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Vasa

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Herausgeber und Herausgeberinnen

Erwin Blessing

Jacqueline Stella

Lisa Tilemann

Sehr geehrte Damen und Herren,

wir freuen uns außerordentlich, Sie auf der 52. Jahrestagung der Deutschen Gesellschaft für Angiologie – Gesellschaft für Gefäßmedizin e.V. und dem 7. DGA-Interventionskongress vom 21. bis 23. September 2023 in Leipzig begrüßen zu dürfen.

Zum einen sind der technische Fortschritt und die zunehmenden interventionellen und medikamentösen Möglichkeiten in der Angiologie absolut beeindruckend und die endovaskuläre Gefäßmedizin verschiebt von Jahr zu Jahr die Grenzen der Machbarkeit. Zum anderen darf der Patient oder die Patientin als Ganzes nicht aus dem Blick geraten. Aufgrund der immer besseren medizinischen Versorgung behandeln wir heute in der Angiologie zunehmend vorerkrankte, komplexe Patient_innen, die uns vor neue Herausforderungen stellen. Das sind auch die Patient_innen, die besonders von einer interdisziplinären Zusammenarbeit profitieren.

Ein zunehmendes Spannungsfeld zwischen der optimalen Versorgung von Patient_innen in Anbetracht knapper Ressourcen stellt auch uns Gefäßmediziner_innen vor weitere große und gegebenenfalls anhaltende Herausforderungen. Ein möglicher Ansatz zur effizienten und doch sicheren Versorgung unserer Patient_innen bietet eventuell eine zunehmenden Ambulantisierung endovaskulärer Eingriffe. Hier wäre, in Anlehnung an den Entwicklungen in der kardiovaskulären Medizin, der zunehmende transradiale Zugangsweg ein möglicherweise vielversprechender Ansatz.

Durch zahlreiche Live-Übertragungen und „Live-in-the-box“-Aufzeichnungen von interventionellen Schwerpunktzentren sollen sowohl „Standardinterventionen“ wie auch Grenzfälle komplexer Interventionen anschaulich dargestellt und anschließend kritisch diskutiert werden. Darüber hinaus wollen wir unseren Fokus auch auf das Thema „Fort- und Weiterbildung“ legen und praxisrelevante Workshops, Hands-on-Kurse, Falldiskussionen, uvm. im Programm integrieren. Ein besonderes Augenmerk soll außerdem auf dem Nachwuchs und den „Jungen Angiolog_innen“ liegen, die auch im Jahr 2023 wieder verschiedene Sitzungen, Kurse und Networking-Veranstaltungen anbieten werden! Da vor allem letzteres in den vergangenen Jahren viel zu kurz gekommen ist, möchten wir zudem über die gesamte Kongressdauer hinweg ausreichend Gelegenheit für rege Diskussionen, spannende Fragen und neue Formate schaffen.

Seien Sie also gespannt auf renommierte nationale und internationale Referent_innen, die ein innovatives und vielfältiges Programm über drei Tage hinweg präsentieren werden. Wir freuen uns auf Sie!

Mit herzlichen Grüßen

Prof. Dr. med. Erwin Blessing
Tagungspräsident

Dr. med. Jacqueline Stella
Tagungspräsidentin

Dr. med. Lisa Tilemann
Tagungspräsidentin

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DGA Jahrestagung 2023 – Abstracts

Gefäßmedizin – im Spannungsfeld zwischen Innovation und Multimorbidität

Postersitzung I

Alternative Zugangswege: von transradial bis retrograd

A-110

Lower limb occlusive artery recanalization with retrograde access through peroneal artery or tibioperoneal trunk puncture: Retrospective exploratory analysis with 1 year follow up

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Background

Retrograde access for recanalization in complex cases of lower limb artery occlusion has emerged as a standard procedure in recent years. However, the peroneal artery for retrograde access is the least common compared to anterior or posterior tibial artery [1]. Therefore further analysis of technical success, safety and outcome (12 months amputation-free survival and freedom from target lesion revascularization) needs to be investigated.

Patients/Materials and methods

Retrospective data were obtained from 161 consecutive recanalization attempts of lower limb occlusive disease with retrograde access via puncture of peroneal artery or tibioperoneal trunk between May 2014 to April 2021. Follow up data were collected through medical record or telephone surveys. Descriptive analysis was used to describe patient's and lesion's characteristics, as well as technical success, procedural outcome and safety. Survival analysis was used to describe follow up outcome. Total of 131 procedure were included in 12 months amputation free survival (AFS) analysis with 30 patients lost to follow. 119 successful procedures were included in 12 months freedom from target lesion revascularization (CD-TLR) analysis with 26 patients lost to follow up.

Results

Retrograde access could be successfully achieved in 98.1% of cases, lesion crossing in 90.7% and procedural success in 90.1% of cases. Complication rate which associated with retrograde access 2.4%, from bleeding and AV Fistula (each 1.2%). Overall AFS at 12 months was 87% (81.7% in patients with critical limb ischemia (CLI) and 95.9% in claudicants ($p=0.025$). Use of drug coated balloon (DCB) did not predict overall survival at 12 months follow up. Freedom from CD-TLR at 12 months was 54.6% (in patients with CLI 42.5% and in claudicants 73.9%). No significance difference in freedom from CD-TLR was observed regarding the use of POBA only, DCB or Stent ($p=0.081$, $p=0.614$ and $p=0.215$ consecutively), as well as the degree of calcification ($p=0.695$). Procedural success was significantly higher in less calcified lesion ($p=0.045$), but no difference was observed regarding lesion length ($p=0.213$). Use of a sheath also did not correlate with procedural complication rates as compared to a sheath less approach.

Conclusions

Retrograde vascular access via the peroneal artery or tibioperoneal trunk show excellent technical success and low complication rates, if performed in a high-volume center. Freedom from target lesion revascularization is acceptable and mainly determined by the complexity of patient and lesion characteristics.

Reference

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A-125

Ultrasound-guided thrombatherectomy of a femoral TEA zone occlusion with the Bycross system in a complex case: Safe application and tricks for additive lumen gain

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Background

A 43-year-old single female patient with a complex vascular history had a peripheral arterial occlusive disease in clinical stage II b according to Fontaine based on a further occlusion of the left femoral bifurcation; there was a wish for therapy.

Patients/Materials and methods

Duplex sonography showed the peculiarity of the case: the inflow to the inguinal region was normal up to the distal external iliac artery (triphasic flow signal), the profunda femoris artery received inflow via the internal iliac artery and fed the superficial femoral artery itself, only the TEA zone in the area of the biopatch was completely occluded by an inhomogeneous mass (B1). this was confirmed on CT angiography (B2).

We planned the intervention with the following goals: If possible, not to implant a foreign body such as a (covered) stent, remove as much occlusive material as possible, at the end of the PTA drug-eluting balloon (DEB) in the TEA zone. The intervention should be ultrasound-guided to save X-rays and to assess the changing hemodynamics. Therefore, we decided to use the Bycross system (B3-4).

Angiography was successfully performed and additive lumen gain was achieved by external compression during active milling (B5-7).

Results

Complaint-free patient, no complication, ABI of 1.1 and TEA zone open with good lumen gain (B8).

Conclusions

The Bycross system can be used safely and successfully under visualization by ultrasound. It can be clearly identified in ultrasound and its therapeutic performance is immediately visible. Lumen gain can be increased by compressing the TEA zone during the milling process.

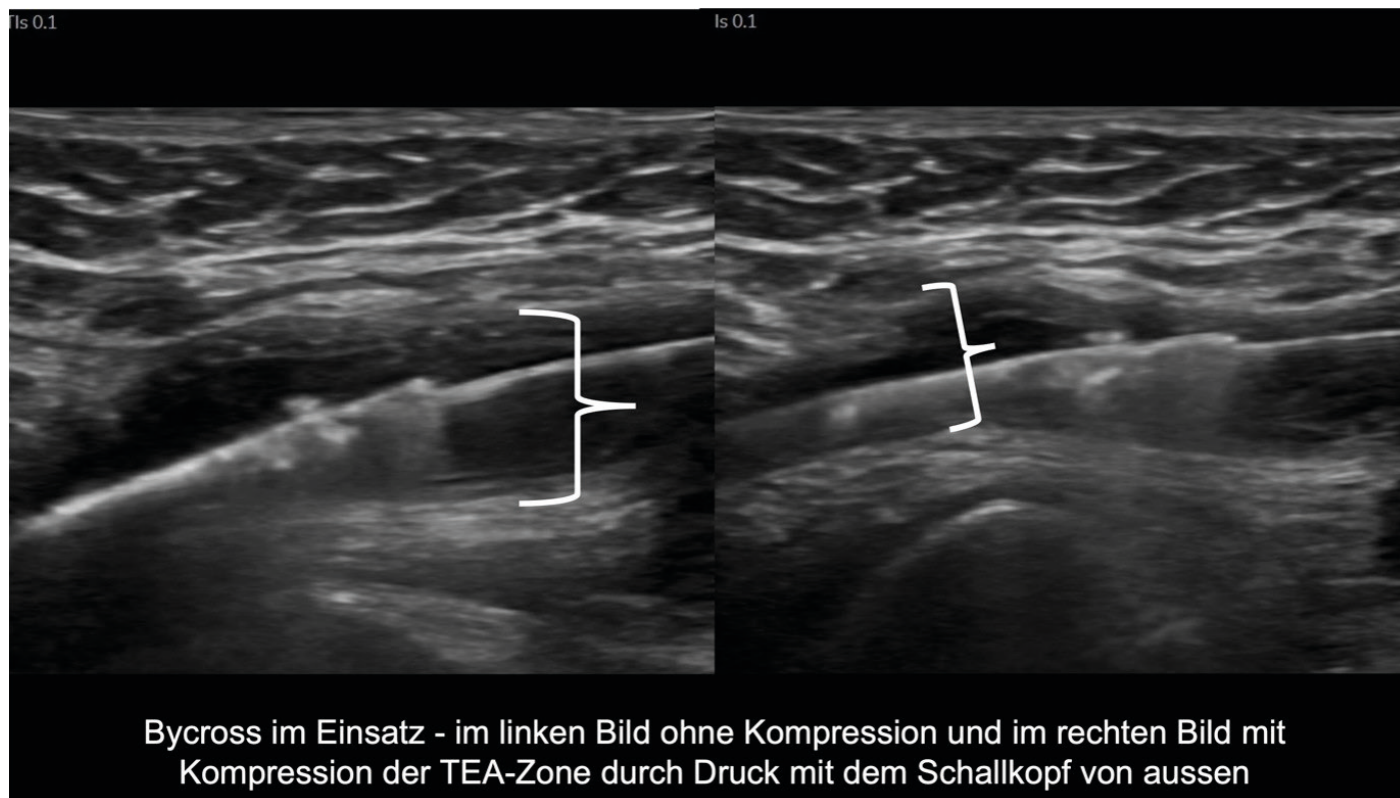


Figure A-125. Ultraschallbild TEA-Zone Bycross mit und ohne Kompression.

A-127

Influence of pseudoxanthoma elasticum on the lipid profile and prognostic implications

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Background

Pseudoxanthoma elasticum (PXE) is a rare, metabolic, recessively inherited disease with an estimated prevalence of 1 in 25,000 and 56,000. Its main clinical features are characteristic skin lesions, progressive loss of vision and early onset atherosclerosis. Clinical manifestations of PXE are most likely mediated by a systemic decrease of pyrophosphate (PPi), which is an important inhibitor of ectopic and arterial calcification. Although PXE is genetically determined, the individual course is highly variable, neither genotype-phenotype correlations nor quantification of PPi were able to explain the individual variability of the PXE phenotype. Therefore, identification of possible predictive markers indicating severity and disease progression is crucial for individual risk stratification. Disturbed cholesterol homeostasis has already been associated with PXE and is, therefore, one possible biomarker. This present study therefore focused the lipid profile of patients with PXE and the possible influence of lipoprotein(a) (Lp[a]) on the clinical severity of peripheral artery disease (PAD).

Patients/Materials and methods

All 112 patients with PXE, who applied to the Angiological Department of the University Hospital of Bonn, where retrospectively screened. Patients without a complete lipid profile consisting of total cholesterol (TC), triglycerides (TGC), high-density lipoprotein (HDL), low-density lipoprotein (LDL) and Lp(a) were excluded as well as patients with already initiated lipid-lowering therapy. 52 patients who met the inclusion criteria were grouped according to the Lp(a)-level (<120 nmol/l; $n=40$ and >120 nmol/l; $n=12$).

Results

Regarding the whole PXE cohort ($n=52$) lipid profile was largely unremarkable (TGC: 135.8 ± 105.8 mg/dl; TC: 172.5 ± 44.4 mg/dl; HDL: 63.0 ± 18.2 mg/dl). Lp(a) varied substantially between the patients (Lp[a]: 65.6 ± 94.6 nmol/l). After grouping, no relevant differences in gender, age, BMI and number of packyears occurred. Comparing the groups regarding Fontaine stages, patients with an elevated Lp(a) >120 nmol/l suffered significantly higher Fontaine stages compared to patients with an Lp(a) <120 nmol/l ($p < .01$). All patients with elevated Lp(a) were affected from atherosclerotic lesions and 11 out of 12 patients presented with symptomatic PAD (Fontaine stages IIa and IIb).

Conclusions

Lp(a) is an acknowledged risk factor for cardiovascular diseases. In this study, patients with PXE and elevated Lp(a) suffered from severe, symptomatic PAD at young ages. These results indicate that Lp(a) may be a relevant modifier of the vascular manifestation in PXE. Patients with PXE should, therefore, be screened for elevated Lp(a) immediately after the diagnosis has been confirmed to identify individuals at risk of rapid PAD progression.

A-130

Invasive Evaluation peripherer Stenosen anhand des Druckgradienten im Katheterrückzug sowie deren Effekt auf klinische Parameter

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Background

In der Planung einer Katheter-interventionellen Prozedur bei peripherer arterieller Verschlusskrankheit (pAVK) ist die Mitbeteiligung der Beckenarterien von großer Relevanz. In Fällen mit fraglich pathologischem Flussmuster ohne direkt darstellbare relevante Stenose in der Duplexsonografie, stellt die invasive Messung eines Druckgradienten über der Läsion eine sehr gute zweite Methode dar.

Patients/Materials and methods

Innerhalb von 14 Monaten erfolgte bei ausgewählten Patienten mit pAVK die Einschätzung der Interventionsbedürftigkeit von Stenosen via invasiver Blutdruckmessung im Katheterrückzug. Der damit erhobene Datensatz wurde retrospektiv ausgewertet. Um eine angiografisch intermediär erscheinende Stenose hämodynamisch zu bewerten, wurde ein 4F-Diagnostikkatheter (MPA - 2) über die Läsion geführt, an eine invasive Druckmessung angeschlossen und unter kontinuierlicher RR-Registrierung manuell über den stenotisierten Bereich gezogen. Die RR-Differenz post- zu prästenotisch wurde berechnet. Eine Läsion wurde als hämodynamisch relevant betrachtet, wenn der systolische Gradient mindestens 20 und/oder der mittlere Gradient ≥ 10 mmHg betrug.

Results

90 Patienten wurden in die Analyse eingeschlossen (Alter: 72.6 ± 10.4 Jahre; Männlich: 57%; Rutherford-Stadium 3: 62%). Überwiegend erfolgten perkutane, transluminale Angioplastien (PTA) der AFS ($n = 34$ [38%]) und AIE ($n = 29$ [32%]). Die Interventionen umfassten dabei zusätzlich Stentimplantationen ($n = 34$ [38%]), Drug Coated Balloon (DCB) - Anwendungen ($n = 37$ [41%]) und weniger häufig Eingriffe unter Einsatz von Scoringballonen ($n = 7$ [8%]) bzw. Lithotripsie ($n = 5$ [6%]). In 41% der Fälle erfolgte die Intervention von 2 bzw. in 25% von 3 Stenosen pro Sitzung auf der betroffenen Seite. Ein konservatives Vorgehen wurde für 23% der evaluierten Stenosen gewählt. Systolisch konnten im Katheterrückzug bei relevanten Stenosen ein poststenotischer RR von 101.6 ± 34.8 mmHg und prästenotisch von 144.9 ± 29.8 mmHg ($p < 0.001$) erhoben werden (Differenz: 43.4 ± 22.7 mmHg). Im Katheterrückzug ergaben sich mittlere RR-Werte poststenotisch von 79.9 ± 23.5 mmHg und prästenotisch von 100.9 ± 18.4 mmHg ($p < 0.01$) mit einem Gradienten von 20.8 ± 12.4 mmHg. Postinterventionell zeigte sich am Folgetag ein Anstieg des ABI auf 0.76 ± 0.21 ($p < 0.01$). Im Follow-up nach 176. 9 ± 119.8 Tagen zeigte sich ein mittlerer ABI von 0.7 ± 0.2 ($p < 0.01$) sowie eine Verbesserung der maximalen Gehstrecke auf 137.4 ± 86.9 m (Laufband; $p = 0.02$).

Conclusions

Der invasive Katheterrückzug zur Evaluation peripherer Stenosen ist ein einfaches und hilfreiches Werkzeug die hämodynamische Relevanz von Engstellen herauszuarbeiten. Strahlungsanwendungen und der Einsatz von Kontrastmittel können dadurch reduziert werden.

A-132

Case report and first results of a retrospective study assessing the occurrence of echo-poor fringes after Eluvia and Zilver PTX stent angioplasty femoropopliteal

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Background

Drug-eluting stents have shown superior outcomes over bare-metal stents. A study evaluating the outcome of Eluvia drug-eluting stents with one- and two-year follow-up presented promising results [1, 2]. In addition, vessel wall degeneration was observed in some patients, which is most likely due to local inflammation. It can be visualized with a “halo” sign on color duplex sonography, showing an echo-poor fringe around the stent [1].

Patients/Materials and methods

In this case report, a patient with a pronounced, nonperfused “halo” around an Eluvia stent is presented. The 69-year-old patient presented with left-sided claudication (Rutherford 3) with thrombotic occlusion of the superficial femoral artery. Femoral recanalization with implantation of one Eluvia stent of the proximal superficial femoral artery was performed.

In the presented study, the occurrence of echo-poor fringes around drug-eluting Eluvia and Zilver PTX stents is evaluated retrospectively using color duplex sonography findings of follow-up examinations. 150 patients who received a Zilver PTX or Eluvia stent implantation between January 2017 and November 2020 were included.

Results

In the presented case report, postintervention duplex sonographic control showed a “halo” without active perfusion and without stenosis of the vessel. In further follow-up until 3 years after the intervention, the “halo” was stable in size.

The initial results of the retrospective study will be presented at the congress.

Conclusions

The benefit of new stent technologies such as the drug-eluting Eluvia stent has been extensively investigated. The “halo” phenomenon around the stent, which was seen in some subjects, needs further investigation. Initial results of our retrospective study will be presented at the congress.

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A-136

The impact of Covid-19 on mortality and clinical characteristics in hospitalized patients with peripheral artery disease in the year 2020

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Background

The Covid-19 pandemic developed its full destructive capacity and caused over 6.8 million confirmed deaths worldwide until now. This retrospective study aimed to examine the effects of Covid-19 on the mortality and clinical characteristics of peripheral artery disease (PAD) patients because

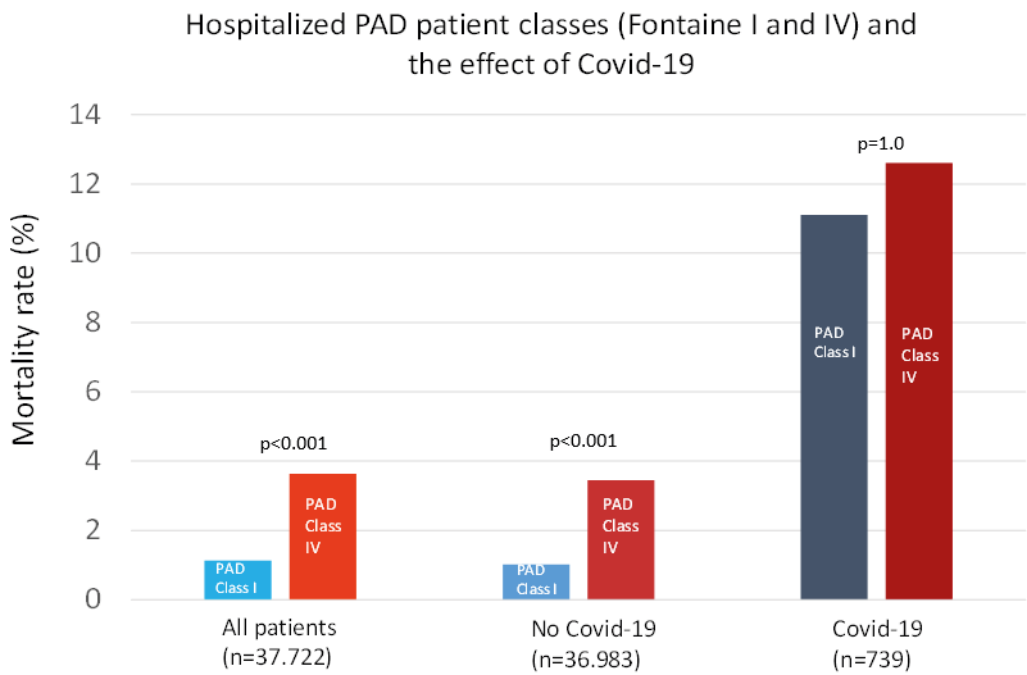


Figure A-136. Mortality rates of PAD patients with and without Covid-19.

these chronically ill patients are at risk for arterial embolic vascular complications and a fatal outcome.

Patients/Materials and methods

From a German nationwide registry of 2020 all patients hospitalized with PAD (n=173.075) were compared in four different groups. The first group had no additional diabetes mellitus type 2 or Covid-19 (n=110.531), the second diabetes mellitus but no Covid-19 (n=59.991), the third diabetes mellitus and Covid-19 (n=1497) and the fourth no diabetes mellitus but Covid-19 (n=1056).

Results

Mortality rates in all PAD patients without Covid-19 were low and ranging between 1.1-3.6%, depending on PAD classification. However, PAD patients with Covid-19 had significantly higher mortality rates of 11.1-12.6%. Clinical characteristics and the Charlson- comorbidity index surprisingly revealed that PAD patients with Covid-19 but without diabetes mellitus presented more complications such as higher rates of stroke (1.4%), cardiogenic shock (3.3%), chronic kidney failure with GFR < 15 ml/min (10.5%) and prolonged ventilation time >48 hours (4.4%).

Conclusions

Covid-19 massively increased death rates in PAD patients in the year 2020. Neither disease severity of different stages of PAD nor additional diabetes mellitus had an effect on in-hospital mortality. Thus, a predisposition for atheroembolic events such as in severe PAD may not be the primary cause of death during a COVID-19 infection. Our study reveals the importance of preventing the spread of Covid-19 disease.

A-137

Comparison between shear wave elastography and duplexsonography in the detection of microcirculation deficits in intensive care unit patients with veno-arterial extracorporeal membrane oxygenation (VA-ECMO)

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Background

Patients with VA-ECMO often suffer from ischemia at the cannulated leg, associated with higher mortality. Duplexsonography is a standard examination to evaluate the perfusion status of the lower limbs and the degree of vascular stenosis or obstruction. It is a reliable method for the detection of alterations in the microcirculation. Compared to duplexsonography novel ultrasound methods such as shear wave elastography (SWE) could help the early detection of lower limb ischemia.

Patients/Materials and methods

In this explorative, first-in-men study we compared shear wave elastography at rest and during passive stretch of the lower limb muscles with duplexsonography to evaluate the sensitivity of SWE in detecting worsening in the microcirculation of the lower limbs. Eleven intensive care unit patients with VA-ECMO were included in this pilot study. All patients recovered from a cardiac arrest due to myocardial infarction, rhythm abnormalities or respiratory failure. Seven patients obtained distal perfusion cannula (DPC) during or after implantation of the VA-ECMO.

We examined the medial gastrocnemius muscle as a region of interest (ROI), using shear wave elastography at rest and during passive stretch. The later was achieved via maximal dorsal flexion of the foot, performed by the same examiner in all cases. We performed duplexsonography of the popliteal arteries and determined the peak systolic velocity (PSV) at the cannulated and cannula-free sides.

Results

We found a significant difference in muscle SWE-values during stretch between the cannulated (58.9 ±13.5 kPa) and cannula-free limb (95.7 ±27.9 kPa; p< 0.001).Muscle elasticity values at rest did not differ between the sides.

We compared the elasticity values and the peak systolic velocity (PSV) during passive stretch at both legs, using a linear regression model. We observed a moderate relationship (R² of 0.283; p=0.034) between both parameters.

Conclusions

SWE is an easy to apply ultrasound technique providing early information about ischemia-related muscle elasticity loss in VA-ECMO patients. This novel method might be helpful in detecting changes in the microcirculation caused by reduced lower limb blood flow due to the arterial ECMO cannulation. Larger trials are necessary to confirm these early results of our pilot study.

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Rotational atherectomy in combination with drug-coated balloon angioplasty for the endovascular treatment of heavily calcified femoropopliteal lesions

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Background

Endovascular treatment for peripheral artery disease (PAD) has been continuously evolving. Despite major technical advances in material and device development, heavy calcification still represents a major obstacle to overcome both due to high number of periprocedural complications (dissections, embolization, etc.), as well as limited long-term durability.

Patients/Materials and methods

To explore the safety, efficacy and long-term durability upon combination treatment of rotational atherectomy followed by a DCB balloon angioplasty in comparison to atherectomy plus POBA in heavily calcified complex femoropopliteal and isolated popliteal lesions. Our study was performed as a retrospective, single center investigation. Only patients who received treatment with the Phoenix atherectomy device were included. Between May 2017 and December 2022, a total of 383 patients with moderately to severely calcified lesions (337 femoropopliteal and 46 isolated popliteal lesions) on the lower extremity were investigated.

Results

337 femoropopliteal and 46 popliteal predominantly heavily calcified lesions PACSS 3 and 4 in 93% have been investigated. Out of 383 cases, in a total of 66 cases atherectomy treatment was followed by a drug-eluting balloon angioplasty (60 [17.8%] in the femoropopliteal and 6 [13%] in the popliteal lesions). The lesions were characterized by a significant length 23.6 ± 13.25 cm and complexity (TASC C in 63% and TASC D in 35% of all cases). Endovascular procedures were associated with a success in the vast majority of all cases (336 [99%] in the femoropopliteal and 45 [97%] in the isolated popliteal lesions). During a mean follow up of 19 ± 11 months a total of 18 (4.7%) died and 13 (3.4%) had a major cardiovascular event (myocardial infarction/stroke).

Clinically driven TLR was performed in 60 (15.6%) lesions. 11 (2.9%) Amputations had to be performed (6 minor and 5 major amputations). Mean ABI was improved from 0.57 ± 0.22 immediately before intervention to 0.86 ± 0.23 upon intervention and remained stable: 0.83 ± 0.16 at follow-up. During follow up, a mean Rutherford category was reduced from 3.62 ± 0.88 and 3.63 ± 0.84 , respectively to 2.55 ± 1.27 and 2.52 ± 1.09 .

Conclusions

DEB treatment upon atherectomy is safe and effective strategy in the treatment of heavily calcified femoropopliteal lesions and even associated with numerically less complications (less perforations and dissections). However, it did not have any significant impact on the rate of bail-out stenting and long-term patency.

Postersitzung II

Alternative Zugangswege: von transradial bis retrograd

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Single centre experience for peripheral arterial interventions via percutaneous brachial artery access

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Background

Peripheral vascular disease is a prevalent cause of morbidity and mortality, requiring interventional therapies. In some patients, peripheral access through the femoral artery is impossible due to severe stenosis, site infections, and/or bypass grafts. Using percutaneous brachial artery access and smaller interventional sheaths, as an alternative, the advantages of lower complication rates and a quicker mobilization of patients after the intervention are possible clinical benefits.

Patients/Materials and methods

A retrospective record review of 148 consecutive cases with brachial artery access for either diagnostic or interventional purposes was performed for the period from 2012 to 2021 at our center.

Results

We included 148 cases that underwent percutaneous peripheral angiography/intervention via brachial artery access (age: 66 ± 10 years; 110 men [74%] and 38 women [36%]). Intravascular access was established in 91% of our cases via the left and in 9% via the right brachial artery. Of these patients, 38 (26%) received an angiography via a 4F radial sheath. In 110 cases an intervention was performed with sheath sizes ranging from 4 to 7F. 42 (42/110 = 38%) patients received an intervention via a 4F sheath, 22 (22/110 = 20%) an intervention via a 5F sheath, 44 (44/110 = 40%) an intervention via a 6F sheath and one patient (2/110 = 2%). Interventions were performed on the subclavian, aortic, iliac, common femoral, and down to the distal superficial femoral arteries. In 73 cases (66% of all interventions) a stent was implanted, 60 chronic occlusions (55%) were reopened and one lysis was performed. Bilateral interventions were necessary for 19% of the patients. Unfavorable results associated with using the brachial artery for vascular entry involved complications during the angiography and access site. We recorded seven complications during the angiography (three dissections, two bleedings, one stent dislocation, one thromboembolism) with four patients receiving preventive high-care monitoring. Access site complications occurred in 8% of the cases (12 patients) – four hematomas with one patient requiring blood transfusion (4F intervention), five aneurysms with two patients requiring surgical intervention (5 and 6F intervention), and three brachial artery dissections (6F intervention) which could be managed conservatively. Three small aneurysms (two 4F and one 6F intervention) were asymptomatic and could be managed conservatively.

Conclusions

Brachial artery access is a reliable and effective option in patients with PVD. With dedicated devices, this access site offers a full range of interventions with a low complication rate and fast mobilization. Especially with 4F sheaths only three major access site complications (3/148 = 2%) were recorded.

A-140

Evaluation von Extremitätenkomplikationen während der Therapie mit extrakorporalen Kreislaufunterstützungssystemen

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Background

Extrakorporale Unterstützungssysteme nutzen großkalibrige Kanülenzugänge von mindestens 14F. Während der Implantation und der Verweildauer im Gefäßsystem zur Behandlung des zu Grunde liegenden Krankheitsbildes kann es zu komplexen, schwierig zu beherrschenden lokalen Komplikationen kommen. Eine möglichst genaue Charakterisierung von Leistenkomplikationen hinsichtlich ihrer Häufigkeit, des Managements und postinterventionellen Verlaufs ist erforderlich.

Patients/Materials and methods

Von 2004 bis 2022 erfolgte bei Patienten, welche ein extrakorporales Kreislaufunterstützungssystem erhielten (Impella [Impella CP], veno – arterielle extrakorporale Membranoxygenierung [VA – ECMO], extrakorporale Membranoxygenierung in Kombination mit einer Impella CP [ECMella]) eine Einschätzung des Lokalbefundes des Gefäßzuganges, der Extremität, sowie der assoziierten Komplikationen nach den Kriterien des Bleeding Academic Research Consortium (BARC), der Global Utilization of Streptokinase and tPA for Occluded Coronary Arteries (GUSTO) und des Valve Academic Research Consortium (VARC)-2.

Results

Die Analyse umfasste 277 Patienten. Die VA-ECMO wurde am häufigsten unter CPR-Bedingungen platziert (92,2% VA-ECMO vs. 56,3% ECMella vs. 0% Impella; $p < 0,05$). Die Schlauchengröße der Impella betrug 14 F, während für die arterielle Kanülierung bei ECMella 19-21 F und für die venöse Kanülierung 21-25 F verwendet wurden. Für VA-ECMO-Patienten wurden arterielle Kanülen von 15-23 F und venöse Kanülen von 17-25 F eingesetzt. 92% der ECMO-Patienten erhielten eine antegrade Beinperfusion (7 F). Anhand der VARC – 2 – Kriterien ließen sich vorwiegend bei VA – ECMO Patienten kritische Lokal – und Extremitätenbefunde erheben (VA- ECMO: 78%; ECMella: 19%; Impella: 3%; $p < 0,05$),

wobei am häufigsten die ipsilaterale Ischämie (klinisch: kalte Extremität und / oder fehlender Puls und / oder Marmorierung mit beginnender Steifigkeit) als major Komplikation (VARC-2) aufgetreten ist vorwiegend bei VA- ECMO Versorgung (VA – ECMO: 73%; ECMella: 22%; Impella: 5%; $p < 0,05$). 21% der Patienten erhielten auf Grund dessen eine Intervention besonders bei Versorgung mittels VA- ECMO (76%). Im gesamten Kollektiv traten moderate Blutungen im Leistenbereich gemessen anhand der GUSTO – Kriterien auf (45%). Nach BARC – Kriterien bestand am häufigsten (30,9%) der Typ3a.

Conclusions

Komplikationen an der Insertionsstelle extrakorporaler Kreislaufunterstützungssysteme sind häufig. Insbesondere bei Einsatz einer VA – ECMO und notfallmäßiger Anlage ist mit Blutungen und kritischen Beinischämien zu rechnen. Es sollten standardisierte Protokolle zur Erfassung und frühen Detektion peripherer Komplikationen von speziell auf das follow – up ausgewiesene interdisziplinäre Teams etabliert werden

A-141

Degeneration of an AV-fistula after anatomy guided venous puncture

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Background

An arteriovenous fistula is a connection between the high-pressure arterial and the low-pressure venous system. We distinguish between congenital and acquired arteriovenous fistulas, the latter of which can lead to vasodilatation, venous hypertension, pulsatile varices, distal ischemia and congestive heart failure.

Patients/Materials and methods

A 39-year-old male presented to our university hospital for pulmonary vein isolation after recurrence of atrial fibrillation. On clinical examination after the procedure with access via the right femoral vein with an 8,5F catheter there was a haematoma of the ligament and a vascular bruit over the right groin on auscultation. In the following duplex sonographic examination an arteriovenous fistula was seen between a branch of the superficial femoral artery and a venous side branch of the common femoral

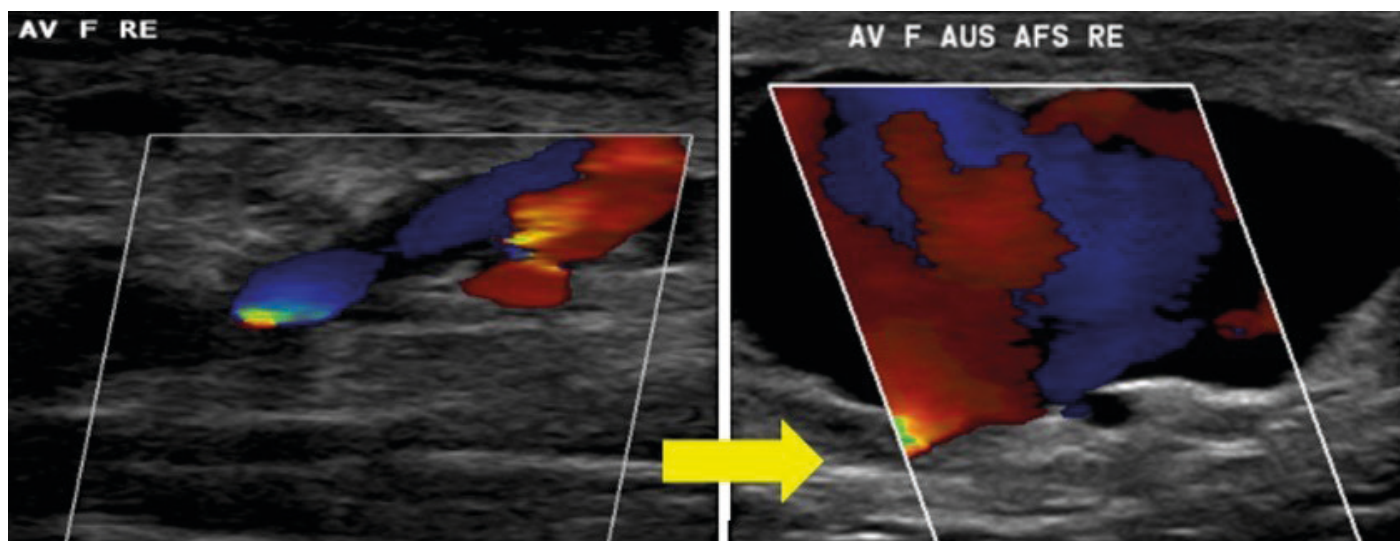


Figure A-141. Duplex sonographic examination of the degenerated arteriovenous fistula.

vein with an initial shunt volume of 90 ml/min. Considering the patient was asymptomatic and the low shunt volume, we decided to proceed conservatively with close clinical and ultrasound examination. The patient continued to be asymptomatic 6 days after the initial examination with a decreased shunt volume of 27 ml/min. 3 weeks after initial diagnosis, he had noticed a pulsating structure of increasing size in his right groin. Duplex sonographic examination showed an increase of shunt volume to 50 ml/min and an increase in size of the now partially thrombosed fistula to 3.2x3.1x1.8 cm with clear arterial inflow and weak outflow. The case was presented to the vascular medicine board, who recommended further imaging. A CT scan was performed and an aneurysmatic dilatation of the arteriovenous fistula at the branch of the common femoral vein was seen.

Results

The arteriovenous fistula then was successfully closed by targeted coiling embolization.

Conclusions

In summary, the increase in flow volume resulted in significant vascular dilatation and subsequently, a venous aneurysm. Various scientific studies have described this aneurysmatic tendency and, as a late complication, ventricular dilatation, remodelling and even heart failure due to chronic volume overload. The volume deprivation can lead to distal ischemia. Ultrasound-guided puncture of the femoral region should be recommended to reduce the number vascular complications.

ted a differential diagnosis of a left thoracic inlet syndrome in addition to a thrombosis par effort / thrombosis after corona booster vaccination / thrombosis while taking hormone preparations. Left thoracic inlet syndrome was confirmed in the further course of an MRI examination.

Results

Unexpectedly, the MRI examination also revealed a long-stretch sinus vein thrombosis on the left side (transverse sinus and sigmoid sinus). The patient was completely asymptomatic in this regard, so we continued oral anticoagulation with apixaban at the full therapeutic dose and did not switch to vitamin K antagonist. Regular MRI follow-up of the sinus veins is planned at initial three-month intervals.

Conclusions

This case report is intended to encourage diagnostic consideration of possible sinus vein thrombosis in such pronounced arm and neck vein thrombosis even in the absence of neurological symptoms, especially when prior corona vaccination is considered a possible trigger, because sinus vein thrombosis usually modifies both initial anticoagulation and subsequent controls.

A-147

Retrograde recanalization of complex chronic infrainguinal occlusions in patients with peripheral arterial disease: Predictors of technical failure in 603 interventions

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Background

Retrograde recanalization technique is becoming an increasingly important method for the treatment of complex peripheral arterial occlusive processes after failure of conventional intervention modalities. The aim of this study was to investigate the technical success rate and periprocedural complication rate of retrograde recanalizations of complex infrainguinal occlusions in patients with peripheral arterial disease (PAD) and to identify predictors of technical failure.

Patients/Materials and methods

In a retrospective single center cohort study, 603 retrograde recanalization attempts of complex chronic infrainguinal occlusions in the setting of PAD, which were performed when antegrade recanalization failed, were analyzed from April 2014 to June 2021. At least one artery of the regions femoro-popliteal, below the knee (BTK), or combined was punctured retrogradely. Patient's and lesion's characteristics, technical success, technical failure rate as well as periprocedural complication rate were evaluated with descriptive statistic methods. Predictors of technical failure were identified using logistic regression analysis.

Results

Critical limb ischemia (CLI) was present in 57.7% of the cases. Most of lesions were TASC(II) D (67.6%), and lesion length was 300.8 +/- 14.6 mm. The degree of calcification according to PACSS was categorized as grade 4 in 35.5% of the cases, no calcification could be detected in 42.2% of the cases.

The majority of the target lesions were located in the femoro-popliteal region (83.6%). In 64.3% of the interventions the retrograde access was BTK. Retrograde sheath was used in 15.3% (4F, 5F, 6F) of the retrograde accesses.

A-145

Unexpected course of arm vein thrombosis

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Background

A 49-year-old female patient presented to our angiology outpatient clinic with painful left arm swelling. The D-dimer was found to be markedly elevated at 4.02 mg/l FEU (norm<0.5). The patient did not complain of any other symptoms, especially headache or neurological symptoms. The patient reported that she had ridden a horse for approximately one hour the previous day with persistent arm posture that was always the same. Furthermore, the patient stated that she had received the third Corona vaccination (Biontech) with injection into the left arm approximately three to four weeks earlier. She had tolerated the first two vaccinations (also Biontech) without complications. No history of thromboembolic events was found. The permanent medication consisted of a hormone preparation (combination of levonorgestrel and ethinyl estradiol).

Patients/Materials and methods

Duplex sonography showed extensive arm and neck vein thrombosis (thrombosis of the internal jugular vein, subclavian vein, axillary vein, and brachial vein, each over the entire length) and thrombophlebitis of the basilic vein on the entire upper arm and the cephalic vein on the proximal upper arm. Thrombophilia testing with tinzaparin revealed unremarkable findings except for a discrete elevated FVIII level. Tumor screening did not reveal evidence of tumor disease.

Nine months after initial diagnosis, therapy with apixaban (2 x 5 mg per day) showed complete recanalization of the above veins. In our subsequent supplementary angiological examination for thoracic outlet syndrome, this was confirmed both in the functional arterial examination and duplex sonographically on the left arm, so that we now also suspec-

The success rate of retrograde puncture was 98%, and retrograde wire passage was successful in 90.7%. The technical success rate of retrograde recanalization was 90%. At 3.0%, the periprocedural complication rate due to retrograde puncture was very low. In only 2.3% of cases a major amputation had to be performed within 30 days after intervention.

Independent predictors for technical failure were previous surgery on the affected limb (p 0.015, odds ratio 1.939, 95% CI 1.134–3.313), presence of CLI (p 0.012, odds ratio 2.036, 95% CI 1.167–3.553), Fontaine's classification stage IV (p 0.010, Odds-Ratio 2.124, 95% CI 1.198–3.763) and male gender (p 0.006, odds ratio 2.577, 95% CI 1.310–5.070).

Conclusions

The results of the study have shown that retrograde recanalization is associated with a high technical success rate and low complication rate at a center with high experience and expertise. Predictors for technical failure of the retrograde recanalization were a) critical limb ischemia, b) previous vascular surgery of the affected limb, c) Fontaine's classification stage IV and d) male gender.

A-150

Cancer-associated thrombosis (CAT) prophylaxis (Px): A patient survey on patient education

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Background

CAT risk is 9-fold higher as compared to general population. Anti-cancer treatments increase CAT risk, especially new strategies as immune or targeted therapy (7-fold compared to chemotherapy). Unfortunately, patients are often not aware of this potentially life-threatening risk and not informed by their physician.

Patients/Materials and methods

This patient survey aimed to gather the education status of cancer patients in Germany with questions on Px, including disease state, cancer therapy, quality of life (QoL), social background, and activity status to evaluate indicators for CAT-Px.

Results

In total 129 cancer patients completed the survey. In 48.8% patients stated that they did not receive any information about their CAT risk. Only 20.9% were informed by physician, followed by the internet (7.0%) and support groups (4.7%). The discrepancy in CAT-Px rate of uninformed (32.6%) vs. informed patients (94.6%) underlined the importance of patients' education. Overall, 49.6% received CAT-Px and even as oral anticoagulants have no indication 78.5% received it in contrast to only 21.5% heparin. Patients with pancreatic tumors mostly obtained CAT-Px in line with current guidelines followed by lung and ovarian cancer (CATTab1). Breast cancer patients rarely got CAT-Px probably due the low CAT risk. A history of venous thromboembolism (VTE) increased the CAT-Px rate from 5.5% to an average of 88.5% as it is a significant risk factor for CAT. Under chemotherapy 59.2% of the patients received CAT-Px. The proportion was less then with immune (44.4%) or targeted (49.2%) therapy, however these patients have a higher CAT risk. CAT-Px neither oral nor parenteral treatment had a significant influence on QoL. The survey population had a mean age of 46.7 years and in majority (70.5%) an elevated educational level. Despite their cancer disease most participants were mobile with a mean activity time of 113 minutes a week. The preferred activities were

walking (n=80), cycling (n=37) and fitness workouts (n=30), but activity level had no influence on the decision for CAT-Px.

Conclusions

This patient survey on CAT-Px indicated the importance of CAT risk education by treating physicians. Cancer type, treatment, and history of VTE influenced the decision for CAT-Px more than social status, QoL and activity level. Despite the low number of patients this survey gave interesting insights in CAT-Px from patients' background.

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Influence of exogenous dietary nitrate on downstream atherogenic metabolites of the enteral microbiome

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Background

A growing body of date shows that the enteral microbiome influences cardiovascular disease. Exogenous dietary nitrate mediates cardioprotective effects and has been shown to have an influence on the oral and enteral microbiome. The nutritional aspects of these cardioprotective effects are particularly intriguing since nitrate is abundant in our everyday diet.

Whether dietary nitrate influences the enteral microbiome and downstream metabolites like short chain fatty acids (SCFA) or trimethylamine N-oxide (TMAO) was investigated in the present study.

Patients/Materials and methods

We recruited a group of 30 healthy patients who were divided into two cohorts. For 30 days, one cohort received dietary nitrate (0, 12 mmol/kg bodyweight) while the other cohort received dietary sodium chloride as a placebo.

We collected blood and stool samples at baseline and after 30 days, as well as measurements of vascular markers, such as pulse wave velocity (PWV) and ankle brachial index (ABI). 16S-rRNA was sequenced from stool samples to analyze microbiome composition. SCFAs and TMAO were also measured in serum samples at baseline and follow-up.

Results

We were able to demonstrate that the systolic blood pressure in the nitrate group significantly decreased (baseline 124,73 mmHg vs follow up 121,87 mmHg, p < 0.05). The levels of TMAO significantly increased, after dietary supplementation (placebo follow up 349, 27 m/L vs. nitrate follow-up 481, 15 m/L, p < 0.05). The dietary nitrate supplementation had no influence on the PWV in healthy subjects (placebo follow up 7, 33 m/s vs. nitrate follow up 7, 5 m/s, p > 0.05). Furthermore, the propionic acid (SCFA) concentration decreased after nitrate supplementation (placebo follow up 1, 7 mmol vs. nitrate follow up 1, 56 mmol, p < 0.05).

Conclusions

In conclusion our results indicate that dietary anorganic nitrate supplementation has an influence on microbiome dependent atherogenic metabolites and is associated with increased TMAO levels and reduced levels in propionic acid concentration. Further ongoing analysis will help identify further correlations between changes in microbiome composition and downstream metabolites.

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periprocedural anticoagulation regime in such occlusions. Investigation is ongoing and long-term data is warranted.

Early experience with the Bycross device in the treatment of occlusive peripheral artery disease: A real-life registry

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Background

Atherectomy and thrombectomy devices are evolving and promising tools for the treatment of occlusive peripheral artery disease.

In this retrospective single center non randomized study the safety and efficacy of the new Bycross device was investigated. Furthermore its technical and clinical success, as well as patency in both thrombotic and calcified occlusions of the lower extremity was assessed.

Patients/Materials and methods

A total of 71 patients (mean age 64.7 +/- 2.5 years, mean Rutherford (RF) category 3.06 +/- 0.1) with predominantly femoropopliteal lesions (63 femoropopliteal cases, 7 iliac cases, 1 subclavian-brachial case, mean PACCS 2.37 +/- 0.1, mean length 21.5 +/- 1.5 cm) were included in the registry. Our early data extends over a mean follow-up of 6 months (176+/-19 days). Atherectomy was performed in 29 cases and thrombectomy in 42 cases.

The primary endpoint was defined as acute procedural success and safety of the device in both groups.

In both groups secondary endpoints were ankle-brachial-index (ABI) during follow-up examination and clinically-driven target lesion revascularization

Results

The acute procedural success was achieved in all cases (28/28) in the atherectomy group and in 93% (39/42) in the thrombectomy group.

Periprocedural complications: distal embolization occurred in one patient in the atherectomy group and in 5 patients in the thrombectomy group.

Ankle-brachial index (ABI) was 0.33 +/- 0.3 at baseline and improved to 0.8 +/- 0.3 immediately upon intervention and to 0.74 +/- 0.05 during follow-up. Freedom from clinically-driven target lesion revascularization was 95.7% in the atherectomy and 62.3% in the thrombectomy group after 6-month follow-up (Figure A-153).

Conclusions

Our early results suggest a high immediate procedural success upon vessel preparation with the Bycross device in both atherosclerotic and thrombotic peripheral occlusions at a reasonable safety profile. While the results in the predominantly calcified lesions are encouraging, there was a high rate of clinically-driven TLR in the predominantly thrombotic occlusions, suggesting the need for a multimodal approach and optimization of the

A-155

Pulsatility index and flow volume of the femoral veins in patients with tricuspid regurgitation

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Background

Tricuspid regurgitation (TR) is a severe valvular disease. In advanced stages TR can lead to irreversible heart insufficiency and is accompanied by high mortality. Progression of TR leads not only to haemodynamic changes in central but also in peripheral veins. The initially non-pulsatile blood flow in femoral veins becomes more and more pulsatile. Although cardiac flow modulation is a well-known phenomenon, a quantitative description and its correlation with severity of TR are lacking. The measurements of flow volume (FV) and pulsatility index (PI) are approved methods for the description of blood flow in patients with peripheral arterial occlusive disease. Its application to analyse haemodynamic changes in veins has not yet been described. As a proof-of-principle-study (PoP), this present investigation therefore focused flow volume and PI of femoral veins in patients with TR.

Patients/Materials and methods

95 consecutive patients with suspected TR were screened. Eight patients were excluded due to prior deep vein thrombosis. 87 eligible patients underwent transthoracic echocardiography (TTE) and ECG-guided measurement of FV and PI of the femoral veins. Sonographers were blinded to the results of TTE. All patients were further subdivided into four groups according to the severity of TI (TI stage 0-I; TI stage II; TI stage III; TI stage >III). FV and PI of 33 patients, of whom 17 underwent transcatheter tricuspid valve repair (TTVR), were followed up within three months.

Results

PI increased significantly with higher stages of tricuspid regurgitation (TI stage 0-I: 1.11 ± 2.80; TI stage II: 2.87 ± 4.12; TI stage III: 8.30 ± 9.40; TI stage >III: 9.30 ± 7.81; p<0.001). FV decreased accordingly, yet without accomplishing a level of significance (p<0.191). As age differed significantly between the groups (p<0.001), we applied an ordinal regression model with adjustment for age. In this regard, PI was significantly associated with TR with an odds ratio of 1.14 (confidence interval [CI]: 1.06 –

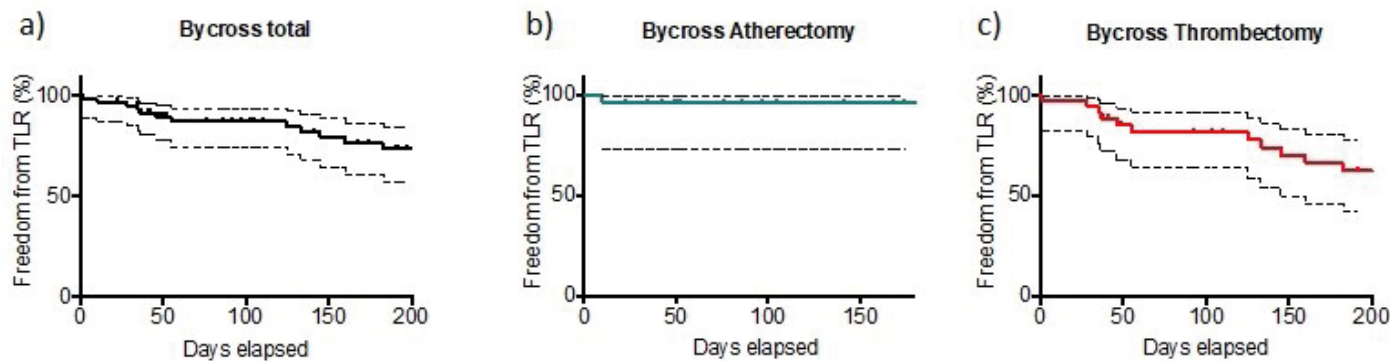


Figure A-153. Clinically driven target lesion revascularization in a) all cases, b) in the atherectomy group c) in the thrombectomy group after 6 month of follow-up.

1.26). There was no significant difference of PI or FV depending on improvement of TR on follow-up.

Conclusions

The results of this ongoing study indicate a significant correlation between PI and the severity of TR. Ordinal regression analysis revealed that PI may be a valuable tool with high predictive power to estimate the severity of TR. Haemodynamic changes in peripheral veins due to TR seem to persist even after TTVR.

In conclusion, PoP was successful. Cardiac flow modulation, severity of TR and the extent of haemodynamic changes due to TR can be estimated by ascertainment of PI. Therefore, PI may be a relevant parameter to complement the diagnostic process of TR.

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Bauchwandhämatom, Achtung Lebensgefahr: eine Komplikation auf die besonders geachtet werden muss

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Background

Anamnese: Eine 92-jährige Patientin stellt sich mit Schwellung und Schmerzen im rechten Unterbauch vor. In der Vorgeschichte ist eine Niereninsuffizienz (KDIGO G4, GFR 25ml/min, Kreatinin 1,7 mg/dl) und ein embolischer Schlaganfall mit linksseitiger Hemiparese vor 6 Wochen bekannt. Bei unzureichendem INR (1,7) wurde die Phenprocoumontherapie (Indikation Vorhofflimmern) pausiert und mit NMH 80 mg 1 x tgl. während des stationären Aufenthaltes durchgeführt.

Patients/Materials and methods

Untersuchung: Bei der körperlichen Untersuchung zeigte sich bei der Patientin (81 kg; 165 cm) eine druckdolente Raumforderung und ein Hämatom im rechten Unterbauch. Die Sonografie des Abdomens zeigte ein ca. 20 x 10 cm messendes Bauchwandhämatom. Ein CT-Abdomen konnte eine aktive Perfusion des Hämatoms und retroperitoneale Einblutungen ausschließen.

Results

Diagnose: Bauchwandhämatom unter subkutaner NMH-Therapie.

Therapie und Verlauf: Weder eine Pausierung der Heparintherapie noch die Substitution von PPSB führte zu einer Thrombosierung des Bauchwandhämatoms und Stabilisierung des HBs. Ein interventionelles Coiling bei Fehlen eines speisenden Gefäßes kam therapeutische nicht infrage und so musste das Bauchwandhämatom mit progredienter Größenzunahme operativ behandelt werden. Bei einem CHA2DS2-VASc Score von 7, einem HAS-BLED-Score von 3 Punkten und einer Blutungskomplikation wurde bei Vorhofflimmern das Vorhoffohr interventionell verschlossen und eine Thrombozytenaggregation mit ASS und Clopidogrel wurde für 3 Monate verabreicht mit anschließender ASS-Monotherapie. Der Verlauf gestaltete sich gut und die Patientin konnte entlassen werden.

Conclusions

Diskussion: Mit dieser Kasuistik möchten wir auf Risiken von NMH gerade bei fragilen Patienten hinweisen. Werden diese eingesetzt gilt es immer wieder die Indikation, Dauer, Begleiterkrankungen, Nierenwerte und die Injektionsstellen zu kontrollieren. Wird ein Bauchwandhämatom nicht erkannt, kann dies oft letal enden [1]. Eine Alternative zur Antikoagulation besteht im Vorhoffohrverschluss, der aufgrund der erhöhten Sturzneigung und der erschwerten INR-Einstellung bei einem CHA2DS2-VASc Score von 7 Punkten indiziert war. [2, 3] Insbesondere bei Patienten

mit Bauchwandhämatom und Niereninsuffizienz kann eine tägliche Point-of-Care Diagnostik mittels Ultraschalles eine gute Möglichkeit zur Blutungskontrolle darstellen. Meist hilft eine Pausierung der Antikoagulation, auch ein Bauchmieder konnte zur Behandlung bereits erfolgreich eingesetzt werden. Ist ein Zuflussgefäß vorhanden, kann dieses endovaskulär verschlossen werden [4]. Eine operative Behandlung sollte als ultima ratio gewählt werden.

A-160

Das Antiphospholipidsyndrom: richtig diagnostiziert, richtig therapiert

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Background

Anamnese: Eine 35-jährige Frau (1,67m; 64kg) stellte sich mit Schmerzen und einer Schwellung im linken Unterschenkel in der Angiologie vor. In der Anamnese wurden keine Thrombosen beschrieben, jedoch traten in der Vergangenheit drei Spontanaborte innerhalb des ersten Trimenons auf. Arterielle Embolien waren bisher nicht aufgetreten.

Patients/Materials and methods

Befund: Das linke Bein präsentierte sich klinisch im Seitenvergleich umfangsvergrößert und überwärmt. Sonographisch ließ sich eine Thrombose in den Vv. tibiales posteriores des linken Unterschenkels darstellen. Wegen des jungen Alters und den Schwangerschaftskomplikationen in der Vergangenheit wurde eine Thrombophiliediagnostik vor Beginn der Antikoagulation durchgeführt: Es konnten positive Lupus Antikoagulantien (LA), Anticardiolipin-Antikörper (ACA) und β_2 -Glykoprotein-I-Antikörper (β_2 GPI-AK) nachgewiesen werden.

Results

Diagnose: Distale Unterschenkelthrombose und Antiphospholipidsyndrom bei 3-fach positiven Antikörpern.

Therapie und Verlauf: Es erfolgte die Antikoagulation mit Marcumar mit einem INR-Zielwert zwischen 2,0-3,0. Die Unterschenkelthrombose war drei Monate nach Erstvorstellung vollständig regredient und die Beinvenen ließen sich vollständig komprimieren. Eine erneute Gerinnungsdiagnostik bestätigte den dreifach-positiven Antikörpernachweis. Eine Umstellung auf ein NOAK führten wir bei Antiphospholipidsyndrom mit 3-fach positiven Antikörpern nicht durch.

Conclusions

Diskussion: Das Anti-Phospholipid-Syndrom ist die häufigste Ursache für wiederkehrende Fehlgeburten [1] und wird bei 15-20% der Frauen mit wiederholten (≥ 3) Fehlgeburten diagnostiziert [2]. Bei Patientinnen mit Schwangerschaftskomplikationen wie Plazentainsuffizienzen, Präeklampsie oder drei oder mehr konsekutiven Fehlgeburten, insbesondere wenn diese im ersten oder zweiten Trimenon auftreten, soll ein Anti-Phospholipid-Syndrom anhand klinischer und laborchemischer Parameter abgeklärt werden [3].

Bei der Diagnostik des APS gilt es die Antiphospholipid-Antikörper: (1) Lupus Antikoagulans, (2) Anti-Cardiolipin AK und (3) β_2 -Glykoprotein I-Antikörper zu bestimmen. Ein hohes Risiko für erneute thromboembolische Ereignis besteht bei (1.) dreifach-positivem Antiphospholipid-Test und venösen Thrombosen oder (2.) bei APS-Patienten mit stattgehabten arteriellen Thrombosen. Bei diesen Patienten ist die Antikoagulation mit einem Vitamin-K-Antagonisten notwendig [4]. Nur, wenn (2) Anti-Cardiolipin-AK und/oder (3) β_2 -Glykoprotein-I-Antikörper positiv und Lupus Antikoagulans negativ sind (ACA- und/oder β_2 GPI-AK-Positivität, LA-Negativität) kann bei Vorliegen von isolierten venösen Thrombosen DOAKs eingesetzt werden [4], wobei die Antikoagulation mit Vitamin-K-Antagonisten zu bevorzugen ist [5, 6].

Young Investigator Sitzung

Konservative Therapie

A-122

Arterial leg ulcers – bacterial patterns, antimicrobial resistance and clinical characteristics: A retrospective single-centre cohort, 2012–2021

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Background

Severe wound infections in patients with peripheral artery disease (PAD) are common, potentially life and limb threatening and difficult to treat. Evidence for patients with infected leg ulcers suffering from PAD is scarce. The present study aims to give insight into microbiological patterns and antimicrobial resistance (AMR) of certain pathogens in patients with arterial leg ulcers.

Patients/Materials and methods

In this retrospective, consecutive single centre study 16 553 patients underwent an endovascular revascularization procedure between 2012 and 2021. Of those, 1 142 patients had PAD Rutherford category 5 or 6 with infected leg ulcers. Logistic regression was performed to identify risk factors for *Staphylococcus aureus* associated infections.

Results

In total 3,431 bacterial isolates were detected of which 2,335 (68.1%) bacterial isolates were gram-positive and 1,096 (31.9%) gram-negative species. The most frequent bacteria were *S. aureus* (18.6%), *Enterococcus faecalis* (9.1%) and *Staphylococcus epidermidis* (7.8%). *Pseudomonas aeruginosa* (5.6%), *Proteus mirabilis* (3.7%) and *Escherichia coli* (3.4%). Resistance of *S. aureus* isolates to Clindamycin was 11.0%. Resistance to oxacillin was rare (1.5%). *P. aeruginosa*, *P. mirabilis* and *E. coli* were frequently resistant to ciprofloxacin (14.4; 7.3; 20.7%) and trimethoprim/sulfamethoxazole (-; 24.6; 22.6%), respectively. Resistance to amoxicillin/clavulanic acid amongst *E. coli* isolates was high (36.8%). Multi-drug-resistance (MDR) rarely occurred in *S. aureus* and *P. aeruginosa* isolates. In contrast proportion of MDR was high in *E. coli* isolates. End-stage renal disease was independently positively associated with *S. aureus* identification ($p = .042$)

Conclusions

S. aureus was the most frequent pathogen in arterial leg ulcers with end-stage renal disease being an independent risk factor. Clindamycin resistance was common, empirical therapy therefore likely to fail. Isolated *E. coli* species had a high proportion of MDR.

A-144

Impact of eosinophilia on atherosclerosis and aneurysm of the abdominal aorta in patients with asthma

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Background

Asthma is an obstructive airway disease that affects 10% of adults and 5% of children worldwide. Eosinophilic asthma (eosinophils $> 300/\mu\text{l}$) is characterised by eosinophilic infiltration of the bronchial walls and subsequent local inflammation leading to asthmatic symptoms. Recent studies have shown that patients with chronic lung disease often suffer from atherosclerotic changes and possibly aortic aneurysm, presumably due to systemic inflammation. However, the mediators of such inflammation remain to be identified. The present study aimed to clarify the role of eosinophils in patients with eosinophilic asthma on vascular function and aortic diameter.

Patients/Materials and methods

100 consecutive patients with asthma were included in this study. All patients underwent extensive clinical and sonographic examination as well as the assessment of differential cell count. The radial strains of the common carotid arteries (CCA) and the abdominal aorta (AA) and the aortic diameter were defined primary outcome variables. The vascular strain analysis is an ultrasound-based technology used to assess vascular stiffness as a sign of early atherosclerosis. Vascular strain analysis included the radial strain (radial expansion per heartbeat in %), radial displacement (mm), circumferential strain (change of the vessel wall in %), radial velocity (cm/s) and radial/circumferential strain rate (1/s) as parameters showing the arterial wall movement over time.

Results

We found a statistically significant correlation between eosinophilic cell count and radial strain of the left ($r = 0.298$, $p = 0.003$) and right ($r = 0.329$, $p = 0.001$) CCA and AA ($r = 0.286$, $p = 0.005$). We also found significantly reduced radial strain values in patients with ≥ 300 eos/ μl compared to patients with < 300 eos/ μl for the left CCA (mean radial strain = 2.49 ± 1.18 vs. 4.26 ± 2.2 , $p < 0.001$), for the right CCA (2.65 ± 1.42 vs. 3.57 ± 1.65 , $p = 0.004$) and for the AA (2.46 ± 1.57 vs. 4.38 ± 2.70 , $p < 0.001$). A significant difference of the mean AA diameter was found comparing patients with ≥ 300 eos/ μl and < 300 eos/ μl (1.66 ± 0.6 cm vs. 1.46 ± 0.25 cm, $p = 0.019$).

Conclusions

The count of peripheral blood eosinophils is associated with a higher stiffness of peripheral arteries and the AA as an early sign of atherosclerosis as well as with a larger diameter of the AA in patients with eosinophilic asthma.

A-151

Histology of large and small arteries in patients with major amputations

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Background

Medial arterial calcification (MAC) is a systemic vascular disorder with predilection for peripheral arteries. In this study we assessed the preva-

lence of MAC and atherosclerosis in patients with major amputations of the lower extremities.

Patients/Materials and methods

39 consecutive patients who underwent major limb amputation for any reasons were included. Following the amputation, a sample of one of the major below-the-knee (BTK) arteries including the surrounding tissue was removed and fixated in 9% formaldehyde. Subsequently, the histology of all samples was analysed by an experienced vascular pathologist according to a standardized protocol. Additionally, clinical data were collected and analysed.

Results

In our cohort, 29 patients were male, and 10 patients were female. The median age was 70 years. Diabetes mellitus was diagnosed in 30 patients and hypertension in 35 patients. 17 patients had a history of smoking. The average BMI was 27.9 kg/m². Hyperlipoproteinemia was described in 27 patients. Coronary heart disease was present in 12 patients. Prior to amputation, peripheral artery disease was clinically diagnosed in 31 patients. 25 patients had a history of either percutaneous transluminal angioplasty or aortofemoral or femoropopliteal bypass surgery.

In the large arteries atherosclerosis was observed in 11 samples. MAC was present in 35 samples, in 10 cases concurrent with atherosclerosis, in 25 without atherosclerosis. Neither atherosclerosis nor MAC could be seen in 3 samples. Associated thrombosis was seen in 20 large arteries. Subendothelial hyperplasia and ossification could be observed in 37 samples and in 16 samples of large arteries respectively. In 14 samples marked fibrosis of the accompanying veins were described: Phlebosclerosis was observed in 7 samples, while phlebothrombosis was present in 7 samples. In the small arteries atherosclerosis has not been present, MAC was seen in 1 sample and subendothelial hyperplasia was seen in 18 samples.

Conclusions

Our study, based on histology obtained from BTK arteries from amputated limbs, showed that in a population with limb-loss the prevalence of MAC was 89.7% while atherosclerosis was seen in 28.2% of cases. MAC was observed in 1 case in a small vessel. Subendothelial hyperplasia, potentially related to MAC, was present in 94.9% of large arteries and 46.2% of small vessels. The high prevalence of phlebosclerosis and phlebothrombosis represented surprise findings, possibly related to a general inflammatory state accompanying severe tissue ischemia. Based on our findings, MAC plays an important role in the development of critical ischemia and subsequent limb loss in the majority of our unselected cohort of patients undergoing major lower limb amputation.

A-156

Telephone health coaching with remote exercise monitoring (TeGeCoach) in peripheral artery disease: A randomized controlled trial

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Background

Peripheral Artery Disease (PAD) is the third most prevalent cardiovascular disease worldwide. The most common clinical manifestation is pain in the lower limbs elicited by physical activity that resolves after a short period of rest – known as intermittent claudication. Clinical guidelines advocate the use of supervised exercise programs as first-line therapy. However, their potential is not fully realized due to limited course availability and poor program adherence. In light of these barriers, we investigated the effectiveness and costs of TeGeCoach, a 12-month home-based walking exercise program with telemonitoring guidance and telephone health coaching.

Patients/Materials and methods

A pragmatic, randomized, usual care controlled, parallel group trial with sequential recruitment of 1,982 patients from three statutory health insurance funds (Kaufmännische Krankenkasse, Techniker Krankenkasse, mhplus). The primary outcome was self-reported walking performance assessed by the Walking Impairment Questionnaire. Secondary endpoints included health-related quality of life and patient activation. Treatment group effects at 12- and 24-month follow-ups were estimated using linear mixed models according to the intention-to-treat principle. Total health care costs were calculated as the sum of total payments for all health care services.

Results

There was a significant improvement in self-reported walking performance at the 12-month [t = 6.19, p < .0001, d = 0.26] and 24-month follow-up [t = 4.34, p < .0001, d = 0.19]. In addition, significant improvements were observed in health-related quality of life and patient activation. Participants receiving TeGeCoach were highly compliant (83.1% completion rate) and reported high satisfaction with the program. The intervention group had non-significant cost savings of €982 per patient after 12 months and €584 per patient after 24 months compared with the usual care group.

Conclusions

Receiving TeGeCoach resulted in significant improvements in self-reported walking performance. The results highlight the potential of home-based walking exercise programs in the treatment of intermittent claudication, while potentially providing savings for the healthcare system. The German Innovation Committee (Innovationsausschuss) has therefore recommended the implementation of TeGeCoach in routine clinical settings.

A-154

Feasibility and safety of percutaneous axillary artery access in a prospective series of 100 complex aortic and aortoiliac interventions

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Background

We aimed to review the feasibility and safe use of the percutaneous axillary artery (AxA, 100 patients) approach for endovascular repair (ER) of thoraco-abdominal aortic aneurysms (TAAA, 90 patients) using fenestrated, branched, and chimney stent grafts and other complex endovascular procedures (10 patients) necessitating AxA access.

Patients/Materials and methods

Percutaneous puncture of the AxA in its third segment was performed using sheaths sized between 6 to 14F.

Baseline angiography of the axillary artery (AxA) after ultrasound guided puncture in the third segment of the vessel. Consistent with the results of a previous CT scan, no relevant atherosclerotic changes were detected in this vessel segment, and the vessel diameter was >5 mm.

For closing puncture sites greater than 8F, two Perclose ProGlide percutaneous vascular closure devices (PVCs) (Abbott Vascular, Santa Clara, CA, USA) were deployed in the pre-close technique.

Results

The median maximum diameter of the AxA in the third segment was 7.27 mm (range 4.50–10.80). Device success, defined as successful hemostasis by PVCs, was reported in 92 patients (92.0%). As recently reported results in the first 40 patients suggested that adverse events, including vessel stenosis or occlusion, occurred only in cases with a diameter of the AxA <5 mm, in all subsequent 60 cases AxA access was restricted to a vessel diameter ≥5 mm. In this late group, no hemodynamic impairment of the AxA occurred except in six early cases below this diameter threshold, all of which could be repaired by endovascular measures. Overall mortality at 30 days was 8%.

Conclusions

In conclusion, percutaneous approach of the AxA in its third segment is feasible and represents a safe alternative access to open access for complex endovascular aorto-iliac procedures. Complications are rare, especially if the maximum diameter of the access vessel (AxA) is ≥5 mm.

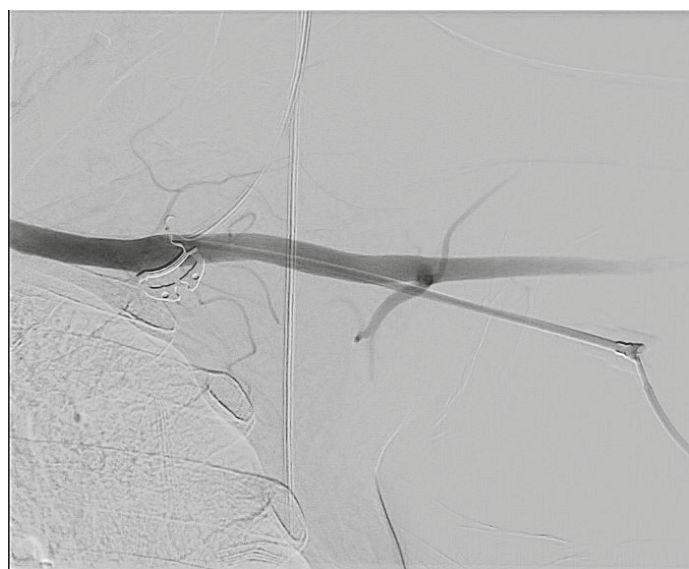


Figure A-154.

Freie Vorträge I

Pathophysiologie / Epidemiologie

A-134

Underutilization of guideline-recommended therapy in patients 80 years and older with peripheral artery diseases

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Background

Ageing is a major cardiovascular risk factor with detrimental pathophysiological changes that culminate in a high atherosclerotic burden. Peripheral artery disease (PAD) is a major manifestation of atherosclerosis with high mortality. Guideline-recommended treatment is essential; however implementation is inadequate. With an ageing society, age-related inequalities are important and have not been elucidated in a high-risk PAD population on a nation-wide scale. We sought to analyse the outpatient treatment structures and guideline adherence in treatment of PAD patients older than 80 years of age.

Patients/Materials and methods

We analyzed age-related differences in prevalence, pharmacotherapy (statins, antiplatelets) and treatment by specialized outpatient care (angiology, vascular surgery, internal medicine, cardiology) in 17 633,970 patients with PAD and statutorily insurance presenting to outpatient care facilities in Germany between 2009 and 2018. The study is based on ambulatory claims data of the panel doctors' services according to §295 SGB V and drug prescription data according to §300 SGB V, comprising 70.1 million patients per year. Diagnosis of PAD was defined upon medical diagnoses of PAD ICD. Statistical analysis was performed with chi-squared test for trend and two-way Anova.

Results

Of 17 633,970 PAD patients included, 28% were older than 80 years. PAD prevalence increased between 2008 and 2019 (1.85% vs 3.14%), with the proportion of the elderly increasing by a third (24.4% vs 31.2%). Octogenarians were undertreated regarding guideline-recommended statin pharmacotherapy compared to younger patients throughout the observed 10-year time frame (statins 2016: 46.5% vs 52.4%; antiplatelets 2016 30.6% vs 29.3%; $p < 0.05$). Furthermore, octogenarians received less specialized outpatient care (angiology: 6.4% vs 9.5%, vascular surgery: 8.1% vs 11.8%, cardiology: 25.2% vs 29.2%, $p < 0.05$).

Conclusions

Our results demonstrate that age-related differences in pharmacotherapy and specialized outpatient care of PAD patients are evident. While overall guideline-recommended outpatient treatment is low, patients 80 years and older are less likely to receive both, leaving age-related health inequalities a challenge of our future.

A-135

Treatment pattern and long-term outcome in atherosclerotic induced upper extremity artery disease: A real world-cohort analysis

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Background

In contrast to lower extremity artery disease (LEAD), the current knowledge about upper extremity artery disease (UEAD) is sparse. UEAD is often considered as a poor predictor for mortality and limb events, but data on contemporary management and short- as well as long-term outcome are lacking or only based on small cohort descriptions.

Patients/Materials and methods

Data of all patients were derived from statutory health insurance data of eleven regional AOK insurance (AOK) hospitalized with a main diagnosis of UEAD between 2010 and 2018 were included and divided into patients suffering from atherosclerotic (UEADa) and into those with concomitant inflammatory disease (UEADi). Analysis of baseline characteristics, risk

factors, comorbidities, pharmacotherapy, revascularization procedure and outcome up to ten years were assessed.

Results

Among 2 437 patients with UEAD, almost 80% suffered from UEADa, while 20% had an additionally inflammatory disorder (UEADi). Patients with UEADa were predominantly male (41.7% women vs. 58.3% men) and median age was similar between sexes (66.9 years in women vs. 67.2 years in men). In contrast, UEADi patients showed balanced sex ratio but male patients were younger than female patients (70.5 vs. 62.5 years). Compared to women, men had higher rates of cardiovascular risk factors and comorbidities such as diabetes mellitus, LEAD, atrial fibrillation or flutter, chronic heart failure, chronic kidney disease or chronic coronary syndrome, all more pronounced in UEADa patients compared to UEADi patients. During index hospitalization, one third of the patients received any revascularization, with highest rates in female UEADa patients, while 14% of all UEAD patients underwent an amputation of the upper limb with higher rates in male patients compared to female patients. Five year Kaplan-Meier estimators for overall survival rates was 55.7% in UEADa, and 59.7% in UEADi patients, with higher survival rates in women than in men.

Conclusions

Patients with UEAD, regardless of the underlying disease, had a poor short- and long-term prognosis marked by high amputation and mortality rates. Male sex was associated with higher burden of cardiovascular comorbidities and higher amputation and mortality rates during ten year follow-up period.

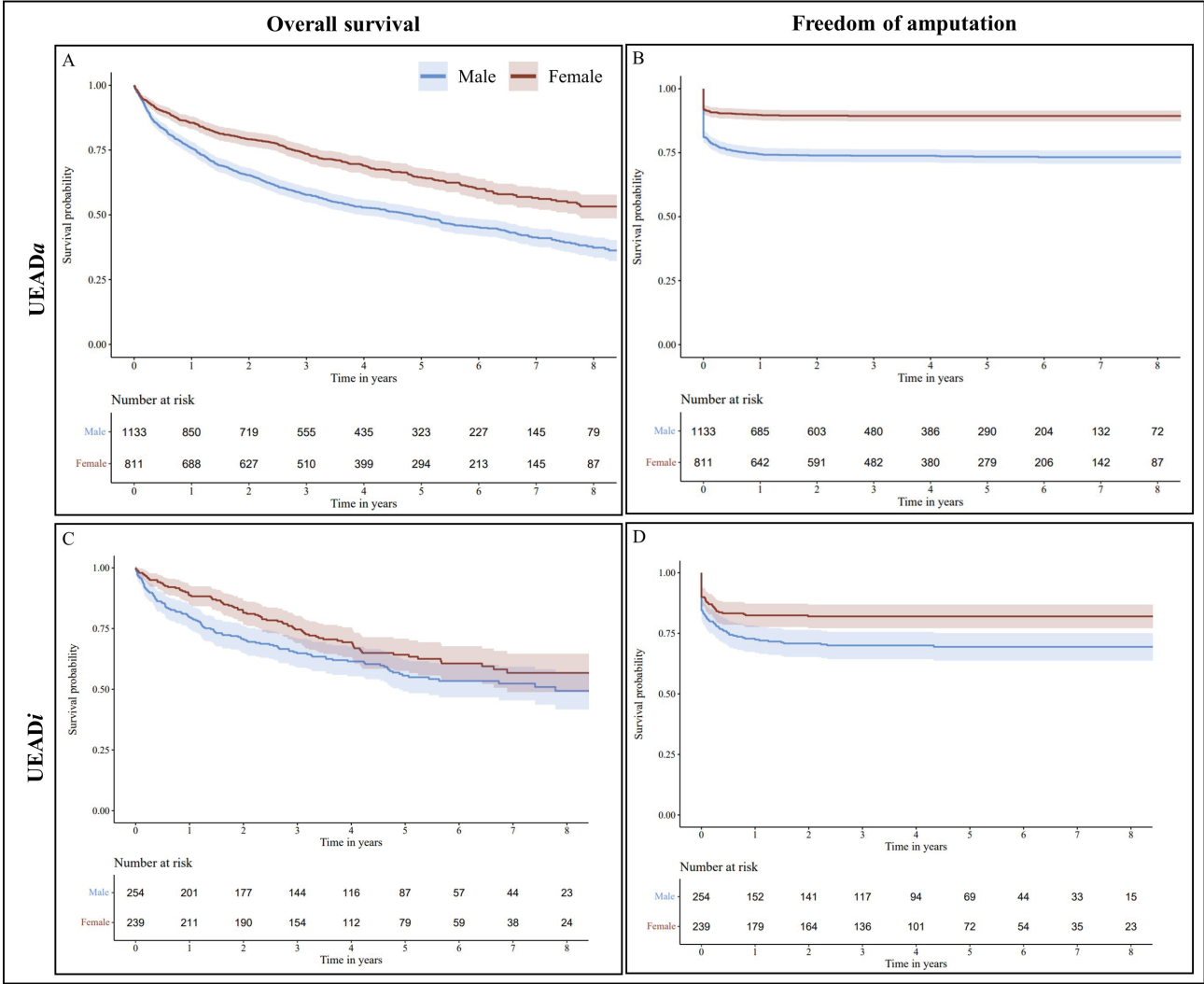


Figure A-135. The event rate for overall survival and freedom of amputation is shown over the time (in years) divided for female (red) and male (blue) patients in atherosclerotic upper extremity artery disease (UEADa) and upper extremity disease with concomitant inflammatory disorders (UEADi).

A-146

Gender-specific analysis of the progress of lesion burden in patients with lower extremity artery disease

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Background

There is a lack of research on gender-related differences regarding anatomic-morphologic lesion characteristics in patients with lower extremity artery disease (LEAD). We aimed to explore the lesions' characteristics, distribution pattern and the progress of lesion burden in a high-risk LEAD-subset.

Patients/Materials and methods

293 Patients (26% female) with known LEAD and repeated endovascular revascularizations (EVR, at least 3 EVR) were retrospectively included. A total of 1,223 EVR was analyzed. A lesion was defined as plaques, stenosis or occlusion. The entire arterial system from the aorto-iliac bifurcation to the distal crural arteries was divided in eleven segments (4 pelvic, 3 fem-pop and 4 below-the-knee) and evaluated regarding lesion characteristics. Progress was defined as any increase in the extent of disease within a segment. This included changes from no affection to any type of lesion and from a less to a more severe lesion grading. Finally, a mixed model analysis was performed to examine the influence of different variables on the progress noted, i.e., age, sex and cardiovascular risk factors.

Results

At the time of the first intervention, women presented with a higher mean age (72 ± 11 vs 68 ± 9 years, $p=0.002$). Men suffered more often from coronary artery disease (58% vs 36%, $p<0.001$), previous myocardial infarction (28% vs 13%, $p=0.009$), diabetes (46% vs 29%, $p=0.009$) and had more often a smoking history (75% vs 55%, $p=0.003$) compared to women. Regarding clinical stage, more than half of the interventions were performed at Fontaine stage 2b and critical limb ischemia was equally frequent in both genders (37% vs 40%, $p>0.05$). Anatomic-morphologic analysis revealed that femoro-popliteal segments were the most affected vessels and also the most at-risk segments to show progress in both sexes. Overall, men presented with more lesions per leg (3.6 vs 2.9 , $p<0.001$), had more stenoses and occlusions (15% vs 10%, $p<0.001$) and were more frequently affected by multi-level disease (29% vs 16%, $p<0.001$) than women. Though men had a higher total lesion burden at baseline, progress over time in femoro-popliteal segments was higher in women than in men. In contrast, men exhibited a higher amount of progress in the pelvic and in the BTK segments. In fact, the mixed model analysis shows first evidence that male gender may be an independent risk factor for progression in those two vascular levels, even after adjustment for other possible confounding factors.

Conclusions

There are remarkable gender-related differences in patients' and lesions' characteristics in patients with LEAD. Gender-specific vascular morphometric analyses might help to deepen our knowledge of the underlying causes for the diverse clinical feature and prognosis of LEAD in men and women.

A-162

Nudging für eine ausgewogene vasculäre Reparatur (vascular remodeling) nach Revaskularisation von Patienten mit pAVK und femoro-poplitealen Läsionen

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Background

Die Katheter-gestützte Revaskularisation mit PTA ist noch (?) nach BASIL-2 und BEST CLI die erste Wahl in der Behandlung der pAVK. Mit diversen Kathetersystemen, Stents mit und ohne Medikamentenbeschichtung können Interventionisten akzeptable Offenheitsraten erreichen. Perfusionseinschränkung - Fontaine-Stadium, Läsionsmuster nach TASC sowie Beeinträchtigung der Ausstrombahn - sind für das Ergebnis bedeutsam. Die Pathophysiologie der AVK sowie die Bedeutung der bekannten Risikofaktoren (erworben oder hereditär) sind seit langem bekannt. Die nachweisbaren hämostaseologischen Veränderungen bestätigen den bekannten Entzündungscharakter bei der Entstehung der AVK.

Patients/Materials and methods

Mit der Angioplastie erfährt der behandelte Gefäßabschnitt eine weitere Endothelschädigung, die zur Migration glatter Muskelzellen mit Bildung neointimalen Gewebes, letztlich zur Hyperplasie, d.h. Reststenose, führen können. Diese vulnerable Phase nach PTA behandeln wir in der Regel postinterventionell mit dualer Thrombozytenaggregationshemmung (TAH), später in Monotherapie. Dennoch führt diese zusätzliche Entzündungsreaktion zu Restenosen, die nicht immer mit antibiotisch wirkenden Medikamenten (z.B. bei Stents/Balloons) abgefangen werden können.

Die Beobachtungen in der post-interventionellen Phase zeigen ein hohes Maß an Vulnerabilität bei der Wiederherstellung der Gefäßmorphologie in den ersten vier Wochen. Um neben der gesicherten Wirkung der TAH die Verschiebung der Gerinnungskaskade zur Koagulation zu verhindern, haben wir zusätzlich einer Faktor XA-Hemmung mittels niedermolekularem Heparin in niedriger Prophylaxe-Dosis eingesetzt - HEPAPAD-Studie.

Ziel war die Vermeidung einer überschießenden Reaktion des Gerinnungssystems nach PTA in der vulnerablen Phase. In dieser Studie, deren Einzelheiten präsentiert werden, haben wir femoro-popliteale Läsionen der TASC-Klassifikation A und B überwiegend im Fontaine-Stadium IIb bei insgesamt 150 Patienten mit cutting-balloon-PTA behandelt. Alle Patienten erhielten die „übliche“ duale TAH mit 100mg ASS und 75mg Clopidogrel sowie vier Wochen lang zusätzlich niedrig dosiertes Heparin (Enoxaparin/Monoembolex).

Results

Die Rate der Re-Interventionen war in der Gruppe der mit zusätzlichem Heparin behandelten Patienten geringer als bei den Patienten ohne zusätzliche Heparin-gabe. In der Langzeitbeobachtung beider Gruppen (3,5 bis 5 Jahre), deren Zusammensetzung vergleichbar war, konnte schon nach einem halben Jahr ein Unterschied bzgl. der Offenheitsrate festgestellt werden.

Conclusions

Die Fortführung der Antikoagulation nach der Angioplastie auf Zeit kann die vulnerable Phase individuell mindern und damit eine ausgewogene Revaskularisation ermöglichen.

A-164

Impact of revascularization on long-term outcome in patients with claudication

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Background

It has been postulated that revascularization (Revasc) procedures in patients with lower extremity artery disease (LEAD) at the stage of claudication might confer in unfavorable cardiovascular and limb outcome. We aimed to evaluate the impact of revasc on long-term outcome regarding cardiovascular and limb events in claudicants.

Patients/Materials and methods

In this retrospective analysis LEAD patients at the stage of claudication who did not have a revasc procedure during the last 4 years were divided in two groups: Those who were revascularized at the index hospitalization and those who were treated conservatively without a revasc. A propen-

sity score matching was applied. Patients were then followed up for up to 4 years and any future revascularization procedures (endovascular and surgical), transition into the stage of chronic limb threatening ischemia (CLTI), limb amputation and cardiovascular events including death were assessed.

Results

After propensity score matching for age, cardiovascular risk factors, comorbidities and Fontaine stage, a total of 11 154 (5 577 with and 5 577 without revascularization) were analyzed. Revascularization was performed in 79.3% endovascular and in 23.1% surgical. During a median follow-up of 4 years, patients without any revascularization at index-hospitalization had higher rates of any (35.5% vs. 32.6%) and of surgical revascularization procedures (20.8% vs. 11.9%), yet lower endovascular revasc procedures (21.4% vs. 25.2%, $P<0.01$ for all). The rate of minor (1.7% vs. 1.2%) and major amputation (1.1% vs. 0.9%) was indifferent. Patients undergoing revasc had higher use of secondary preventive drugs such as statins and antiplatelet agents ($p<0.01$). Kaplan Meier based projected 4-years amputation-free survival was higher among revascularized than in non-revascularized claudicants ($p<0.01$, see Figure A-164).

Conclusions

In this retrospective, PSM-based analysis revascularization at the stage of claudication was neither associated with increased progress to CLTI stage nor with increased rate of limb amputation. These data reinforce the need of a prospective randomized trial to assess the impact of revascularization on long term outcome in claudicants.

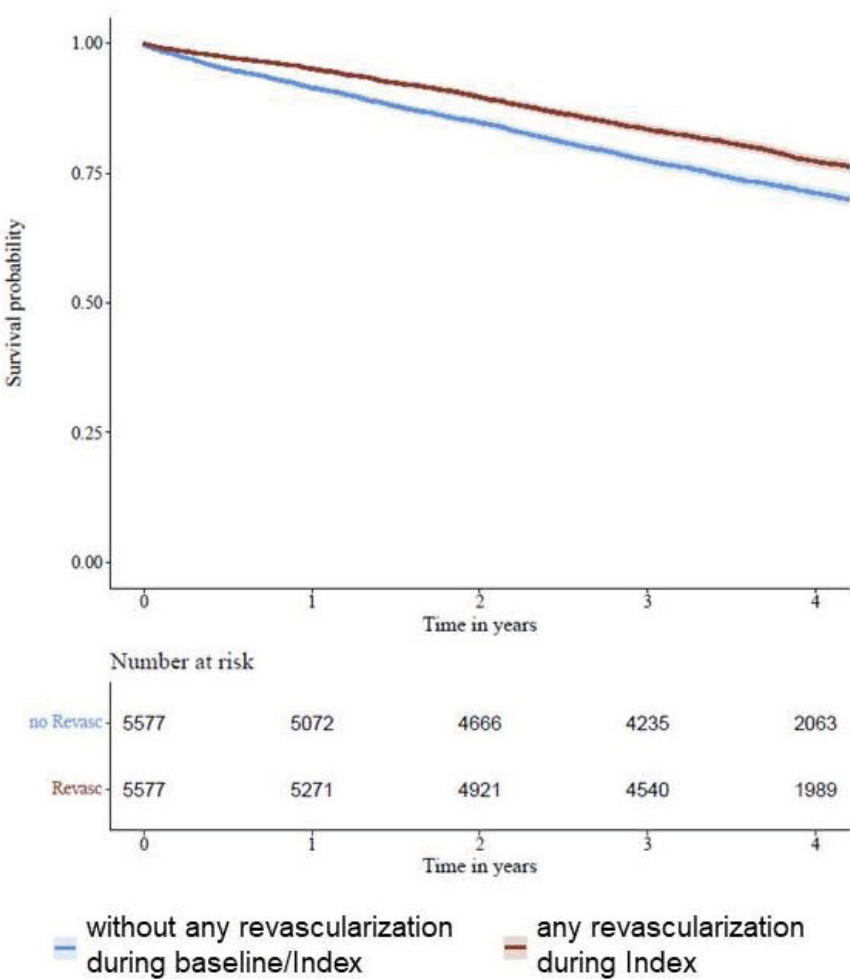


Figure A-164. Kaplan Meier curve of propensity-score matched cohorts illustrating amputation-free-survival among patients without any revascularization during 4 year baseline period and Index hospitalization (blue) and among patients with any revascularization during Index hospitalization (red).

A-165

Vascular effects through sirolimus vs. paclitaxel DCB treatment in symptomatic peripheral artery disease

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Background

Sirolimus-coated balloons (SCB) represent a promising alternative drug eluting device to the already existing paclitaxel coated balloons (PCB) for the treatment of peripheral arterial disease (PAD).

The impairment of endothelial function does not only initiate but further provokes the development of atherosclerosis and thus myocardial infarction or interventions, making efficient lesion management crucial.

DCB treatment alters the endothelium, but the impact is only incompletely understood, especially regarding Sirolimus or Paclitaxel. We now determined the impact and mechanisms of Sirolimus and Paclitaxel on endothelial function in symptomatic PAD.

Patients/Materials and methods

In this investigator-initiated randomized controlled trial, vascular function is determined in 70 PAD patients with complex femoropopliteal artery lesions and chronic symptomatic lower limb ischemia (Rutherford 2–4).

Patients are either treated with SCB (*Sirolimus Solution SLR™, MedAlliance*) or PCB (*Paclitaxel In.Pact™, Medtronic*) angioplasty.

The primary objective is the local endothelial function as determined through flow-mediated dilation (FMD) in the proximal non-stenotic segment of the target SFA, non-target SFA and the brachial artery, with clinical outcomes being assessed prior to intervention, as well as at 1, 6 and 12 months.

Additionally, vascular stiffness and compliance determined by vascular strain analysis and pulse wave velocity (PWV) of target and control vessels is evaluated, along with the Ankle-Brachial Index (ABI) to objectify vascular function. Further, inflammation markers (hs-CRP, IL-6, TGF-β), endothelial function markers (Hb, Endothelin-1) and cardiac markers (Troponin I) in serum samples are assessed at every clinical follow-up.

Results

The vast majority of the 70 patients enrolled have completed their 1-month clinical follow up, leaving us with current data on the acute improvement of endothelial function and differences between SCB and PCB. An altered endothelial and vascular function after DCB treatment following SCB vs PCB treatment will be presented at DGA 2023.

Conclusions

Evidence is provided for an improved acute local and systemic endothelial function after interventional treatment of PAD. Our RCT data will support the concept for a better mechanistic understanding to enhance endovascular treatment strategies in PAD.

Background

We report a case of a 62-year-old woman presented to the Department of Internal Medicine I with intermittent claudication of both legs. She was an active smoker and suffered from hypercholesterolemia and glucose tolerance disorder. The ABI was reduced to 0.5 while duplex sonography was suspicious for high-grade iliac stenosis and occlusion.

Patients/Materials and methods

Case report of a 62-year-old woman presented for the first time on 04.11.2018. The data was analyzed retrospectively.

Results

Few minutes after first contrast media (CM, Accupaque™ 300) application during invasive angiography, she developed an anaphylactic reaction, which led to termination of the procedure. Continuous hemodynamic monitoring in the intensive care unit followed the event. Subsequently, MR angiography was performed, which unraveled a chronic Leriche syndrome. A second attempt to perform an angiography under allergy prophylaxis failed again in the same way. An allergy test revealed no evidence of IgE sensitization to the CM used, but a borderline elevated tryptase. The allergology colleagues interpreted the reaction in terms of a pseudoallergic reaction. The patient was prescribed an emergency kit consisting of fenistil drops, celestamine liquidum, and a FASTJEKT autoinjector containing Epinephrin hydrochlorid, which she should always carry with her.

The third invasive angiography was performed using a non-iodine containing CM (Solutrast 300) and allergy prophylaxis with prednisolone. The Leriche syndrome was successfully treated interventionally with balloon- and selfexpandable stents. At 7-month follow-up, ABI values of 1.0 were measured.

Conclusions

Despite a low incidence of (pseudo)-allergic acute reactions on contrast media of approximately 1.5% with intra-arterial administration of CM, the presence of a pseudoallergy should be considered early in cases of clinical suspicion and the use of iodine-free CM should be contemplated.

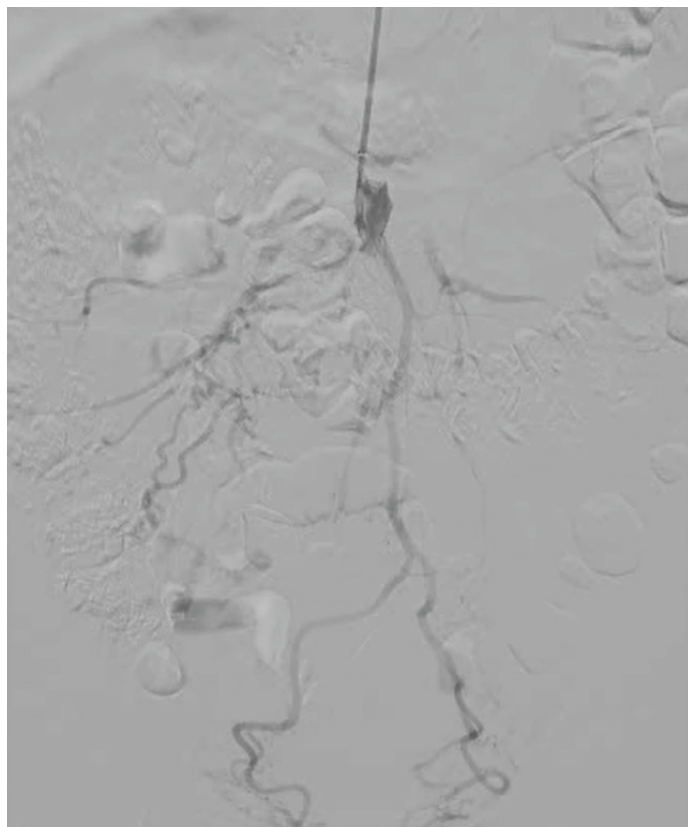


Figure A-129. Inital finding. Leriche-syndrom.

A-129

Allergy, pseudoallergy, or something else?

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A-131

Does colour matter? Shunt flow measurements in everyday clinical practice: Does the use of different ultrasound modes such as color coding, power mode, B-flow or MVI have an influence on the result? – Yes and no!

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Background

We reviewed whether the determination of shunt volume by pulsed wave (PW) Doppler leads to different measurement results when volume was measured in B-scan or when using color-coded duplex sonography (FKDS), power mode, B-Flow, or micro-vascular imaging (MVI) mode.

Patients/Materials and methods

All patients presenting for evaluation of shunt dysfunction or for shunt intervention (dialysis shunts and apheresis shunts) were included.

Sonographically (Logiq E10, probes ML 2-9 and 6-15), systolic and diastolic diameters of the brachial artery were measured in M-mode and the diameter (D) to be used for shunt volume measurement was calculated: $(2 \times D \times \text{Dsys})/3$.

Measurement sequence: B-scan, FKDS, B-scan, power mode, B-scan, MVI, B-scan, B-flow, B-scan.

The volume (ml/min) and the exact time of each measurement were recorded. To estimate the precision of the different modes, a theoretical B-scan value at the exact time of each determined by FKDS, power, MVI, or B-flow was calculated using the respective flanking B-scan measurements. The measured and calculated values were compared as well as the actual measured values.

Results

The values determined in B-scan, FKDS, Power and B-flow are considered equivalent under everyday conditions. The comparison of the calculated values with the actually determined values proves the precision of these modes. Only the MVI mode is (so far) not suitable for the exact determination of the minute volume and requires a software update.

Conclusions

Every user should find out whether there are any weaknesses in his ultrasound device that lead to imprecise measured values when using certain modes. The use of standard modes seems unproblematic and equivalent to B-scan measurement.

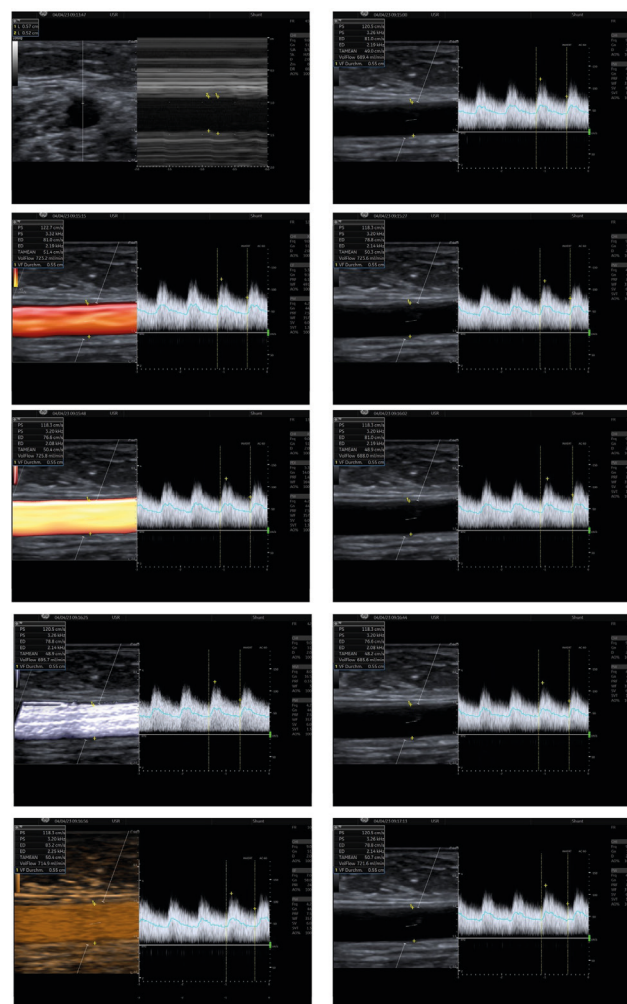
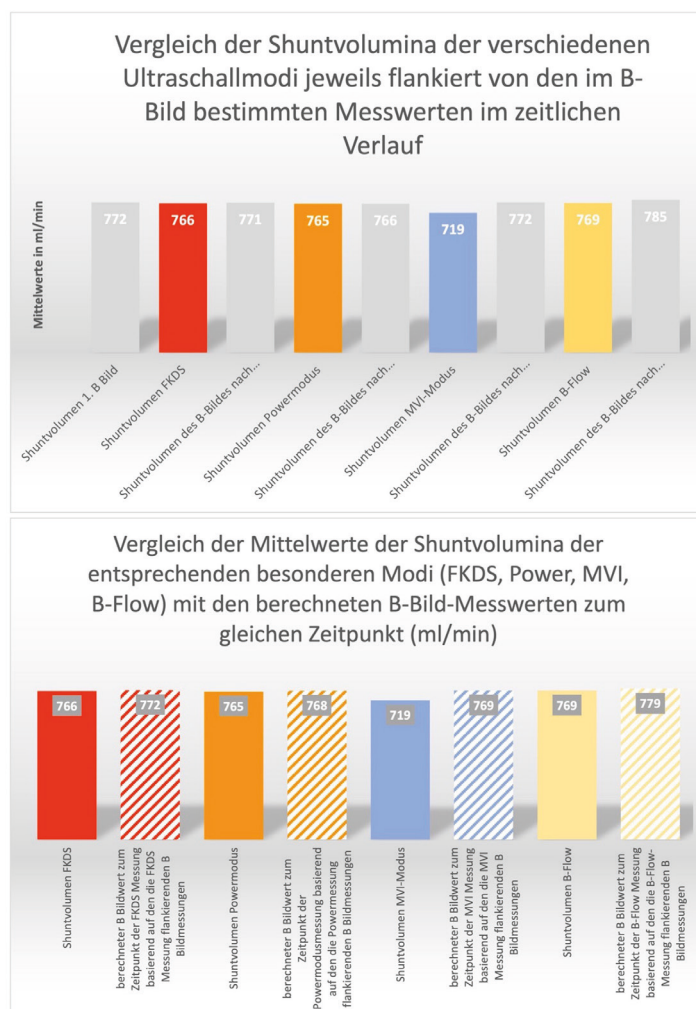


Figure A-131. Duplex und Ergebnisgrafiken.



A-133

On new paths: Purely ultrasound-guided shunt interventions instead of digital subtraction angiography (DSA) technique: Results and experiences of our first 100 cases after the change

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Background

In order to preserve remaining urine excretion of dialysis patients by avoiding contrast medium administration and to minimize radiation exposure for patients and for the team, we performed shunt interventions in the arm region exclusively ultrasound guided.

Patients/ Materials and methods

Since 11/2018, we offered ultrasound-guided intervention to all patients (dialysis shunt, apheresis shunt) who were suitable for intervention in the arm region. Before and after the intervention, the shunt volume was measured, the target stenosis (V max, diameter) was described and the dura-

tion of the examination was documented. An outpatient follow-up after 4-6 weeks was offered.

The interventions were performed under standard conditions with usual intervention material. The ultrasound scanner used was a Logiq E10 with probes L 2-9 and ML 6-15.

Collective: women 43%, upper arm intervention 76%, left shunt 50%, dialysis shunt 88%, interventions: AV fistula 8%, puncture line 63%, draining vein 28%, artery 1%.

Results

Shunt volume was increased on average from 490 to 821 ml/min; 853 ml/min in the ambulatory control. On average, the intervention lasted 42 minutes (± 21 minutes). The primary success rate was 100%. Typical (threatening) complications such as thrombosis, dissection, haematoma formation could be detected or even avoided.

Conclusions

Ultrasound-guided shunt PTA is safe, effective and can be performed with the lowest complication rate. There is no deterioration in renal performance. The standard material (sheaths, wires, balloons) can be reliably identified, so that the change from intervention in DSA technique to ultrasound-guided intervention can be made easily. The learning curve is low. The method was readily accepted by the patients and the treating nephrologists and has become the standard in our hospital.

For the benefit of all, classical interventionalists should try ultrasound-guided PTA; they will not be disappointed.

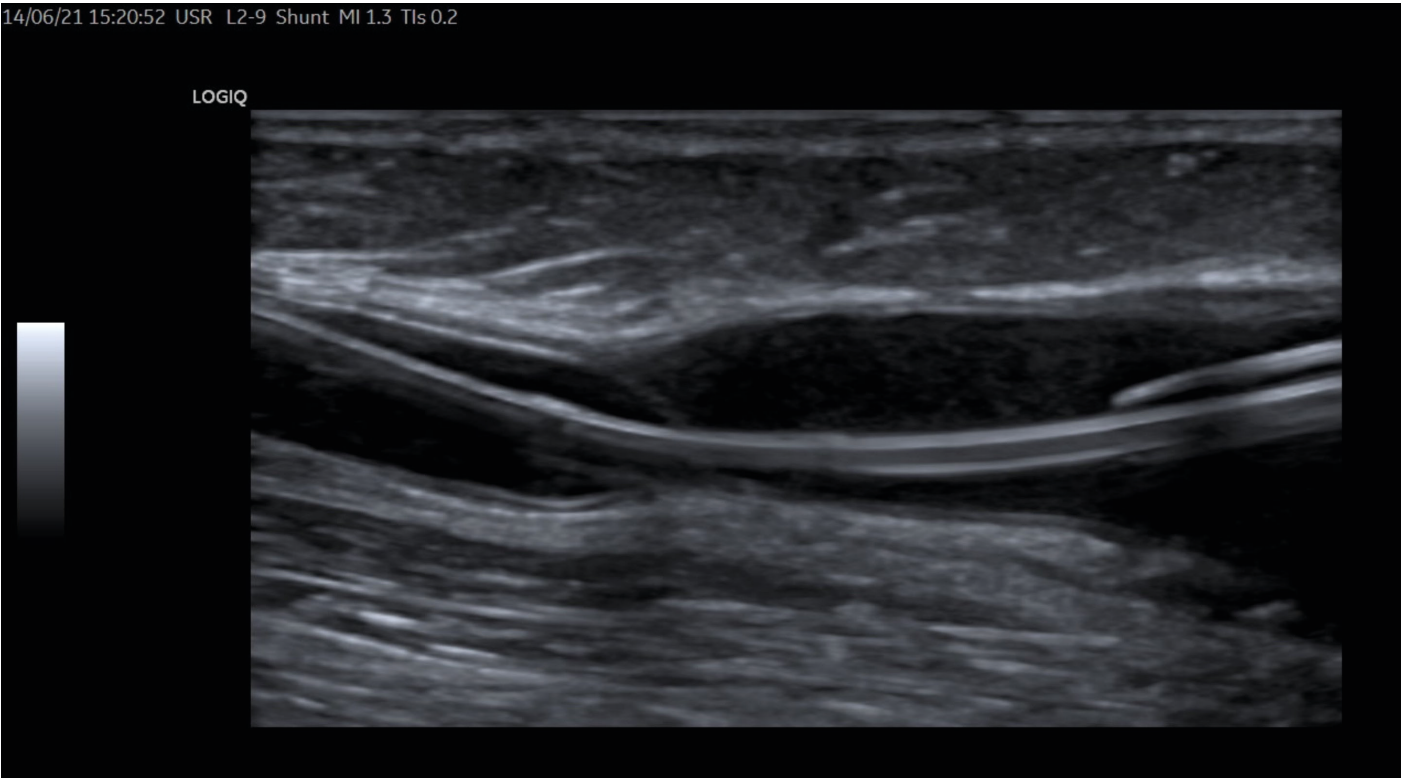


Figure A-133. PTA mit dem Sterling Ballon im Shunt unter Ultraschall.

A-159

The use of Bycross under ultrasound: First experiences and findings

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Background

Bycross is a 6 French interventional catheter for bi-directional rotational atherectomy and thrombectomy. An integrated pump guides the removed material to the outside. We report our experience with ultrasound (US)-guided interventions with this system.

Patients/Materials and methods

Since 12/22, we have performed US-guided interventions with the Bycross 8 times in patients with clinical stage II b or III after Fontaine.

Collective: 8 men, 3 women, p AVK IIb: 5, p AVK III: 3, age: 47-72, ABI: 0.21-0.61, region: A iliaca (AI), Art femoralis communis (AFC), Art femoralis superficialis (AFS), treated lesions: Stenoses and occlusions.

The interventions were prepared using digital subtraction angiography (DSA) technique and supplemented with an ultrasound machine prepared for sterile use. Wire passage through the target lesion, deployment of the bycross, lumen gain and improvement of haemodynamics were visualised as much as possible using US, which reduced the use of contrast media and X-rays.

Results

All interventions were primarily successful and without complications. The Bycross system can also be used safely, precisely and successfully under visualisation by ultrasound. It can be clearly seen on ultrasound and its therapeutic benefits in terms of lumen gain and improvement of haemodynamics are immediately visible. Critical moments such as contraction of the vessel due to suction of the Bycross pump with entrapment of the catheter can also be detected, prevented or reversed.

Conclusions

The Bycross system can also be used effectively and safely at suitable points by visualisation using ultrasound.

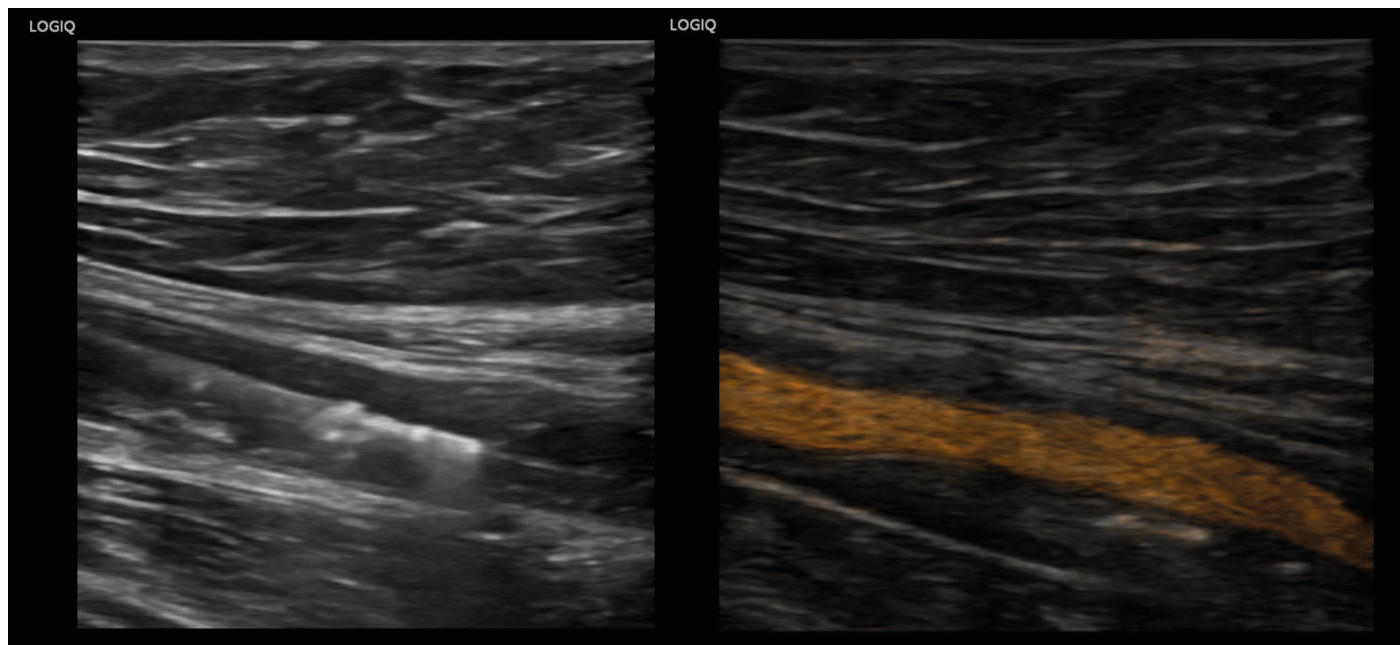


Figure A-159. Dualbild Bycross B Bild und B Flow.

Freie Vorträge II

Vaskuläre Bildgebung: Etablierte Verfahren und Zukunftsmusik

A-108

The lordogenetic midline syndrome: Pathophysiology, diagnosis and treatment of abdominal vascular compression syndromes

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Background

Abdominal vascular compression syndromes are frequent and debilitating but little known entities. We present a holistic understanding as a family of lordogenetic diseases often in women with genetic connective tissue disorders. An exaggerated lumbar lordosis is the common denominator of all compression syndromes from head to toe.

Patients/Materials and methods

We present our experience from more than one thousand patients with vascular compression syndromes and describe our functional and quantitative color Doppler sonographic diagnostics and the surgical decompression by excision of the median arcuate ligament in celiac artery compression and extrenal PTFE-wrapping in venous compressions and Wilkie-syndrome plus nephropexy in a single operation.

Results

The functional and quantitative color Doppler measurement of renal perfusion with the PixelFlux-technique, flow volume measurements of pelvic venous return, standardized tissue perfusion quantification or uterus, vagina and urethra, sidewise comparison of gluteal venous drainage, celiac trunk respiratory flow velocity changes, direct observation of duodenal food passage, quantification of orthostatic renal and aortic flow volume drop, 3-dimensional color Doppler flow volume measurements of the carotids and femoral venous flow volume measurements are cornerstones of a holistic understanding of complex vascular compression syndromes and allow a functional restoration of vascular, intestinal and vegetative damage by external PTFE-wrapping of congested veins, celiac artery and ganglion decompression, duodenal decompression and nephropexy.

The clinical success rate is high.

Conclusions

The peculiarities of abdominal vascular compression syndromes require a holistic and unifying concept to overcome current shortfalls as psychosomatic explanations, venous stenting, hysterectomy, venous coiling or renal autotransplantation or even nephrectomy.

A-113

Venous stenting of abdominal compression syndromes (ACS): Basically not a good idea

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Background

Venous stenting is a widely accepted procedure in the treatment of post-thrombotic obstruction but was also recommended for abdominal venous compression syndromes as May-Thurner-Syndrome and Nutcracker-Syndrome.

These disorders are but consequences of an extraluminal compression instead of an intraluminal obstruction. Moreover, the obstruction is the result of a mainly unilateral compression from behind by the underlying aorta or the spine due to an exaggerated lumbar lordosis in this mostly female patient which are very frequently afflicted by hypermobility disorders (mainly Ehlers-Danlos syndrome).

These facts are the basis for a successful treatment of ACS.

Patients/Materials and methods

We report on common complications of venous stents in 54 ACS patients observed from 01/2018 – 12/2022. The underlying mechanism for the systematic complications has been identified.

Results

Basic reason for a failing stent function in ACS is the strong curvature imposed on the compressed vessels by the lordotic ventral shifting of structures in front of the spine in patients with an exaggerated lordosis.

Inherited connective tissue disorders causing hyper flexibility of joints and laxness of ligaments are a main reason for the development of an exaggerated curving of the spine which starts as a lumbar lordosis developing later to a scoliosis.

The stiffness of the stent material required to maintain an open venous lumen counteracts its bending to follow the course of the compressed veins smoothly. Thus, not rarely venous stenting of the primary compression in ACS is creating one or multiple new compressions. Moreover, the localized bony pressure increases the risk for stent collapse, fracture and displacement. Often the apertures of the stents poke into the anterior wall of the stented vein producing severe pain.

We observed the following mechanisms of stent failure:

- Curtain effect
- Rebound effect
- Springboard effect
- Collapse of the stent
- Wall penetration
- Displacement

Dysfunction of an open iliac stent due to missing a coexisting left renal vein compression

- Stent increasing other vascular compression
- Stent producing a new vascular compression
- Travelling stent produces new compression
- Seesaw effect
- Angulation of 2 overlapping stents
- Posture dependent narrowing or collapse

All types of stent failure are illustrated sonographically and intraoperatively.

Conclusions

ACS fundamentally differ from thrombotic venous occlusions due to the stretching and bending of the afflicted veins by the lordotic lumbar spine. This produces fundamental conflicts between the stent and the compressed vein. Thus, multiple stent complications are common findings in ACS

patients. We therefore disregard stenting in ACS patients and favor an external PTFE-shielding to prevent the compression of the veins.

A-119

Regnase-1 halts aortic aneurysm progression in Marfan syndrome

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Background

Marfan syndrome is an autosomal-dominant genetic disorder affecting microfibrils in elastic fibers. Cardiovascular complications comprise rupture or dissection of thoracic aortic aneurysms, still representing the main mortality risk for patients. Development of a pro-inflammatory environment and matrix digestion regulated by matrix-metalloproteinases (MMPs) play a central role in the pathological changes in the aortic wall. Regnase-1 is a newly identified endoribonuclease cleaving the mRNA of pro-inflammatory cytokines such as interleukin-6. Hence, we hypothesized that targeted adeno-associated virus (AAV)-mediated regnase-1 overexpression inhibits development and progression of aortic aneurysms due to its anti-inflammatory effects.

Patients/Materials and methods

In vitro tests were performed in primary aortic smooth muscle cells transduced either with AAV9-regnase-1 or AAV9-enhanced green fluorescent protein (EGFP) as control group. Experiments included Western Blot, real-time PCR, ELISA, macrophage migration assay and elastin degradation assay. A well-characterized murine model for Marfan syndrome (mgR/mgR) was used for *in vivo* studies. Here, regnase-1 overexpression was achieved by tail vein injection. Aortic aneurysm size was determined using ultrasound-based assessment four weeks after injection. Elastin architecture was analyzed by elastin-van-giesson stainings of aortic cryosections.

Results

AAV-mediated regnase-1 overexpression resulted in a marked decrease of inflammatory parameters and elastin degradation in aortic smooth muscle cells *in vitro*. Intravenous injection of endothelial-targeted AAV led to efficient transduction of the aortic wall. Importantly, mice receiving our gene therapy presented with significantly lower aortic diameter compared to EGFP-injected mice. Furthermore, regnase-1 overexpression strongly improved the architecture of the media, shown by a clear reduction in the number of elastin breaks. Additionally, we could observe significantly lower levels of circulating pro-inflammatory cytokines in the plasma as well as decreased MMP expression and activity.

Conclusions

Targeted regnase-1 overexpression ameliorates pathological changes in the aortic wall of Marfan mice and potentially prevents formation or progression of thoracic aortic aneurysms. Thus, it seems to be a promising approach as a novel gene therapeutic approach to Marfan syndrome.

A-126

Retrograde versus antegrade recanalization of long femoropopliteal chronic total occlusions (CTOs)

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Background

Retrograde recanalization (RR) has been proposed as a valuable alternative option in case of failed antegrade guide wire crossing with femoropopliteal CTOs. We sought to investigate if retrograde recanalization is associated with similar or different rates of stent placement, especially in moving femoropopliteal segments compared to the antegrade approach. In addition, we investigated the influence of the antegrade vs retrograde recanalization strategy on target lesion revascularization (TLR) rates and limb outcomes.

Patients/Materials and methods

Technical and peri- and post-procedural results were analysed in 227 patients who underwent endovascular revascularization of long (>20cm) femoropopliteal CTOs due to symptomatic PAD between 01/17-06/22. After exclusion of technical failures (n=4, 1.8%) and In-Stent-Restenosis (ISR), (n=43, 18.9%), 90 cases with successful antegrade and 90 with failed antegrade and successful RR were analysed.

Lesion specific parameters included lesion length, calcification by PACSS score and extent of dissection (Type A to F dissections) after angioplasty. In addition, TLR and major amputation rates were assessed.

Results

Patients were 75(66-82) yrs. old, 76(42.2%) were female and 78(43.3%) had diabetes mellitus. Of 180 patients, 78(43.3%) had intermittent claudication and 102(56.7%) exhibited critical limb ischemia (CLTI). Mean lesion length was 300mm(240-360mm) and mean occlusion length 240mm(190-310mm). Lesion calcification by PACSS was moderate to severe (3.0[2.0-4.0]). Rutherford categories, lesion, occlusion lengths and calcification by the PACSS score were similar between the 2 subgroups.

Dissection severity on the other hand, was substantially higher with the antegrade vs retrograde recanalization subgroup (4.0[3.0-4.0] vs 3.0[2.0-4.0], p<0.001).

In addition, the number of stents in all segments and the rate of bail-out stenting in moving femoropopliteal segments was significantly higher with antegrade versus retrograde recanalization (2.0[1.0-3.0] vs 1.0[0-2.0], p<0.01 and 37.8% vs 14.4%, p<0.001).

During follow-up, major amputation was necessary in 3(5.5%) patients who underwent antegrade vs 1(2.3%) patient who underwent RR (p=0.43, in patients with CLTI), whereas TLR rates were similarly high in both subgroups (20.0% vs 28.8%, p=0.27).

Conclusions

RR is associated lower rates of dissections, resulting in lower rates of consecutive stent placement especially in moving femoropopliteal segments. However, this does not seem to translate to favorable limb outcomes in terms of TLR or amputation rates during follow-up compared to the standard antegrade approach although a numerical trend was observed for lower amputation rates in CLTI patients who underwent RR.

A-128

Chronic thromboembolic without pulmonary hypertension?

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Background

We report a case of a 18-year-old woman presented to the emergency department with a 5-day history of pain in the thoracic region and dyspnea after physical stress. In addition, she complained of swelling of the right leg. She was on contraception with estrogen and had a known obesity. CT angiography confirmed a central pulmonary artery embolism (LAE) on the left side. Anticoagulation was initiated and catheter directed lysis was performed.

Patients/Materials and methods

Case-report of a woman presented the first time on 30.12.2018. The data was analyzed retrospectively.

Results

Another 6 months later, the patient presented again to the emergency department with dyspnea, syncope, and tachycardia. Anticoagulation

was discontinued due to menorrhagia in the meantime. CT angiography revealed a postthrombotic subtotal obliteration of the left pulmonary artery with consecutive hyperinflation of the right lung and right heart hypertrophy.

Subsequently, under suspicion of chronic thromboembolic pulmonary disease, a ventilation-perfusion scintigraphy was performed, which confirmed the CT findings. Anticoagulation was again initiated. Right heart catheterization excluded chronic thromboembolic pulmonary hypertension (CTEPH) with a pulmonary artery mean pressure of 9 mmHg, and pulmonary angiography confirmed the CT finding of complete occlusion of the left pulmonary artery (Figure A-128).

Diagnosed with chronic thromboembolic disease-CTED, the patient was presented to an International Reference Center for the Treatment of Patients with CTEPH.

There, a thrombendarterectomy of the affected pulmonary artery in deep hypothermia with use of the heart-lung machine followed without complications. Furthermore, a recommendation for lifelong anticoagulation and one-year follow-up was made, which has not yet taken place due to the recent surgery.

Conclusions

The prevalence of chronic thromboembolic hypertension is 8.4%, whereas that of chronic thromboembolic disease, this means without the presence of pulmonary hypertension, is found in only 3.3% of clinical cases.

Nevertheless, regardless of the presence of a history of pulmonary artery embolism, patients with unexplained dyspnea should be considered for the presence of these two disease entities and a prompt diagnostic should be initiated.

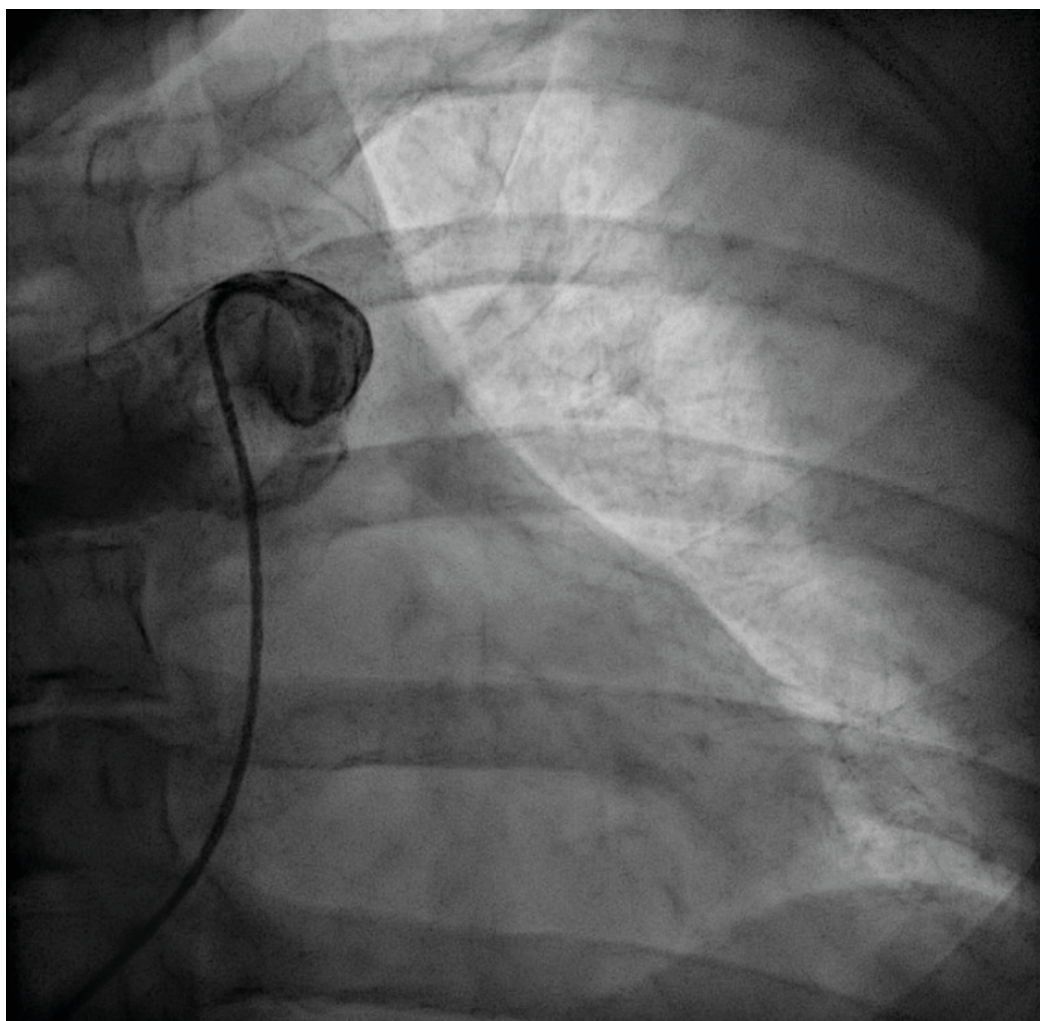


Figure A-128. Selective invasive pulmonary angiography.

A-142

Endovascular thrombectomy of a pulmonary artery embolism in a patient on VA-ECMO due to refractory cardiac arrest

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Background

For acute therapy of high-risk pulmonary embolism (HR-PE), surgical and recently also endovascular thrombectomy (ET) are available next to the gold standard, lysis therapy. The value of ET in acute HR-PE is not well studied yet. This case report presents an ET in a patient on VA-ECMO.

Patients/Materials and methods

The 73-year-old patient was hospitalized to implant a Y-prosthesis for a thrombotically occluded EVAR. Postoperatively, repeated surgical revisions were necessary due to abdominal bleeding complications. In presence of the nurses the patient was mobilized for the first time at the 18th

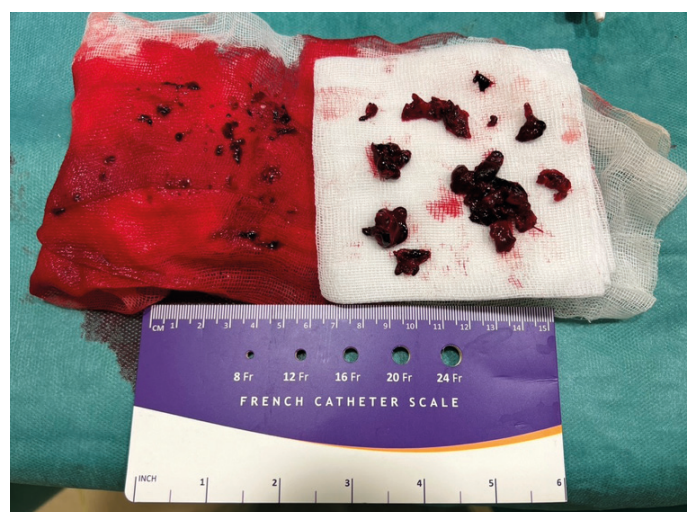
postoperative day. During mobilization, an in-hospital cardiovascular arrest with immediate cardiopulmonary resuscitation occurred. Transthoracic echocardiography showed an embolism in the right atrium and the inferior vena cava and a dilated right ventricle as signs of acute PE. In the absence of reentry of spontaneous circulation, extracorporeal circulation was established after 38 minutes using VA-ECMO.

Results

The subsequent conducted CT angiography showed a bilateral central pulmonary embolism with spread to the subsegmental level. With a PESI score of 193 and initial troponin T of 1.16 µg/l, the patient presented with a HR-PE according to the current ESC and German Society of Angiology guidelines. Because of the contraindication to lysis therapy, immediate ET was indicated. During the 2,5 hour lasting procedure embolus material was successfully retrieved (Figure A-142). After this, the patient was stabilized and transferred to the intensive care unit for further therapy. ECMO therapy was stopped six days later, and the patient was subsequently weaned off ventilation. Echocardiography showed normal systolic right ventricular function 20 days after PE, with normal-sized right heart cavities. The patient was discharged without neurological deficit.

Conclusions

According to the current guidelines, the primary therapeutic option for the treatment of HR-PE is still drug-assisted lysis therapy. ET should be considered in patients with HR-PE if there is a contraindication to lysis therapy. However, its exact value especially in vulnerable patients such as patients with refractory cardiovascular arrest needs to be investigated in more detail to assess its value.



Figures A-142. Successfully retrieved thrombus material.

A-149

Nutcracker syndrom causing paraparesis: Pathology, hemodynamics and treatment

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Background

The nutcracker Syndrome (NCS) is the chameleon among the venous compression syndromes. It is our impression, that NCS in the presence of MAY-THURNER syndrome (MTS) appears often in patients with hypermobility syndrome disorders, especially in hypermobile EHLERS-DAN-LOS syndrome, and causes a variety of unexpected neurological syndromes.

Patients/Materials and methods

We report about our experience of 127 patients (female 110, male 17) which underwent decompressive surgery for NCS (5), MTS (4) or both (118). The diagnosis was confirmed by functional USD-Doppler Duplex (Th.Sch.) and imaging (most often CTA). Due to paraparesis 8 patients arrived wheelchair bound. Sixteen patients arrived after stenting (MTS n=8, NCS n=7, both n=1). In 5 patients kidney auto TX had been performed elsewhere.

Results

Seven of 8 patients with paraparesis (all NCS and MTS) went home walking on their own feet, in one patient with paraparesis up to the neck walking was also possible, but the muscles were dystrophic.

Conclusions

The explanation of the success is given through the hemodynamic effect on venous pressure release through the trunc reno-rachidien. This structure serves as important collateral to release the pressure caused from the NCS in the left renal vein. That structure is known since 1971 and the over-flow and pressure through which, into the epidural vein plexus can cause headache, migraine and paraparesis, which was released in our patients after decompression surgery for NCS and MTS.

A-161

Alternative use of nitinol mesh disks as temporary inferior cava filter during interventional thrombectomy for venous thromboembolic events in the context of high-risk pulmonary embolism (PE)

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Background

PE remains a high medical burden with high incidence and an unchanged high mortality rate over the past decades. Current medical treatments are daunting. Alongside systemic therapy, catheter-derived solutions are on the rise with the aim of rapid thrombus mass reduction, lessening of RV dilatation and post-PE syndrome. One pitfall of mechanical maneuvers is distal embolization into patent vessels.

Patients/Materials and methods

A 57-year-old male patient was admitted to the emergency department due to syncope and persistent respiratory distress after resuscitation. At arrival, oxygen saturation had dropped to 57%, systolic blood pressure was 90 mmHg and heart rate was 130/min. Bedside echocardiography revealed right heart strain with an RV/LV diameter ratio of 1.4. Troponin level was elevated to 169 ng/L. CT angiography showed bilateral central and paracentral pulmonary embolisms. Interdisciplinary considerations with our PERT led to the decision to perform pulmonary artery thrombectomy in this high-risk patient using the INARI FlowTrieve System. Initial manoeuvres were executed in a typical manner. Following the initial suction, a condition commonly referred to as “lollipop” was observed, wherein a thrombus had been partially aspirated and remained lodged at the catheter’s tip. Three additional dry suctions were conducted within a 20-minute timeframe to enhance the adherence of the “lollipop”. This scenario presents the potential hazard of thrombus detachment during the retraction through the cardiac region and particularly during the femoral access passage. A second access was established via the left common femoral vein and the self-expanding nitinol mesh disks of the INARI ClotTrieve system were inserted in the inferior vena cava below the renal veins. Subsequently the catheter system was carefully withdrawn beneath the disks, which were then unfurled. The system was retracted further while salvaging a large thrombus mass. A subsequent catheterization procedure was performed to extract the remaining thrombotic material, which was preserved beneath the disks.

Results

The patient’s hemodynamic status improved with decreasing heart rate (130 to 101 bpm) and increasing oxygen saturation levels (86% to 95%) accompanied by a decrease in oxygen demand, stabilization of blood pressure and a reduction in pulmonary artery pressure from 37/27 (mean PAP 32 mmHg) to 33/18 mmHg (mean PAP 23 mmHg). The final angiogram showed notable enhancement in the perfusion of the pulmonary arteries with no central thromboembolism leftovers.

Conclusions

Aspiration thrombectomy shows astonishing short-term clinical improvements by direct clot mass reduction and might be supported by alternative use of mesh disks as a temporary inferior cava filter to prevent distal embolization.

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