SUBCLAVIAN STEAL SYNDROME- DIAGNOSIS, INDICATIONS AND MANAGEMENT

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WVES

PRESENTER DISCLOSURE

I have no current relationships with commercial entities.

AGENDA

- Definitions
- etiology
- Workup
- Guidelines
- Management
- Special considerations

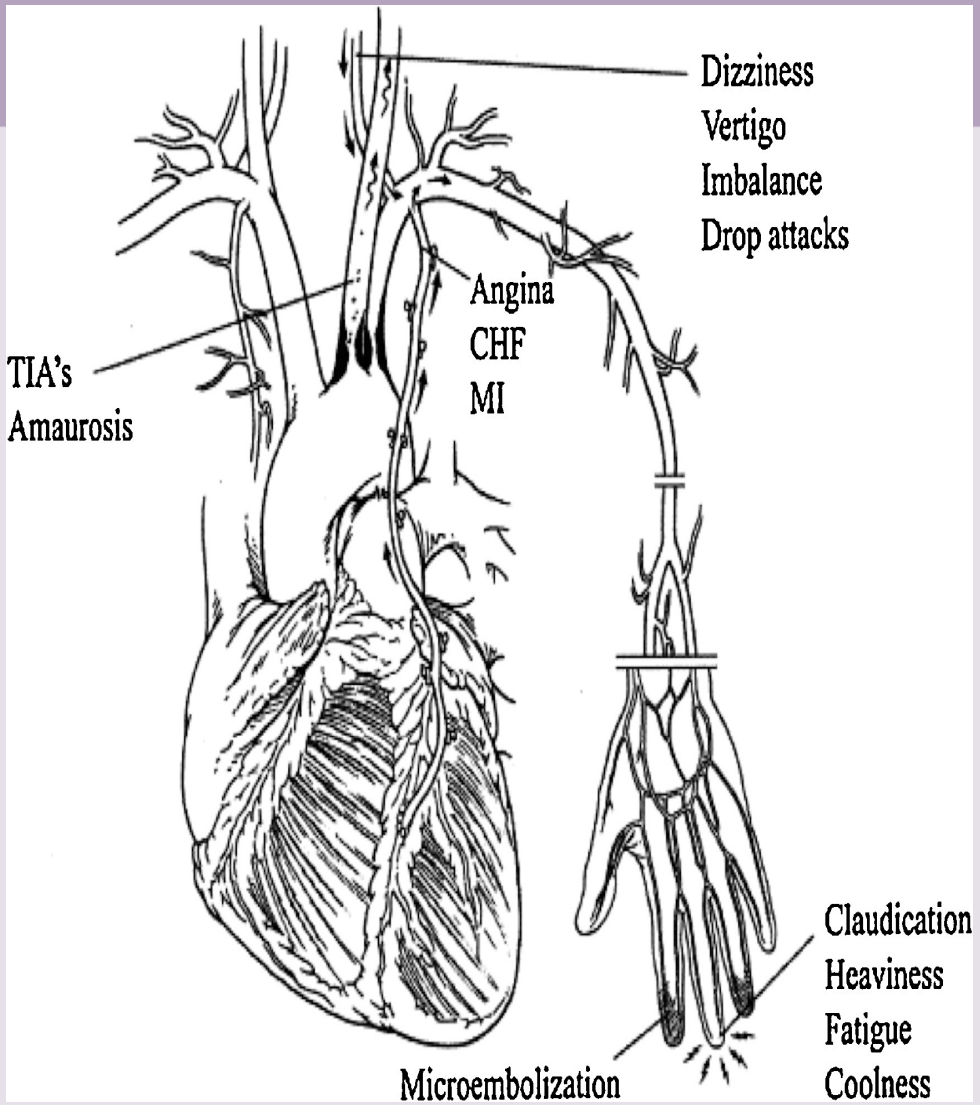
Definitions

- Subclavian steal phenomenon
- Subclavian steal syndrome
- Coronary subclavian steal

Epidemiology

Clinical population: 2.2-3.1%

General population: 2%



Aburahma et al. JVS 2025

ETIOLOGY

1. Atherosclerosis (most common)
2. Autoimmune disorders (TA, GCA)

- LSA more commonly affected artery in TA
- 80% isolated proximal lesions
- 15% involvement of SCA in GCA

1. FMD
2. Post aortic surgical repair (aortic coarctation, tetralogy of Fallot)
3. Radiation induced arteriopathy
4. Arterial TOS (rare)
5. Iatrogenic: TEVAR with LSA coverage

WORK-UP

- History and physical examination
- Non-invasive vascular testing
- Duplex Ultrasound
- CTA, MRA
- Catheter directed Angiography

CLINICAL HISTORY

Mostly Asymptomatic 85%
Up to 30% symptomatic

Vertibrobasilar insufficiency	**Upper extremity ischemia Most common**	**Myocardial ischemia**	**Lower extremity ischemia**
• Ipsilateral UE induced: Light headedness Drop attacks Vertigo Ataxia Diplopia nystagmus Motor deficits	• Arm claudication • fatigue • Coolness • Paresthesia • Rest pain	In the context of a CABG with IMA-LAD. • Angina + LUE claudication • Ventricular arrhythmias • STEMI, NSTEMI • CHF with systolic dysfunction • Sudden cardiac death	In the context of an axillofemoral bypass. • Claudication • parasthesia

PHYSICAL EXAMINATION.

Comprehensive vascular physical exam with:

- Peripheral pulse exam
- Supra & infra-clavicular auscultation
- Suboccipital auscultation
- Bilateral upper extremity BP measurements

BLOOD PRESSURE GRADIENT

- 15-20 mmhg indicates central stenosis.

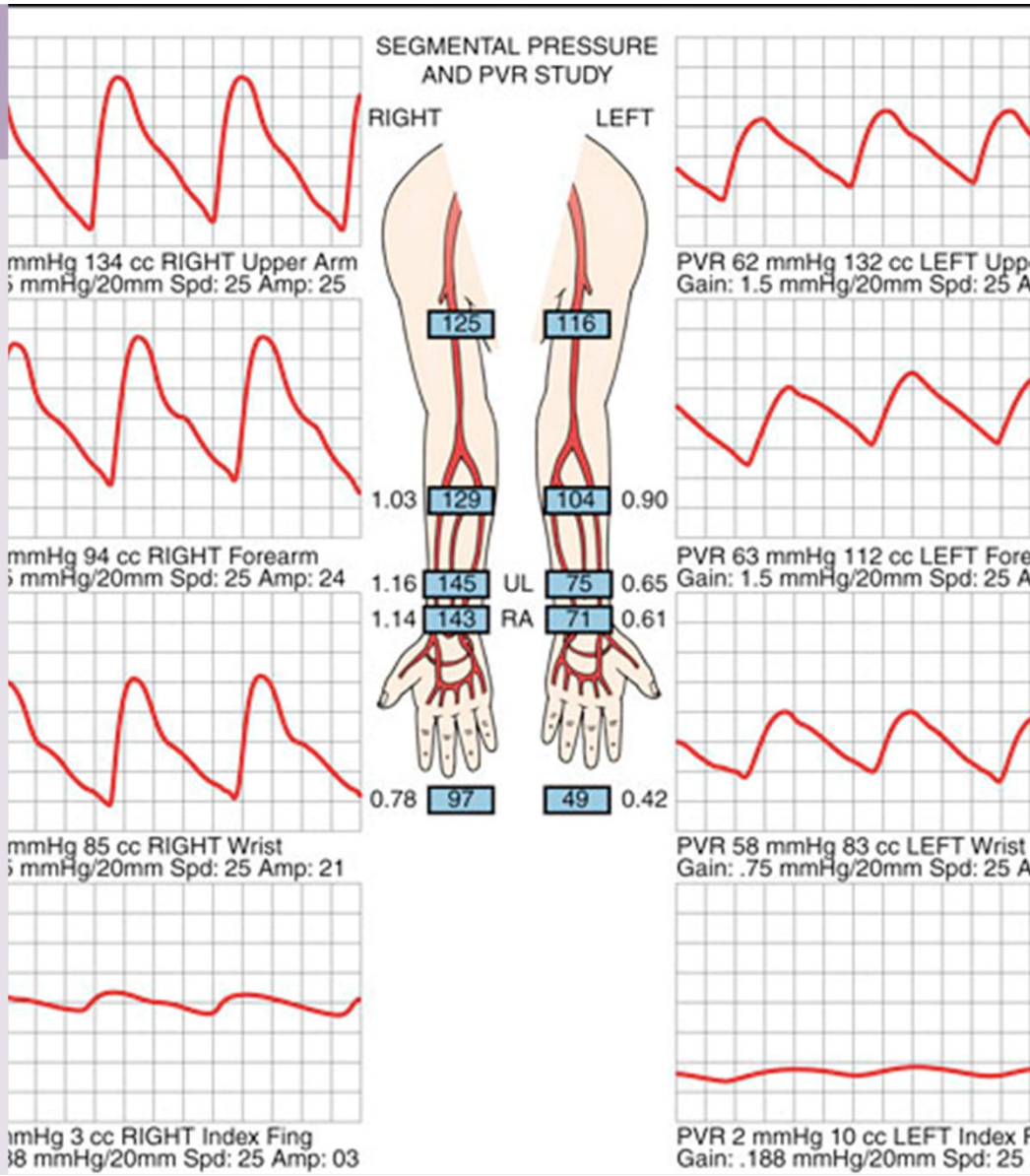
- ***Elhefnawy et al. Jour Neur Sci 2025*** : BP gradient ≥20mmhg 55.6% sensitive and 92.4% specific for SCA stenosis

- ***Aburahma et al. JVS 2022***:

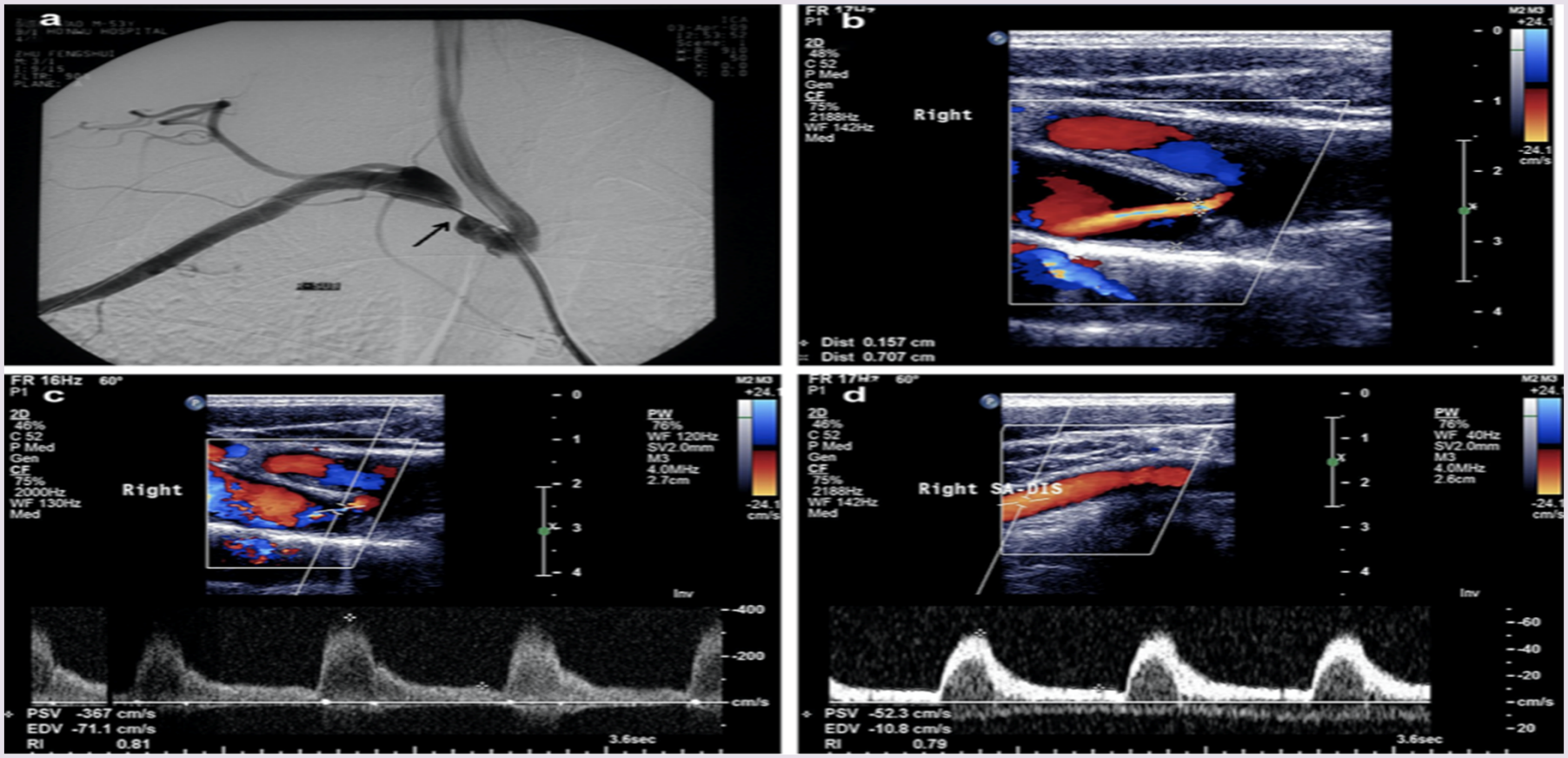
Mean arm doppler pressure gradient	**Mean systolic arm pressure**
Asymptomatic: 32.3mmhg Symptomatic: 37mmhg (P = .3254)	Antegrade VA flow: 146mmhg Biderctional VA flow: 134mmhg Retrograde VA flow: 105mmhg (P=.0001)

NON-INVASIVE VASCULAR ASSESSMENT

- Segmental pressures
- PVR
- Finger PPGs



DUPLEX ULTRASOUND



Color Doppler Ultrasonography for the Evaluation of Subclavian Artery Stenosis

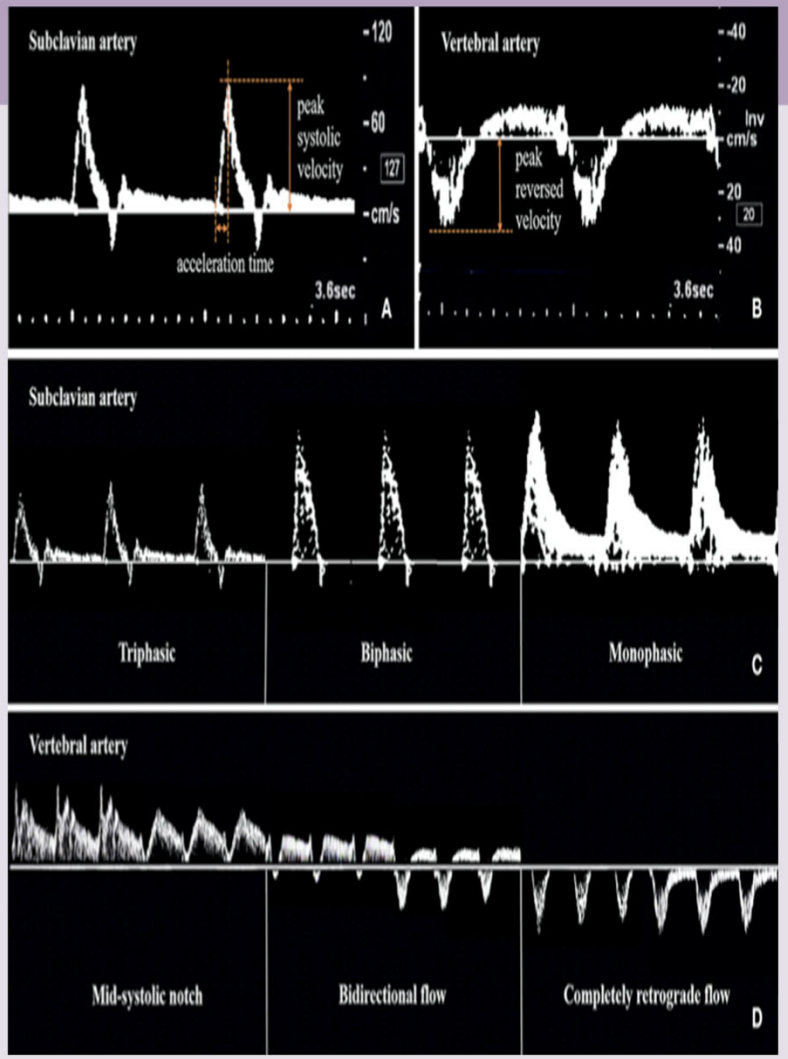
Jie Zhang[1], Lijuan Wang[1], Ying Chen[1], Sibo Wang[1], Yingqi Xing[2] and Li Cui[1*]*

PSV, PSVr, VA waveform changes were the parameters with the strongest correlation with SCA stenosis.

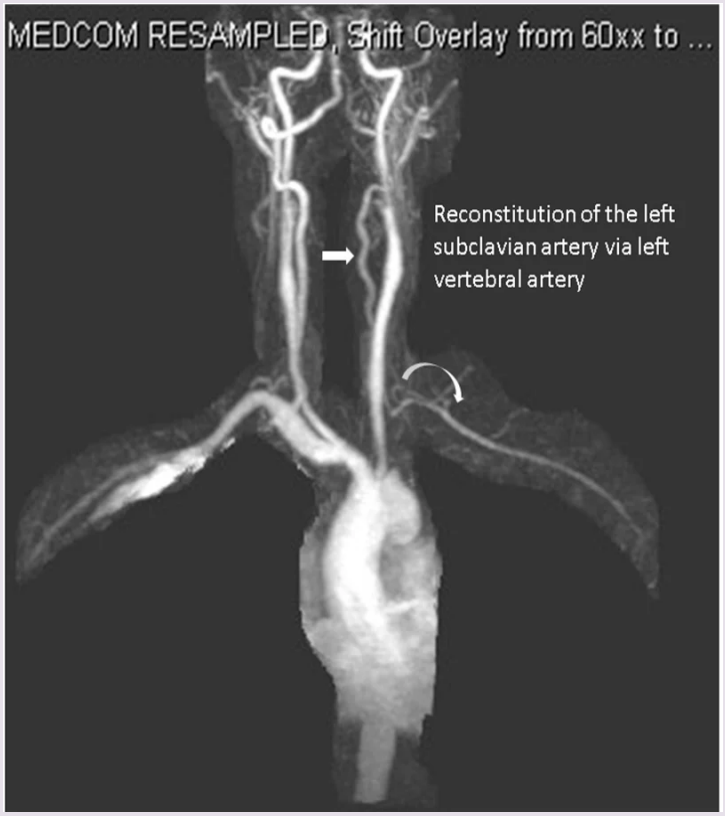
PSV ≥ 230 cm/s, PSVr ≥2.2 indicates a stenosis ≥ 50%

PSV ≥ 340 cm/s, PSVr ≥3 indicates a stenosis ≥ 70%

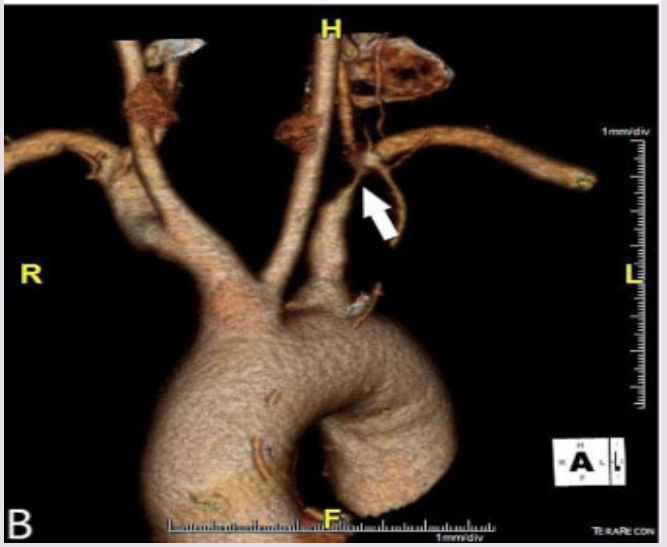
VA waveform change was the most specific parameter for ≥ 70% subclavian stenosis. Specificity of 96.3%



CTA & MRA


MEDCOM RESAMPLED, Shift Overlay from 60xx to ...
Reconstitution of the left subclavian artery via left vertebral artery


R
L
A
F


H
R
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ANGIOGRAPHY GOLD STANDARD

- Reserved for therapeutic intent
- Visualization of vessel origin
- Degree of stenosis
- Superior visualization of luminal contour
- Lesion characteristics

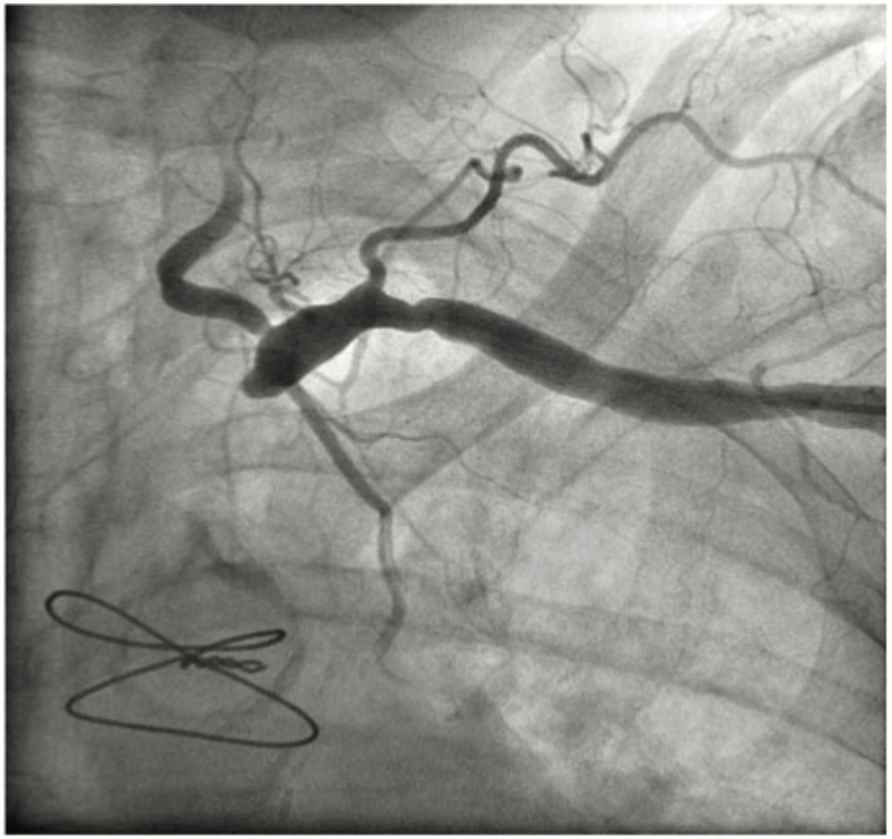


Figure 1. Left subclavian artery angiogram confirming long occlusion of the proximal subclavian artery with preserved filling of the LIMA graft.

2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/ SAIP/SCAI/SIR/SNIS/SVM/SVS Guideline on the Management of Patients With Extracranial Carotid and Vertebral Artery Disease

CLASS IIa

1. Extra-anatomic carotid-subclavian bypass is reasonable for patients with symptomatic posterior cerebral or cerebellar ischemia caused by subclavian artery stenosis or occlusion (subclavian steal syndrome) in the absence of clinical factors predisposing to surgical morbidity or mortality (690–692). (*Level of Evidence: B*)
2. Percutaneous endovascular angioplasty and stenting is reasonable for patients with symptomatic posterior cerebral or cerebellar ischemia caused by subclavian artery stenosis (subclavian steal syndrome) who are at high risk of surgical complications. (*Level of Evidence: C*)
3. Revascularization by percutaneous angioplasty and stenting, direct arterial reconstruction, or extra-anatomic bypass surgery is reason- able for patients with symptomatic ischemia involving the anterior cerebral circulation caused by common carotid or brachiocephalic artery occlusive disease. (*Level of Evidence: C*)
4. Revascularization by percutaneous angioplasty and stenting, direct arterial reconstruction, or extra-anatomic bypass surgery is reason- able for patients with symptomatic ischemia involving upper- extremity claudication caused by subclavian or brachiocephalic arterial occlusive disease. (*Level of Evidence: C*)
5. Revascularization by either extra-anatomic bypass surgery or subclavian angioplasty and stenting is reasonable for asymptomatic patients with subclavian artery stenosis when the ipsilateral internal mammary artery is required as a conduit for myocardial revascularization. (*Level of Evidence: C*)

CLASS III: NO BENEFIT

1. Asymptomatic patients with asymmetrical upper-limb blood pressure, periclavicular bruit, or flow reversal in a vertebral artery caused by subclavian artery stenosis should not undergo revascularization unless the internal mammary artery is required for myocardial revascularization. (*Level of Evidence: C*)

Eur J Vasc Endovasc Surg (2018) 55, 305–368

Editor's Choice – 2017 ESC Guidelines on the Diagnosis and Treatment of Peripheral Arterial Diseases, in collaboration with the European Society for Vascular Surgery (ESVS)

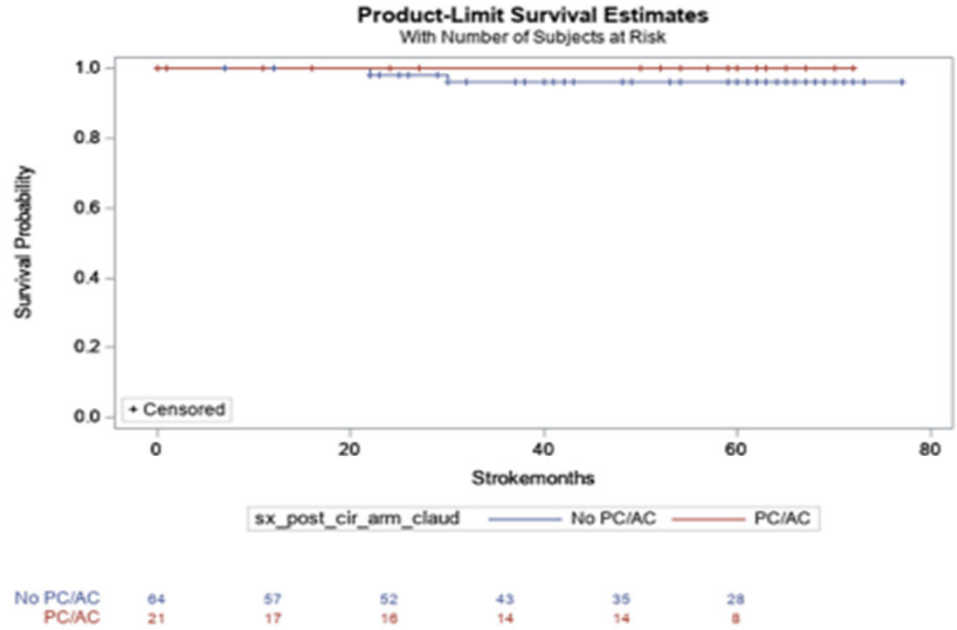
Recommendations on the management of subclavian artery stenosis

Recommendations	Class[a]	Level[b]
In symptomatic patients with subclavian artery stenosis/occlusion, revascularization should be considered.	IIa	C
In symptomatic patients with a stenotic/occluded subclavian artery, both revascularization options (stenting or surgery) should be considered and discussed case by case according to the lesion characteristics and patient's risk.	IIa	C
In asymptomatic subclavian artery stenosis, revascularization:		
• should be considered in the case of proximal stenosis in patients undergoing CABG using the ipsilateral internal mammary artery	IIa	C
• should be considered in the case of proximal stenosis in patients who already have the ipsilateral internal mammary artery grafted to coronary arteries with evidence of myocardial ischaemia	IIa	C
• should be considered in the case of subclavian artery stenosis and ipsilateral arteriovenous fistula for dialysis	IIa	C
• may be considered in the case of bilateral stenosis in order to be able to monitor blood pressure accurately.	IIb	C

SHARED DECISION MAKING

Late neuro events in asymptomatic vs symptomatic isolated subclavian steal

Ali F. AbuRahma, MD,[a] Christina Veith, DO,[a] Noah Dargy, MD,[a] Robert Cragon, MD,[a]
Suy Sen Hung Fong, MD,[a] Scott Dean, PhD, MBA,[b] *and* Elaine Mattox, RN, EdD,[b] *Charleston, WV*



	*No PC/AC**			*PC and/or AC**		
	At risk	*%*	*SE*	*At risk*	*%*	*SE*
	85			30		
6 mos	60	100		18	100	
1 yr	56	100		17	100	
2 yr	52	98.2	1.8	15	100	
3 yr	43	96.1	2.7	14	100	
4 yr	33	96.1	2.7	14	100	
5 yr	26	96.1	2.7	7	100	

MANAGEMENT

conservative	open	endovascular
BMT: • Smoking cessation • antiplatelet therapy • Lipid lowering therapy: LDL < 1.8mml/L • BP control: < 130/80mmhg • Glycemic control: HBA1C < 7%	Transthoracic extra-anatomic • SCT • CSB • CAB • Axillo-axillary bypass	PTA Primary stenting

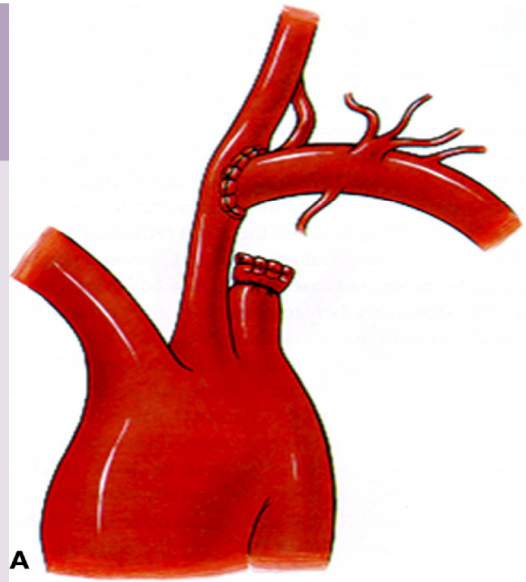
SUBCLAVIAN-CAROTID TRANSPOSITION

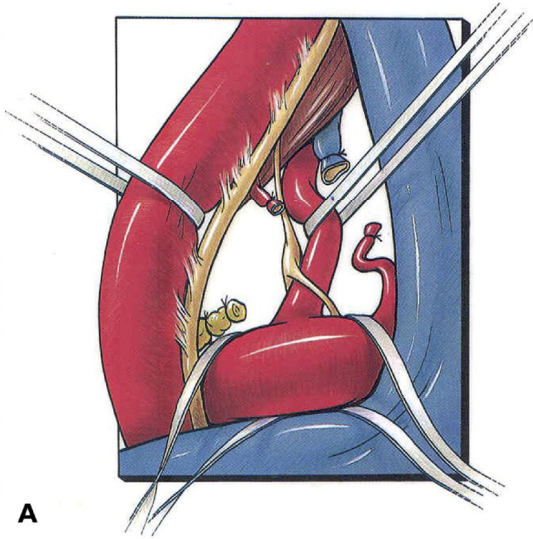
Pros:
-single incision
-no synthetic grafts
-single anastomosis

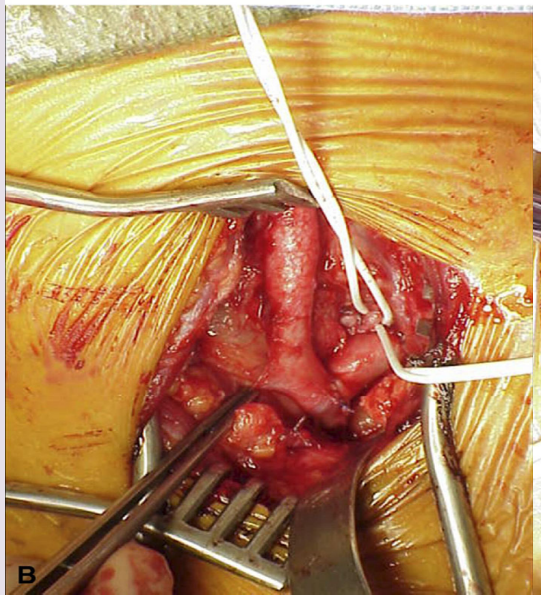
Cons:
-Risk of stump retraction and bleeding

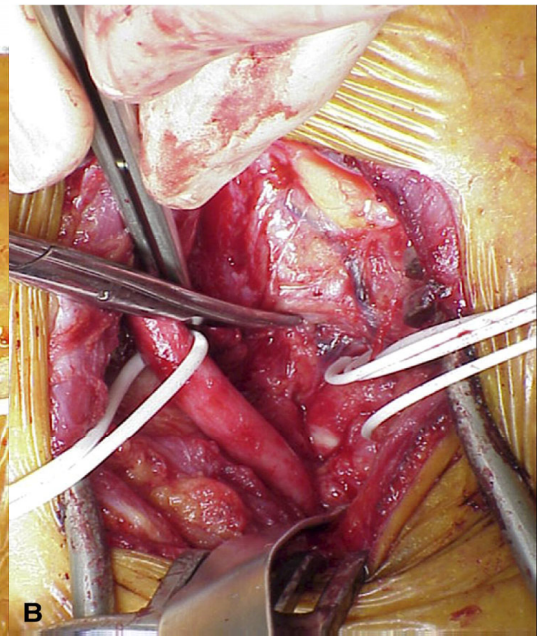
Contraindications:
-Hx of CABG with utilization of the ipsilateral IMA
-Ipsilateral VA terminating in the PICA
-contralateral VA occlusion

Relative C/I:
Long tortuous VA
Early branching vertebral artery









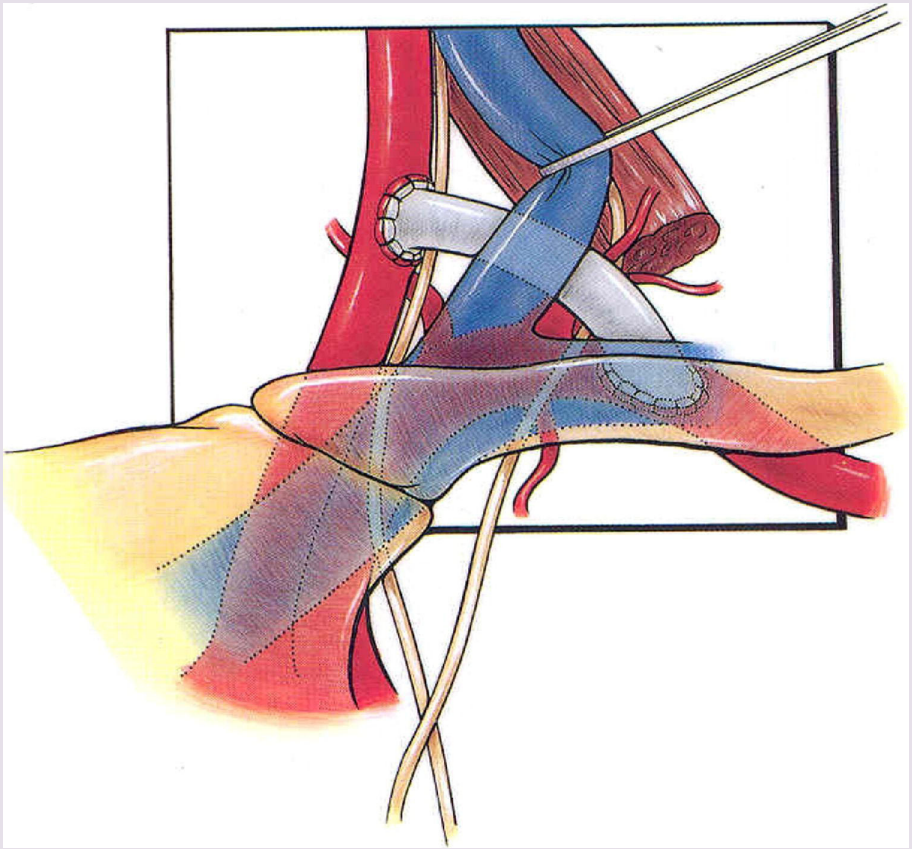
CAROTID-SUBCLAVIAN BYPASS

Versatile option

Accommodates to different VA anatomical variations

preserves the IMA in cases of a previous CABG

Can provide both cerebral and subclavian perfusion



Which Graft should be used?

CSB 5 year patency rate by graft

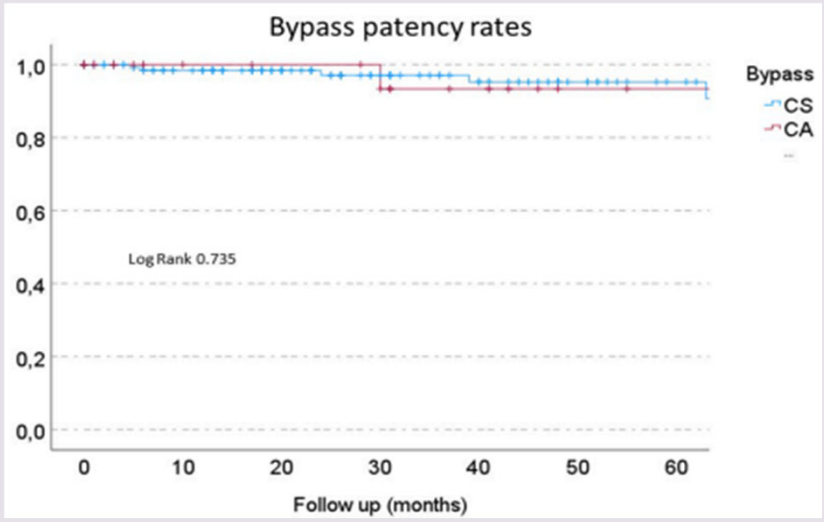
Ziomek et al.	**Law et al.**
Synthetic: 94.1% Autogenous: 58.3%	PTFE: 95.2% +/- 4.6% Dacron: 83.9% +/- 10.5% Autogenous: 64.8% +/- 10%

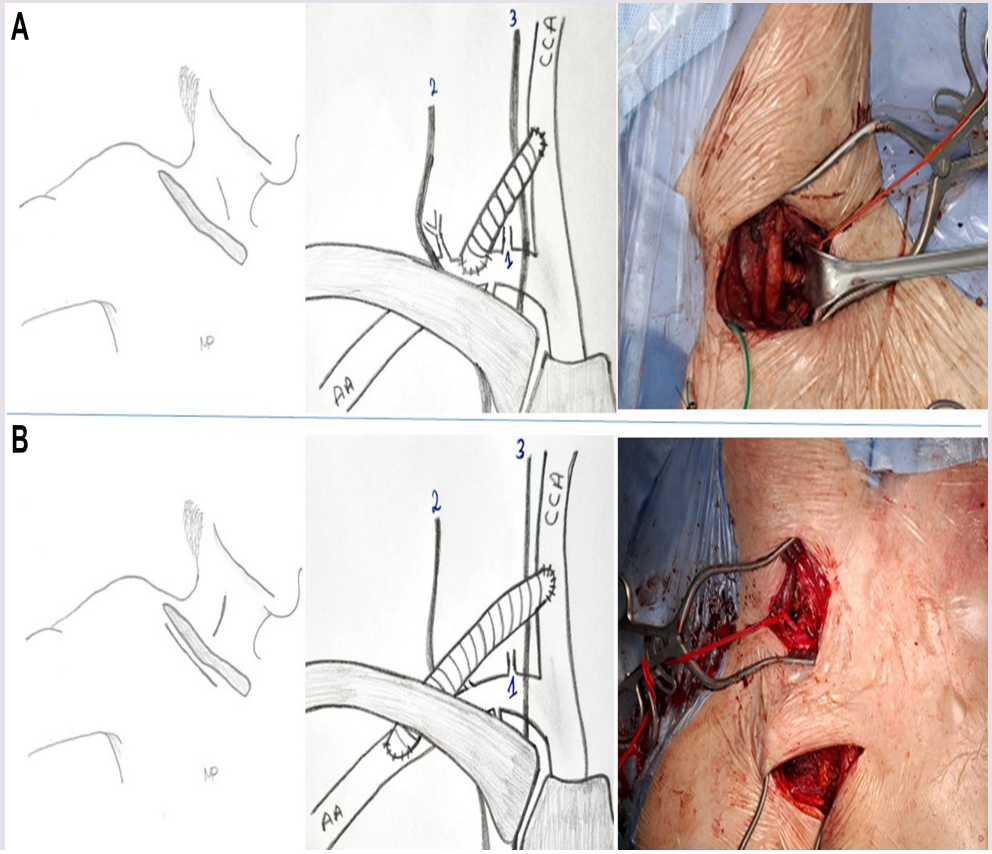
Comparison of carotid-subclavian vs carotid-axillary bypass: A multicenter study of 238 patients

Abdulhakim Ibrahim, PhD,[a] Artis Knapsis, PhD,[b] Hubert Schelzig,[b] Tong Trinh, PhD,[c] Philipp Schminke,[c] Simon Ylinen,[b] Bernhard Dorweiler,[c] Miroslav Dimitrov Yordanov, PhD,[a] Markus Penner, PhD,[a] *and* Alexander Oberhuber,[a] *Muenster, Dusseldorf, and Cologne, Germany*

Journal of Vascular Surgery
March 2026

"The open surgical revascularization of LSA using the axillary artery as the distal bypass target is a safe alternative to traditional CSB. It requires a more superficial approach and reduces the incidence of well-known complications such as phrenic nerve affection and lymphatic leakage."





AXILLO-AXILLARY BYPASS

Indications:

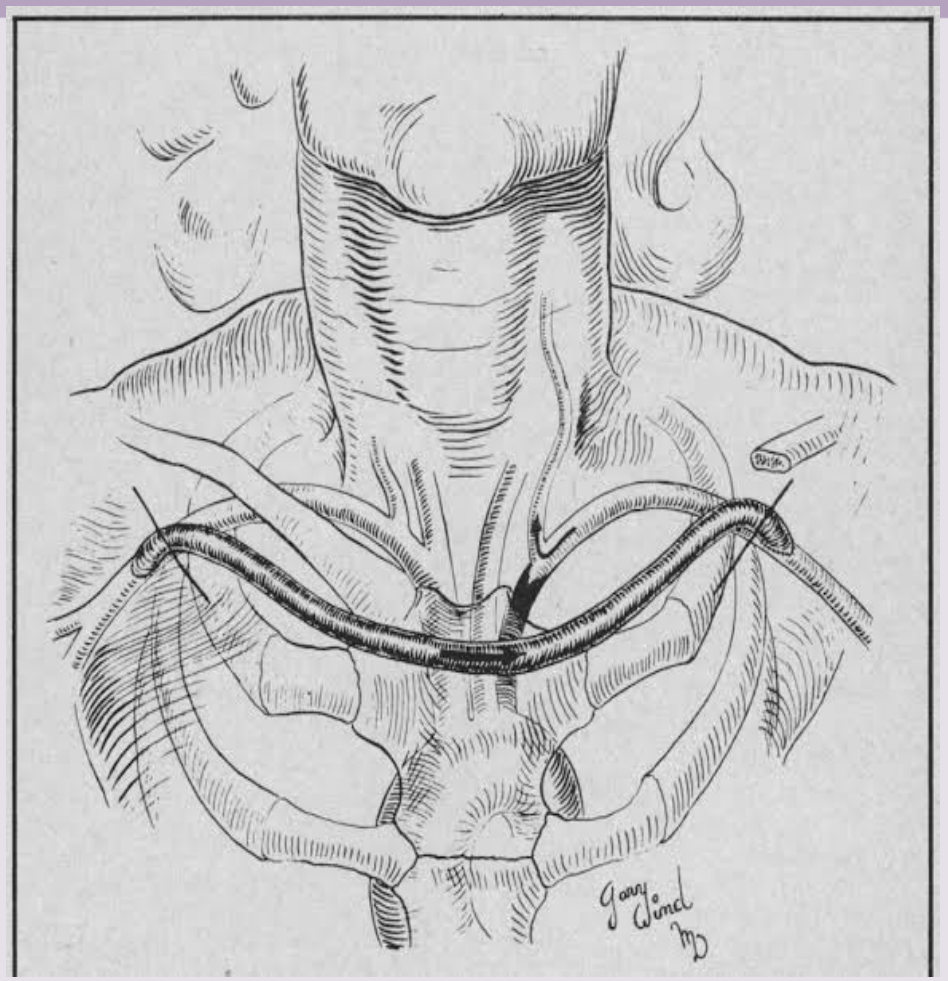
- High cardiopulmonary risk
- Compromised CCA inflow
- Not a candidate for extensive repair
- Long segment subclavian artery disease
- Occasional utility in zone 0 TEVAR
- Usually performed for subclavian steal syndrome when chosen

Downsides:

- Superficial: risk of erosion and infection
- Risk of compression
- Risk of compromise in future sternotomy
- Risk of peripheral neuropathy

Chang et al.

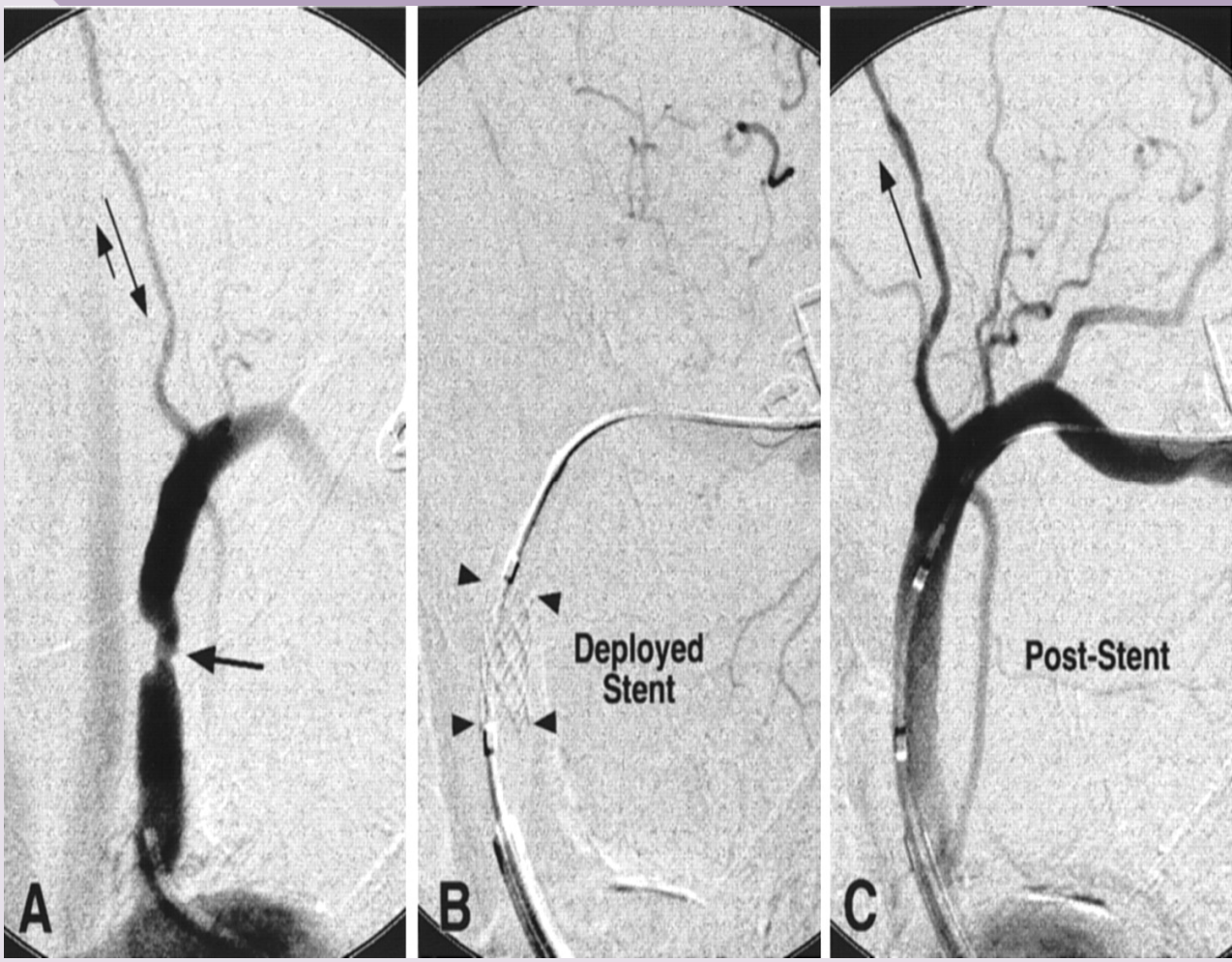
- 90% & 88% patency rate in 5 & 10 years



OUTCOMES

Series Author	Year	Patients/Type	Mortality %	Stroke %	MI %	Survival %		Patency %	
						5-year	10-year	5-year	10-year
Crawford [67]	1969	177 CSB	2.3	NA	NA	NA	NA	NA	NA
Crawford [66]	1983	99 CSB	1.0	2.0	NA	NA	NA	NA	NA
Vitti [91]	1994	124 CSB	0.8	0	2.4	83	59	94	94
Schardey [88]	1996	108 SCT	0	1.9	NA	83	NA	100	NA
Berguer [29]	1999	182 All	0.5	3.8	3	72	41	91	82
Mingoli [82]	1999	61 Ax-Ax	1.6	0	0	93	67	87	83
AbuRahma [75]	2000	51 CSB	0	0	2	86	57	96	92
Cina [72] SystematicReview	2001	27 SCT	0	0	NA	NA	NA	NA	NA
		516 CSB	1.2	6.6		86		84	
		511 SCT	1.2	4.4		85		99	
Ozvath [79]	2003	24 Car-Car	0	4	0	NA	NA	50	NA
Byrne [80]	2007	143 All	0.7	1.4	4.3	NA	NA	NA	NA
Domenig [89]	2008	150 SCT	0.7	1.3	0	80	51	NA	NA
Takach [28]	2011	287 CSB	1.0	2.1	0.3	88	73	94	89
Madenci [77]	2013	789 CSB/SCT	2.9	3.3	NA	NA	NA	NA	NA
Illuminati [90]	2018	45 CSB	2.2	2.2	0	71	NA	96	NA
AbuRhama [85]	2020	37 CSB+CEA	2.7	2.7	0	NA	NA	85	NA

ENDOVASCULAR INTERVENTION



OUTCOMES: PTA VS. PRIMARY STENTING

Ahmed et al. (cardiovasc intent radiol. 2016) Systemic review and meta-analysis	Technical success : stent vs PTA (92.8 vs 86.8%, p = 0.007). Long-term primary patency (76.9 vs 79.6%, p = 0.729) symptom resolution (82.2 vs 73.0% p=0.327) Stroke (2% vs 2% p=0.742)
Chatterjee et al. (Am J Ther. 2013) Systemic review &meta-analysis	Stenting after PTA significantly superior to PTA alone for maintaining patency at 1 year (odds ratio 2.37, 95% CI 1.32-4.26, p = 0.004)

Journal of Endovascular Therapy
Volume 22, Issue 4, August 2015, Pages 626-633

https://doi.org/10.1177/1526602815590579

Subclavian and Carotid Artery Stenting

Perioperative and Long-term Outcomes of Endovascular Treatment for Subclavian Artery Disease From a Large Multicenter Registry

Yoshimitsu Soga, MD[1], Yusuke Tomoi, MD[1], Masahiko Fujihara, MD[2], Shinya Okazaki, MD[3], Yasutaka Yamauchi, MD[4], Yoshiaki Shintani, MD[5], and Kenji Suzuki, MD[6] on behalf of the SCALLOP Investigators

Analysis of multicenter retrospective registry

(n=718)

Procedure success: 96.8%, procedure failure: 3%

primary patency: 90.6%, 83.4% ,80.5%

Secondary patency: 99.2%, 98.2%, 97.7%

Perioperative CVA: 1.8%
ipsilateral posterior infarct: 0.9%
Perioperative mortality: 0.7%

OPEN VS ENDO

Galyfos et al. JVS 2019	**Zhang et al. Jour Endo Ther 2025**
Systemic literature review Open (n=463), Endo (n=297)	Comparative retrospective analyis CSB (n=38), SCT (n=43), Endo (n=111)
Early outcomes: no statistical significance Technical success Primary patency Death Cardiac events CNS events Access site • Only PNS rates (5.4% vs 0.2% P=.001)	Median follow up 42.5 months Technical success rate: (Endo vs CSB vs SCT ::807' #vs#;906' #vs#32202' + Immediate symptom relief: 96%
Long-term primary patency rates: 1,3,5 years 1-year (95% vs 89% *P*=.0003) 3-year (91% vs 83% *P* < .0001) 5-year (87% vs 75% *P =.0004*)	Peri-operative complications: (Endo vs CSB vs SCT : 5.4% vs 13.2% vs 16.3%+ (n=0) CVA, MI, perioperative mortality Primary patency rates: Endo vs CSB vs SCT 1-year (93.4% vs 94.1% vs 100%) 3-year (88.2% vs 86.8% vs 100%) 5-year (77.6% vs 72.3% vs 100%)
5-year freedom of recurrence: no statistical significance	

THANK YOU!

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