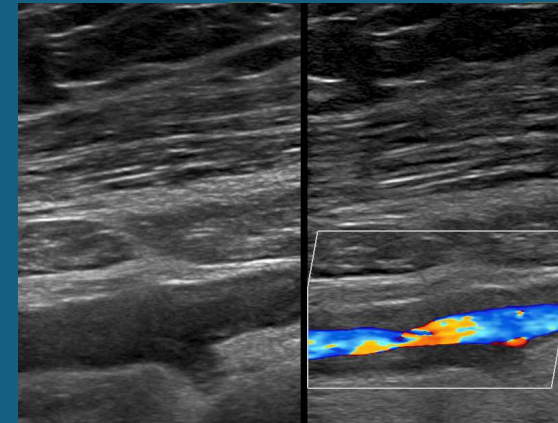


# Periphere Arterien

## Nachsorge nach peripherer Intervention

Freitag, 24.04.2026

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# Bypass: Pathologien

- **early failure** (<30d )
  - Technischer Fehler (Anastomosenprobleme, Torsion, outflow ungenügend, schlechte Vene etc)
- **intermediate failure** (30d – 2years)
  - Myointimale Hyperplasie
- **late failure** (> 2 years)
  - Progression der Atherosklerose

→ 2-Jahres-patency 19-31% nach Verschluss

→ PPV 12-23% für ABI alleine zur Entdeckung eines drohenden graft-Versagens

# Einführung

- Ziel einer Intervention ist **Verbesserung der Durchblutung**  
(Symptome, Mobilität, Läsion Abheilung, Extremitäten-Erhalt)
- Überwachungsprogramme nach Interventionen dienen der **Erfassung** und **Behandlung** einer den Interventionserfolg bedrohenden Pathologie (meist Stenose)
- Eine **prophylaktische Reintervention** ist einer Revaskularisation bei (Re-)Okklusion überlegen

# Weniges hält ewig.....

**After endovascular treatment**, restenosis and occlusion ranges **from 5% in the pelvic region to >50% in the infra-popliteal arteries.**<sup>623,624</sup>

Unlike after surgery, no plateau phase is seen, and the failure rate is constant for at least 5 years.

# Faktoren pro und contra postinterventionelle Kontrollen

1. Routine/Interesse
2. Hohes Risiko für Rezidiv  
(langstreckige Rekanalisation, schmalkalibrige BP-Vene, schlechter outflow...)
3. Qualitätskontrolle («Register»)
4. Patientenwunsch
5. Kosten (Leistungserbringer vs. Kostenträger)
6. Evidenz

# Gewisse Diskrepanz.....


## Cis – atlantische Artificial Intelligence (2025)



versus

## Europäische humane Intelligenz

European Heart Journal (2024) **00**, 1–163 <https://doi.org/10.1093/eurheartj/ehae179>

For patients with **infrainguinal autogenous vein bypass grafts and no new symptoms**, it is reasonable to perform **ABI and arterial duplex ultrasound surveillance at 1–3 months postoperatively, then at 6 and 12 months, and annually thereafter**. This approach aims to identify subclinical restenosis, as neointimal hyperplasia is a common cause of graft failure in this population. However, for **prosthetic bypass grafts**, the benefit of routine duplex surveillance is uncertain, and the decision should be individualized. 

Recommended follow-up after percutaneous transluminal angioplasty (PTA) includes clinical assessment, ankle-brachial index (ABI) measurement, and **duplex ultrasound (DUS) at regular intervals - typically at 1, 3, and 6 months, then annually** - to detect restenosis and maintain vessel patency, especially in the first year.<sup>[1-3]</sup>

The Society for Vascular Surgery and the Society of Interventional Radiology, in their global guidelines, emphasize that **clinical follow-up alone may be insufficient**, as patients may remain asymptomatic until occlusion occurs.

# 2024 ESC Guidelines for the management of peripheral arterial and aortic diseases

Developed by the task force on the management of peripheral arterial  
and aortic diseases of the European Society of Cardiology (ESC)

## 8.1.3. Acute limb ischaemia

### 8.1.3.4. *Follow-up*

.....aetiology of ALI should be investigated, and OMT ensured.

.....

While there is only sparse evidence, the inclusion of PAD patients after revascularization into **structured follow-up may improve their functional outcomes.**<sup>627</sup>

# 2024 ESC Guidelines for the management of peripheral arterial and aortic diseases

Developed by the task force on the management of peripheral arterial  
and aortic diseases of the European Society of Cardiology (ESC)

## 8.1.2. Chronic limb-threatening ischaemia

### 8.1.2.4. *Follow-up*

.....

Due to the **lack of evidence**, recommendations are largely based on consensus and expert opinions.<sup>128</sup>

.....

Surveillance includes clinical assessment looking for recurrent symptoms or signs, ABI measurement, **and DUS** based on the first check-up: **if normal, DUS is recommended if symptoms reappear; if abnormal, initial DUS, re-intervention, or closer DUS follow-up on a case-by-case basis** are recommended.<sup>128</sup>

# 2024 ESC Guidelines for the management of peripheral arterial and aortic diseases

Developed by the task force on the management of peripheral arterial and aortic diseases of the European Society of Cardiology (ESC)

## Recommendation Table 21 — Recommendations for follow-up in patients with chronic limb-threatening ischaemia

Recommendations	Class <sup>a</sup>	Level <sup>b</sup>
In patients with CLTI, following revascularization it is recommended to follow up patients on a regular basis. <a href="#">552,626,627</a>	I	C
At follow-up, it is recommended to assess clinical, haemodynamic and functional status, limb symptoms, treatment adherence, and CVRFs. <a href="#">552,625–628</a>	I	C

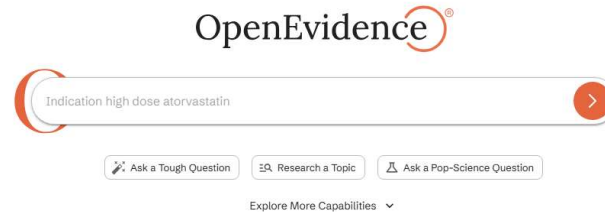
CLTI, chronic limb-threatening ischaemia; CVRFs, cardiovascular risk factors.

<sup>a</sup>Class of recommendation.

<sup>b</sup>Level of evidence.

# Exkurs: Definition einer (re-)interventionsbedürftigen Stenose

Cis – atlantische Artificial Intelligence (2025) 😊



Reintervention is considered for recurrent or de novo stenosis detected by DUS or for recurrent symptoms. DUS criteria for significant restenosis include **a peak systolic velocity (PSV) >223cm/s or a velocity ratio (Vr) >2.5** in the femoropopliteal segment

## Europäische humane Intelligenz

European Heart Journal (2024) 00, 1–163 <https://doi.org/10.1093/eurheartj/ehae179>

Keine spezifische Empfehlung, wie eine hochgradige, Re-Intervention triggernde Läsion zu definieren ist

## (Re-)interventionsbedürftige, kritische Stenose (>70%)

- PSV > 300cm/s....
- PSV ratio > 3.5
- Mittlere PSV <45cm/s.... (oder Vmax nirgends im BP > 45cm/s....)

**Table VIII.** Duplex ultrasound (DUS) velocity and ankle-brachial index (ABI) threshold criteria for stratification of risk for thrombosis of infrainguinal vein grafts

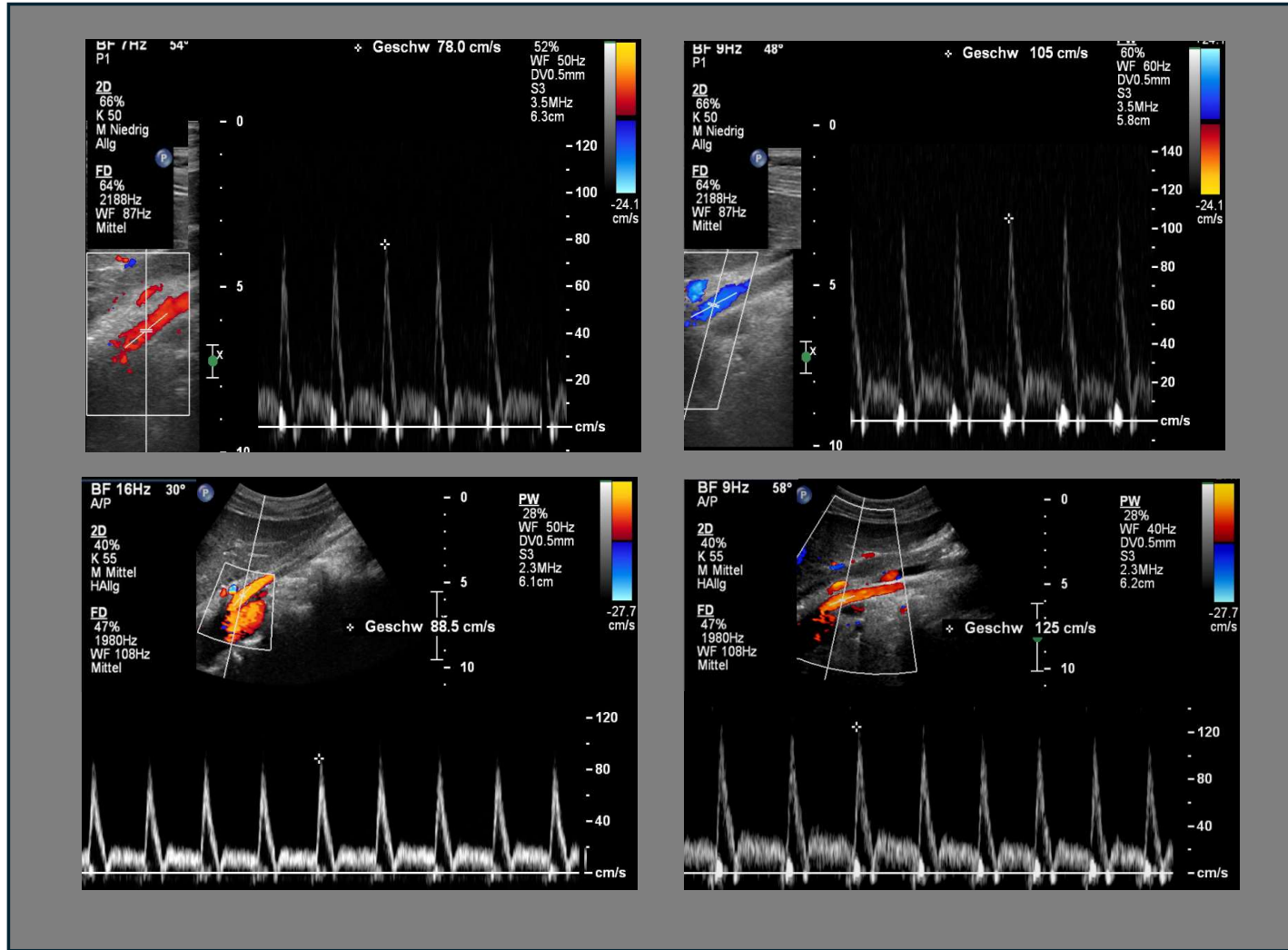
Category	High-velocity criteria (PSV)	Velocity ratio (Vr)	Low-velocity criteria (GFV), cm/s	Change in ABI
Highest risk	>300 cm/s	>3.5	<45	>0.15
High risk	>300 cm/s	>3.5	>45	<0.15
Moderate risk	180-300 cm/s	>2.0	>45	<0.15
Low risk	<180 cm/s	<2.0	>45	<0.15

*GFV*, Graft flow velocity; *PSV*, peak systolic velocity; *Vr*, PSV velocity ratio—PSV at the site of a stenosis divided by the PSV in a normal vessel segment proximal to the stenosis.  
Adapted from Bandyk DF, Seabrook GR, Moldenhauer P, Lavin J, Edward J, Cato R, et al. Hemodynamics of vein graft stenosis. *J Vasc Surg* 1988;8:688-95.

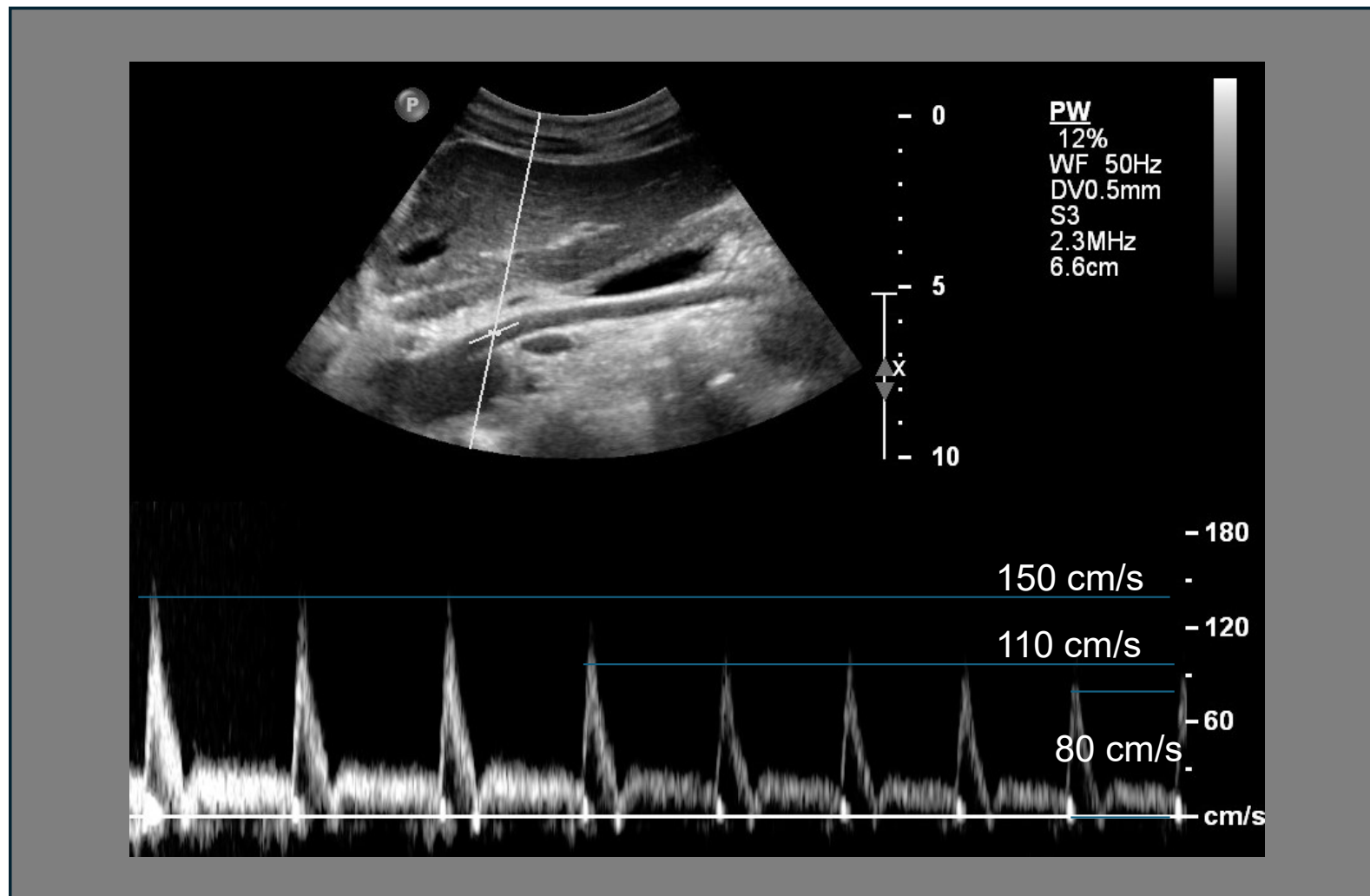
# Aber Achtung: Schallkopf, Korrekturwinkel

L9-3, Box, Korrekturwinkel

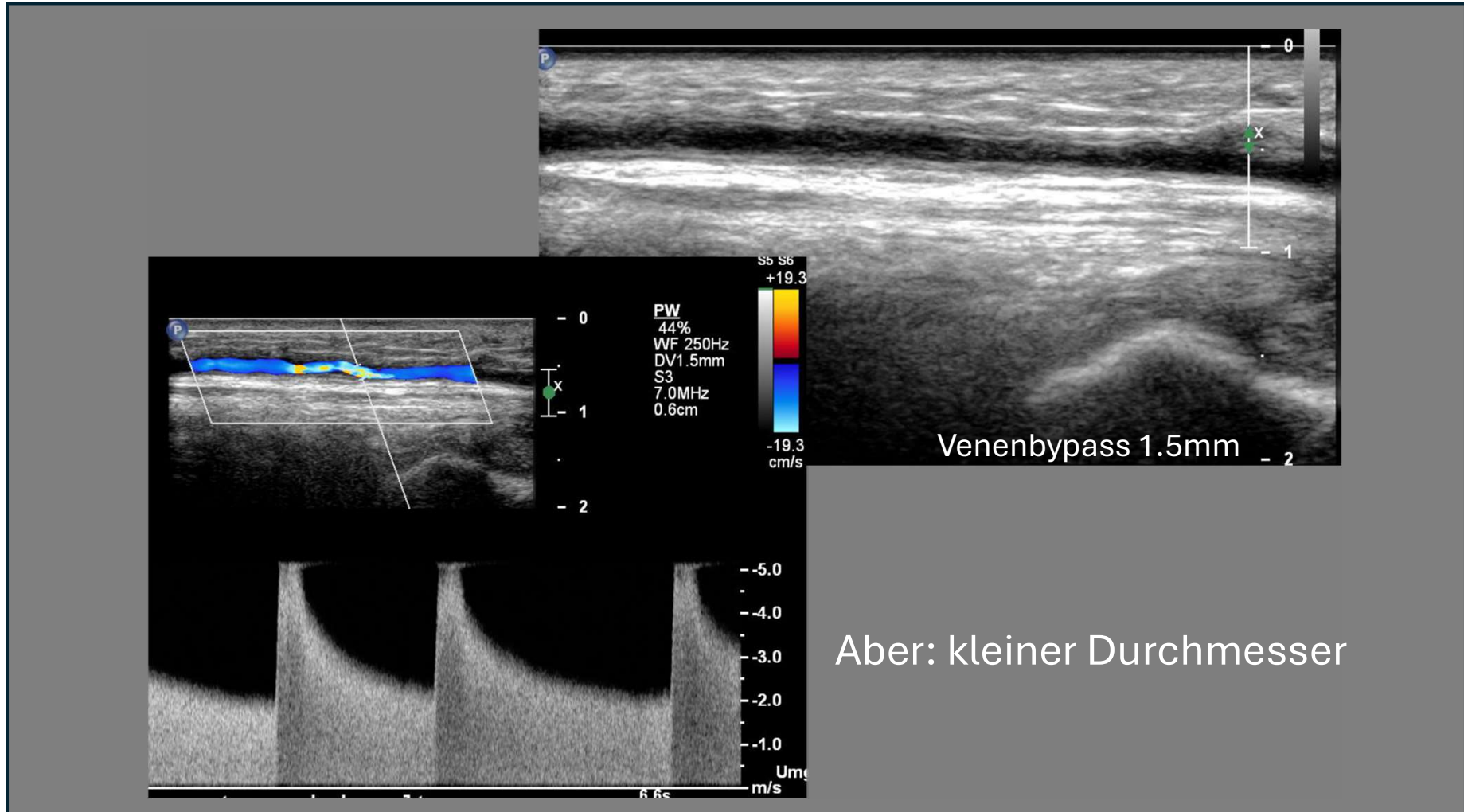
C5-1, Korrekturwinkel



# Aber Achtung: PW - gain



# No doubt – bezüglich Stenosegraduierung.....

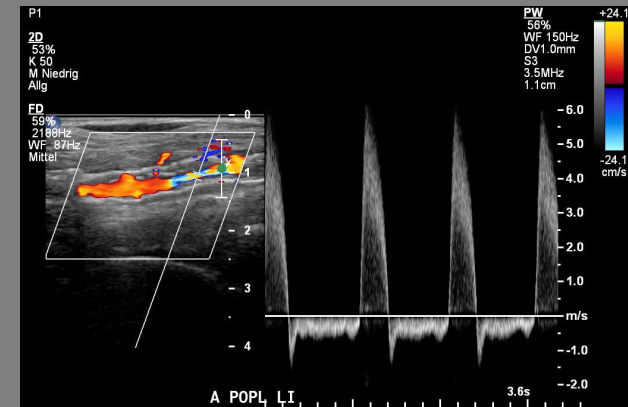


# No doubt – wichtige Information.....



Stent-Fraktur (Viabahn)

myointimale Hyperplasie in Stent



# Neuere Literatur.....(2023)

## mit/ohne Duplex

short term (1 - 18 resp. 24 Mt): **limb salvage, secondary patency = n.s.**

Summary of findings 1. Duplex ultrasound plus pulse palpation and arterial pressure index (ABI or TBI) versus pulse palpation plus arterial pressure index (ABI or TBI) (short term)

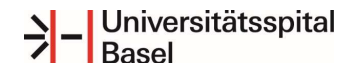
Duplex ultrasound plus pulse palpation and arterial pressure index (ABI or TBI) versus pulse palpation and arterial pressure index (ABI or TBI) (short term)					
Patient or population: people with peripheral arterial disease requiring revascularisation					
Setting: outpatient					
Intervention: duplex ultrasound plus pulse palpation and arterial pressure index (ABI or TBI)					
Comparison: pulse palpation and arterial pressure index (ABI or TBI)					
Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)
	Risk with pulse palpation and arterial pressure index (ABI or TBI)	Risk with duplex ultrasound plus pulse palpation and arterial pressure index			
Limb salvage rate Follow-up: from 1 month to 18 months	Study population		RR 0.84 (0.49 to 1.45)	936 (2 RCTs)	⊕⊕⊕⊕ Low <sup>a,b</sup>
	740 per 1000	621 per 1000 (362 to 1000)			
Vessel or graft secondary patency Follow-up: from 1 month to 24 months	Study population		RR 0.92 (0.67 to 1.26)	1092 (3 RCTs)	⊕⊕⊕⊕ Low <sup>a,b</sup>
	279 per 1000	256 per 1000 (187 to 351)			
Adverse events resulting from DUS surveillance	No studies measured this outcome.				

ohne Duplex      mit Duplex



Duplex ultrasound for surveillance of lower limb revascularisation (Review)

Sarke AKP, Flumignan CDQ, Nakano LCU, Trevisani VFM, Lopes RD, Guedes Neto HJ, Flumignan RLG



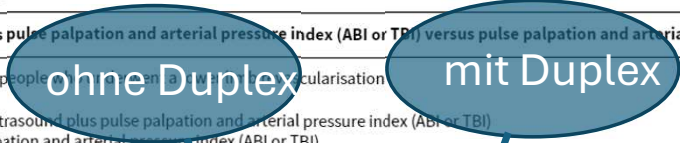
# Neuere Literatur.....(2023)

mit/ohne Duplex

long term (24 - 36 Mt): **secondary patency = n.s.**

Summary of findings 2. Duplex ultrasound plus pulse palpation and arterial pressure index (ABI or TBI) versus pulse palpation plus arterial pressure index (ABI or TBI) (long term)

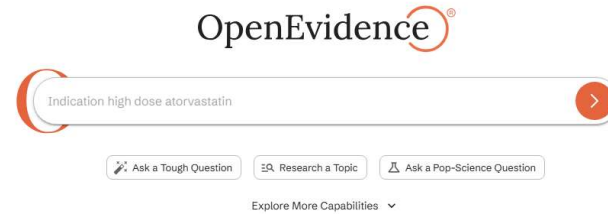
Outcomes	Anticipated absolute effects* (95% CI)		Relative effect (95% CI)	Nº of participants (studies)	Certainty of the evidence (GRADE)
	Risk with pulse palpation and arterial pressure index (ABI or TBI)	Risk with duplex ultrasound plus pulse palpation and arterial pressure index (ABI or TBI)			
Limb salvage rate	No studies measured this outcome.				
Vessel or graft secondary patency	Study population		RR 0.83 (0.19 to 3.51)	156 (1 RCT)	⊕⊕⊕⊕ Low <sup>a,b</sup>
Follow-up: from 24 to 36 months	312 per 1000	259 per 1000 (59 to 1000)			
Adverse events resulting from DUS surveillance	No studies measured this outcome.				
All-cause mortality	No studies measured this outcome.				



Duplex ultrasound for surveillance of lower limb revascularisation (Review)

Sarke AKP, Flumignan CDQ, Nakano LCU, Trevisani VFM, Lopes RD, Guedes Neto HJ, Flumignan RLG

# Rehabilitation.....



**Despite widespread use**, the clinical benefit of routine DUS surveillance after PTA remains uncertain, as randomized trials have not demonstrated improved limb salvage or patency rates compared to clinical follow-up alone, and **DUS may increase reintervention rates without clear impact on major outcomes.**<sup>[5]</sup>

# Zusammenfassung

- Evidenz für follow – up suboptimal
- Evidenz für (Routine) Ultraschall noch geringer
- Evidenz für follow – up bei Claudicanten.....

Konsequenz?

zurück auf Feld 1....

# Zusammenfassung

1. Routine/Interesse
2. Hohes Risiko für Rezidiv  
(langstreckige Rekanalisation, schmalkalibrige BP-Vene, schlechter outflow...)
3. Qualitätskontrolle («Register»)
4. Patientenwunsch
5. Kosten (Leistungserbringer vs. Kostenträger)

....kann, darf, soll mitberücksichtigt werden

Sorry.....



Ende