JUXTA-ANASTOMOTIC STENOSIS

PROXIMALIZATION OR JUMP GRAFT
VS
ANGIOPLASTY

Sitthichai Vachirasrisirikul , MD.

Diploma of The Thai Board of Vascular Surgery

Vascular surgeon , Buddhachinaraj Hospital , Phitsanulok

Juxta-Anastomotic Stenosis (JAS)

JUXTA-ANASTOMOTIC STENOSIS
Incidence

Juxta-anastomotic stenosis with a viriable reported incidence of **43-65%(up to 77%)** is a major cause for early AVF failure and arrested maturation

G.A.Beathard, et al. Kidney Int, 2003
Badero OJ, et al. Am J Kidney Dis, 2008

Characteristic Sites of Stenosis for the Three Most Common AVFs

ACCESS TYPE	COMMON SITE
Radiocephalic fistula	Juxta-anastomotic : 55–75% : Swing vein stenoses are the commonest (45.7%)
Brachiocephalic fistula	Cephalic arch : 55% Juxta anastomotic : 22%
Brachial artery–to–transposed basilic vein fistula	Proximal swing segment

Keith Bertram Quencer, et al. AJR , 2015

RADIOCEPHALIC FISTULA

ADVANTAGES

- Ease of creation
- Upstream vein is preserved
- Low rate of steal syndrome
- Rare are ischemic monomelic neuropathy

DISADVANTAGES

- **Low rate of maturation**
  - 35-40% in first year
- **Low flow rate**

Keith Bertram Quencer, et al. AJR , 2015

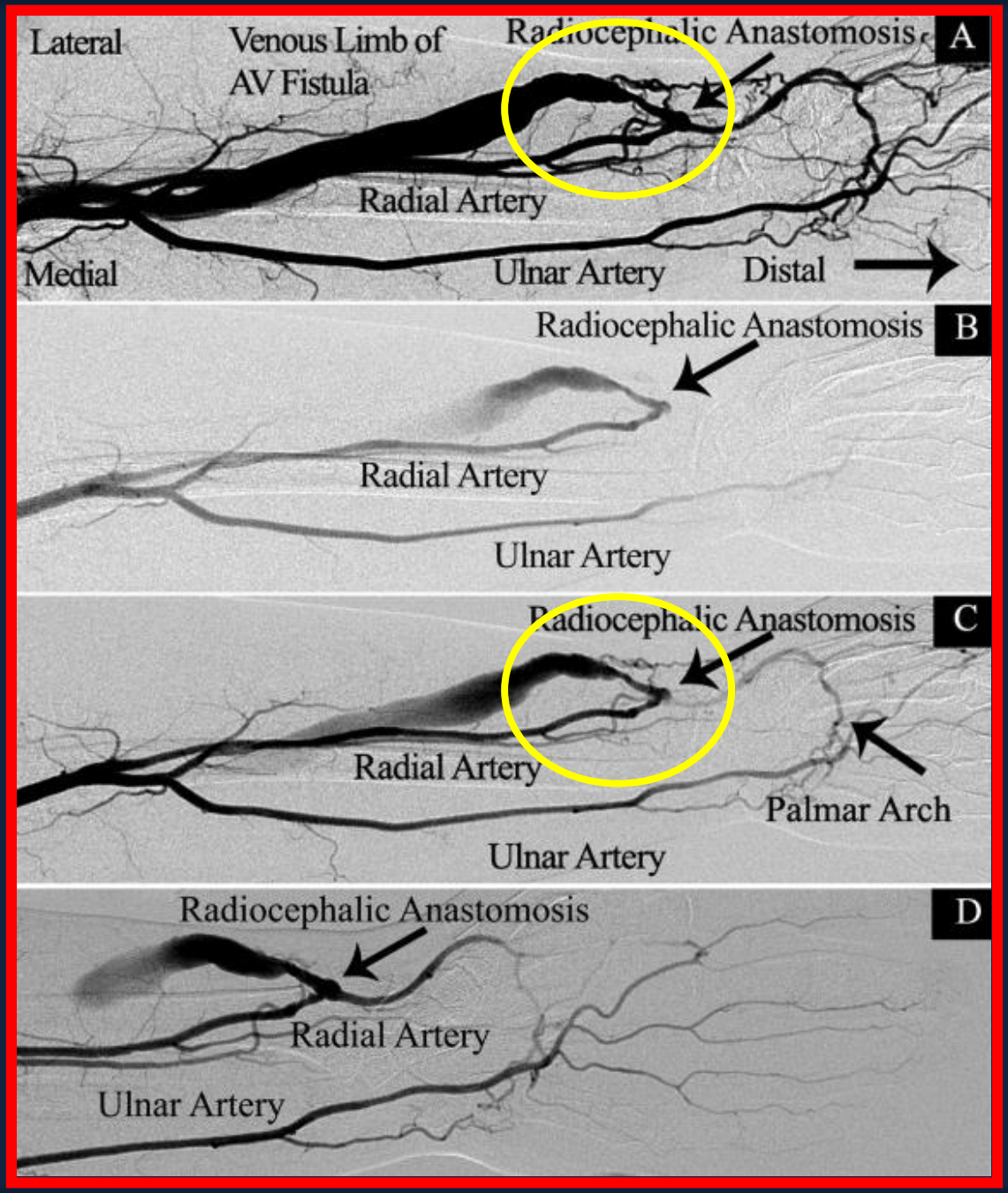
JUXTAANASTOMOTIC STENOSIS (JAS)
Definition

1. >50% reduction of diameter of the outflow vein within 2-5 cm from the arteriovenous anastomosis

Asif A, et al.Kidney Int 2005
Nassar GM, et al. Clin J Am Soc Nephrol 2006
Kwon H, et al. Ann Vasc Surg. 2014

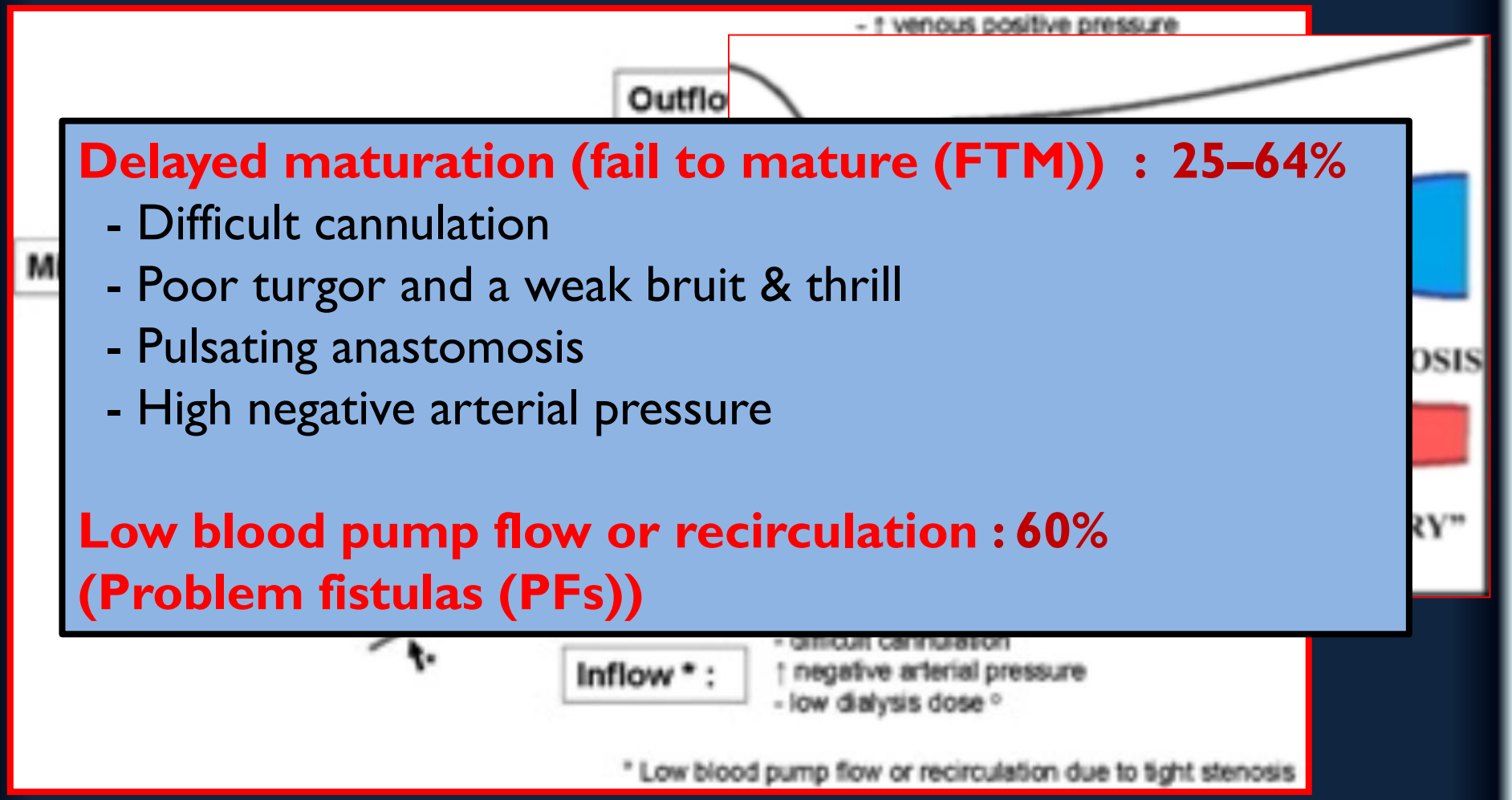
2. >50% in the artery, anastomosis or vein
   - the last 2 cm of the radial artery, and 5 cm of the swing vein
   - within 3 cm of the anastomosis

Swinnen J, et al. J Vasc Surg. 2015
Long B, et al. J Vasc Surg. 2011


Lateral
Venous Limb of
AV Fistula
Radiocephalic Anastomosis
A
Radial Artery
Medial
Ulnar Artery
Distal
Radiocephalic Anastomosis
B
Radial Artery
Ulnar Artery
Radiocephalic Anastomosis
C
Radial Artery
Palmar Arch
Ulnar Artery
Radiocephalic Anastomosis
D
Radial Artery
Ulnar Artery

JUXTAANASTOMOTIC STENOSIS (JAS)

Inflow stenosis : artery , anastomotic ,juxta-anastomotic



Delayed maturation (fail to mature (FTM)) : 25–64%

- Difficult cannulation
- Poor turgor and a weak bruit & thrill
- Pulsating anastomosis
- High negative arterial pressure

Low blood pump flow or recirculation : 60%
(Problem fistulas (PFs))

Nicola Pirozzi, et al. J Vasc Access 2014

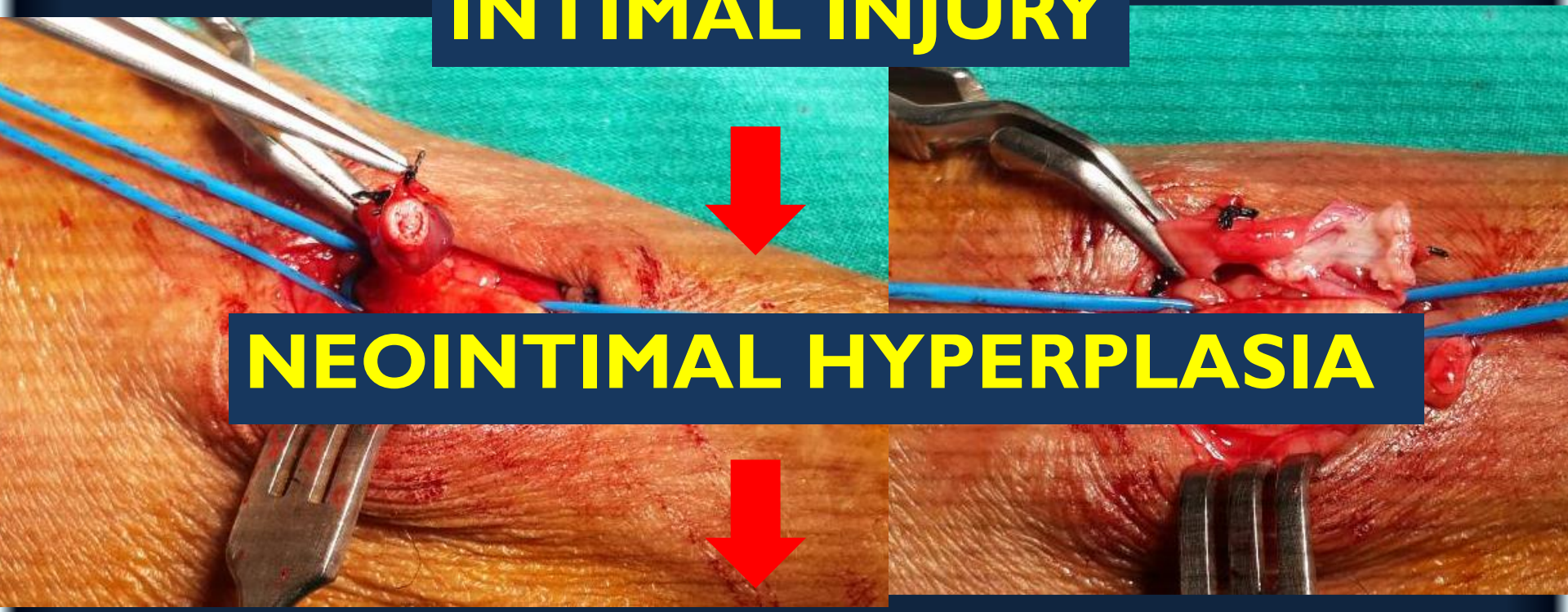
Juxta-Acastomotic Stenosis (JAS)

CAUSES OF JAS

Unclear, but multiple hypotheses exist

1) Loss of the vasa venosum during skeletonization for mobilization
2) Low and fluctuating shear stress
3) Kinking : increased turbulence of the vein
4) Torsional stress
5) AVF's geometry : angle , length

Keith Bertram Quencer, et al. AJR , 2015


INTIMAL INJURY
NEOINTIMAL HYPERPLASIA
STENOSIS

REDUCTION IN JAS

- **Piggyback straight onlay technique (pSOT)**

  - underside of cephalic vein + anterior aspect of RA
  - reduced the 1-year rate of JAS from 18.5% to 5.1%

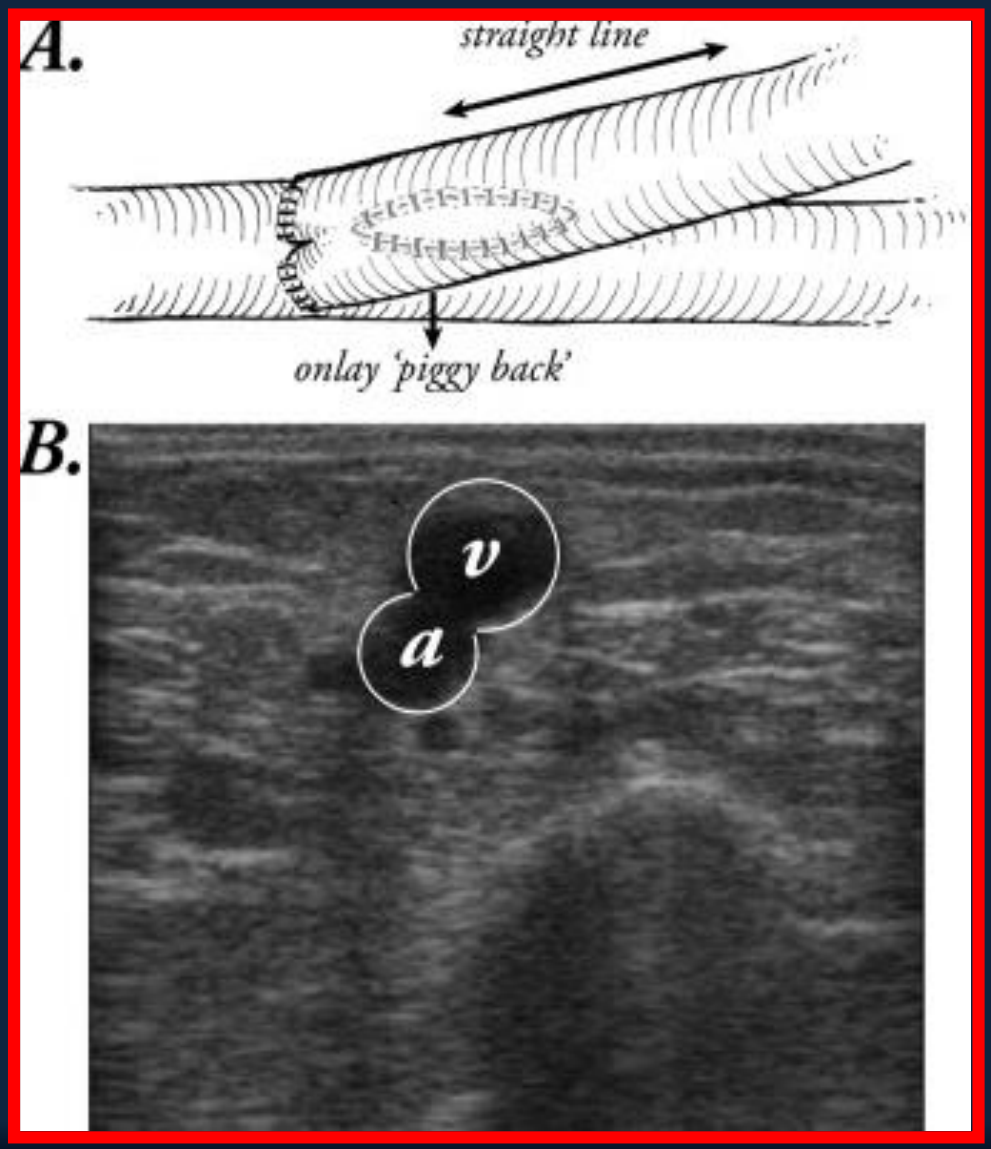
Bharat A, et al. J Vasc Surg 2012

- **Radial artery deviation and reimplantation (RADAR)**

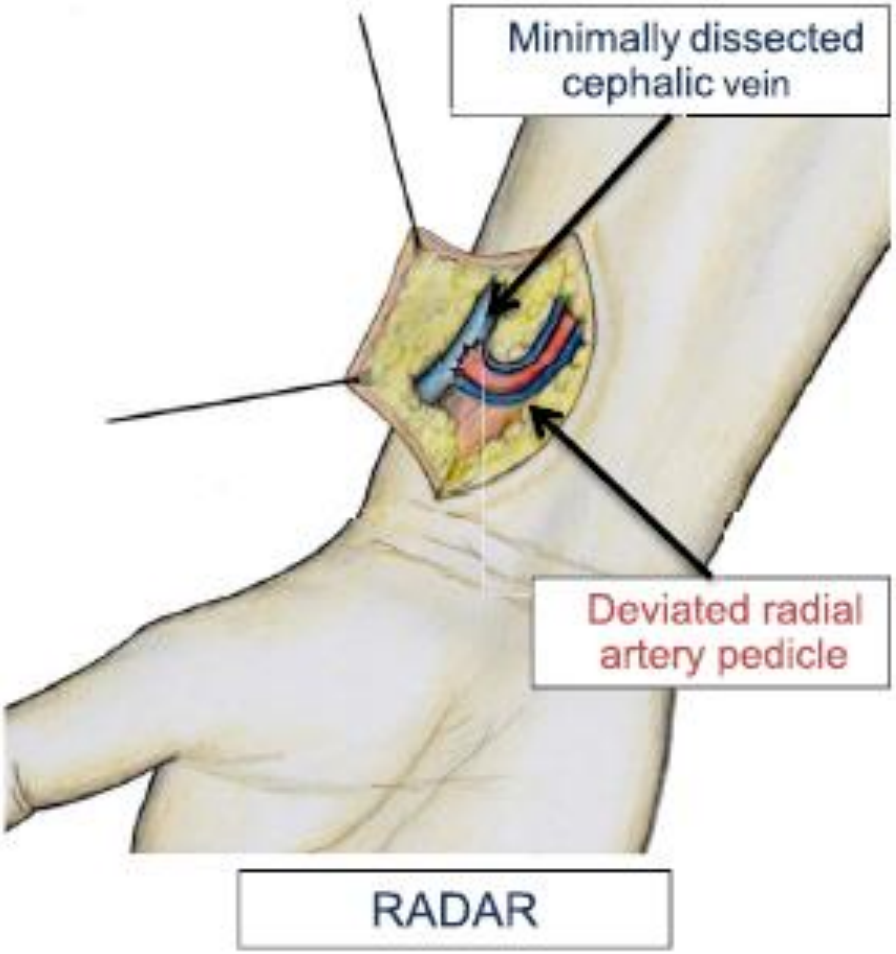
  -End artery to side vein anastomosis

Sadaghianloo N ,et al. J Vasc Surg 2016

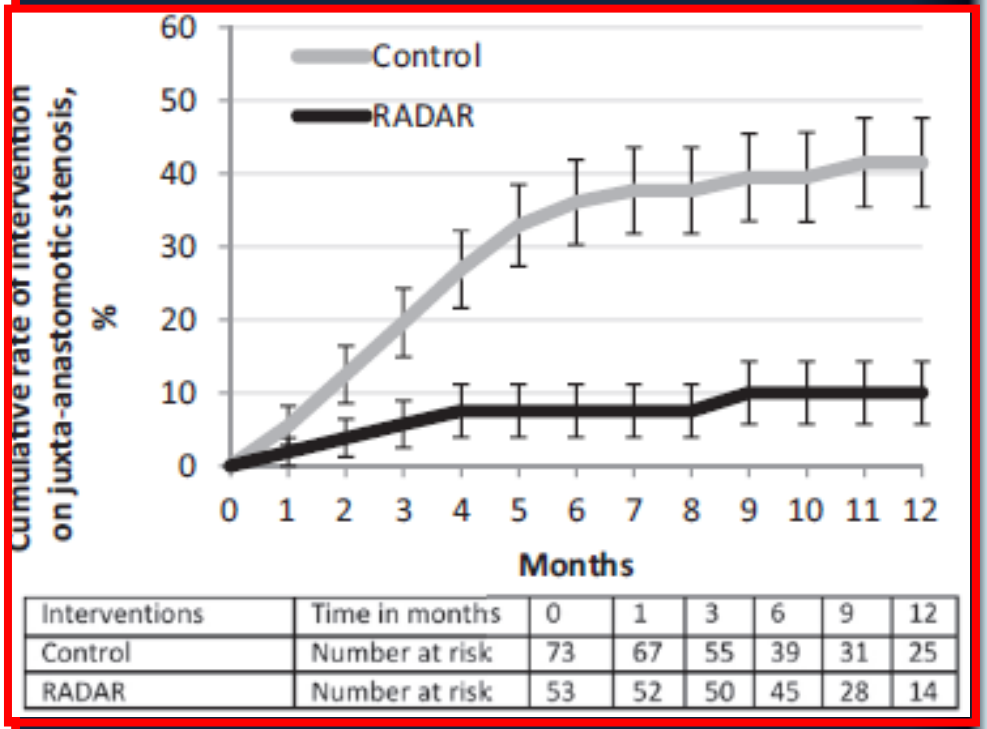
Piggyback straight onlay technique (pSOT)



Radial artery deviation and reimplantation (RADAR)



No ischemic symptoms



Interventions	Time in months	0	1	3	6	9	12
Control	Number at risk	73	67	55	39	31	25
RADAR	Number at risk	53	52	50	45	28	14

Sadaghianloo N ,et al. J Vasc Surg 2016

Snuffbox AVF

- Patency rate comparable to radiocephalic fistula at wrist
- Non-diabetic male patients
- ?? Reduce JAS

Pflederer TA, et al Semin Dial , 2008

INDICATION

- The diameter is reduced by **>50%**
  + reduction in access flow or in measured dialysis dose (clinical or physiological abnormalities)

- Asymptomatic case : still debate
  - Low flow (<500 mL/min) or significant drop (>20%) in two consecutive assessments

DOQI NKF. Am J Kidney Dis. 2006
Nicola Pirozzi, et al. J Vasc Access 2014
Swinnen J, et al. J Vasc Surg. 2015

TREATMENT OF JAS

- **Immature fistula & Mature fistula**

1. **Distal vascular access (RC AVF)**

   Proximalization vs PTA

2. **Proximal vascular access (BC AVF)**

   : a comparative study is lacking

   PTA vs Proximalization vs Jump grafting

   (arterial steal and high output states)

Proximalization of Lt. Brachial AVF

TREATMENT OF JAS

Surgical approaches : proximalization of the anastomosis

- Proximal radio-cephalic anastomosis
- Local anesthesia

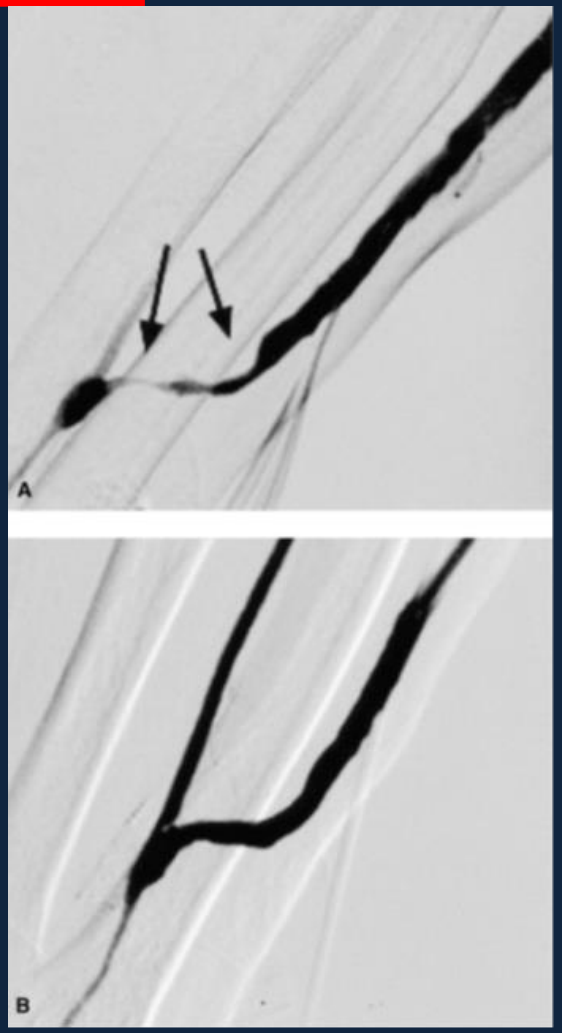
Keith Bertram Quencer, et al. AJR , 2015

Proximalization of RC AVF

TREATMENT OF JAS

Endovascular approaches
: PTA+/- Stenting

1) Retrograde direction
   (Venous puncture)
2) Antegrade direction
   (Brachial artery puncture)
3) Balloon angioplasty
   6-mm (recommended size)
4) Hard stenoses
   : cutting balloons or ultrahigh pressure balloons (up to 32 atm)



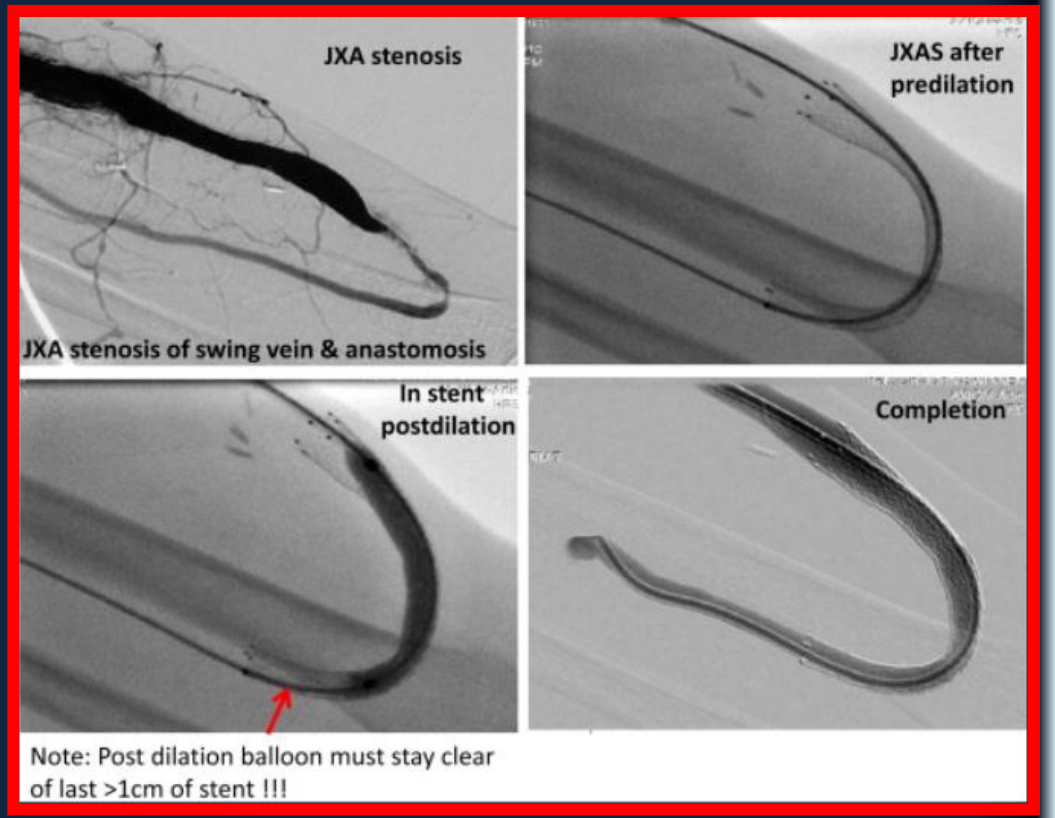
Keith Bertram Quencer, et al. AJR , 2015

TREATMENT OF JAS

Endovascular approaches : PTA+/- Stenting

Stenting

1) Recurrent stenosis
2) Elastic recoil >30%
3) >1 JXA stenosis
4) Single stenosis ≤ 1 cm of the anastomosis



Swinnen J, et al. J Vasc Surg. 2015

TREATMENT OF JAS

Surgical approaches
: Proximalization

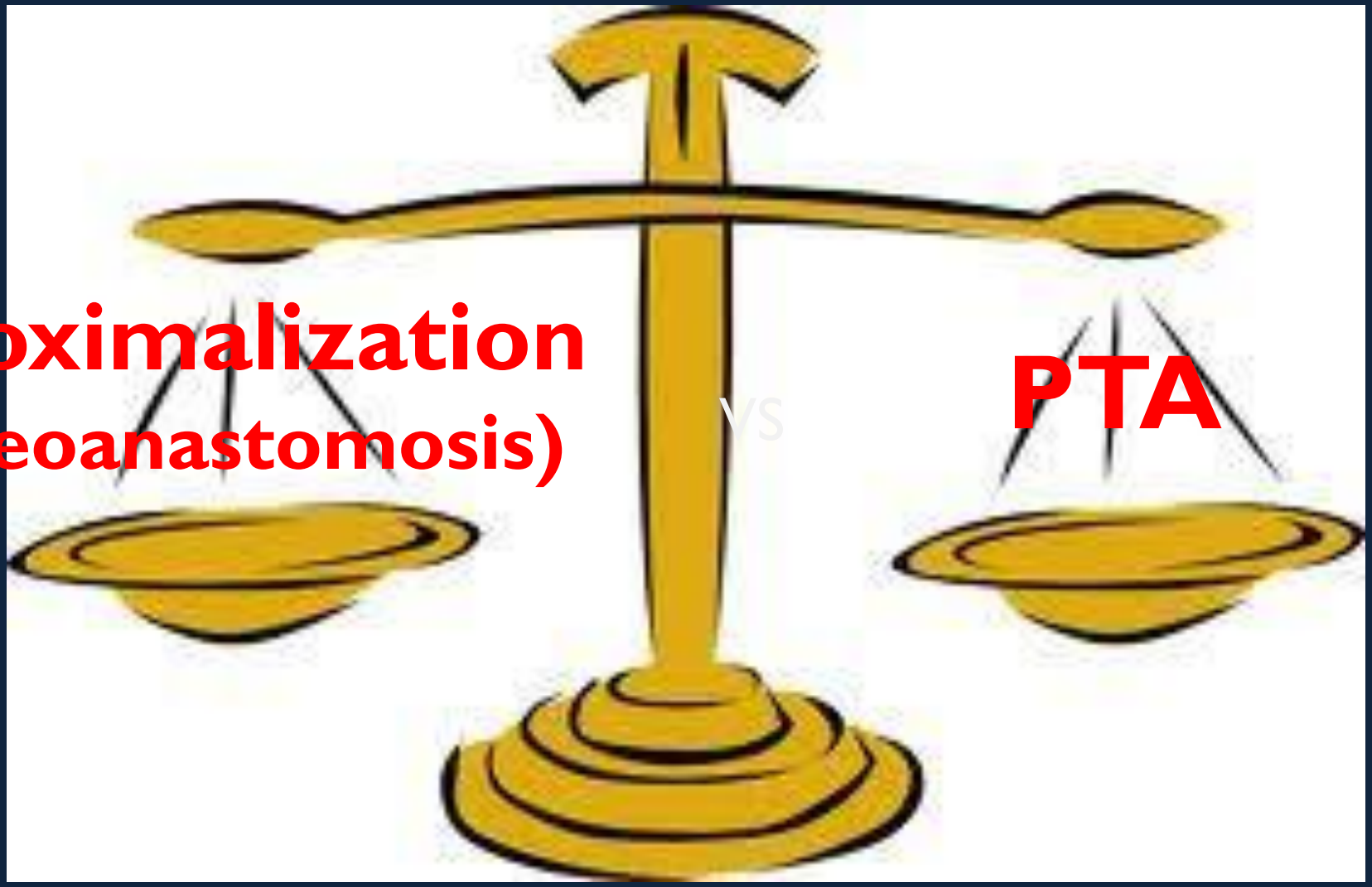
1) Necessary sacrifice of a portion of puncturable vein
2) Increased invasiveness

Endovascular approaches
: PTA +/- Stenting

1) 1/3 fail to show increased blood flow
2) Rates of restenosis
   : 2–2.5 times
3) Increased number of procedures

Swinnen J, et al. J Vasc Surg. 2015
Keith Bertram Quencer, et al. AJR , 2015

MORE EVIDENCE



JVA
ISSN 1129-7298

J Vasc Access 2015; 00 (00): 000-000
DOI: 10.5301/jva.5000444

REVIEW

Preemptive open surgical vs. endovascular repair for juxta-anastomotic stenoses of autogenous AV fistulae: a meta-analysis

Christos Argyriou, Nikolaos Schoretsanitis, Efstratios I. Georgakarakos, George S. Georgiadis, Miltos K. Lazarides

Department of Vascular Surgery, Democritus University Hospital, Alexandroupolis - Greece

4 non-randomized cohort studies (297 patients)

Outcome : primary patency at 12 and 18 months and the assisted primary patency at 24 months

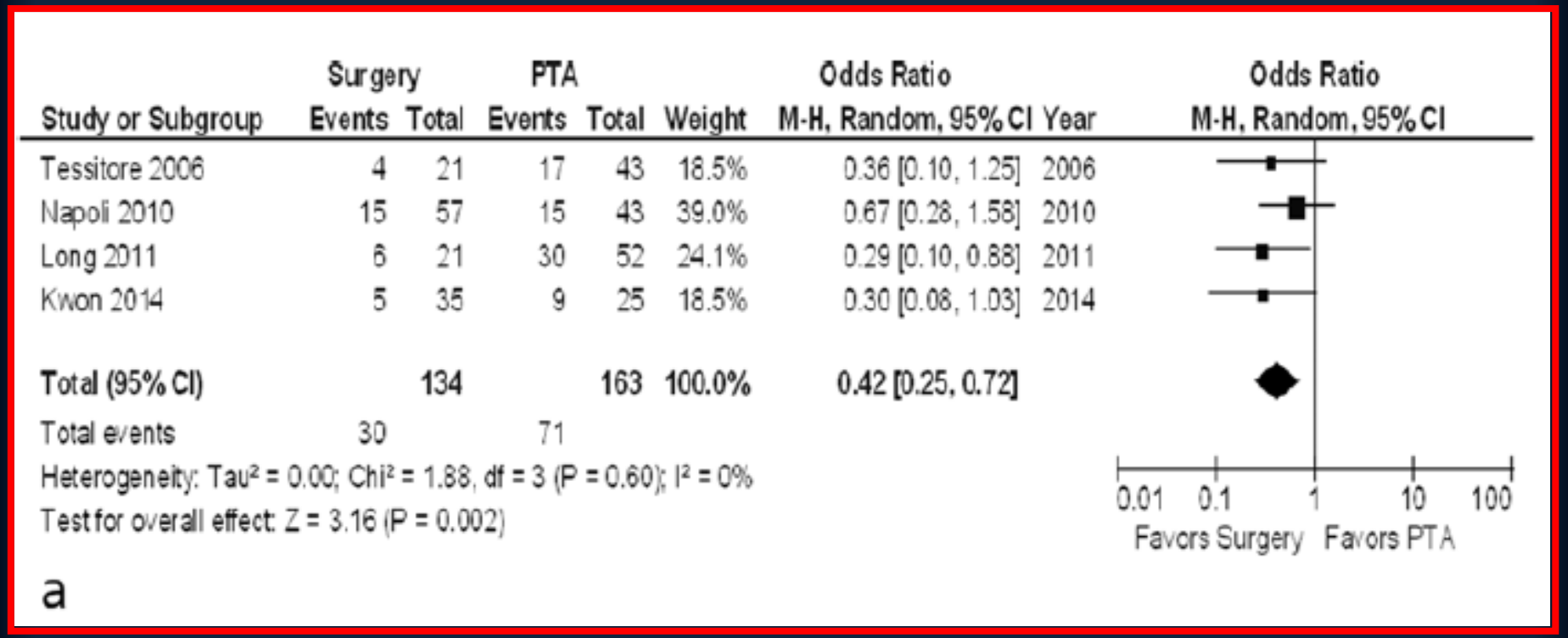
Argyriou C et al. J Vasc Access 2015

SURGICAL REPAIR VS ENDOVASCULAR REPAIR

	N (S/Endo)	Newcastle-Ottawa score	Stenosis definition	Forms of surgical repair	Forms of endo-vascular repair
Tessitore et al 2006 (7)	64 (21/43)	7.6	>50% of the first 5cm of the vein	Neoanastomosis short PTFE (n = 10)	PTA
Napoli et al 2010 (8)	100 (57/43)	7	In the artery, anastomosis or vein	Neoanastomosis	PTA (high pressure balloons)
Long et al 2011 (9)	73 (21/52)	8.3	>50% In the artery, anasto-mosis or vein	Neoanastomosis	PTA (high pressure balloons)
Kwon et al 2014 (10)	60 (35/25)	8.3	>50% of the first 3cm	Neoanastomosis	PTA (2 pts aspiration thrombectomy)

Argyriou C et al. J Vasc Access 2015

Primary fistula patency at 12 months



Study or Subgroup	Surgery Events	Surgery Total	PTA Events	PTA Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Tessitore 2006	4	21	17	43	18.5%	0.36 [0.10, 1.25]	2006
Napoli 2010	15	57	15	43	39.0%	0.67 [0.28, 1.58]	2010
Long 2011	6	21	30	52	24.1%	0.29 [0.10, 0.88]	2011
Kwon 2014	5	35	9	25	18.5%	0.30 [0.08, 1.03]	2014
Total (95% CI)		**134**		**163**	**100.0%**	**0.42 [0.25, 0.72]**	
Total events	30		71				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 1.88$, $df = 3$ ($P = 0.60$); $I^2 = 0\%$

Test for overall effect: $Z = 3.16$ ($P = 0.002$)

Odds Ratio M-H, Random, 95% CI

0.01 0.1 1 10 100

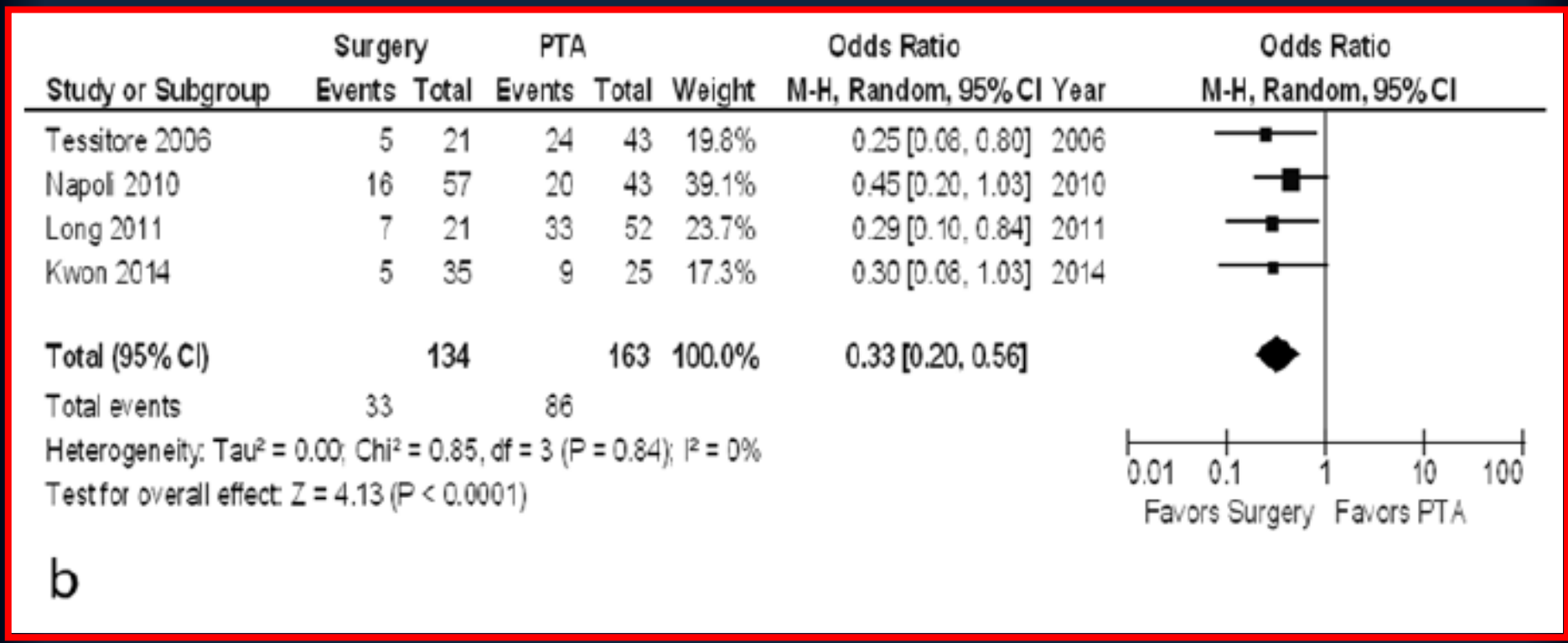
Favors Surgery Favors PTA

a

p -value = 0.002

Argyriou C et al. J Vasc Access 2015

Primary fistula patency at 18 months



Study or Subgroup	Surgery Events	Total	PTA Events	Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Tessitore 2006	5	21	24	43	19.8%	0.25 [0.06, 0.80]	2006
Napoli 2010	16	57	20	43	39.1%	0.45 [0.20, 1.03]	2010
Long 2011	7	21	33	52	23.7%	0.29 [0.10, 0.84]	2011
Kwon 2014	5	35	9	25	17.3%	0.30 [0.06, 1.03]	2014
Total (95% CI)		**134**		**163**	**100.0%**	**0.33 [0.20, 0.56]**	
Total events	33		86				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.85$, df = 3 (P = 0.84); $I^2 = 0\%$

Test for overall effect: Z = 4.13 (P < 0.0001)

Odds Ratio M-H, Random, 95% CI

0.01 0.1 1 10 100

Favors Surgery Favors PTA

b

p -value < 0.0001

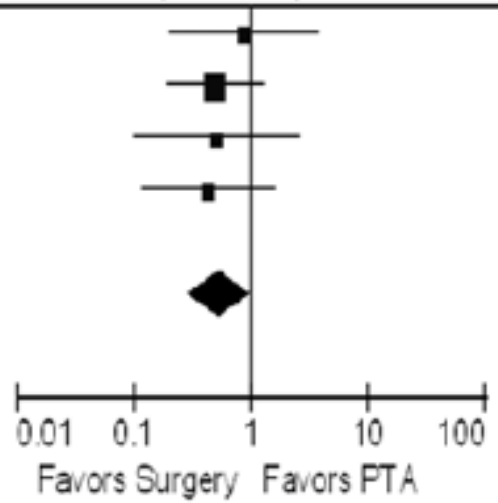
Argyriou C et al. J Vasc Access 2015

Assisted primary patency at 24 months

Study or Subgroup	Surgery Events	Surgery Total	PTA Events	PTA Total	Weight	Odds Ratio M-H, Random, 95% CI	Year
Tessitore 2006	3	21	7	43	18.1%	0.86 [0.20, 3.71]	2006
Napoli 2010	10	57	13	43	43.7%	0.49 [0.19, 1.26]	2010
Long 2011	2	21	9	52	14.7%	0.50 [0.10, 2.55]	2011
Kwon 2014	5	35	7	25	23.4%	0.43 [0.12, 1.55]	2014
Total (95% CI)		**134**		**163**	**100.0%**	**0.53 [0.28, 0.98]**	
Total events	20		36				

Heterogeneity: $Tau^2 = 0.00$; $Chi^2 = 0.55$, df = 3 (P = 0.91); $I^2 = 0\%$

Test for overall effect: Z = 2.01 (P = 0.04)



C

p -value = 0.04

Argyriou C et al. J Vasc Access 2015

One-year primary patency rates

Author	Year	Type of repair	Patency %
Lipari et al	2007	Surgery	81
Kim et al	2011	Surgery	97
Mallik et al	2011	Surgery	78.5
Manninen et al	2001	PTA	20
Asif et al	2006	PTA	47
Cohen et al	2009	PTA	56
Swinnen et al	2015	PTA and stenting	59
Giuffrida et al	2017	PTA (Z-configuration)	54.1%

Argyriou C et al. J Vasc Access 2015

Developed endovascular techniques

- Routine rupture of stenoses and frequent use of uncovered nitinol stents

  : prevent recoil

Swinnen J, et al. J Vasc Surg. 2015

- "V shape configuration" balloon angioplasty

Giuffrida S, et al. Ann Vasc Med Res. 2017

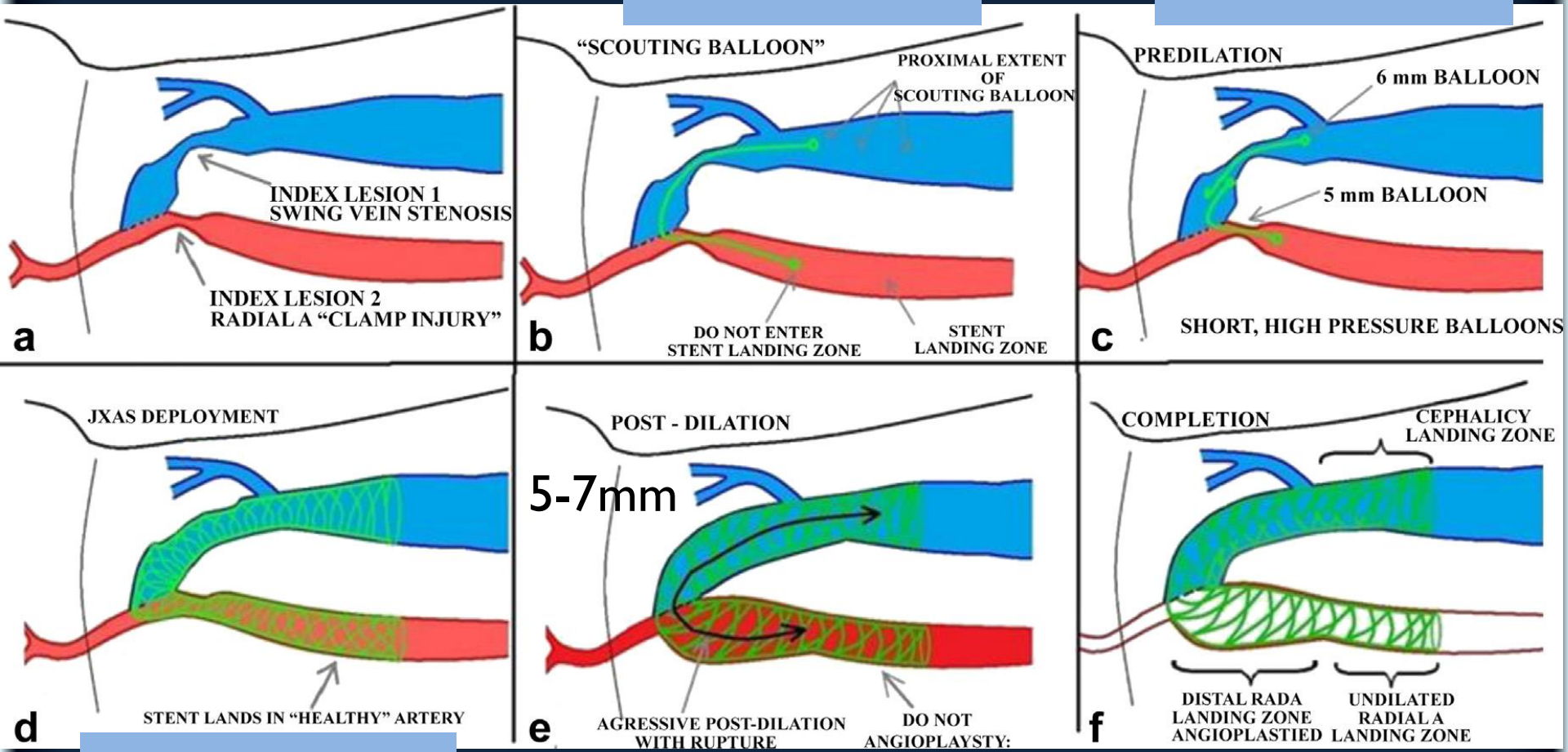
- Drug eluting balloons (DEB)

Patanè D, et al. J Vasc Access. 2014
Giuffrida S, et al. Il giornaleitaliano di Radiologia Medica. 2016

Rupture of stenoses + Uncovered nitinol stents(JXAS)

3-4mm balloon

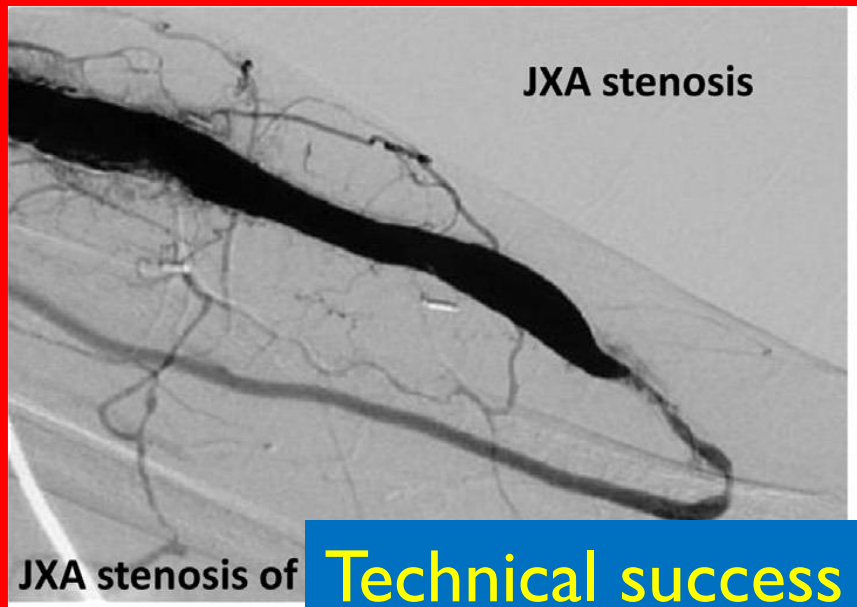
5-6mm balloon

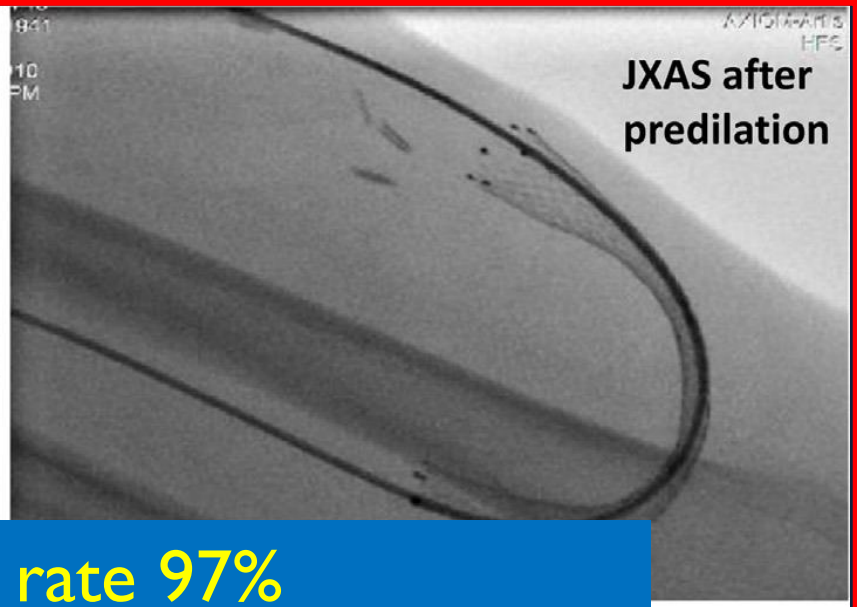


6mm stent (1-2)
60-100mm long

4-5mm

Swinnen J, et al. J Vasc Surg. 2015

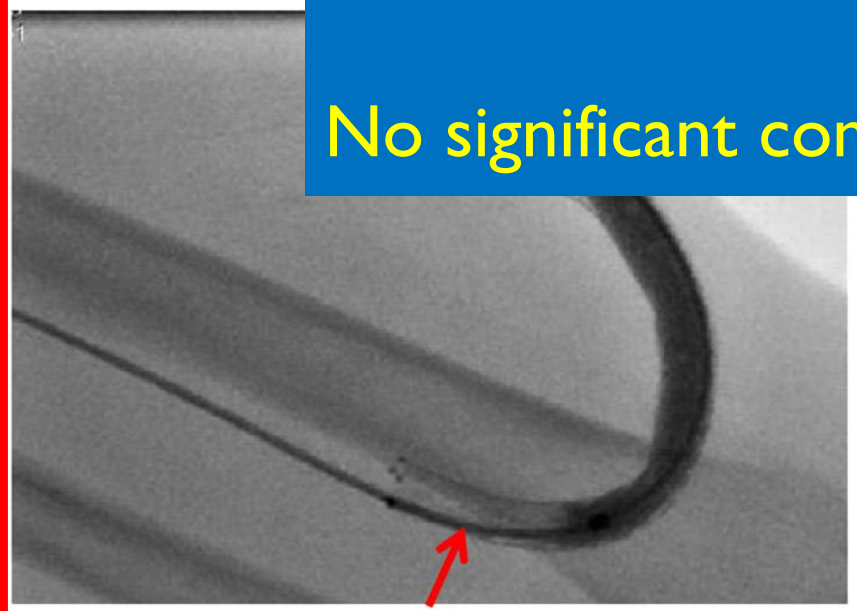




JXA stenosis of

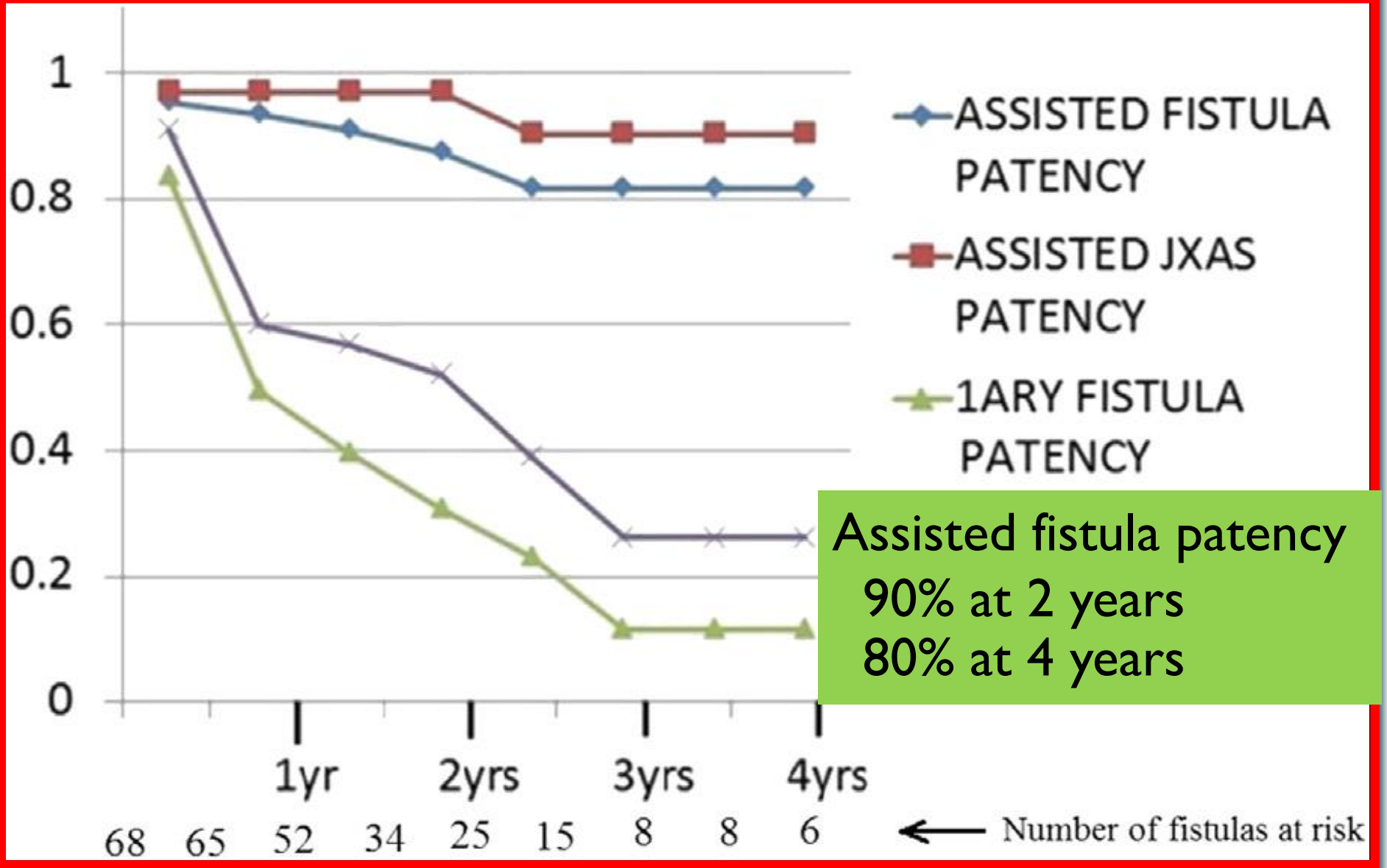
Technical success rate 97%

No significant complications occurred



Note: Post dilation balloon must stay clear of last >1cm of stent !!!

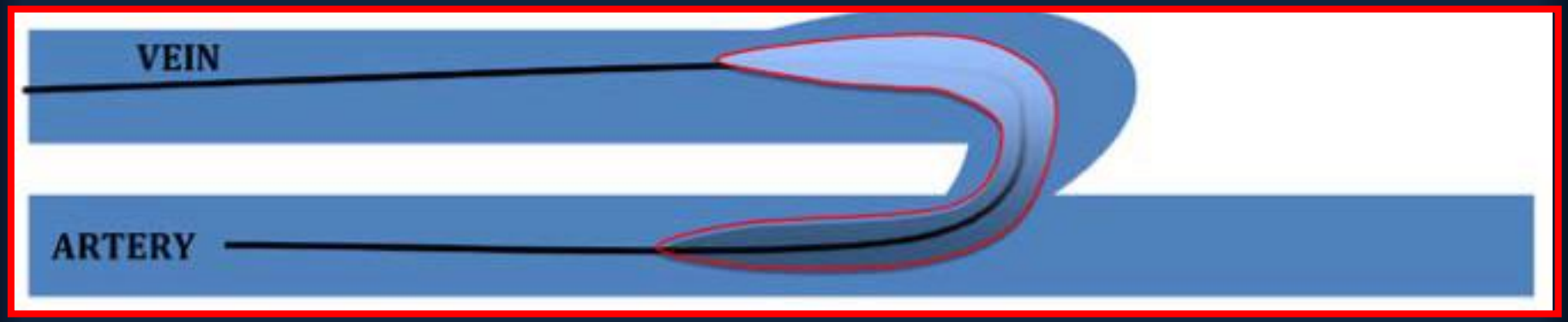
Swinnen J, et al. J Vasc Surg. 2015



Assisted fistula patency
90% at 2 years
80% at 4 years

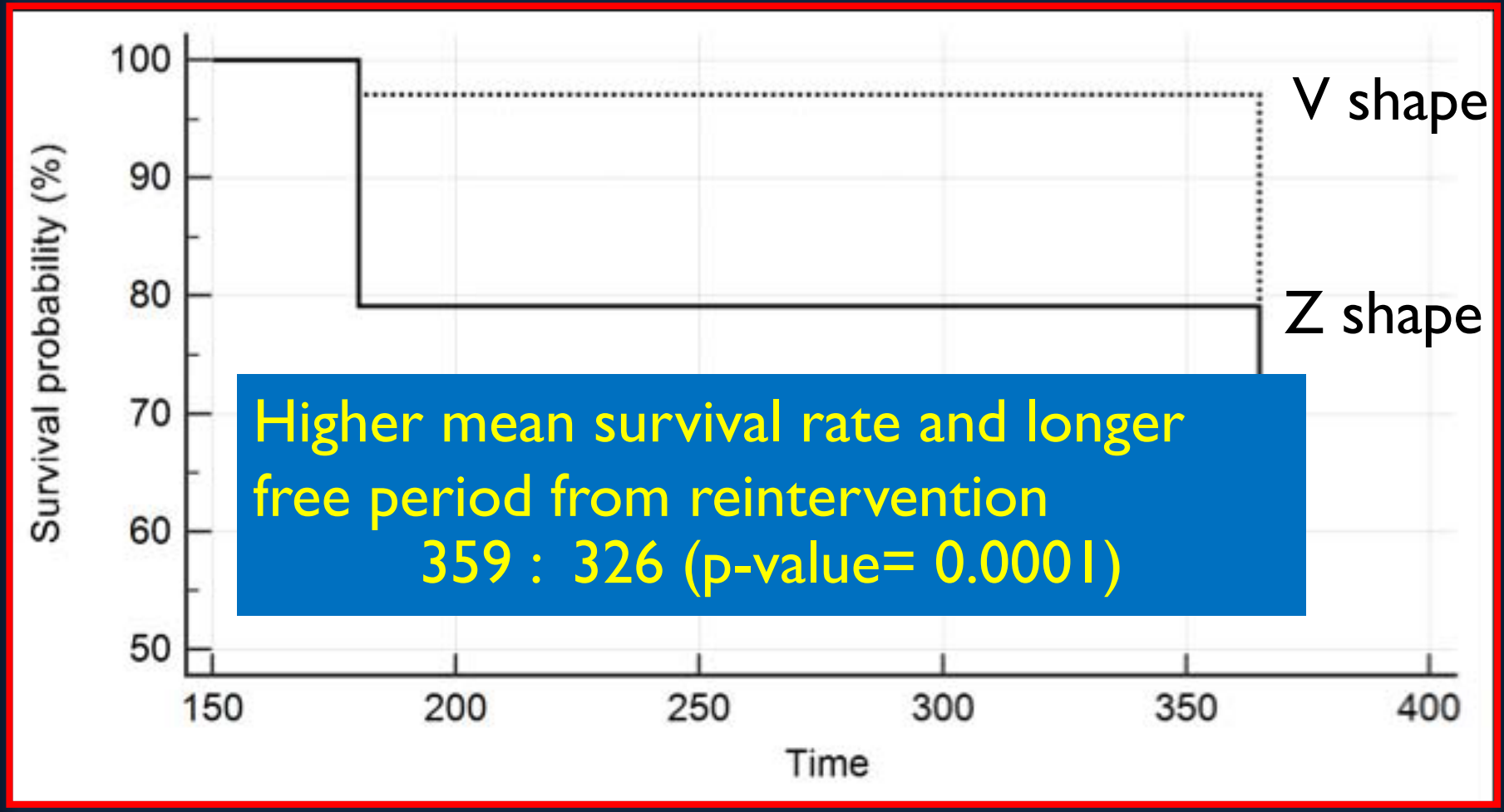
Swinnen J, et al. J Vasc Surg. 2015

“V shape configuration” balloon angioplasty



- Retrograde access
- Crossed with 4 F, angled catheter
- Thin guidewire (0.014”,0.018”)
- 3-4 mm, low profile, compliant balloon(suitable diameter)
- Technical and clinical successes : 100%

Giuffrida S, et al.Ann Vasc Med Res. 2017



Primary Patency rates

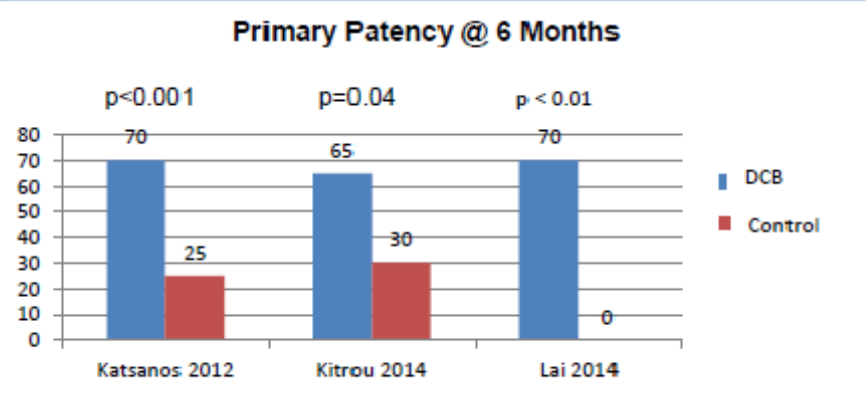
- 97% (100/103) in 6 months
- 79.6% (82/103) in 12 months

Giuffrida S, et al. Ann Vasc Med Res. 2017

Drug eluting balloons (DEB)

RCTs: DCB vs PTA

	Katsanos 2012 / 2015 [1,2]	Kitrou 2014 [3]	Lai 2014 [4]
Design	Prospective, randomized, single centre	Prospective, randomized, single centre	Prospective, randomized, single centre
Devices	**IN.PACT DCB** vs. High-pressure PTA	**IN.PACT DCB** vs. High Pressure PTA	SeQuent Please vs. POBA
# Patients	40 (1:1)	40 (1:1)	10 (20 lesions; 1:1)
Primary Endpoint	Primary Patency 6M / 12M	TLR-free survival	Freedom from TLR (FTLR)
Anastomosis	AVF and AVG	AVF	AVF
Outcomes: DCB vs. control	6M: 70% vs 25% 12M : 35% vs 5% p < 0.001	TLR-free survival: 308 vs 161 days p = 0.04	FTLR: 251T vs. 103T 6M PP 70% vs. 0% 12M PP 20% vs. 0% p < 0.01



[1] Kitrou PM et al. J Vasc Interv Radiol. 2015 Mar;26(3):348-54
[2] Katsanos et al. J ENDOVASC THER 267 2012;19:263–272
[3] Kitrou PM et al. European Journal of Radiology 84 (2015) 418–423
[4] Lai C-C et al. J Vasc Interv Radiol 2014; 25:535–541a

Drug eluting balloons (DEB)

	Patanè 2014 [1]	Swinnen 2015 [2]	Ierardi 2017 [3]	Kitrou 2017 [4]
Design	Prospective, single centre	Retrospective, single centre	Retrospective, single centre	Retrospective, single centre
DCB	Unbekannt	IN.PACT DCB	Cardionovum + Cuttting balloon	Lutonix
# Patients	26	37	50	39
Primary Endpoint	Primay Patency @ 6M / 12M / 24M	TLR-free survival	Primary Patency @ 8M	Primary Patency@ 6M
Anastomosis	AVF	AVF	AVF + AVG	AVF + AVG
	6M: 96.1% 12M: 81/8% 24M: 57.8%	12M TLR-free: 69% vs. 19% $p < 0.001$	8M: 87.7%	6M: 72.2%

[1] Patanè D et al. J Vasc Access 2014; 15(5): 338 – 343
[2] Swinnen JJ et al. J Vasc Access 2015; 16 (5): 388-393
[3] Ierardi AM et al. Radiol med (2017) 122:69–76
[4] Kitrou PM et al. Cardiovasc Intervent Radiol (2017) 40:50–54

CONCLUSION

- PTA remains a valuable but less durable option
  : Multiple stenoses , length of the access is a concern
- Endovascular techniques has been developed
  : waiting for large well-controlled comparative study