CONTROVERSES ET ACTUALITÉS EN CHIRURGIE VASCULAIRE

CONTROVERSIES & UPDATES IN VASCULAR SURGERY

JANUARY 25-27 2018

MARRIOTT RIVE GAUCHE & CONFERENCE CENTER

PARIS, FRANCE WWW.CACVS.ORG

CAN DUPLEX CHARACTERIZATION OF LESIONS HELP SELECT THE PROPER TREATMENT FOR STENOSIS?

G.FRANCO
PARIS

Disclosure

Speaker name:

.....

- ☐ I have the following potential conflicts of interest to report:
- ☐ Consulting
- ☐ Employment in industry
- ☐ Shareholder in a healthcare company
- ☐ Owner of a healthcare company
- ☐ Other(s)
- ☒ I do not have any potential conflict of interest

GUIDELINES

Recommend routine AVF and AVG surveillance for early identification and pre-emptive correction of a stenosis before the access becomes dysfunctional

(ie.for stenosis >50%)

HOW TO DEFINE IT?

Clinical practice guidelines for vascular access. *Am J Kidney Dis* 2006

PRE-EMPTIVE CORRECTION OF ACCESS STENOSIS

Meta analyse 14 trials (1,390 participants; follow-up, 6-38 months)

« Pre-emptive correction of a newly identified or known stenosis in a functional AV access does not improve access longevity. Although pre-emptive stenosis correction may be promising in fistulas existing evidence is insufficient to guide clinical practice and health policy. While pre-emptive stenosis correction may reduce the risk of hospitalisation, this benefit is uncertain whereas there may be a substantial increase (i.e. 80%) in the use of access-related procedures and procedure-related adverse events (e.g. infection, mortality). The net effects of pre-emptive correction on harms and resource use are thus unclear.»

P.Ravani. Preemptive Correction of Arteriovenous Access Stenosis *.Am J Kidney Dis. 2016*

CDUS AVANTAGES

DUAL ANATOMICAL AND HEMODYNAMIC APPROACH

- **FLOW MONITORING +++**
- **VELOCITY+++ RATIO PSV>3**
- **Hemodynamic significance of stenotic lesion**
- **Lengh/ Residual Diameter**
- **Etiology/ Typesetting**
- **Elasticity /Stretchiness**
- **POSITIONAL INVESTIGATION**

Risk of Recurence
or
Uselessness of the Procedure

BERNOUILLI'S EQUATION

An increase in the speed of a fluid occurs simultaneously
with a
decrease in pressure or a decrease in the fluid' s potential energy

Modified Equation:

$\Delta P = 4 \cdot (V2^2 - V1^2)$

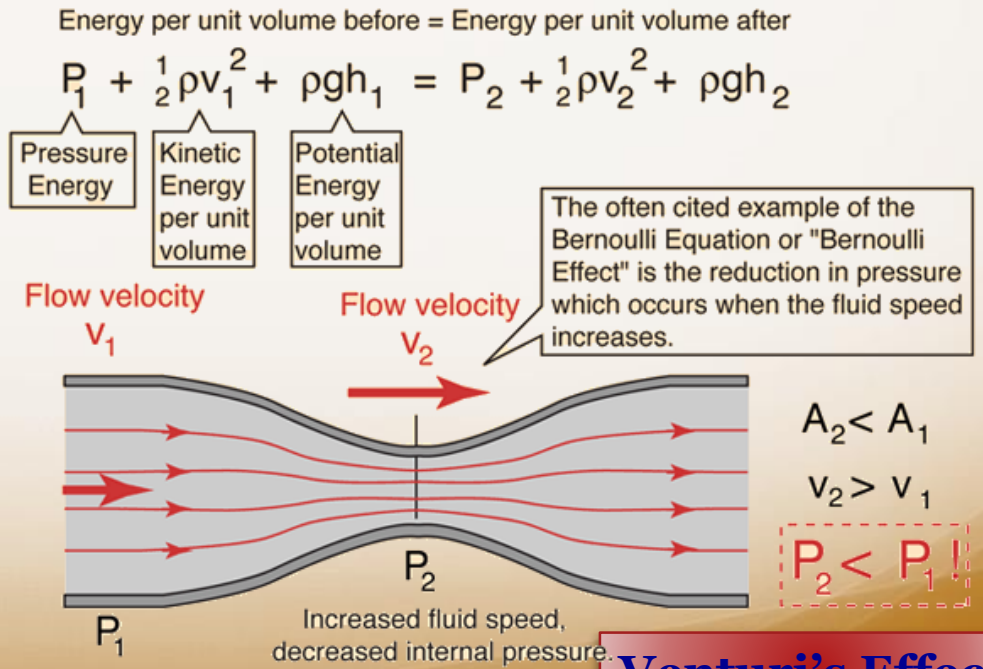
V1 : velocity upstream stenosis

V2 : velocity donwstream

If V1 < 1.5 m/sit can be neglected

Simplified Equation

$\Delta P = 4 \cdot (V^2 \text{ max})$



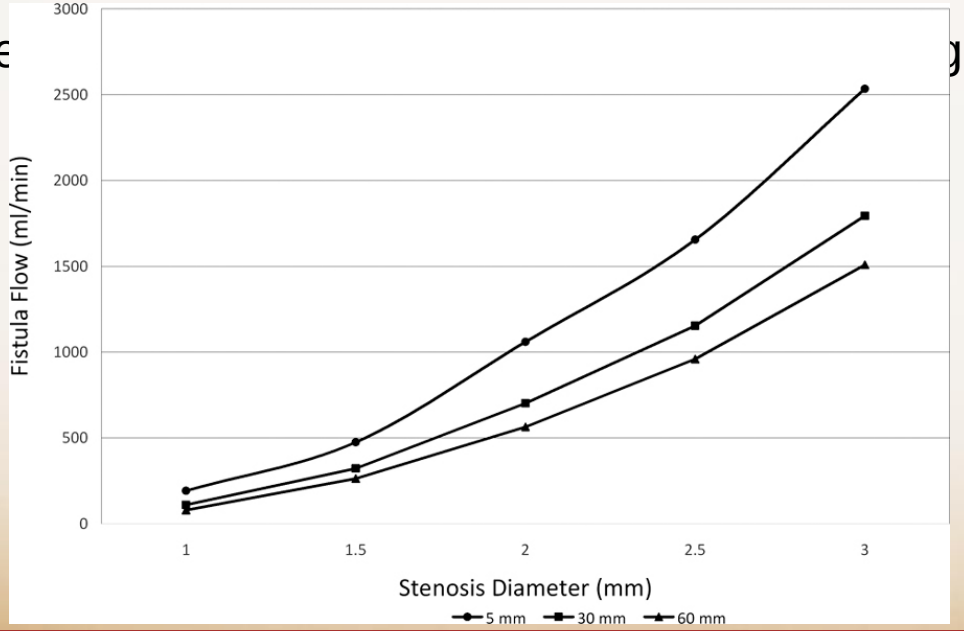
FLOW RATE and STENOSIS

AVF under physiologic extremes of mean blood pressures (50-160 mmHg)

1.5 mm stenosis of 5 mm length is capable of delivering: 301mL/min>flow rate <642 mL/min

2.5 mm stenosis of 5 mm in length is capable of delivering: 1,027mL>flow rate <2,262 mL/min

3 mm ste g: 902mL>flow rate <2093 mL/min



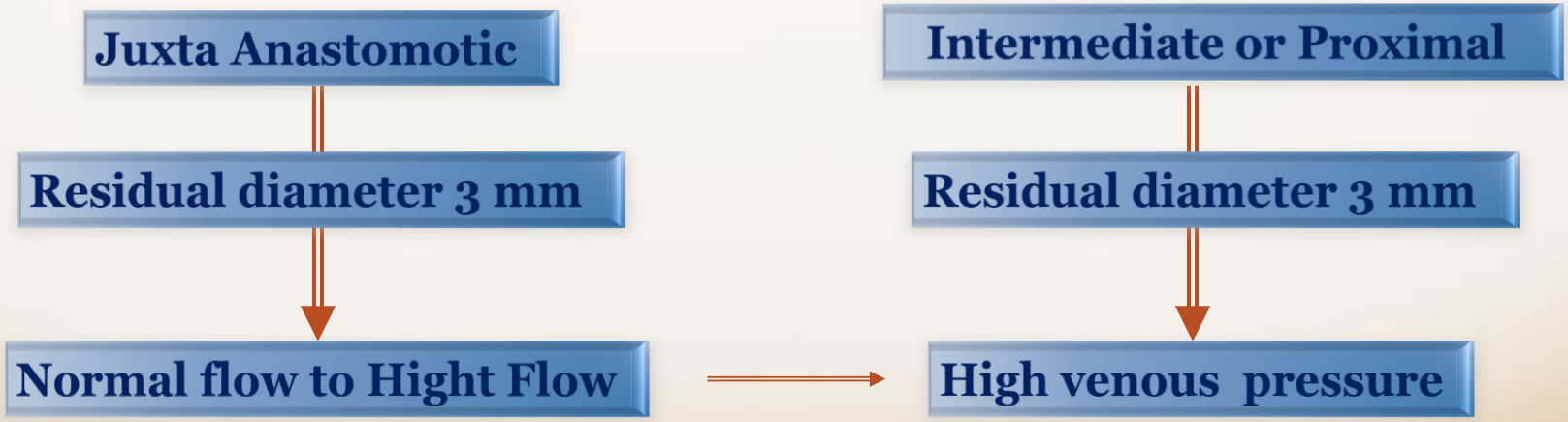
Hoganson D M,.Validation of computational fluid dynamics-based analysis to evaluate hemodynamic significance of access steno J Vasc Access 2014

The model clearly suggests that under physiologic extremes of mean pressures, a diameter of 2.5 mm is ample to provide flows over 1,000 mL/min

IMPACT OF STENOSIS or RESTENOSIS

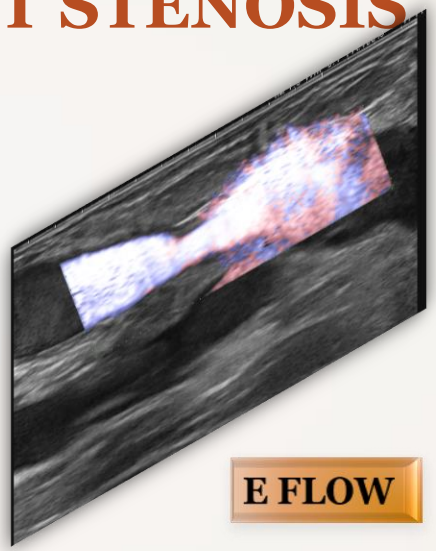
Differs with its location

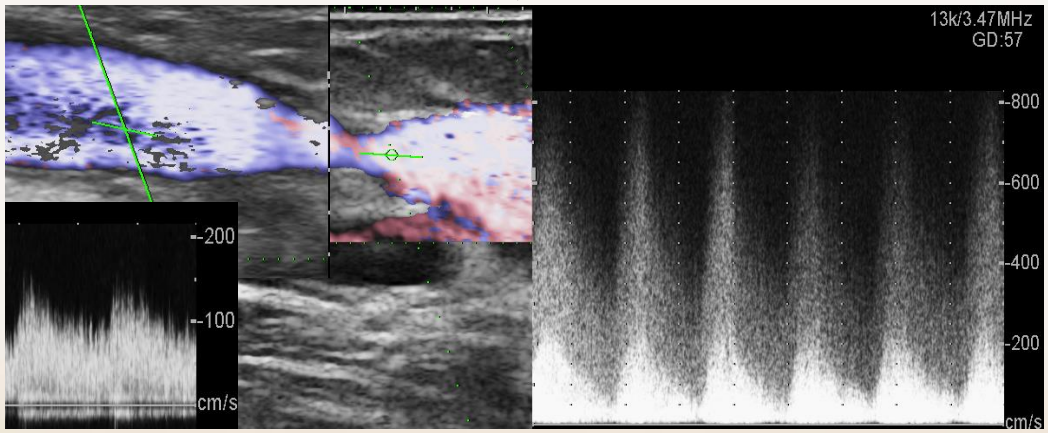
50% recoil with 6mm balloon= 3mm residual diameter> critical treshold



CRITERIA FOR DEFINING SIGNIFICANT STENOSIS

- **PSV RATIO>3**
- **RESIDUAL DIAMETER**
- **RI> 0,7**





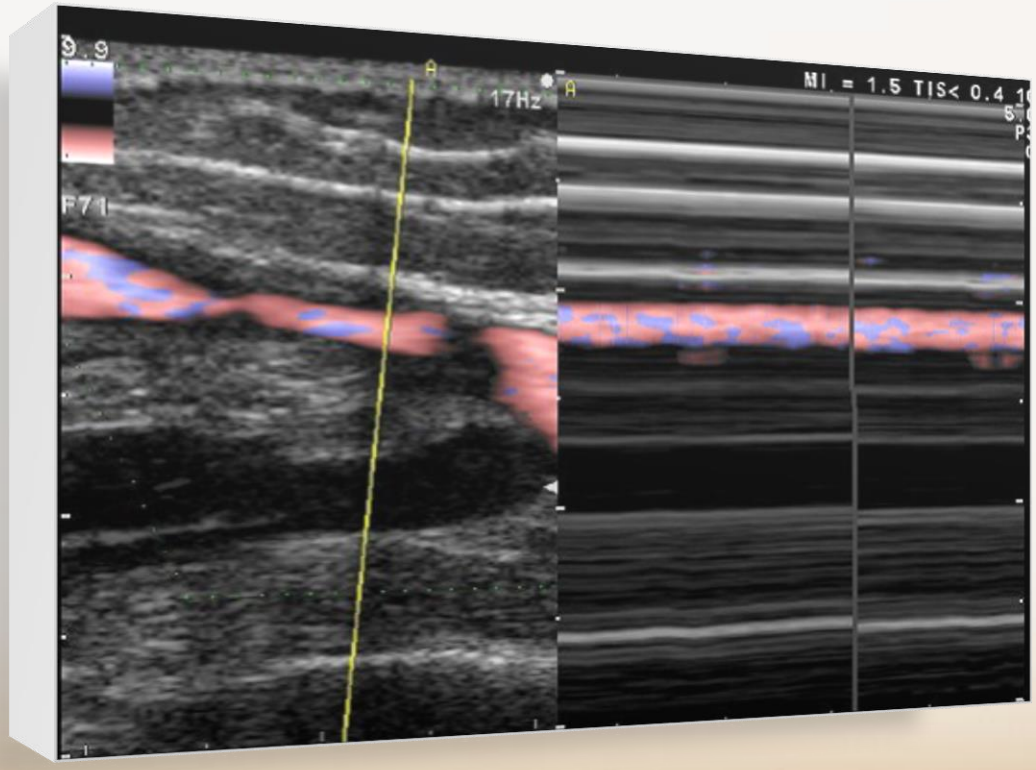
V1:150 cm:s RD: 2,2mm V2: 850 cm/s RATIO PSV:5,6
RI :0,7

RESIDUAL DIAMETER OF 2.7 mm :SECURITY TRESHOLD

Fahrtash F et al. Defining a significant stenosis in an autologous radio-cephalic arteriovenous fistula for hemodialysis. *Semin Dial. 2011*

Elasticity /Stretchiness

Diameter variation under downstream compression



E Flow
TM Doppler

Leads to Recoil after balloon dilatation

CDUS and ETIOLOGY of STENOSIS

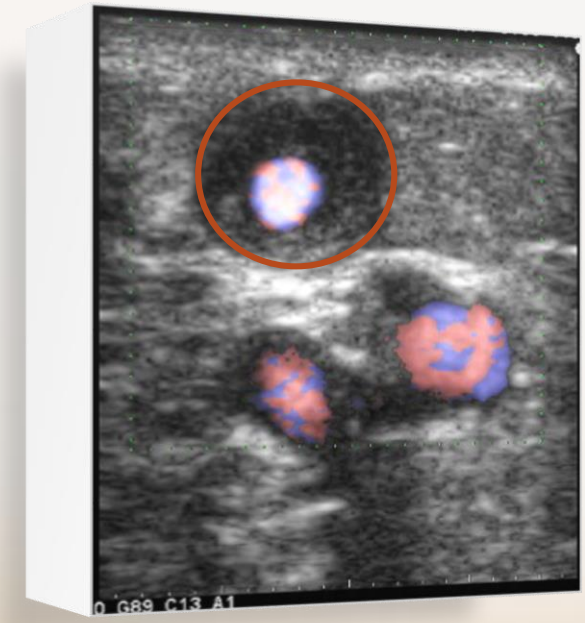
- NEO INTIMALHYPERPLASIA
- THROMBUS
- VALVULAR LESION
- COMPRESSION
- MIXED PROCESS

Better Targeting The Lesions And Diversifying The Weapons

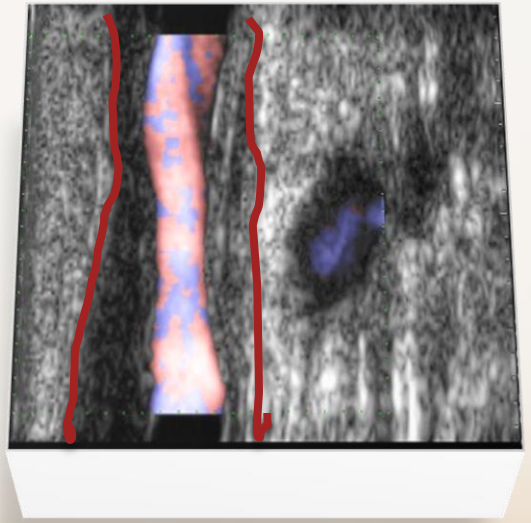
MYO INTIMAL HYPERPLASIA

Balloon angioplasty has primary patency rate after six months can be lower than <50%

DRUG-ELUTING OR CUTTING BALLOON FIRST to AVOID STENT ?



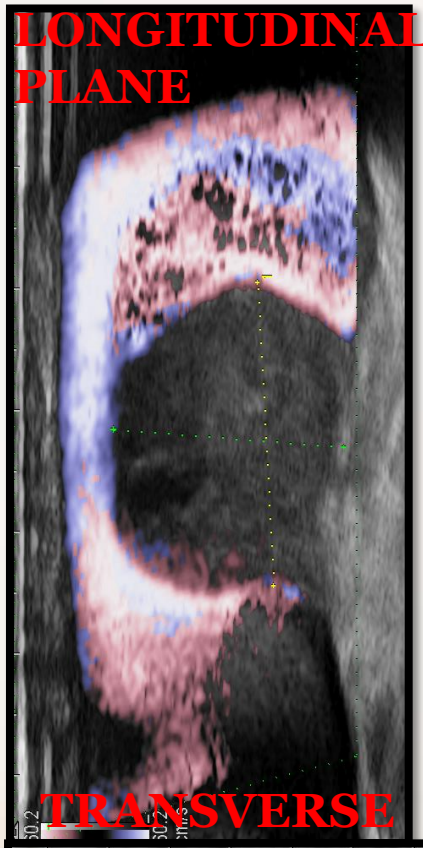
Tranverse plane

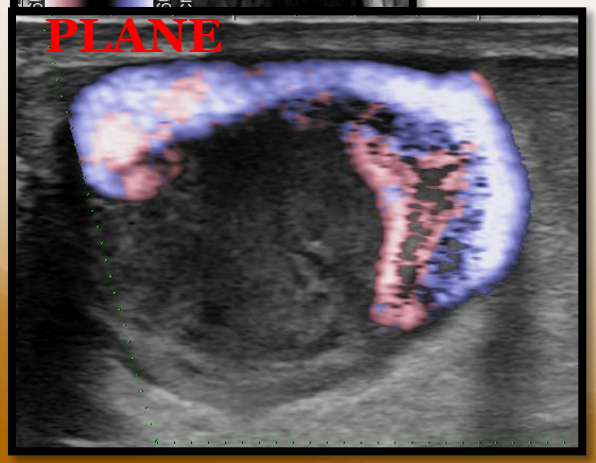


Longitudinal plane

"re-intervention-free percentage at 12 months" before and after DEB: 19% vs. 69%.
JJ.Swinnen.J Vasc Access 2015

STENOSIS :WALL THROMBUS





TREATMENT FOCUSED ON

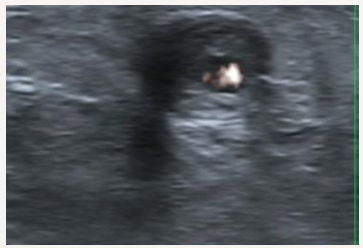
- **STENOSIS**
  - **PTA ALONE**
- **CLOT**
  - **THROMBO-ASPIRATION**
  - **THROMBOLYSIS**
  - **PHARMACOMECHANICAL KT-DIRECTED THROMBOLYSIS**

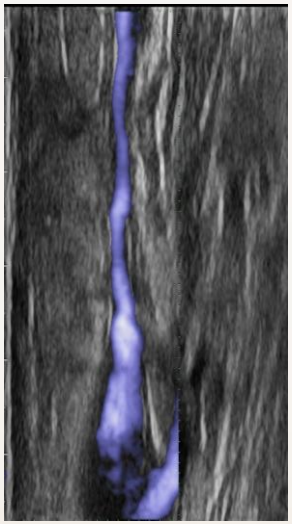
FTM: JUXTA ANASTOMOSIC STENOSIS

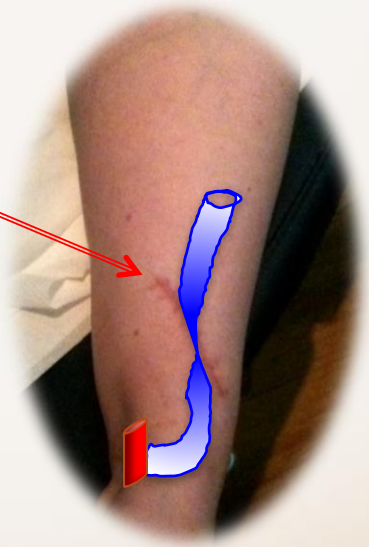
ADVERSE VASCULAR REMODELLING

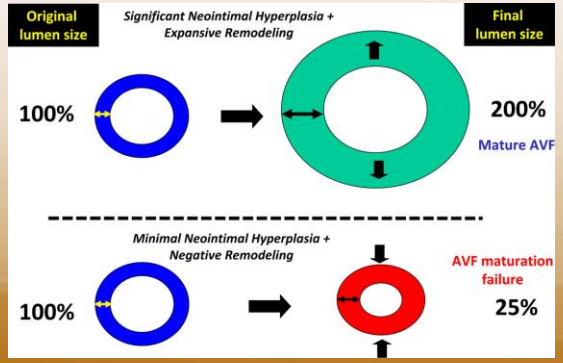
NIH---FAT TISSUE ,OEDEMA AND SCAR TISSUE COMPRESSION

NIH







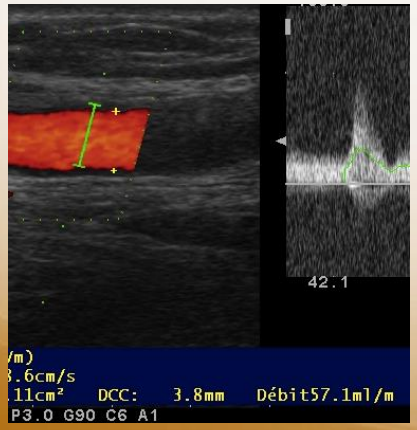


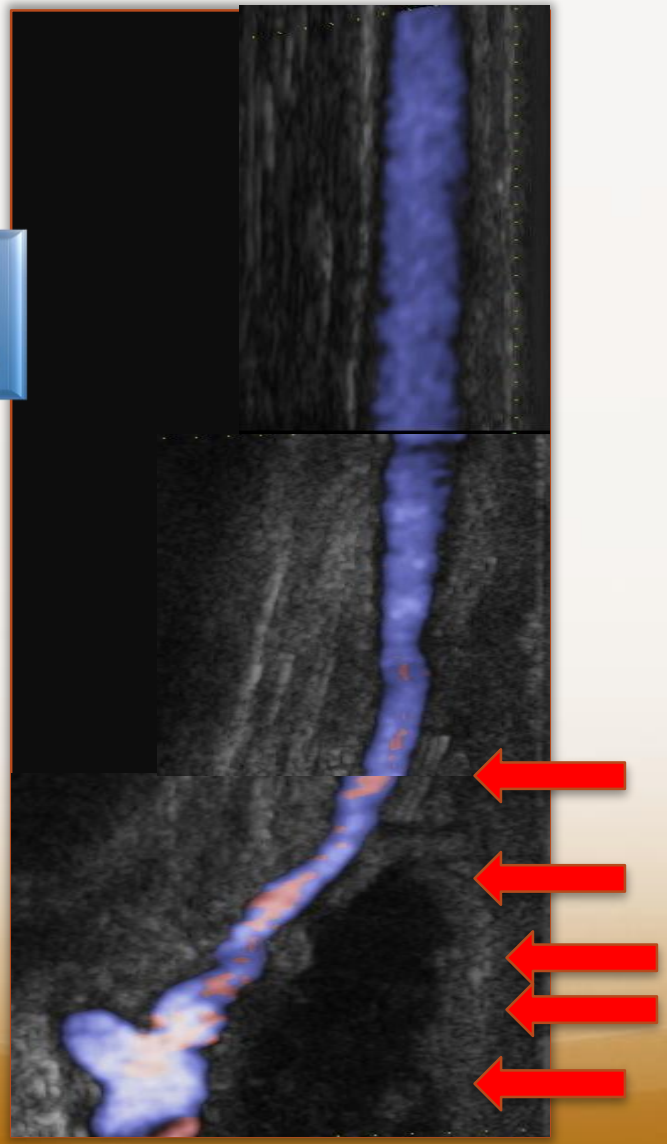
K.Konner. *Nephrol Dial Transplant 2002*

PSEUDO OCCLUSIVE STENOSIS :COMPRESSIVE HEMATOMA FTM

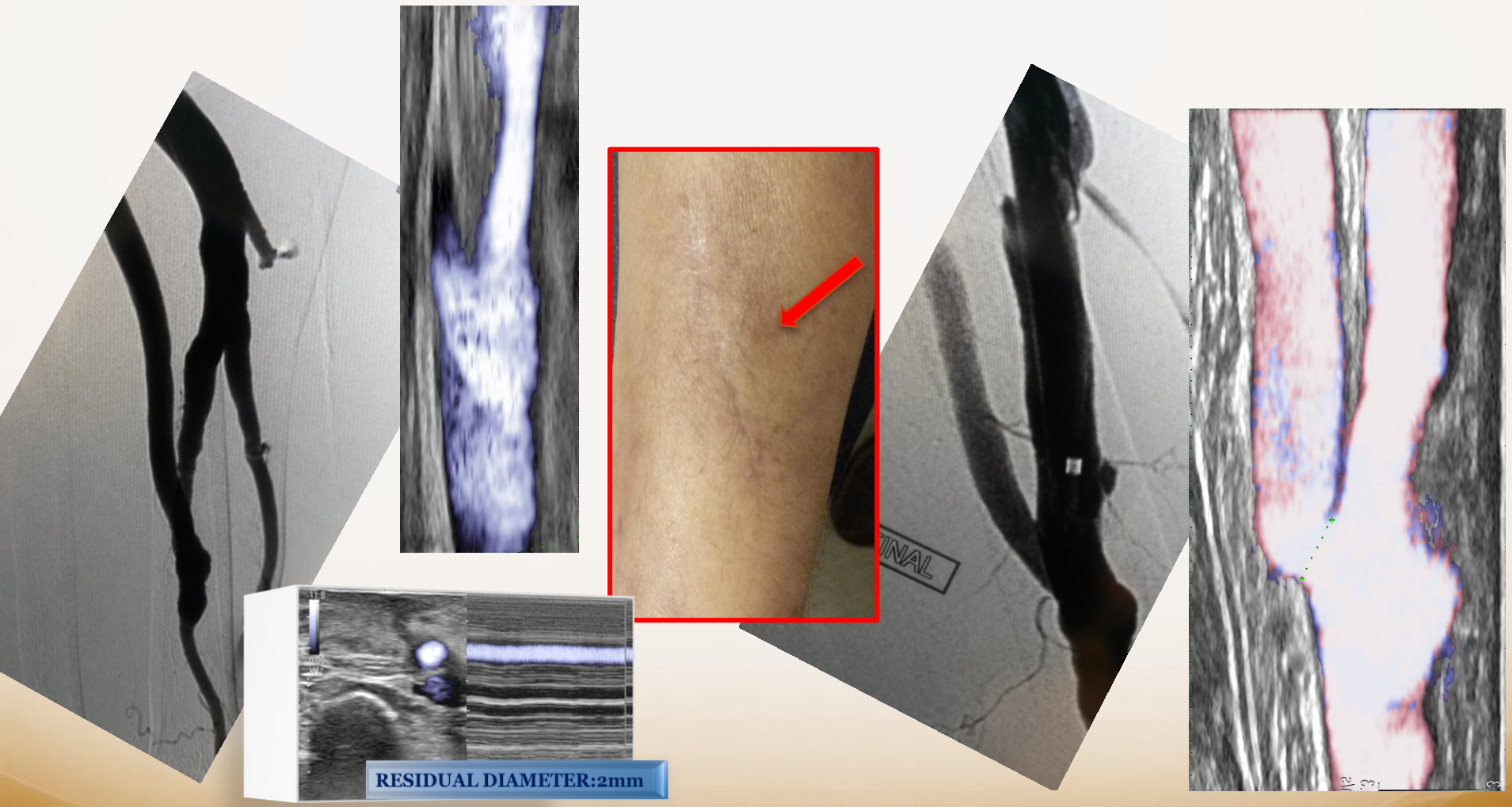
SURGICAL DRAINAGE +/- PTA OR REFECTION OF ANASTOMOSIS

VERY LOW FLOW:60 ml/mm
THIGHT STENOSIS:
RESIDUAL DIAMETER:0,6mm





FTM: JUXTA ANASTOMOSIC STENOSIS



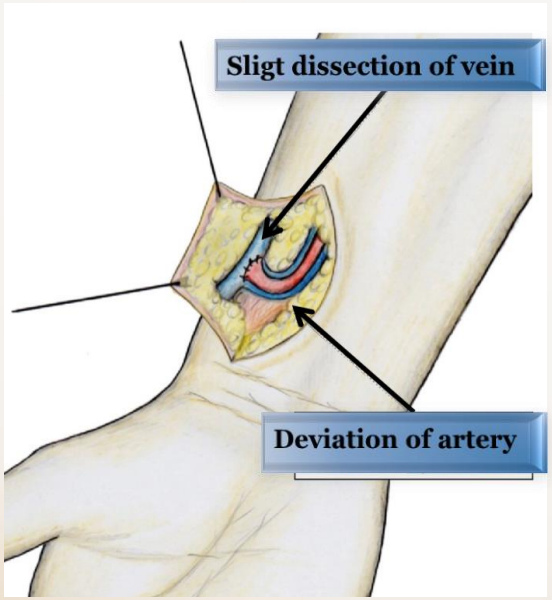
BEFORE PTA

AFTER PTA

+ 8 DAYS
4 mmϕ
30% Restenosis

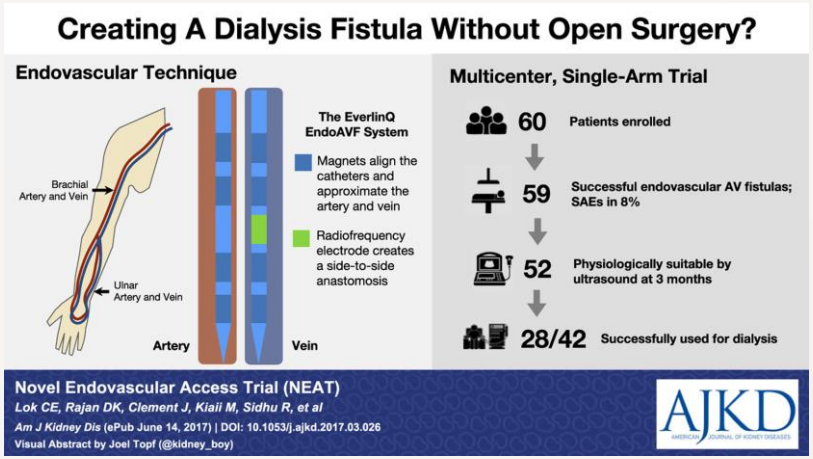
WHAT'S UP

RADAR



RADIAL ARTERY DEVIATION AND REIMPLANTATION

N.Sadaghianloo.*J Vasc Surg*. 2016

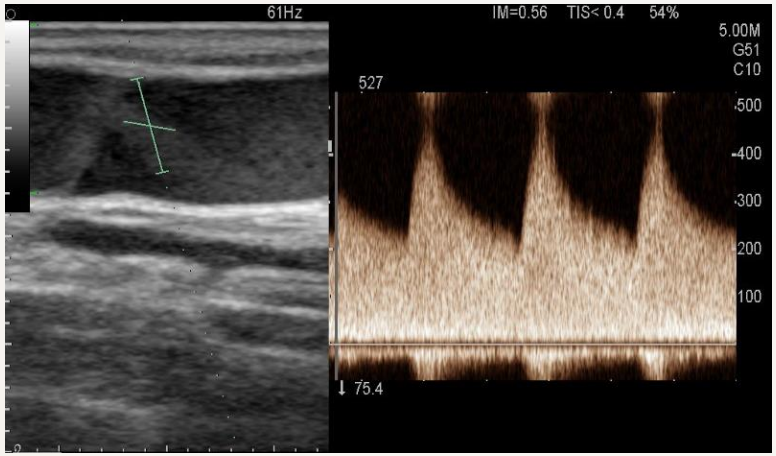


Ellipsys Vascular Access System
By Jeffrey E. Hull, MD

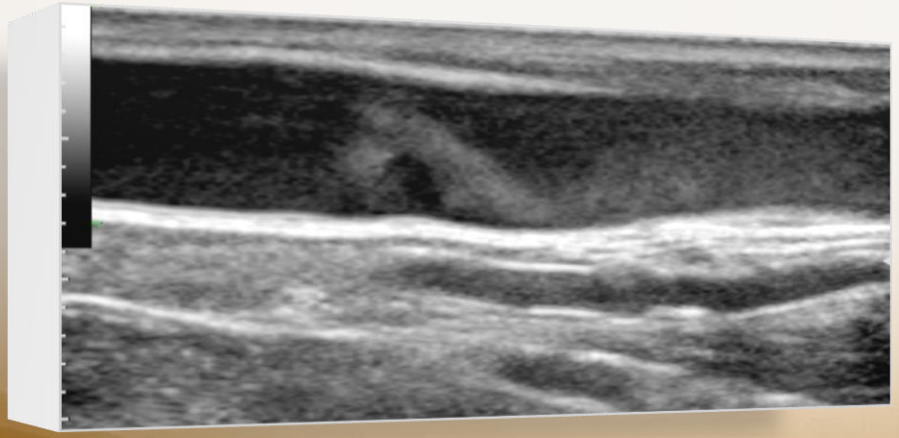
Patients are started on aspirin and clopidogrel 48 to 72 hours prior to the procedure. The procedure is done with local regional anesthesia. I often perform a supraclavicular brachial plexus block, but this is not required. The antecubital fossa is sterilely prepped and draped. Retrograde access to the cubital vein is obtained with ultrasound guidance, which is also used to perform the remaining steps in the procedure. The access needle is directed toward the perforating vein. The wire is advanced through the needle into the perforating vein. The access needle is advanced over the wire through the perforating vein to the proximal radial artery. The proximal radial artery lies medial to the perforating vein and is entered as it would be in any ultrasound-guided arterial access procedure. The wire is advanced into the radial artery. The needle is withdrawn, and a 6-F sheath is placed over the wire into the artery. The Ellipsys catheter is positioned through the sheath, and the artery and vein wall are engaged. The catheter is closed and activated, and the fistula is created using low-power direct current energy. The sheath is removed, and hemostasis is achieved with gentle pressure.

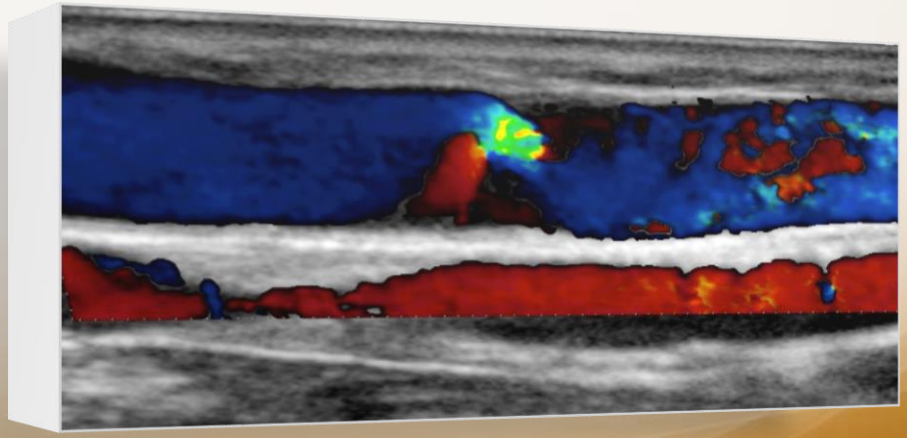
EARLY VALVE STENOSIS

Should we wait?

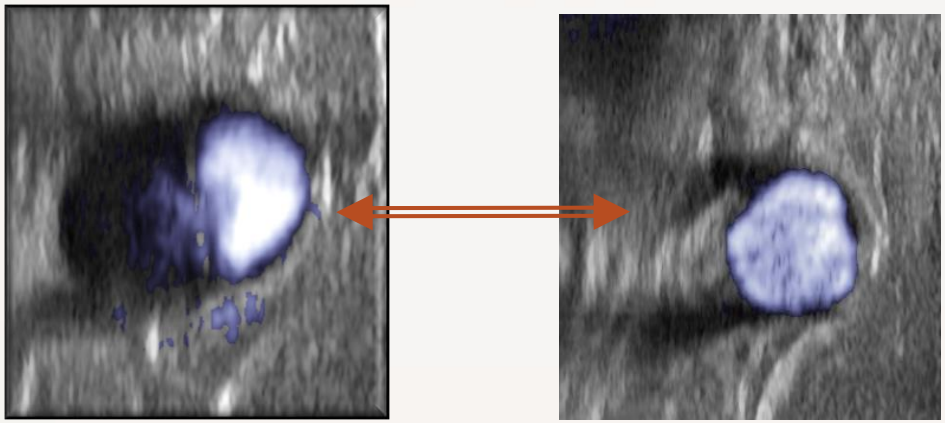


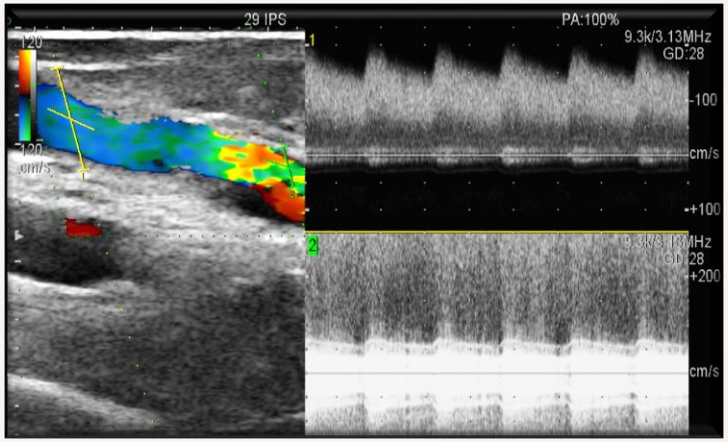
- **Non still dialysed patient**
- **Early stenotic venous segment**
- **Thin venous valves have fused together**
- **Altered hemodynamic shear stress profiles**
- **Jet lesion**
- **Increase neointimal hyperplasia**
- **Post stenotic dilatation**

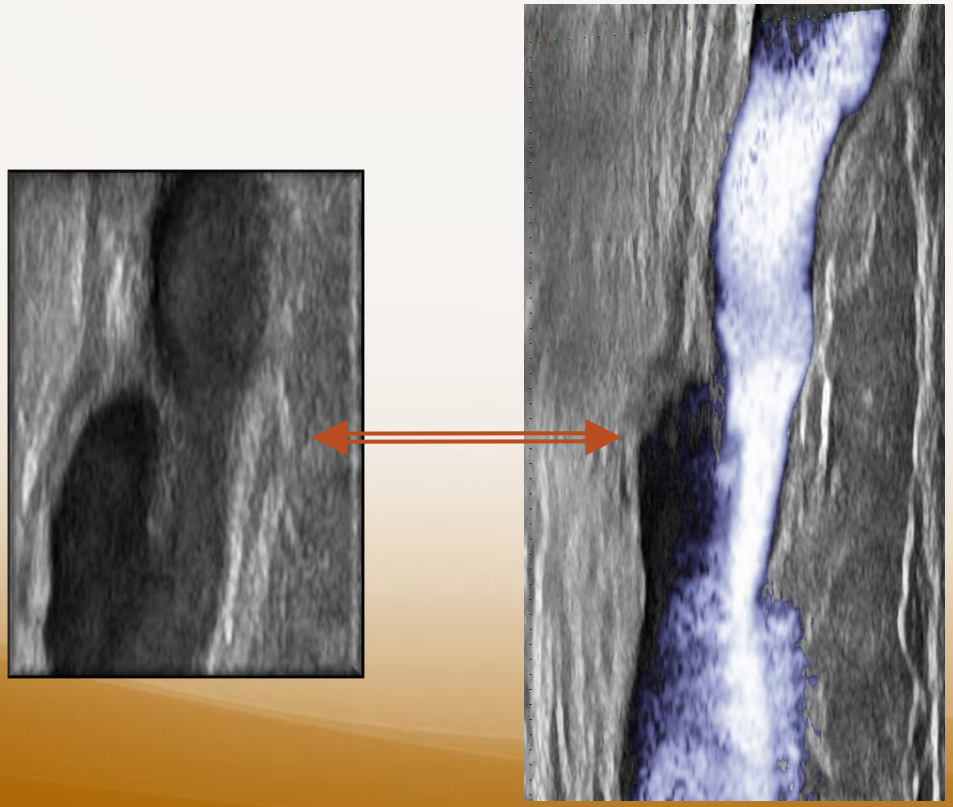




ECCENTRIC VALVULAR STENOSIS

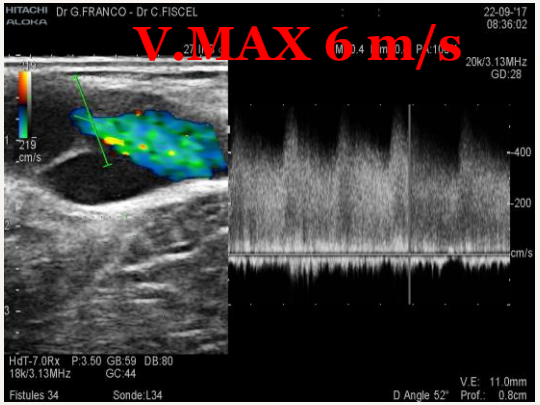


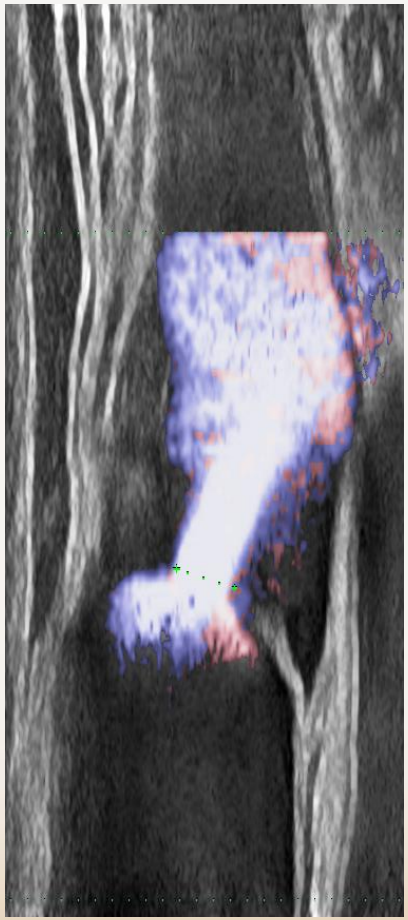




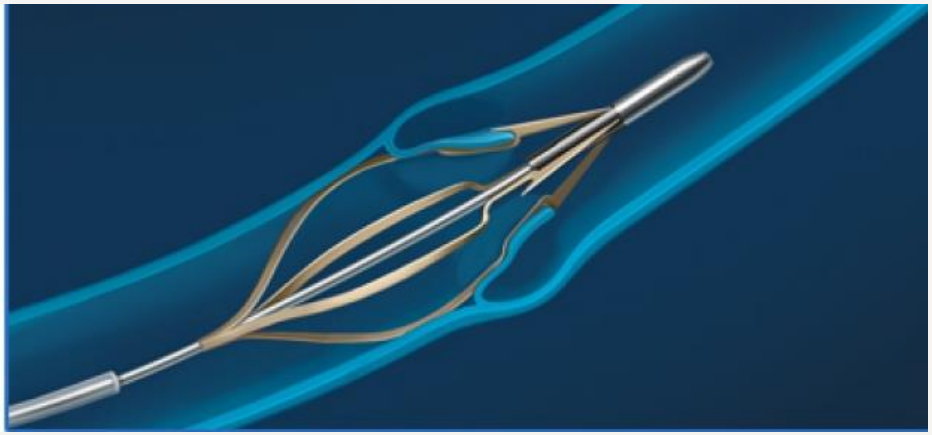
VALVE HYPERTROPHY
VALVE LEAFLETS FUSION
FIBROUS STRINGS

CONCENTRIC VALVULAR STENOSIS





VALVULAR LESION



COULD VALVULOTOMY BE PREFERRED?

TO AVOID INCREASED CELL PROLIFERATION INDUCED BY PTA

Percutaneous valvulotomy in the management of failing dialysis fistulas and grafts
Connolly, S. et al.Journal of Vascular and Interventional Radiology , 2015

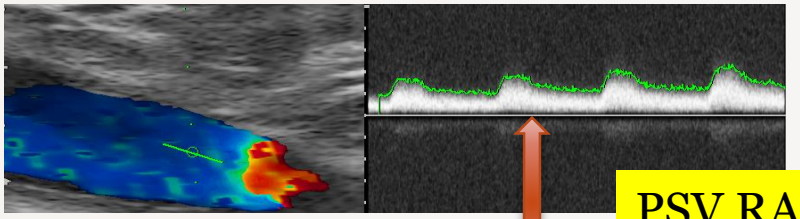
Percutaneous Valvulotomy as an Alternative to Transposition of a Brachiocephalic Fistula.
Hull, Jeffrey E. et al .Journal of Vascular and Interventional Radiology , 2014

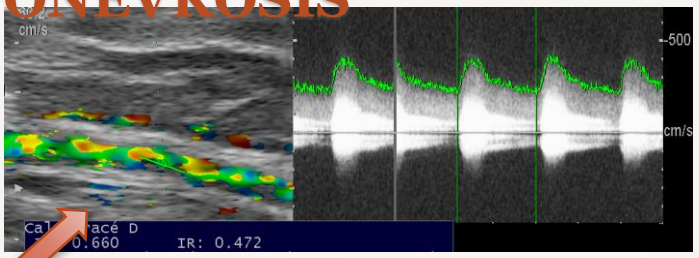
Chang C-J.*Am J Kidney Dis* 2004

PROXIMAL COMPRESSION
of
BASILIC VEIN
or
CEPHALIC ARCH

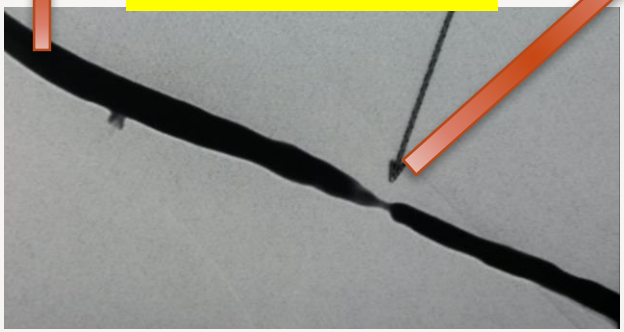
SURGICAL PREVENTION
and
TREATMENT
Rather Than
PTA

COMPRESSION OF BASILIC VEIN between BRACHIAL ARTERY and APONEVROSIS



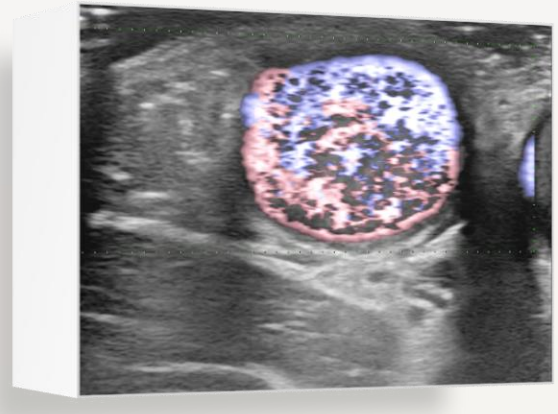


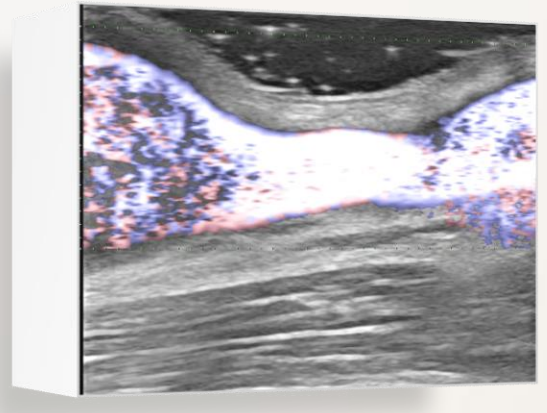
PSV RATIO:3,5



- **ANGIOPLASTY**
- **RECOIL**
- **STENT**
- **NIH**

BASILIC VEIN STENOSIS IN APONEVROTIC TUNEL





HIGH RECURRENCE STENOSIS RATE WITH BALLON ANGIOPLASTY

↓

STENT

↓

HIGH RECURRENCE INTRA STENT STENOSIS

↓

IT COULD BE MORE EFFECTIVE
TO OVOID or RELIEVE SURGICALLY THE COMPRESSION

POSITIONAL STENOSIS OF CEPHALIC VEIN

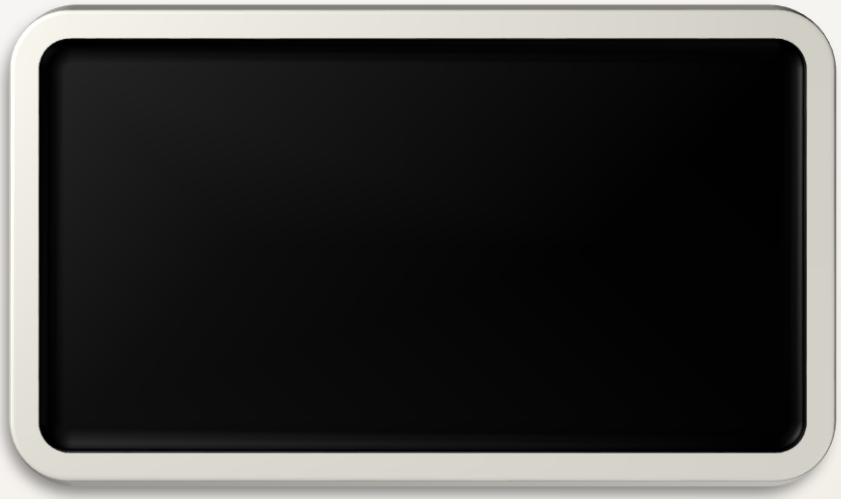
COMPRESSION BY AXILARY ARTERY

ABDUCTION INCREASE STENOSIS

ADDUCTION DECREASE STENOSIS

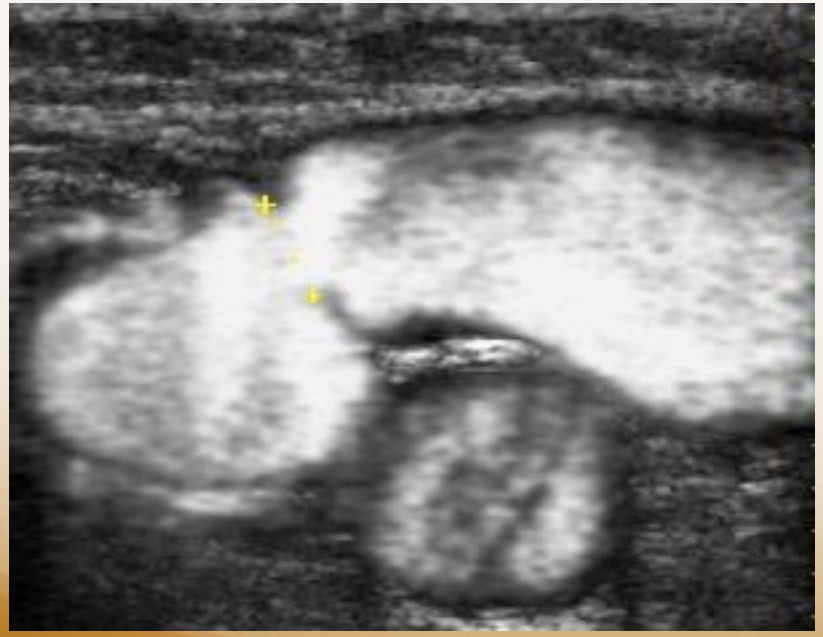
RETROGRADE FLOW IN UNDERLYNG COLLATERAL VEIN

FALSE POSITIVE ELEVATION MANEUVER



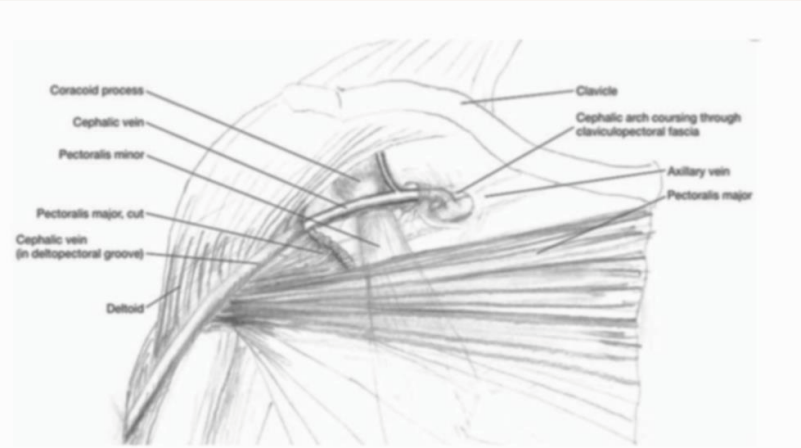
RESTENOSIS OF CEPHALIC VEIN

High Flow
Valvular Ring Can't Follow



RECALCITRANT STENOTIC LESIONS OF THE CEPHALIC ARCH

INTERVENTION	TECHNICAL SUCCESS	OUTCOME 2 YEARS
ATL	70%	63%
STENTING	80%	59%
TRANSPOSITION	96%	90%
BYPASS	100%	92%



M G.Davies .Outcomes of intervention for cephalic arch stenosis in brachiocephalic arteriovenous fistulas. *J Vasc Surg*. 2017

HIGH FLOW /STENOSIS

Circ Res. 1977 Jul;41(1):99-107.

Hemodynamics of arterial stenoses at elevated flow rates.

Young DF, Cholvin NR, Kirkeeide RL, Roth AC.

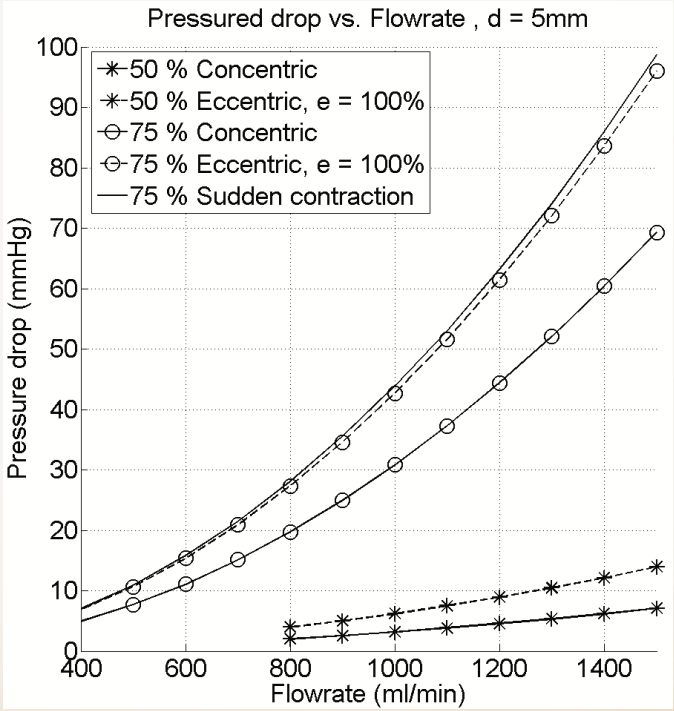
Abstract

This study is concerned with the pressure drop that develops across an arterial stenosis, with particular emphasis on the effect of the stenosis at high blood flow rates induced by a locally administered vasodilator drug. Stenoses, ranging in severity from 55.7% to 91.0% reduction in lumen [illegible] taneous flow rates and pressure drops we [illegible] /sec. Experimental data support the applic [illegible] elocities and stenosis geometries. Results show that blood flow through a particular artery can increase by a large factor, in the range of 4-5, under conditions of vasodilation with a corresponding large decrease in pressure distal to the stenosis. The pressure drop increases in a nonlinear manner with velocity and thereby accentuates the importance of the stenosis at elevated flow rates. We suggest that a critical stenosis be defined in terms of its effect on maximal flow rather than resting flow.

Pressure drop increase with velocity and accentuates the importance of the stenosis at elevated flow rates

RELATION STENOSIS /FLOW

DIVISION OF FLOW BY 2
DIVIDED BY 4 THE PRESSURE GRADIENT



Access flow reduction and recurrent symptomatic cephalic arch stenosis in brachiocephalic hemodialysis arteriovenous fistulas.

Miller GA[1], Friedman A, Khariton A, Preddie DC, Savransky Y.

Recurrent cephalic arch stenosis (CAS) has been linked to high flow and has a high rate of recurrence following angioplasty. This study investigates the effectiveness of access flow reduction in decreasing rapidly recurrent symptomatic CAS.

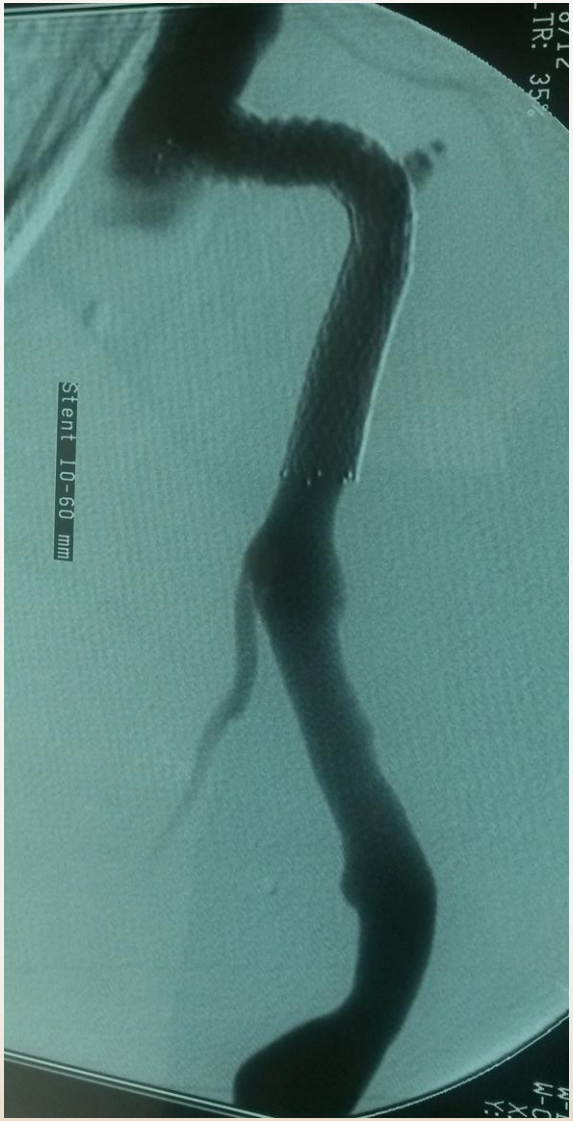
RESULTS:

At 3, 6, and 12 months, the cephalic arch primary lesion patency was 91%, 76%, and 57%. The cephalic arch intervention rate was reduced from 3.34 to 0.9 per access-year (t=7.74, p<.001). The average follow-up time was 14.5 months (range, 4.8-32).

CONCLUSION:

Flow reduction of a brachiocephalic arteriovenous hemodialysis fistula may effectively diminish the incidence of symptomatic CAS.

Miller GA.J Vasc Access.2010



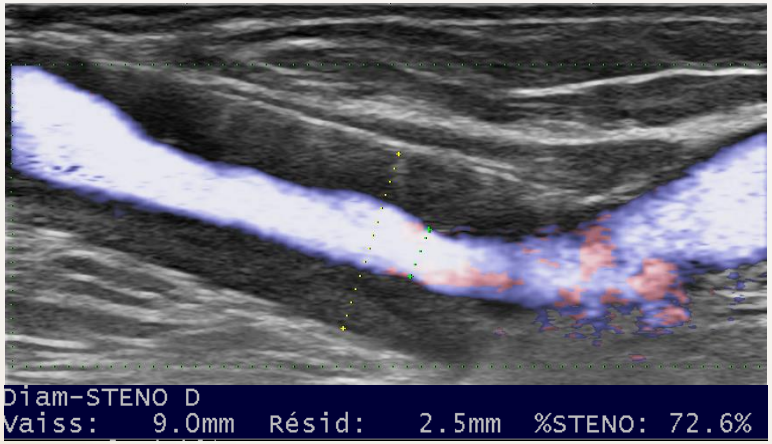
Long Plane

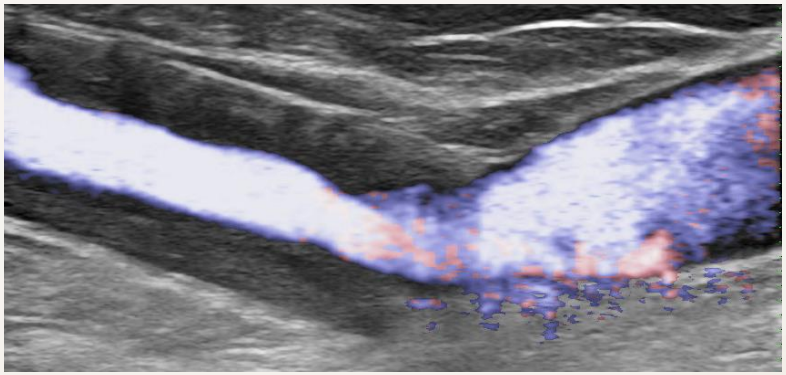
Transverse Plane

16 years old
BC AVF 2L for 1,73 m2
Fonctional ST of Final Arch
STENT instead Flow Reduction
BV:doomed

INTRASTENT RESTENOSIS

INTRASTENT STENOSIS> 70% in ϕ





INTRA STENT RESTENOSIS(ISR)

Drug Eluting Balloon
Stent Graft

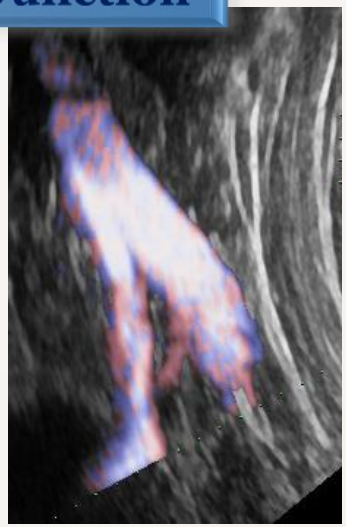
Atherectomy ?

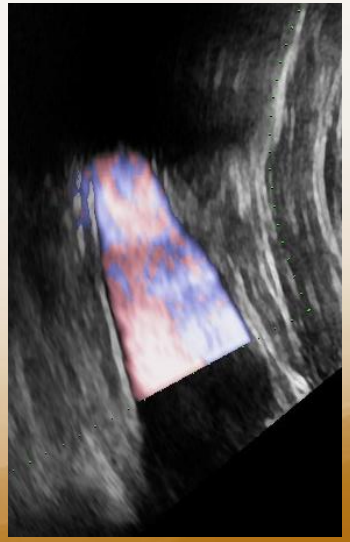
- ✓ **REAL TIME IMAGING OF VESSEL LUMEN**
- ✓ **OPTICAL COHERENCE TOMOGRAPHY(OCT)**
- ✓ **DIRECTIONAL ATHERECTOMY**
- ✓ **NO RADIATION**
- ✓ **3D ECHO GUIDANCE in FUTURE**

Pantheris Luminar System

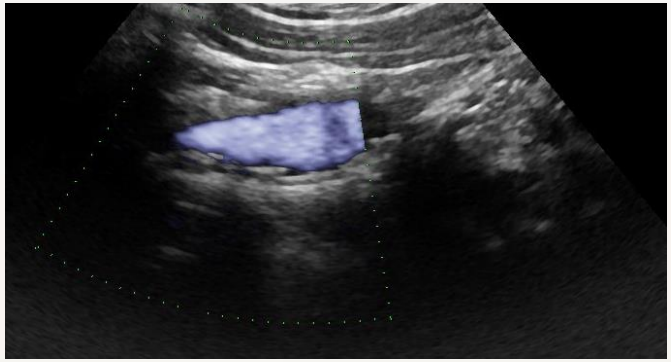
TOS SCV STENOSIS

FALSE POSITIVE :ARM ELEVATION TEST
Positional Stenosis at Costoclavicular Junction





TOS



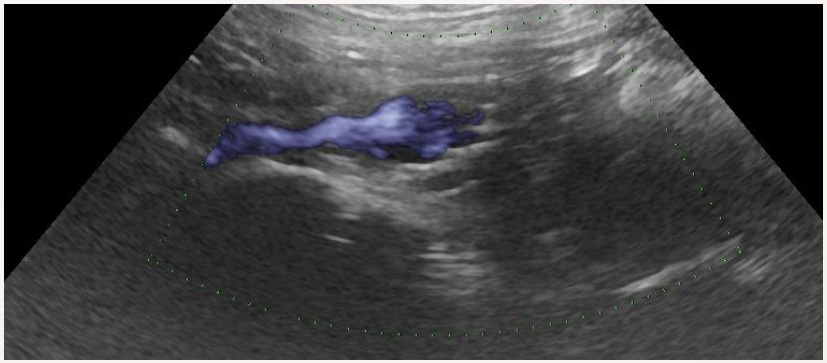
SCV and STENT COMPRESSION

DISLOCATION

TOS

SCV COMPRESSION POST STENT CEPHALIC VEIN

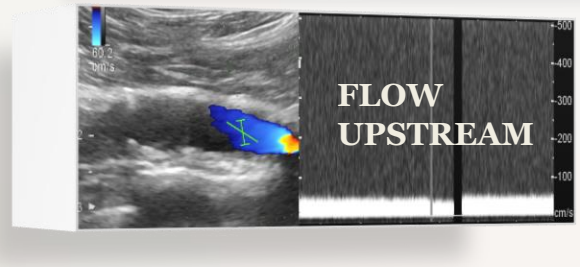
BEFORE PTA



AFTER PTA

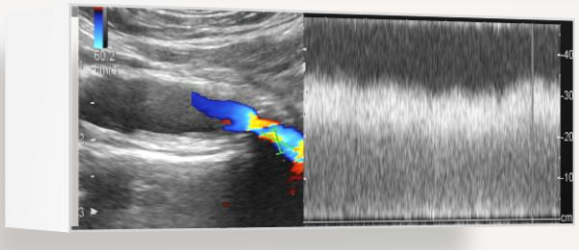
SCV STENT RESTENOSIS

PRE-STENOTIC VELOCITY: 60 cm/s

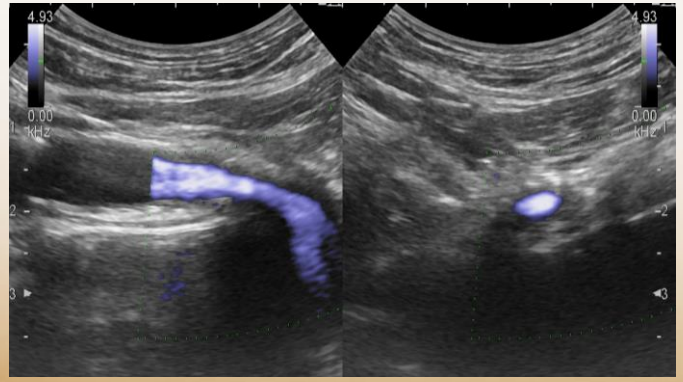


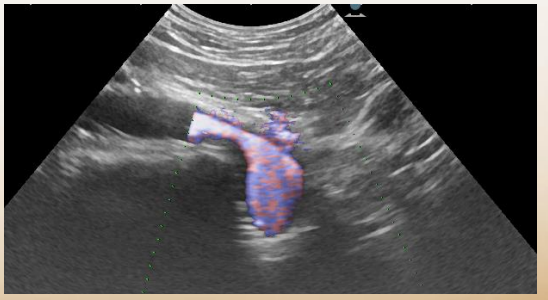
PSV RATIO:6
Δ P:40 mm Hg

PRE-STENOTIC VELOCITY: 360 cm/s



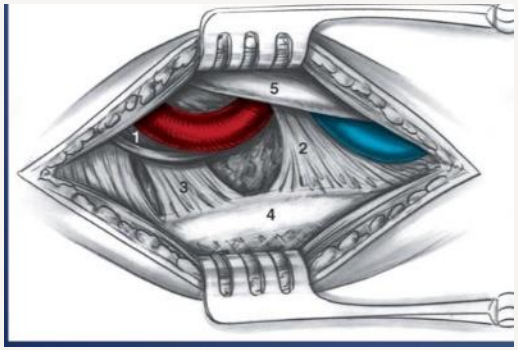
SCALENUS COMPRESSION :STENT DEFORMATION
SLIGHT NIH



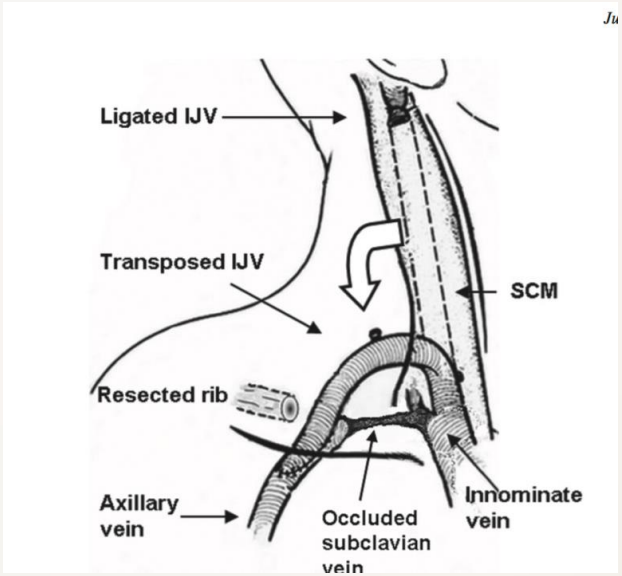


SURGICAL MANAGEMENT OF TOS

Claviculectomy



First Rib Resection



IJV to Distal SCV Transposition

Glass, C.Costoclavicular venous decompression in patients with threatened AV access. *Ann Vasc Surg*. 2011

Illig, K.A. Management of central vein stenoses and occlusion: the critical importance of the costoclavicular junction. *Semin Vasc Surg*. 2011

Illig, K.A Aggressive Costoclavicular Junction Decompression in Patients with Threatened AV Access Ann Vasc Surg; 2015

CONCLUSION I

DUPLEX CHARACTERIZATION HELPS SELECT THE BEST STENOSIS TREATMENT

SHOULD BE INTEGRATED WITHIN MULTIDISCIPLINARY STAFF

AS IT IS MANDATORY IN CANCEROLOGY

CONCLUSION II

« **Stenotic lesions should not be repaired merely because they are present .If such correction is performed then intaprocedural prior and following PTA should be conducted to demostrate functional improvement with a succesfull PTA »**

Besarab A,*Blood purification 2006*