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A STEP GUIDANCE FOR ENDOVASCULAR PROCEDURES

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WHAT THIS DOCUMENT PROVIDES

A Step Guidance for Endovascular Procedures is the result of the work done by the members of Writing Committee, developed in different sessions of the Vascular Surgery Working Groups carried out under the auspices of Terumo. This booklet present materials proposals and choices for the intraoperative decision-making process. And advice for radiation protection, still inherent to all procedures.

Disclosures

These recommendations are the result of a working group of experienced KOL's (national and international), based on their daily use of tips and tricks in the endovascular world. The aim of this guidance is a technical teaching and assistance, creating a practical framework, and in any circumstance could NOT replace universal guidelines issued by the ESVS, ESC or other scientifically recognized entities including other Medical organizations and Societies.

The opinions expressed by all the members of the Writing Committee in this booklet are his own and do not reflect those of Terumo. Unattributed data, device selection and procedural guidance is a matter of the physician preference and opinion derived from own observations and experiences and should be treated accordingly.

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Refer to product labels and packaging insert for complete warnings, precautions, potential complications, and instructions for use.
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Document structure

Which materials should be on table / available and which technique steps should be followed. The cadenza, particularly in PAOD, is divided in access / crossing / treating / closing.

Preliminary Notes
Which disease aims to be treated by the procedure (under established consensus).

Procedure
For the access options which puncture site, type of access, namely ipsilateral or contralateral, echo guided, ambulatory management.
Discussion adjusted per procedure.
Adequate materials selection and use (guidewires, catheters, re-entry systems, balloons, stents).
The intraoperative steps.
Closure Systems options, when and why, vantages and disadvantages.

Tips & tricks
Suggestions from the experts.
The most frequent and not so frequent ones.

References
The references are listed at the end of the document, according to each topic/ chapter. A relational support for the text, underlining the main conclusions, including sometimes the historical evolution of the scientific knowledge, can be found. Clinical evidence background / experiences / analysis / statements are available, with direct pubmed links, for easy consultation.

I RADIATION PROTECTION ADVICE

Radiation emitted during fluoroscopic procedures is responsible for the greatest radiation dose for medical staff.

Radiation from diagnostic imaging modalities, such as computed tomography, mammography, and nuclear imaging, are minor contributors to the cumulative dose exposures of healthcare personnel (ref 1).

Formal radiation protection training helps reduce radiation exposure to medical staff and patients.

Any amount of radiation exposure will increase the risk of stochastic effects, namely the chances of developing malignancy following radiation exposure. Radiation exposure can produce biological effects as either a dose-dependent effect or a dose-dependent probability.

There are three basic principles of radiation protection: justification, optimization (precision), and dose limitation, resulting in the golden "ALARA" principle: "As Less As Reasonably Achievable". The duration of radiation exposure, distance from the radiation source, and physical shielding are the key facets in reducing exposure.

Advice(s) (ref 2):
- plan in advance the required images to avoid unnecessary and redundant exposure
- all X-ray system settings should be defaulted to low dose
- limit exposure duration whenever possible
- use magnification judiciously as it significantly increases the exposure to the patient and operators
- use pulsed fluoroscopy, which obtains about five images per second without impairing imaging quality; continuous or live fluoroscopy may be helpful to understand anatomy during procedures better, but standard fluoroscopy machines capture roughly 35 images per second
- use collimation systematically to minimize scatter radiation and focus only on the area of interest
- replace digital subtraction angiography by recorded fluoroscopy runs whenever possible.

• increase the distance between the x-ray beam and the part that is being imaged to minimize exposure
• image intensifier or x-ray plate should be as close to the patient as possible, with the x-ray tube positioned as far away as possible while maintaining adequate image resolution
• decrease scattered radiation (radiation that surgeons, interventionalists, and operating room staff commonly encounter during procedures requiring fluoroscopy) exposure levels by a factor of four by doubling their distance from the source
• use fusion as it can facilitate endovascular navigation, and allow table and C-arm positioning without fluoroscopy in EVAR and FEVAR (ref 3,4)
• use CO2 angio in alternative to iodinated contrast (or mixed use)
• use both (CO2 and fusion) for FEVAR, whenever possible (ref 5)
• consider IVUS use for EVAR &TEVAR procedures (ref 6)
• in the case of superficial femoral, popliteal or below the knee arteries retrograde puncture, consider performing it under ultrasound guidance (rather than under fluoroscopy)
• in the case of performing it under fluoroscopy consider using lead gloves or a needle extensor
• wear leaded aprons for protection (preferably those that wrap circumferentially around the body)
• use a thyroid shield.
• use leaded glasses (can reduce radiation exposure to the lens by 90%)
• use dosimeter and confirm monitoring
• ask for ceiling-suspended lead acrylic shields, which can reduce doses to the head and neck by a factor of 10

II PAOD
GENERAL GUIDANCE FOR ENDOVASCULAR PROCEDURES

1. Type of access?

What puncture type – access type? choose the introducer type
Access location?
Puncture type - anterior and posterior / anterior wall?
Use closure system up to 7Fr - 5mm artery diameter – FEMOSEAL OR ANGIOSEAL?
Depending on the access, is the patient discharged on the same day?
Cross Over X Ipsilateral access?
Request Eco-Doppler for echo-guided puncture of the common femoral artery and superficial femoral artery?
In case of stenting - 6Fr introducer, by default; confirm Fr. compatibility with the stent delivery system?

2. Which guidewire?

Start with a workhorse guidewire (Standard or stiff angled hydrophilic, workhorse durable nitinol wire – TERUMO glide wire; Terumo Advantage Track)

3. Which catheter?

Glidecath (for trackability in tortuous areas)
Cateter tip and caliber to be determined according to artery to navigate and to be treated, type of lesion and guidewire selected. Optitorque (more support vs Glidecath in non-challenging anatomies).
Curves: the Berenstein 2 (depending on the anatomy of the vessel) and, optionally, the Vertebral one (RIM, UF, JB2).

4. Which stent? (ref 1)

Primary or direct stenting: complex occlusions or stenosis (eccentric, calcified, ulcerated) that can cause embolization.

Balloon expandable stent: short, calcified, eccentric lesions located in the ostia of the common iliac artery and iliac artery - greater radial force.

Self-expanding stent: nitinol stents, thermal memory, in tortuous lesions or with important kinkings (angulation risk of distal apposition of the balloon-expandable stent).

Better results in long, tortuous, less calcified lesions and when there are abrupt diameter variations. Available in longer lengths.

Stent grafts: perforations, fistulae, trauma, iatrogenic rupture; have always in "baillout" - for procedures in lesions at risk of rupture. Consider in complex lesions and in the aortic bifurcation.

And:
Kissing stent: Ipsilateral Advantage and contralateral guidewire with 0.035" x 260 cm PTFE guide. 6Fr stent (7Fr introducer?). The diameter of the introducer will depend on the type and the diameter of the stent to be used. Usually, 6Fr or 7Fr.

Balloon: "ballooning" - only afterwards and only in the self-expanding one (ref 2)

5. Which closing system stent?
6-8F femo/angioseal
10-14 F 1 Proglide/prostyle
>14F 2 Proglides/prostyles

Proglide can be used for 5-21Fr (Max. 26Fr OD) arterial sheaths and 5-24Fr (Max. 29FrOD) venous sheaths.

ILIAC ARTERIES ANGIOPLASTY AND STENTING
TECHNIQUE & MATERIALS

Access
• ipsilateral or contralateral femoral
• preferably ultrasound-guided puncture
• puncture in the upper limb – humeral/brachial or radial (when more materials suitable are available), preferably left upper limb (shorter distance from the target lesion, less manipulation of the aortic arch)
• the choice should be defined according to the type of puncture and, with that, the choice of the Fr. But start with introducer 5 or 6 F, 11 cm (in case of radial access, use a radial dedicated introducer)
• after crossing the lesion, change to a caliber introducer adjusted to the device to be used
• this introducer should be longer, particularly if used in crossover, or to overcome complex lesions and protect device progression

Crossing
• Heparinization, usually 5000 units of unfractionated heparin (100 UI/kg) (or 50 a 100 UI/Kg)
• guidewires (either contralateral, unilateral or double puncture) according to personal preference – usually '0.035 hydrophilic guidewire (eg. Terumo Glidewire, 260 cm); eventually x 2 (bilateral puncture) - serves as an exchange guidewire
• for crossover use Pigtail (to do the cross); as alternatives a Cobra, Berenstein, internal mammary, JR or even a Simmons; then, a Support Catheter – Navicross '0.035. Use a GLIDECATH for tortuous areas where need of greater navigability is necessary
• if there is difficulty in crossing the lesion, reduce profile to guide '0.018 or even '0.014; possibility to use dedicated guide for CTO, low profile.
• if there is an occlusion, use a guide such as the Straight Terumo Stiff '0.035 - with the possibility of switching to Advantage TRACK 0.035" (straight or angled depending on the type of injury)
• after crossing the lesion, exchange for a more rigid guide, to provide greater support (eg. PTFE 260 cm, Glidewire Advantage, Amplatzer) – namely for stent progression – 180 or 260 cm in length, depending on the catheter size of the material to be used.

Treating

• choose angioplasty balloons with an 80 cm catheter: privilege low profile for good navigability
• pre-dilate in most of the situations improving artery diameter that will allow the passage of the balloon expandable stent, if to be used

In case of post dilatation after the placement of a self-expandable stent, use large diameter balloons (8 * 60 mm x2; 9 * 60 mm x2); same dimensions for non-covered expandable stents.

Take note:
• balloon stents – in occlusive lesions or heavily calcified lesions – pre-dilate or overcome lesion with a long introducer – after placing the stent, remove the introducer/sheath
• external iliac artery – usually a self-expanding stent is chosen
• common iliac artery – usually a balloon-expandable stent is chosen
• in lesions with thrombosis or heavily calcified, the option of covered stent (COBEST trial) should be considered
• a covered stent for an eventual emergency (iliac rupture) should be available

Closing

• Femoseal – prefer this one in cases of a calcified artery at the puncture site; Femoseal only allows access in the same place after 3 months (with Proglide we can puncture immediately) up to 7Fr introducer

• Proglide - avoid in calcified femoral arteries; in anterograde puncture complications may occur (however with Femoseal this does not happen) – 1 device up to 10-14Fr introducer; 2 or more for larger introducers
• AngioSeal – consider if introducer is <= 8 F

Tips & Tricks

• cross the lesion:
1st option – intraluminal (use lower profile guide if necessary)
2nd option – crossover/upper limb access (snare if necessary)
3rd option – subintimal + re-entry (use of re-entry devices), retrograde access

RECONSTRUCTION OF AORTIC BIFURCATION WITH COVERED STENTING (CERAB)

TECHNIQUE & MATERIALS

Preliminary notes

In planning, it is essential that some aspects should be considered:

- proximal limit of aortic stent implantation
- risk of embolization to renal arteries – if any, a renal artery protection mechanism should be used
- checking for stenotic/occlusive lesions of the visceral arteries and the risk that a possible occlusion of the inferior mesenteric artery can trigger intestinal ischemia (using covered stents)
- consider access through the upper limb (left) – image/control implantation, crossing of lesions in an anterograde way
- choosing stent diameter – iliac kissing stents should take into account the aortic diameter at the level of the bifurcation

Access

- bilateral femoral artery
- preferably ultrasound-guided puncture
- puncture in the upper limb – humeral/brachial or radial; preferably left upper limb (shorter distance from the target lesion; less manipulation of the aortic arch) (in case of radial access, use a radial dedicate introducer)
- start with intro 5 or 6 Fr, 11 cm, and progress to 7Fr
- after crossing the lesion, change to an introducer with a caliber adjusted to the device to be used – 11 F to 14 F in the case of the side where the aortic stent will be implanted (see table)
- this introducer should be longer, to overcome complex lesions and protect device progression (ex: Dryseal, Sentrant)

Crossing

- Heparinization, usually 5000 units of unfractionated heparin (100 UI/kg) (or use 50 a 100 UI/Kg)
- cross the lesion:

1st option – intraluminal (use a lower profile guide if necessary)
2nd option – crossover/upper limb access (snare; treat contralateral side if disease

limits crossover access)
3rd option – subintimal + re-entry (use of re-entry devices), "rendez-vous" technique,
• in occlusive lesions or heavily calcified lesions – pre-dilate. The use of a long introducer is preferable, specially to protect progression through the lesion and for greater support
• according to personal preference – usually '0.035 hydrophilic guide (eg. Terumo Glidewire, 260 cm) to cross the lesion; consider using:
• Terumo 180 cm x 2 - start with this one
• Terumo 260 cm x 2 - serves as an exchange guide
• Straight Terumo Stiff - in occlusions with the possibility of switching to Advantage 0.035"(angled)
• if there is difficulty in crossing the lesion, reduce profile to guide '0.018 or even '0.014; there is a possibility to use dedicated guide for CTO
• In presence of occlusion, some health professionals prefer to use a guide such as the Terumo Stiff straight '0.035
• after crossing the lesion, exchange for a more rigid guide, to provide greater support (eg. PTFE 260 cm, Glidewire Advantage, Amplatzer) – namely for stent progression) – 180 or 260 cm in length, depending on the catheter size of the material to be used
Consider the use of one (or several) of those catheters:
• Berenstein 2
• Straight
• Vertebral
• Pigtail

Note: GLIDECATH for tortuous areas where greater navigability is necessary

Treating
Angioplasty balloons
• need for proximal over dilatation of the proximal aortic stent to have "funnel"/conical CERAB
• eventual need for over-dilatation of the iliac stent if the iliac caliber is greater than the implanted stent or iliac artery, with difference in caliber between the proximal and distal segments
With pre-dilatation, in most situations, a diameter that allows the passage of the balloon-expandable stent should be used. In the case of post-dilatation after placement of a self-expanding stent, then large diameter balloons can be used:

BALLOONS FOR OVERDILATATION			
Brand	Diameters	Extension	Introducer
Zelos (Optimed)	12-28 mm	20 to 40 mm	6-12F
XXL (Boston)	12-18 mm	20 to 60 mm	7-8F
Maxi LD (Cordis)	14-25 mm	40 to 80 mm	8-12F
Atlas Gold (BD)	12-26 mm	20 to 60 mm	7-12F

Stents

Diameters: Compatible with angioplasty balloons (and in relation with the artery diameter)

• balloon expandable covered stent - Covered / Not covered (see ref 3)

Consider the use of a self-expandable covered stent (Viabhan) in long lesions or balloon expandable covered stents as alternatives (ref 4):

BALLOON-EXPANDABLE COVERED STENTS				
Brand/Company	Diameters	Extension	Introducer	Material
VBX (Gore)	5-11mm (expandable to 16mm)	15 to 79 mm	7-8F*	Steel + PTFE (coated surface)
V12 (Getinge)	5-10mm	16 to 59 mm	6-7F	Steel + PTFE
V12 large diameter (Getinge)	12mm (expandable to 16mm)	29 to 61 mm	9F	Steel + PTFE
Lifestream (BD)	5-12mm	16 to 58 mm	6-8F	Steel + PTFE
Begraft Peripheral (Bentley)	5-10mm	18 to 58 mm	6-7F	Chromium Cobalt + PTFE
Begraft Peripheral Plus (Bentley)	5-10mm	27 to 58 mm	7-8F	Chromium Cobalt + PTFE (double layer)
I Cover (I vascular)	5-10mm	17 to 57 mm	6-7F	Chromium Cobalt (CoCr L605) + PTFE (double layer)

Closing

Similar to the notes on ILIAC ARTERIES ANGIOPLASTY AND STENTING

6-8F femo/angioseal

10-14 F 1 Proglide/prostyle

>14F 2 Proglides/prostyles

FEMORAL / POPLITEAL ANGIOPLASTY
TECHNIQUE & MATERIALS

Preliminary notes
Patients with femoropopliteal peripheral arterial disease often have a multilevel disease, either in the aorto-iliac or distal sectors. Revascularization of the most proximal sector should be performed first. Likewise for a satisfactory clinical result, obtaining at least one permeable distal artery up to the foot may be necessary.
The proposed approach is aimed only at chronic lesions and primary interventions, and in acute/subacute cases or re-occlusions, another type of approach or associated procedures should be considered.

Access
The puncture should always be ultrasound guided and in most cases only with local anesthesia.

Placement of a 4Fr to 6Fr introducer (if the use of a stent or other devices is necessary, check compatibility). In case of contralateral retrograde access, crossover, and placement of a 6Fr long sheath in the external iliac artery/common femoral artery are required.

Depending on some characteristics, the following accesses should be chosen:

1. Anterograde puncture:
balloons/stents with a shorter stem/catheter should be chosen (whenever possible this one should be the first choice)

2. Retrograde puncture:
long-stem/catheter balloons/stents should be chosen.
Ideal for lesions in the first few centimeters of the superficial femoral artery and in obese patients,
need for crossover in the aortic bifurcation and introduction of a 6Fr or 7Fr sheath (Destination, Terumo) as distal as possible.

3. Access alternatives
• Contralateral femoral puncture - lesions in the first centimeters of the superficial

femoral artery
• Contralateral access in superficial femoral artery in very obese patients plus lesion in the superficial femoral artery- contralateral puncture + crossover
• Anterograde puncture of the superficial femoral artery.
• Upper limb (humeral or radial)
• Retrograde puncture of the superficial femoral, popliteal, or distal arteries.

Crossing

• Arteriography for lesion characterization: stenosis/occlusion, lesion extent, calcification degree, chronic/subacute.
• Heparinization, usually 5000 units of unfractionated heparin (100 UI/kg) (or 50 a 100 UI/Kg)
• Crossing:

A) Intraluminal: whenever possible this approach should be tried, especially in stenosis, short occlusions and with little calcification.

Materials commonly used:

Guidewires: 0.018 or 0.35 angled (0.035" Terumo Standard, Stiff 0.035" Terumo, V18 - Boston Scientific; Command, Connect – Abbott; Radiofocus Guidewire, Advantage – Terumo)

Catheters: Berenstein or multipurpose 4 or 5Fr, use of low-profile support catheters (eg. Navicross) or low-profile angioplasty balloons.

Also consider:
• Glidecath
• Vertebral
• Straight catheter
• Support catheter (eg. NAVICROSS)

In case of occlusions, consider CTO 0.018 or 0.014 wires (eg. Connect 250T, Hi-torque winn – Abbott; Astat 30 – Asahi).

B) Subintimal: alternative to intraluminal recanalization, when this is not possible, whi-

ch often occurs in long occlusions.

Materials commonly used:

Guidewires: 0.018 or 0.35 resistant and angled, straight and more rigid wires can be used in a second approach. (eg. V18 - Boston Scientific; Command, Connect – Abbott; Radiofocus Guidewire, Advantage – Terumo)

Catheters: Berenstein 4 or 5Fr; long low-profile support catheters (eg Navicross).

Possibility of re-entry devices (Outback - Cordis; Pioneer Philips), if re-entry is not possible either by an antegrade and/or retrograde route.

C) Retrograde: Puncture of a healthy vessel downstream of the lesion (distal superficial femoral artery, popliteal artery, or a tibial vessel).
Echo-guided or fluoroscopy-guided puncture. Initial attempt at intraluminal retrograde recanalization; if unsuccessful, subintimal retrograde recanalization is performed.

Materials commonly used:

Guidewires: 0.018 (eg. V18 - Boston Scientific; Command, Connect - Abbott)

Usually no introducer needed - use of low-profile support catheters or use of 3Fr micro puncture kit – Cook

Treating

• Arterial dilatation/pre-dilatation with a simple balloon:
Usually with balloons 1 mm smaller than the diameter of the artery (4 or 5 mm).
Angioplasty balloons - to be defined according to each procedure

• 6*100 mm • 6*40 mm
• 5*100 mm • 5*40 mm
• 4*100 mm• 4*40 mm
Long insufflations (3-5 min) are recommended to reduce the incidence of flow-limiting dissections.
In case of recoil, persistent stenosis or flow-limiting dissection, angioplasty for longer

periods is recommended, and different balloon diameters can be used.
Typical indications for stent use are recoil, residual stenosis (greater than 30%) or flow-limiting dissections, as well as anatomically complex, highly calcified lesions (eccentric calcification), long occlusions

The treatment proposal based on the type of lesion:

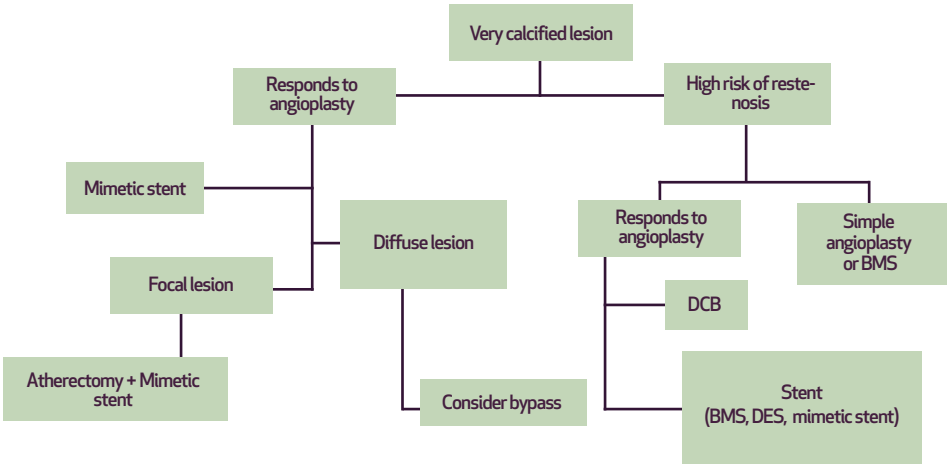

Figure 1: Treatment proposal according to the type of lesion. (DCB - Drug coated balloon. BMS: bare metal stent. DES - Drug eluting stent)
Based on: KOEN DELOOSE. Lesion-Specific SFA Device Selection VOL. 18, NO. 9 SEPTEMBER 2019 ENDOVASCULAR TODAY

Self-expanding stent (measures will depend on the lesion)

Simple angioplasty: Pre-dilatation in simple and short lesions (5mm or 6mm).
However, we can always pre-distend in long lesions

• Primary stenting SFA (ref 5)
• Coated stent: Viabahn in long lesions or in-stent lesions
• Claudication: is it not treated? Treat in "disabling claudication if BMT not succeeded?" (ref. 6)
• Stent with drug / DES (ref. 7)
• Balloon with drug (ref. 8)

Closing

1. Manual compression
2. Closing system:
Proglide or Femoseal (see previous notes on iliacs)

DISTAL ANGIOPLASTY
TECHNIQUE & MATERIALS

Access
An antegrade femoral access is preferred (after having excluded, through imaging, relevant lesions upstream, as well as in the initial segment of the superficial femoral artery)
Echo-guided femoral artery puncture and placement of a 4-6F sheath

In more complex cases needing to maximize support, a 45 cm 4-6F sheath can be placed up to the third portion of the popliteal artery.

Crossing
A 0.014" or 0.018" guide with moldable hydrophilic tip and semi-rigid to rigid body should be used as the workhorse wire (Terumo Glidewire Advantage; Abbott Command 14 ES or Command 18 ST; Boston Scientific V18)
The selection of the different below the knee vessels can take place only with the guide after the tip has been molded or with a Bernstein 4F catheter
Consider the use of a support catheter 0.018"(Terumo Navicross; Boston Scientific Rubicon; Cook CXI)

Treatment
Angioplasty balloons – Length and diameter should be defined according to the target lesion. The option of using a balloon with drug should always be decided depending on the injury and, ultimately, on the experience of the health professional:
Consider low-profile angioplasty balloons to prepare heavily calcified lesions that are not crossable with standard balloons (Cook, Boston, Biotronik, Terumo, Abbott)
Consider performing sequential angioplasty with increasing diameter balloons
Extended inflation time (2 min) is recommended.
For short focal lesions consider the use of a drug eluting stent
For long lesions: only POBA – probably in the future atherectomy + DCB

Closing
See iliac and femoral angioplasty comments

Ticks & tips

Alternative Techniques:
To be used when it is not possible to cross an occlusion with anterograde techniques:

Retrograde puncture
- 21G needle 4 cm (foot) or 7 cm (leg) in length
- X-ray guided (with proximal injection of contrast) or echo-guided
- A 0.018" guide with moldable hydrophilic tip and rigid body should be used (Abbott Command 18 ST; Boston Scientific V18, Terumo Advantage)
- Consideration may be given to placing an introducer with an external diameter of 4F (Cook Micropuncture Pedal Introducer Access Set) in punctures at leg level
- Advance guide with/without support catheter (even though preferably without)
- After successfully having crossed the occlusion retrogradely, snaring the guide into a Bernstein 4F catheter (achieving continuity of the created antegrade and retrograde subintimal spaces may involve several techniques such as the rendez-vous technique)
- Treat the vessel
- At the end of the procedure, hemostasis can be achieved by extrinsic compression with/without low pressure balloon angioplasty and prolonged inflation

Pedal-plantar loop technique
- A 0.014" guide with hydrophilic floppy tip and semi-rigid or floppy body should be used (Abbott Command 14; Terumo Runthrough NS floppy)

III AAA /TAAA
AAA
ENDOVASCULAR TREATMENT OF THE ABDOMINAL AORTIC ANEURISM

TECHNIQUE & MATERIALS

Access
Two possibilities:

• Bilateral access to the common femoral artery with its Exposure

• Alternatively, in some cases, EVAR can be performed through percutaneous puncture, always with echo-guided puncture. In this case, a closure device is previously introduced / prepared (depending on the closure device) (ref. 1,2,3).

Note[1]: In some cases, a retroperitoneal approach may be necessary by dissecting the common iliac artery, with an 8 mm Dacron straight prosthesis anastomosis that will serve as access for the introduction of the endoprosthesis (ref. 4)

Note[2]: Heparinized patient with an activated clotting time ≥ 300 sec. This anticoagulation level is maintained throughout the procedure (ref. 5,6).

Procedure
A. Introduction
1. Guided by a 0.035 mm hydrophilic guidewire (Radiofocus Guidewire Standard, Terumo), a
"pigtail" catheter (Cordis or COOK) is positioned above the proximal neck of the aneurysm.

2. Study of the anatomy of the patient's aorta, iliac arteries and aneurysm. The endovascular prosthesis should be chosen considering the advantages and disadvantages of each one - several numbers of prostheses (close to the chosen one), several iliac extensions, as well as "cuffs" or proximal extensions should be available (ref. 7,8,9).

B. Catheterization

1. Main Branch

• 60 cm "pigtail" catheter (different brands) and introduction of extra-rigid guidewire (Lunderquist – Cook, Amplatz - Boston Scientific, BackupMeier – Boston Scientific or Advantage - Terumo) to conduct the endoprosthesis to the proximal neck of the aneurysm.

• Bifurcated endovascular prosthesis, a second extra-rigid guidewire guide on the contralateral leg. The rigid guide on the main body helps to keep the bifurcated endoprosthesis fixed during manipulation for implantation of the contralateral branch.

• Main body positioned immediately below the lower renal artery and oriented in order to allow easy access to the contralateral branch.

2. Contra-lateral branch catheterization

• Advance 0.035" hydrophilic guidewire (Radiofocus GuideWire, Terumo).

• Placement of a pigtail catheter (different brands) above the renal arteries.

C. Main body and branches of the endoprosthesis

1. Angiography with marking of the lower renal artery (in the best projection for visualization of the lower renal artery)

2. Opening of the prosthesis in a juxtarenal positioning, that is, opening of the prosthesis up to the height of the contralateral branch

3. Branch catheterization (favour the use of short catheters, 45 cm / 60 cm):

• Beacon Tip VanSchie (COOK)

• Berenstein (Boston)

• Cobra (Radiofocus, Terumo)

• Vertebral (Radiofocus, Terumo)

4. Confirmation with a pigtail catheter or an equivalent one of the correct catheterization of the contralateral branch: Use the pigtail or NC inflatable balloon (different brands)

5. Final opening of the main body and bi-iliac extension with angiographic control through hypogastric visualization

6. Extension of the bi-iliac arteries, always up to the hypogastric ones, with angiographic control of the same.

7. Final Biplane Angiography with Pigtail and hydrophilic guidewire at the contralateral artery:

• Injections with volumes: between 10 and 15 ml

• Speed: 20 sec
• Pressure: 600 and 800 PSI
8. Initial and final angiography in apnea

D.Closing
• Artery direct or percutaneous closure (Proglide, Abbott; or Manta, Teleflex) (ref 10,11).

TAAA

ENDOVASCULAR TREATMENT OF THE AORTIC ANEURYSM WITH FENESTRATED ENDOPROSTHESIS (REF 12)

TECHNIQUE & MATERIALS

Preliminary notes

Study of the patient's aorta artery, iliac arteries and aneurysm anatomy. The endovascular prosthesis should be chosen taking into account: aorta characteristics (parietal thrombus, angulations, calcium), visceral vessels (gauge, orientation, origin in healthy or aneurysmal aorta), femoral/iliac accesses (diameter, angulations, calcium).

Access

Two possibilities:

1 Bilateral access to the common femoral artery with its exposure

2 Alternatively, in some cases, EVAR can be performed through percutaneous puncture, always with echo guided puncture. In this case, a closing device is introduced in advance (depending on the closing device).

Note 1: In some cases, a retroperitoneal approach may be necessary, dissecting the common iliac artery, with anastomosis of an 8mm straight Dacron prosthesis that will serve as access for the introduction of the endoprosthesis (ref. 4).

Note 2: Heparinized patient with an activated clotting time ≥ 300 sec. This level of anticoagulation is maintained throughout the procedure (ref. 5,6).

Procedure

• 60cm pigtail catheter (different brands) and extra-rigid guidewire introduction (Lunderquist, Cook; BackupMeier, Boston: or Advantage, Terumo) to guide the endoprosthesis to the proximal neck of the aneurysm.

Guided by a 0.035mm hydrophilic guide (Radiofocus Guidewire Standard, Terumo), a pigtail catheter (Cordis or COOK) is positioned above the renal arteries.

• Orientation of the fenestrated prosthesis outside the patient and placement of the endoprosthesis in the aorta respecting the previously established orientation. Confirmation of placement in the aorta.

Angiography to identify the renal arteries and endoprosthesis release in its cephalo-

caudal orientation, making the fenestrae for the renal arteries coincide with the respective ostia.
Removal of pigtail and catheterization of fenestrated endoprosthesis for placement of rigid guide and 18F sheath
Arch angulation for deprojection of each fenestra and catheterization of the fenestra and the respective visceral vessel.

- Berenstein (Boston)
- Cobra (Radiofocus, Terumo), Shepherd Hook (Cordis), uni select (Cordis)
- Vertebral (Radiofocus, Terumo)

Replacement of hydrophilic guide with rigid guide (Rosen, Amplatz) and introduction of a 6/7F sheath in the target vessel. (Note: in the case of 3/4 fenestrae only two fenestrae will have sheaths and the remaining ones will only have guides)
Complete release of the fenestrated endoprosthesis and eventual balloon dilatation
Placement of the respective stents in the visceral vessels and post dilatation with a 10/12 mm balloon (flare)
Bifurcated endovascular prosthesis release after aortic bifurcation angiography.
Catheterization of the contralateral branch (the use of short catheters, 45cm/60cm should be privileged):

- Beacon Tip VanSchie (COOK)
- Berenstein (Boston)
- Cobra (Radiofocus, Terumo)
- Vertebral (Radiofocus, Terumo)

Confirmation with a pigtail catheter or equivalent of the correct catheterization of the contralateral branch: Use the pigtail or NC inflatable balloon (different brands).

Completion of the opening of the main body and bi-iliac extension with angiographic control and visualization of the hypogastric arteries.
Balloon dilatation of the bifurcated prosthesis and iliac extensions

Final Biplanar Angiography with Pigtail and hydrophilic guidewire on the contralateral side:

- Injections with volumes: between 15 and 20ml
- Speed: 20sec
- Pressure: 600 and 800PSI

Initial and Final Angiography in Apnea

Closure systems

• Direct artery or percutaneous closure (Proglide, Abbott; or Manta, Teleflex)

Tips & Tricks (13, 14, 15, 16)

IV VISCERAL ANEURISMS
EMBOLIZATION OF VISCERAL ANEURISMS
TECHNIQUE & MATERIALS (REF. 1,2)

Access
• Femoral access is usually preferred; consider (left) brachial access depending on the celiac trunk anatomy

Catheterization and navigation

• Selective catheterization of the celiac trunk (prefer 4/5F hydrophilic catheters such as Terumo Glidecaths with dedicated shape – Simons 1.2; Cobra 1.2; Yashiro)
• Hydrophilic guidewire with regular body and curved tip 0.035" x 260 cm (Terumo Glidewire)
• A more rigid guidewire for the placement of a sheath (Cook Rosen; Terumo Glidewire Stiff Curved Tip or Terumo Glidewire Advantage 0.035" x 260 cm)
• Placement of a hydrophilic sheath in the splenic artery (location depending on the segment of the artery to be treated and the anatomy; sheath caliber to be determined by the planned procedure: covered stent placement versus embolization)

Treatment
Covered stent (preferred technique for the proximal third of the splenic artery) (ref 3)
• Prefer self-expanding covered stents (Viabahn, Gore)
• In some circumstances, a balloon-expandable covered stent can be considered (Viabahn VBX, Gore; Papirus, Biotronik; BeGraft, Bentley)
• In circumstances where a 0.018" platform is chosen, prefer guidewires with a rigid body and flexible hydrophilic tip such as the Terumo Glidewire Advantage 0.018" or Abbott Command ST
Embolization (preferred technique for the middle and distal third of the splenic artery) (ref 4)
• Place the hydrophilic catheter as distal as possible
• Navigating with microcatheter (Terumo Progreat 2.9F and associated microguide – Radiofocus GT Wire, Terumo)
• Distal and proximal release of coils (prefer detachable volume coils – Terumo AZUR and AZUR CX; if the release of coils in the aneurysmal sac is necessary, start with a framing coil (Terumo Azur Framing Coil; thrombogenic coils can also be considered

(Nestor or Tornado,COOK)

*Consider alternative techniques such as the stent-assisted coiling technique

V CAROTID
CAROTID ANGIOPLASTY AND STENT PLACEMENT

Preliminary notes
Patients receive aspirin in a dose of 80-100mg / day and Clopidogrel in a dose of 75 mg / day, both starting at least six days before the procedure (ref. 1). As an alternative - a loading dose of clopidogrel 300 mg the night before the procedure. Aspirin should be maintained indefinitely and Clopidogrel for at least 3 to 6 months after the intervention.

TECHNIQUE & MATERIALS
Access
The access decision should be based on the image and with a special focus on the study of the aortic arch. Femoral / radial accesses should be considered. Situations that may contraindicate femoral access (formal or relatively) are presence of vascular prostheses, aneurysms, long occlusive disease, "shaggy" aorta, aortic arch pathology or unfavorable morphology.

Consider cervical surgical access (Silk Road T- CAR - Trans Carotid Artery Revascularization) as alternatives to avoid manipulation of the aortic arch with direct approach of the common carotid artery at the base of neck and the brachial access (useful on the right or also on the left if there is a bovine aortic arch).

A. Introducers: after percutaneous puncture of the femoral artery with a 5F or 6F introducer (Radiofocus Introducer II, Terumo)

The puncture must always be echo-guided with local anesthesia. Avoid the use of sedatives and other drugs that impair the patient's collaboration and his/her neurological evaluation during the procedure.

B. Guidewire in the aortic arch (hydrophilic 0.035 x 260 mm - (Radiofocus Guidewire, Terumo)

Anticoagulation with 100 U / kg unfractionated heparin should take place next.

Crossing

A. Common carotid catheterization to be managed with Glidecath vertebral 4F – 120, MP or Headhunter catheter (usually the first options).

Note: consider the use of dedicated and Steerable catheters (Piton GC, Medtronic; TourGuide Medtronic)

B. Diagnostic angiography (have the utmost caution with gas embolization, so all materials must be purged and the use of 3-way taps is mandatory) and projection of the carotid bifurcation.

C. Placement of wire in the external carotid artery and change it for a rigid wire (Rosen, COOK; Amplatz, COOK or Boston). The use of the ADVANTAGE guide, Terumo should also be considered.

D. Stabilize the sheath on the common carotid artery (Destination, Terumo; or Flexor, by COOK). If the Mo.Ma brain protection system (Medtronic) is used, a sheath is not necessary.

E. Road-mapping to pass the stenosis with a Cerebral Protection Filter (FPC) and its positioning in the distal internal carotid artery.

Adopt protection in patients at risk (symptomatic)
In asymptomatic patients no protection should be considered

Can use:

• Flow inversion - Mo.MA (Medtronic)

• Filters:
Emboshield (Abbott)
Spider FX ((Medtronic)
Filterwire EZ (Boston)

Treatment

Placement of a self-expanding dual layer stent that advances over the filter and should be positioned at the level of the stenosis.

In cases of impossibility to advance the filter due to severe stenosis, it can be crossed by a 0.014 guidewire and the angioplasty can be performed with a 30 / 20 mm diameter balloon (maneuver to be avoided)

Stent (ref 6)

*Roadsalvationr (Terumo) - Attention to the double mesh marks that must be positioned on the stenosis center.

Post-dilatation balloon
*Balloons over the wire and with short measures (2 cm) for 0.014 wires for post ballooning of the internal carotid artery intrastent segment only

Closing (ref 7)

* Angioseal (Terumo), Femoseal (Terumo), Mynx (Cordis)

VI VENOUS

ENDOVASCULAR TREATMENT OF THE PELVIC VENOUS CONGESTION SYNDROME (REF 1,2)

TECHNIQUE & MATERIALS

Access

Access can take place either through the both femoral vein or through the jugular veins, either basilic or cephalic ones.

- echo-guided puncture of the *sangradouro* vein (eg. basilic or cephalic vein in the cubital fold)
- 4F or 5F introducer (Radiofocus Introducer II, Terumo)
- After being confirmed the dilatation and venous reflux, the selective catheterization of the vessel must take place (Multipurpose, Vertebral or Mammary 5F Glidecath, Terumo)
- Placement of the guidewire and catheter in the most distal possible position

Note: Ileoangiography of the ovarian and hypogastric veins with the patient in a prone position

Treatment (Embolization)

Materials (ref 3,4)

- Polidocanol (Etoxisclerol® - or its ICD - lauromacrogol 400) 2%, Rubeaspharma)
- Volume coils (AZUR and AZUR CX, Terumo) and non-thrombogenic ones

Treatments have been reported with both liquid agents and solid agents such as coils and plugs, that can be used alone or in combination. In general, the choice of the embolic agents is up to operators'experience and preferences, since clinical and technical success rates are high for all of them. Endovascular treatment is essentially aimed at treating ectatic vessels; there is no agreement in the literature on how many vessels should be treated (ref. 5)

The release of coils should begin at the lower aspect of the ovarian vein, trying to avoid the occlusion of the deep pelvic plexus; stainless steel or fibered platinum coils

of several sizes can be used.

Embolization with glues, possibly in association with coils, is a valid alternative in the treatment of pelvic venous congestion syndrome. Enbucrilate, also known as n-Butyl cyanoacrylate, n-BCA or NBCA, is a liquid embolic system, composed of cyanoacrylate, which is usually administered mixed with lipiodized oil to increase its radiopacity.

Mixed Technique

• Embolization of pelvic varicose veins with 2% dense foam - preparation with foam passage 40 times at least)
• Selective catheterization and vessel embolization with volume coils
• Placement of the first coil as distal as possible with controlled release, followed by foam application and so on until the last vanishing point
• Controlled release of volume coils with a minimum oversize of 30% to 40%, with exclusion of the hypogastric branches in which the oversize should
• be always 50% - (embolize always the selected branches and never the hypogastric trunk).

It seems that there is no statistically significant difference in performing an unilateral or bilateral procedure, in terms of clinical outcome

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https://pubmed.ncbi.nlm.nih.gov/31926836/

2020 : no associations between PTX and midterm mortality

"A total of 2 071 patients were analysed: 966 patients (46.6%) were treated with PTX (952 [46%] had CLTI and 1 119 [54%] severe claudication [Rutherford stage 3]). Over a 24 months median follow up, 456 (22.1%) patients died. Using multivariable Cox regression, PTX was not associated with mortality (HR 0.94, p = .46), even when assessed separately for those with intermittent claudication (HR 1.30, p = .15) or CLTI (HR 0.81, p = .060). In the case matched analysis (885 matched pairs of patients), PTX was not associated with mortality (HR 0.89, p = .17). Paclitaxel dose and use of a DCB or DES were not associated with mortality in any subanalysis. When relevant risk factors were taken into account, there were no associations between PTX and mid-term mortality in patients with PAOD"

In:
Paclitaxel and Mortality Following Peripheral Angioplasty: An Adjusted and Case Matched Multicentre Analysis
Athanasios Saratzis, Talia Lea, Trixie Yap, Andrew Batchelder, Benedict Thomson, Prakash Saha, Athanasios Diamantopoulos, Nikos Saratzis, Robert Davies, Hany Zayed
Eur J Vasc Endovasc Surg. 2020 Aug;60(2):220-229.
doi: 10.1016/j.ejvs.2020.04.008. Epub 2020 May 1.
https://pubmed.ncbi.nlm.nih.gov/32370918/

9.
DEB BTK (infrapopliteal)

"DCB is safe and effective for recurring infrapopliteal disease. It outperforms the objective performing goals for CLI patients with clinical and anatomical high-risk features."
In:
Drug-coated balloon angioplasty for the management of recurring infrapopliteal disease in diabetic patients with critical limb ischemia
Luis M Palena, Larry J Diaz-Sandoval, Efren Gomez-Jaballera, Olga Peypoch-Perez, Enrico Sultato, Cesare Brigato, Enrico Brocco, Marco Manzi
Cardiovasc Revasc Med. Jan-Feb 2018;19(1 Pt B):83-87.
doi: 10.1016/j.carrev.2017.06.006. Epub 2017 Jun 20.
https://pubmed.ncbi.nlm.nih.gov/28648324/

but:
"Based on this systematic review and meta-analysis no significant differences in limb salvation, survival, restenosis, TLR, and AFS rates were found when DCB angioplasty was compared with standard PTA"

In:
Editor's Choice - Drug Coated Balloon Angioplasty vs. Standard Percutane-ous Transluminal Angioplasty in Below the Knee Peripheral Arterial Disease: A Systematic Review and Meta-Analysis
Jetty Ipema, Eline Huizing, Michiel A Schreve, Jean-Paul P M de Vries, Çağdaş Ünlü
Eur J Vasc Endovasc Surg. 2020 Feb;59(2):265-275.
doi: 10.1016/j.ejvs.2019.10.002. Epub 2019 Dec 27.

&
2021:

"Different angles of interpretation of the data, important missing data, and pertinent types of biases have been touched upon to allow for a more educated appraisal of the available evidence to date. In the meantime, most individual patient data from large, randomized studies remain inaccessible, thereby prohibiting replication and more in--depth analyse"
In:
The Rollercoaster of Paclitaxel in the Lower Limbs and Skeletons in the Closet: An Opinion Review
Konstantinos Katsanos, Panagiotis Kitrou, Stavros Spiliopoulos
Journal of Vascular and Interventional Radiology, 2021-06-01, Volume 32, Edition 6, Pages 785-791
https://doi.org/10.1016/j.jvir.2021.03.537

III
AAA /TAAA

Percutaneous access versus cutdown access:

1.
"PEVAR is a safe and efficacious approach with a similar technical success rate and a lower incidence of complications compared to OFA. Due to shorter procedure times, PEVAR should be the preferential approach."
In:
Safety and Efficacy of Totally Percutaneous Access Compared With Open Femoral Exposure for Endovascular Aneurysm Repair: A Meta-analysis.
Cao Z, Wu W, Zhao K, Zhao J, Yang Y, Jiang C, Zhu R.
J Endovasc Ther. 2017 Apr;24(2):246-253. doi: 10.1177/1526602816689679.
https://pubmed.ncbi.nlm.nih.gov/28164730/

2.
"A trend towards fewer complications was seen in the arteriotomy closure devices group (i.e., seroma, dehiscence, femoral neuropathy, and SSIs). (…) but more pseudo--aneurysms are found when compared with surgical cutdown."

In:
Editor's Choice - Arteriotomy Closure Devices in EVAR, TEVAR, and TAVR: A Systematic Review and Meta-analysis of Randomised Clinical Trials and Cohort Studies.
Eur J Vasc Endovasc Surg. 2017 Jul;54(1):104-115.
doi: 10.1016/j.ejvs.2017.03.015.
https://pubmed.ncbi.nlm.nih.gov/28164730/

3.
"Percutaneous EVAR appears to be safe and effective having comparable clinical outcomes with conventional EVAR performed by surgical exposure of the femoral arteries. The duration of the procedure is shorter than cutdown EVAR, and it can be considered in patients in whom local anaesthesia is deemed a better anaesthetic option. Furthermore, a percutaneous approach may be a suitable option for patients undergoing ambulatory EVAR, who have reduced requirements for analgesia and monitoring of surgical sites for seroma or infection."
In:
Percutaneous Access Does Not Confer Superior Clinical Outcomes Over Cutdown Access for Endovascular Aneurysm Repair: Meta-Analysis and Trial Sequential Analysis of Randomised Controlled Trials.
George A. Antoniou, Stavros A. Antoniou
Eur J Vasc Endovasc Surg. 2021 Mar;61(3):383-394.
doi: 10.1016/j.ejvs.2020.11.008. Epub 2020 Dec 10.
https://pubmed.ncbi.nlm.nih.gov/33309488/

Retroperitoneal approach / Iliac conduit

4.
"Iliac Conduits are a safe and viable option for high-risk patients with challenging iliac artery access for EVVAR. ICs are best performed in a planned fashion or in a staged manner, when feasible"
In:
Iliac conduits remain safe in complex endovascular aortic repair
Jarrad W Rowse, Katherine Morrow, James F Bena, Matthew J Eagleton, Federico E Parodi, Christopher J Smolock
J Vasc Surg. 2019 Aug;70(2):424-431.
doi: 10.1016/j.jvs.2018.10.099. Epub 2018 Dec 28.
https://pubmed.ncbi.nlm.nih.gov/30598354/

Use of heparin:

5.

"The use of heparin is a general vascular surgery principle. Accepted doses range between 50 and 100 IU/kg, and heparin efficacy may be tested using an activated clotting time (ACT) test to ensure adequate anticoagulation."

In:

Prophylactic perioperative antithrombotics in open and endovascular abdominal aortic aneurysm (AAA) surgery: a systematic review.

Wiersema AM, Jongkind V, Bruijninckx CM, Reijnen MM, Vos JA, van Delden OM, et al.

Eur J Vasc Endovasc Surg. 2012 Oct;44(4):359-67.

doi: 10.1016/j.ejvs.2012.06.008. Epub 2012 Jul 24.

https://pubmed.ncbi.nlm.nih.gov/22831869/

&

6.

Pro: activated clotting time should be monitored during heparinization for vascular surgery.

Jordan E Goldhammer, Darin Zimmerman,,J Cardiothorac Vasc Anesth. 2018 Jun;32(3):1494-1496.

doi: 10.1053/j.jvca.2017.04.047. Epub 2017 Apr 26.

https://pubmed.ncbi.nlm.nih.gov/28943189/

Choice of stent-graft:

7.

"There are no data that convincingly favour any of the above features or one particular EVAR device over another. Comparative studies are lacking and given the rapid technological development, even within the same branding, device specific studies are rapidly outdated. Pending further evidence, local preference and experience should therefore guide device selection."

In :

Editor's Choice - European Society for Vascular Surgery (ESVS) 2019 Clinical Practice Guidelines on the Management of Abdominal Aorto-iliac Artery Aneurysms.

Wanhainen A, Verzini F, Van Herzeele I, Allaire E, Bown M, Cohnert T, Dick F et al.

Eur J Vasc Endovasc Surg. 2019 Jan;57(1):8-93.

doi: 10.1016/j.ejvs.2018.09.020. Epub 2018 Dec 5.

doi: 10.1016/j.ejvs.2018.09.020.

https://pubmed.ncbi.nlm.nih.gov/30528142/

8.
"In cases of hostile infra-renal neck morphology, Active Suprarenal Fixation appears to be used more frequently. Our data suggest that ASF may be useful for certain patients but may be unfavourable for others, such as those with wide necks or several difficult neck features. Nevertheless, further research is needed to evaluate more optimal treatment options, such as fenestrated EVAR, branched EVAR, and endovascular adjuncts such as EndoAnchors (Aptus Endosystems, Sunnyvale, Calif), in dealing with high-risk anatomic characteristics that may not be optimally managed with standard EVAR devices with active fixation"
In:
Outcomes of using endovascular aneurysm repair with active fixation in complex aneurysm morphology
Rami O Tadros, Alex Sher, Windsor Ting, Michael Marin, Peter Faries
J Vasc Surg.2018 Sep;68(3):683-692.
doi: 10.1016/j.jvs.2017.12.039.Epub 2018 Mar 13.
https://pubmed.ncbi.nlm.nih.gov/29548813/
9.
"This is the first report to show a significant increase in operative mortality in patients undergoing EVAR with severely angulated suprarenal neck. Patients who survive the operation are at increased risk of secondary interventions. These findings suggest that EVAR should be used with caution in patients with severe - angulation and support the role of close follow-up in this particular population."
In:
Impact of suprarenal neck angulation on endovascular aneurysm repair out-comes
Asma Mathlouthi, Satinderjit Locham, Hanaa Dakour-Aridi, Mahmoud B Malas, James H Black, J Vasc Surg. 2020 Jun;71(6):1900-1906.
doi: 10.1016/j.jvs.2019.08.250. Epub 2019 Nov 8.
https://pubmed.ncbi.nlm.nih.gov/31708299/

Closure devices

10.
"In patients undergoing transfemoral TAVI, the MANTA VCD showed a similar risk of VARC-2 vascular and bleeding complications compared to the ProGlide VCD, but it reduced significantly the need of additional vascular closure devices for completion of hemostasis."

In:
MANTA versus ProGlide vascular closure devices in transfemoral transcatheter aortic valve implantation.
Biancari F, Romppanen H, Savontaus M, Siljander A, Mäkikallio T, Piira OP, Piuhola J, Vilkki V, Ylitalo A, Vasankari T, Airaksinen JKE, Niemelä M.
Int J Cardiol. 2018 Jul 15;263:29-31.
doi: 10.1016/j.ijcard.2018.04.065. Epub 2018 Apr 14.
https://pubmed.ncbi.nlm.nih.gov/29681408/

11.
"The MANTA device demonstrated a short time to hemostasis and low complication rates compared with published literature results of other percutaneous closure devices. (…) The MANTA device provides reliable closure with a single percutaneous device for PEVAR/TEVAR procedures."
In:
Pivotal Clinical Study to Evaluate the Safety and Effectiveness of the MANTA Vascular Closure Device During Percutaneous EVAR and TEVAR Procedures.
Krajcer Z, Wood DA, Strickman N, Bernardo N, Metzger C, Aziz M, Bacharach JM, Nanjundappa A, Campbell J, Lee JT, Dake MD, Lumsden A, Nardone S.
J Endovasc Ther. 2020 Jun;27(3):414-420.
doi: 10.1177/1526602820912224. Epub 2020 Mar 20.
https://pubmed.ncbi.nlm.nih.gov/32193971/

Overview TAAA

12.
"Based on the results reported in the literature, regardless of its complexity and costs, fEVAR for jrAAA has been accepted in substantial number of hospitals worldwide, while number of reported procedures is reaching OR."
In:
The role of fEVAR, chEVAR and open repair in treatment of juxtarenal aneurysms: a systematic review
Igor B Končar, Aleksa L Jovanović, Stefan M Dučič
J Cardiovasc Surg (Torino). 2020 Feb;61(1):24-36.
doi: 10.23736/S0021-9509.19.11187-1.
https://pubmed.ncbi.nlm.nih.gov/32079378/

13.
"In the reported case, the use of coronary stents was a safe and long-lasting solution

to rescue an iatrogenic renal artery dissection during F/B-EVAR."
In:
An Original Bailout Solution for Renal Artery Dissection after Fenestrat-ed/Branched EVAR
Alice Lopes, Miguel Lemos Gomes, Ryan Melo, Pedro Amorim, Gonçalo Sobrinho, Luís Mendes Pedro, Ann Vasc Surg. 2020 May;65:286.e1-286.e4.
doi: 10.1016/j.avsg.2019.11.006. Epub 2019 Nov 8.
https://pubmed.ncbi.nlm.nih.gov/31712189/

14.
"This article summarizes the basic concepts of device design, case planning, techniques of implantation, and some of the "bail-out" maneuvers that may be required during endovascular repair using the Zenith fenestrated stent-graft system."
In:
Technique of implantation and bail-out maneuvers for endovascular fenes-trated repair of juxtarenal aortic aneurysms
Gustavo S Oderich, Bernardo C Mendes, Karina S Kanamori
Perspect Vasc Surg Endovasc Ther. 2013 Jun;25(1-2):28-37.
doi: 10.1177/1531003513512372.
https://pubmed.ncbi.nlm.nih.gov/24317632/

15.
"FEVAR after previous FEVAR is a feasible and efficient treatment option. The modified "snare-ride" technique can be used to catheterize target vessels in the absence of an Indy snare."
In:
Technique for Fenestrated Stent-Graft Implantation as a Proximal Extension to a Previous Fenestrated Endovascular Repair for Abdominal Aortic Aneu-rysm
Konstantinos Spanos, Nikolaos Tsilimparis, Franziska Heidemann, Fiona Rohlffs, Christian-Alexander Behrendt, Eike Sebastian Debus,Tilo Kölbel

J Endovasc Ther. 2018 Feb;25(1):16-20.
doi: 10.1177/1526602817745779. Epub 2017 Dec 13.
https://pubmed.ncbi.nlm.nih.gov/29235384/

16.
"FEVAR TIPS & TRICKS FROM SIZING TO CBCT ASSESSMENT"
Gustavo Oderich PP presentation
https://linc2017.cncptdlx.com/media/1405_Gustavo_Oderich_25_01_2017_Room_2_-_Main_Arena_2.pdf

IV VISCERAL ANEURISMS

Overview

1
"Interventional procedures are normally performed under local anaesthesia, with high technical success rates, low complication rates, and shorter hospital stays. (…) Our data analysis yielded a technical success rate of 93.3%"
In:
Visceral artery aneurysms: Incidence, management, and outcome analysis in a tertiary care center over one decade.
Pitton MB, Dappa E, Jungmann F, Kloeckner R, Schotten S, Wirth GM et al.
Eur Radiol. 2015 Jul;25(7):2004-14.
doi: 10.1007/s00330-015-3599-1. Epub 2015 Feb 19.
https://pubmed.ncbi.nlm.nih.gov/25693662/

2
"There are several endovascular methods that an operator may choose to treat visceral artery aneurysms, and selection of the appropriate technique depends on the type and size of aneurysm and the anatomy of the affected artery."
In:
Endovascular management of visceral arterial aneurysms
Hemp JH, Sabri SS.
Tech Vasc Interv Radiol. 2015 Mar;18(1):14-23.
doi: 10.1053/j.tvir.2014.12.003. Epub 2014 Dec 29.
https://pubmed.ncbi.nlm.nih.gov/25814199/

Vessel preservation

3
"In the present single-center series with stent-grafts, the parent visceral artery paten-

cy rate was 81.8% and the sac thrombosis rate was 100% (...) Irrespective of their etiology and acuteness, VAAs can be treated with stent-grafts, with an excellent clinical long-term outcome and a high patency rate."
In:
Stent-graft repairs of visceral and renal artery aneurysms are effective and result in long-term patency.
Künzle S, Glenck M, Puippe G, Schadde E, Mayer D, Pfammatter T.
J Vasc Interv Radiol. 2013 Jul;24(7):989-96. doi: 10.1016/j.jvir.2013.03.025.
J Vasc Interv Radiol.2013 Jul;24(7):989-96.
doi: 10.1016/j.jvir.2013.03.025. Epub 2013 May 30.
https://pubmed.ncbi.nlm.nih.gov/23727420/

Embolization
4
"Embolization has recently gained popularity and is an alternative to open and laparoscopic repair. An 85% success rate with embolization has been reported."
In:
Splenic artery aneurysms: two decades experience at Mayo clinic.
Abbas MA, Stone WM, Fowl RJ, Gloviczki P, Oldenburg WA, Pairolero PC et al.
Ann Vasc Surg. 2002 Jul;16(4):442-9.
doi: 10.1007/s10016-001-0207-4. Epub 2002 Jul 1.
https://pubmed.ncbi.nlm.nih.gov/12089631/

V CAROTID

1.
Combined Anti-platelet Treatment in Carotid Artery Stenting
"The dual anti-platelet regime has a significant impact on reducing adverse neurological outcomes without an additional increase in bleeding complications."
in:
The benefits of combined anti-platelet treatment in carotid artery stenting.
McKevitt FM, Randall MS, Cleveland TJ, Gaines PA, Tan KT, Venables GS.
Eur J Vasc Endovasc Surg. 2005 May;29(5):522-7.
doi: 10.1016/j.ejvs.2005.01.012.

https://pubmed.ncbi.nlm.nih.gov/15966092/

Cerebral protection devices

2.
The use of cerebral protection systems [after CAS] was associated with a lower risk of stroke or death"
In:
Systematic review of the perioperative risks of stroke or death after carotid angioplasty and stenting.
Touzé E, Trinquart L, Chatellier G, Mas JL.
Stroke. 2009 Dec;40(12):e683-93.
doi: 10.1161/STROKEAHA.109.562041.
Epub 2009 Nov 5
https://pubmed.ncbi.nlm.nih.gov/19892997/

3.
"No significant difference was found between carotid endarterectomy and stenting with embolic protection for the treatment of atherosclerotic carotid bifurcation stenosis with regard to the composite end point of stroke, death, or myocardial infarction."
In:
Stenting versus endarterectomy for treatment of carotid-artery stenosis.
Brott TG, Hobson RW 2nd, Howard G, Roubin GS, Clark WM, Brooks W et al; CREST Investigators.
N Engl J Med. 2010 Jul 1;363(1):11-23.
doi: 10.1056/NEJMoa0912321.
Epub 2010 May 26
https://pubmed.ncbi.nlm.nih.gov/20505173/

4.
"carotid-artery stenting with a device to capture and remove emboli ("embolic protection") is an effective alternative to carotid endarterectomy in patients at average or high risk for surgical complications."
In:
1Rosenfield K, Matsumura JS, Chaturvedi S, Riles T, Ansel GM, Metzger DC et al; ACT I Investigators.

Randomized Trial of Stent versus Surgery for Asymptomatic Carotid Stenosis.
N Engl J Med. 2016 Mar 17;374(11):1011-20.
doi: 10.1056/NEJMoa1515706.
Proximal versus distal protection devices

5.
"The number of new ischemic lesions per patient and the incidence of ischemic lesions as seen on post-procedural diffusion-weighted magnetic resonance imaging were significantly greater in the distal protection devices group than in the proximal protection devices group. Most of the new lesions (>90%) were no more than 3 mm in diameter. No difference was found between the clinical periprocedural or 30-day adverse event rates between the 2 groups, suggesting that cerebral microembolism itself might not be associated with the clinical outcomes."
In:
Comparison of Embolic Protection with Proximal and Distal Protection Devices: Periprocedural Complications, Clinical Outcomes, and Cerebral Embolic Lesions on Diffusion-Weighted Magnetic Resonance Imaging.
Kim MS, Rho MH, Hong HP, Park HJ, Chung PW, Won YS.
World Neurosurg. 2020 Mar;135:e731-e737.
doi: 10.1016/j.wneu.2019.12.121.
Epub 2019 Dec 30.
https://pubmed.ncbi.nlm.nih.gov/31899400/

Double-layered stents

6.
"DLS can be safely used for guideline-based treatment of symptomatic or asymptomatic extracranial carotid artery stenosis, allowing a low rate of periprocedural complications and of post-procedural adverse events by 30 days"
In:
Use of Dual-Layered Stents in Endovascular Treatment of Extracranial Stenosis of the Internal Carotid Artery: Results of a Patient-Based Meta-Analysis of 4 Clinical Studies.
Stabile E, de Donato G, Musialek P, De Loose K, Nerla R, Sirignano P, et al.
World Neurosurg. 2020 Mar;135:e731-e737.
doi: 10.1016/j.wneu.2019.12.121.
Epub 2019 Dec 30
https://pubmed.ncbi.nlm.nih.gov/31899400/

Closure devices

7.
"VCDs have shown marked improvement in patients' comfort and satisfaction as well as in time to hemostasis and ambulation after percutaneous vascular procedures."
In:
A systematic review of vascular closure devices for femoral artery puncture sites.
Vincent J Noori, Jens Eldrup-Jørgensen
J Vasc Surg. 2018 Sep;68(3):887-899.
doi: 10.1016/j.jvs.2018.05.019. Epub 2018 Jun 29
https://pubmed.ncbi.nlm.nih.gov/30146036/

VI VENOUS
REFERENCES

Diagnostic imaging

1.
"(...) in over the half of the patients reflux was present in more than one of the pelvic veins. This underscores the importance of selectively visualizing the ovarian as well as the internal iliac venous system in every patient. This complex anatomy, combined with the fact that reflux often affects more than one pelvic vein, makes it difficult to identify and treat all points of reflux, and, on the other hand, facilitates the development of alternative reflux pathways once one refluxing vein has been successfully treated."
"(...) embolization as treatment for isolated OV incompetence gives satisfactory clinical results at 3 years follow-up. In this large cohort of women with PVI, we observed significant improvements in overall pain perception levels after a mean of 45 months of follow-up. Our results were less satisfactory in the presence of combined incompetence of the OV and the IIV, especially if not all of the incompetent veins could be occluded."
In:
Pelvic venous incompetence: reflux patterns and treatment results.
Asciutto G, Asciutto KC, Mumme A, Geier B.
Eur J Vasc Endovasc Surg. 2009 Sep;38(3):381-6.
doi: 10.1016/j.ejvs.2009.05.023.

Epub 2009 Jul 1.
https://pubmed.ncbi.nlm.nih.gov/19574069/

2.
"How should we evaluate the pelvic veins, what are the signs to look for, and what are the currently established criteria for (pre-interventional) imaging."
In:
Arnoldussen CW, de Wolf MA, Wittens CH. Diagnostic imaging of pelvic congestive syndrome.
Phlebology. 2015 Mar;30(1 Suppl):67-72.
doi: 10.1177/0268355514568063.
https://pubmed.ncbi.nlm.nih.gov/25729070/

Treatment

3.
"Clinical success of studies involving mixed percutaneous methods including sclerosant with coil and/or Gelfoam embolization ranges from 83 to 100% (M: 94.9, IQRQ3–Q1: 17.1) in 196 patients".
In:
Pelvic Congestion Syndrome: Systematic Review of Treatment Success.
Brown CL, Rizer M, Alexander R, Sharpe EE 3rd, Rochon PJ.
Semin Intervent Radiol. 2018 Mar;35(1):35-40.
doi: 10.1055/s-0038-1636519.

4.
"Incompetent pelvic veins were treated by embolization during the same procedure according to the sandwich technique using pushable coils and 3% polidocanol foam. (...) Pelvic congestion syndrome was improved in 55 patients (91%)".
In:
Embolization is essential in the treatment of leg varicosities due to pelvic venous insufficiency.
O Hartung

Phlebology. 2015 Mar;30(1 Suppl):81-5.
doi: 10.1177/0268355515569129.
https://pubmed.ncbi.nlm.nih.gov/25729072/

5.
Liquid and Solid Embolic Agents in Gonadal Veins
Francesco Tiralongo, Giulio Distefano,Monica Palermo,Antonio Granata, Francesco Giurazza ,Francesco Vacirca, Stefano Palmucci, Massimo Venturini, and Antonio Basile

J Clin Med. 2021 Apr; 10(8): 1596.
Published online 2021 Apr 9.
doi: 10.3390/jcm10081596
PMCID: PMC8069975
PMID: 33918908
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8069975/

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TERUMO
INTERVENTIONAL
SYSTEMS