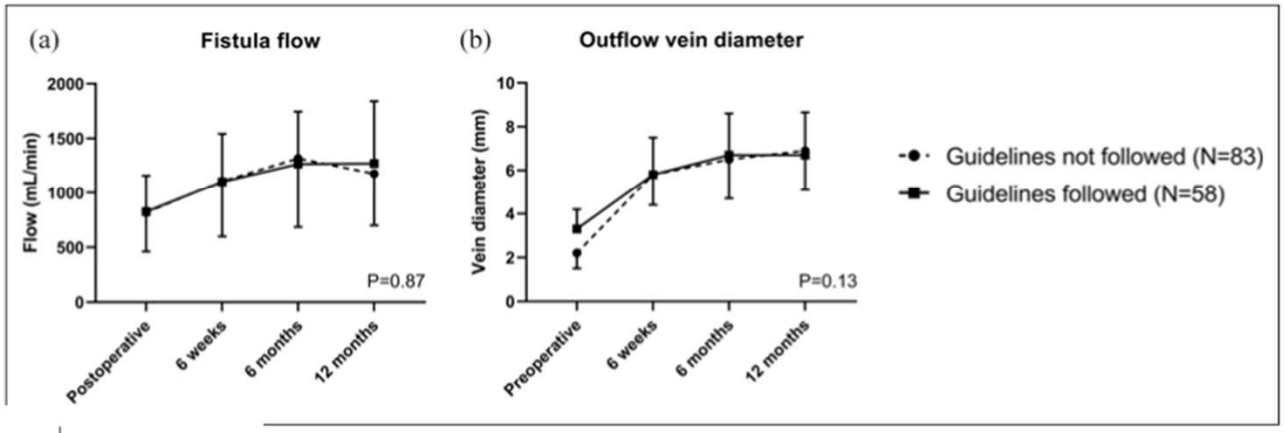
Curtis Woodford [1], Devin Zarkowsky [2], Bian Wu [3], Adam Z Oskowitz [4], Robert Shahverdyan [5], Shant M Vartanian [4]

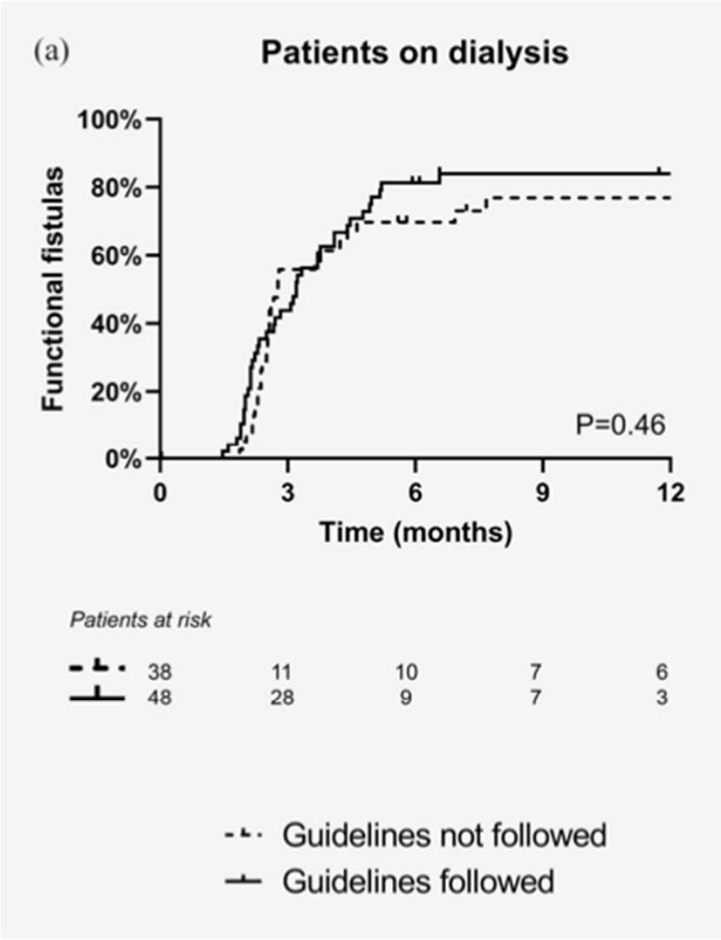
Variabili per funzionamento FAV: fattori anatomici (diametro vena)
fattori fisiologici: **DISTENSIBILITA'** della vena
fattori clinici : patologie

Problema FAILURE TO MATURE
inizio della dialisi con CVC (in USA 80% paz)

Guideline recommendations on minimal blood vessel diameters and arteriovenous fistula outcomes

Letty V van Vliet[1,2], Niek Zonnebeld[1,3], Jan H Tordoir[2], Wouter Huberts[1], Lee H Bouwman[3], Philippe W Cuypers[4], Stefan G Heinen[5], Laurens C Huisman[6], Susan Lemson[7], Barend ME Mees[2], Felix J Schlösser[8], André A de Smet[9], Raechel J Toorop[10], Tammo Delhaas[1] and Maarten G Snoeijs[2]





JVA The Journal of Vascular Access

Il solo diametro vascolare **non deve quindi rappresentare un criterio di esclusione assoluto**.

The Journal of Vascular Access
2024, Vol. 25(5) 1584–1592

I VASI VENOSI PROFONDI: ESCLUDIAMO STENOSI VASI CENTRALI

Valutazione bilaterale di:

- vene brachiali
- ascellare
- succlavia (escludere segno dello scaleno ovvero riduzione significativa o scomparsa del flusso nella vena succlavia durante abduzione/elevazione dell'arto superiore, espressione di compressione venosa dinamica a livello dello stretto toracico)

Valutazione di pervietà, comprimibilità, stenosi, trombosi e circoli collaterali

Analisi spettrale: fasicità respiratoria, pulsatilità cardiaca e simmetria dei flussi bilateralmente

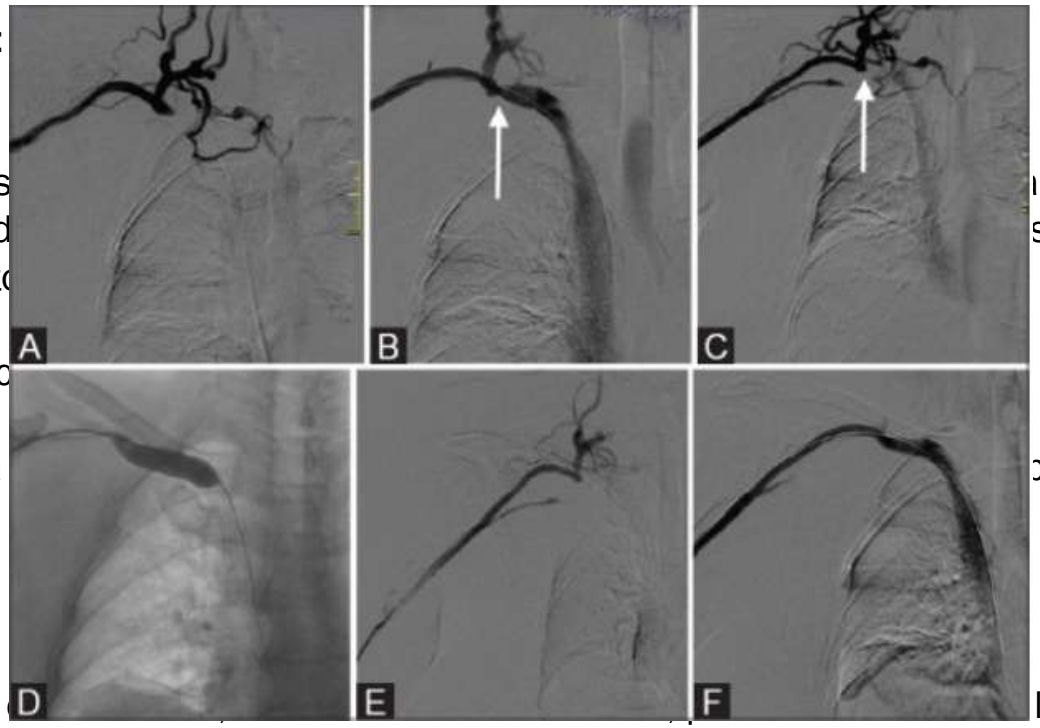
SE.....

Flusso continuo, perdita della fasicità, asimmetria controlaterale, presenza di collaterali....DUBBIA stenosi...

I VASI VENOSI PROFONDI: ESCLUDIAMO STENOSI VASI CENTRALI

Valutazione bilaterale di:

- vene brachiali
- ascellare
- succlavia (escludere s… …n del flusso nella vena succlavia durante abd… …ssione venosa dinamica a livello dello stretto t…



Valutazione di pervietà, c…

Analisi spettrale: fasicità … …pettro) e simmetria dei flussi bilateralmente

SE…..

Flusso continuo, perdita … …li, sospetta trombosi ------ ……DUBBIA stenosi…



Grazie di



a tutti!