Clinical case report[1]

Endovascular treatment of peripheral artery disease within an Angio-CT suite

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Department of Diagnostic and Interventional Radiology, Graduate School of Medicine, Osaka City University, Japan

Etsuji Sohgawa, MD, PhD; Yoshinori Takao, RT; Akira Yamamoto, MD

The scientific overlay is not that of the individual pictured and is not from a device of Siemens Healthineers. It was modified for better visualization.

[1] Results from case studies are not predictive of results in other cases. Results in other cases may vary.

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Patient history and diagnosis

A 60 year old male patient who suffered an ischemic stroke a year ago presented with a complaint of claudication on the left leg (<100 meters), which had expanded to the right leg before he arrived at our hospital. The ankle-brachial index[1] was measured as 0.70/0.54 (right/left).

In the diagnostic IV-CTA images (Figure 1–3 (a,b)) from the outpatient CT scan, multiple severe stenosis was observed at the mid superficial femoral artery (SFA) (1), midpopliteal artery (2), tibial-peroneal trunk (3, 5), and anterior tibial artery (4) on both the left leg and the right leg.

It was diagnosed as peripheral artery disease, Rutherford III, Fontaine II, TASC A.

The physicians decided to start with endovascular treatment (EVT) on the left leg first. The right leg was treated several weeks later. The reasons for performing EVT on only one side per day were:

- Long procedure time
- X-ray exposure dose and contrast medium
- Reimbursement

After the catheter is positioned in the left external iliac artery under angio guidance, the patient is switched to CT for a periprocedural CTA with intra-arterial injection.

Compared to IV-CTA, which was performed before the procedure as an initial diagnotic scan, the vasculature on the IA-CTA images can be visualized with higher density and more details thanks to the nature of selective injection (Figures 1–3 (c,d)).

Abbreviations

CTA:	CT angiography
IV-CTA:	intravenous CTA
IA-CTA:	intra-arterial CTA
EVT:	endovascular treatment
PTA:	percutaneous transluminal angioplast
POBA:	plain old balloon angioplasty
SFA:	superficial femoral artery
IVUS:	intravascular ultrasound
MIP:	maximal intensity projection
VR:	volume rendering

Read more:
T. Norimasa et al. Intra-arterial computed tomography angiography (IA-CTA) with diluted contrast medium (CM) for peripheral artery disease (PAD). ECR 2019 / C-1962

[1] The normal range for the ankle-brachial index is between 0.90 and 1.30. An index under 0.90 means that blood is having a hard time getting to the legs and feet: 0.41 to 0.90 indicates mild to moderate peripheral artery disease; 0.40 and below indicates severe disease.

Lead minimally invasive procedures with multi-modal image guidance

Contents

CTA images above the knee – Improved contrast enhancement with intra-arterial injection

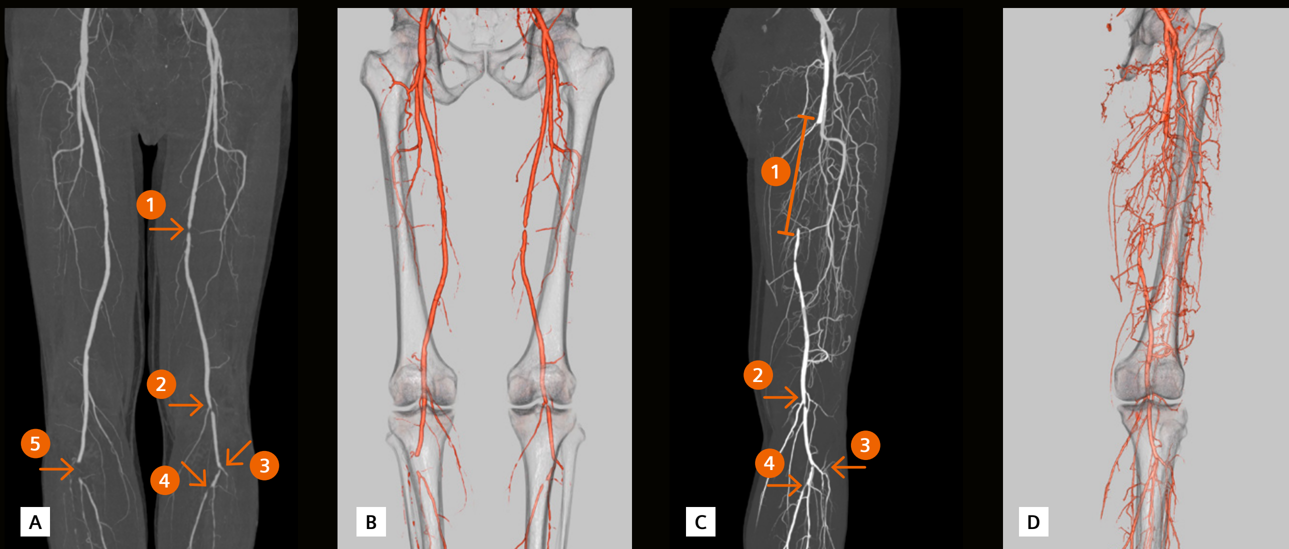


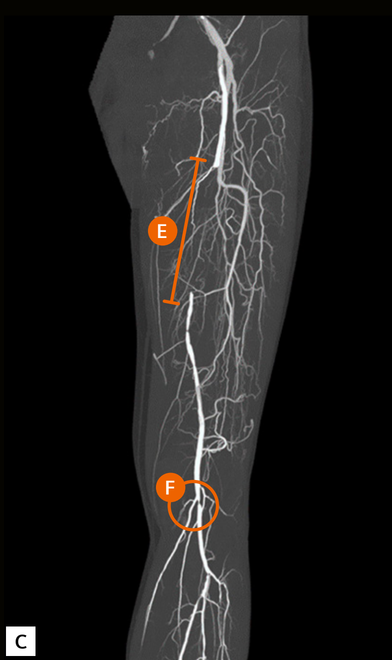
Figure 1

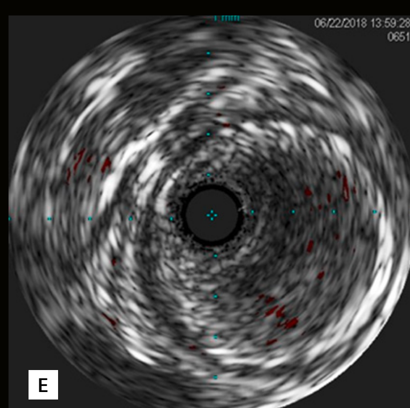
(A) MIP and (B) volume rendering of pre-procedural CTA of the whole leg on both sides with intravenous injection.

(C) MIP and (D) volume rendering of peri-procedural CTA of the whole left leg with intra-arterial injection.

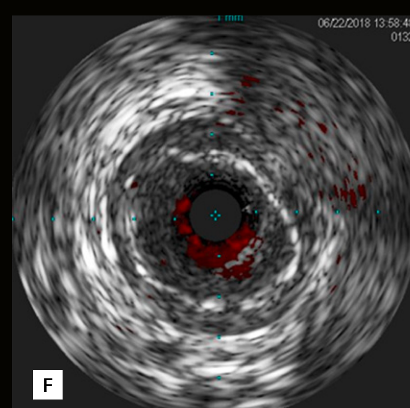
1. superficial femoral artery; 2. mid popliteal artery; 3. tibial-peroneal trunk; 4. anterior tibial artery; 5. tibial-peroneal trunk

IVUS images





(E) IVUS image showing the complete occlusion of the SFA.



(F) IVUS image showing 95% stenosis of popliteal artery. Red indicates blood flow.

Figure 1 (continued)

CTA images below the knee – Enhanced vessel visibility with intra-arterial injection

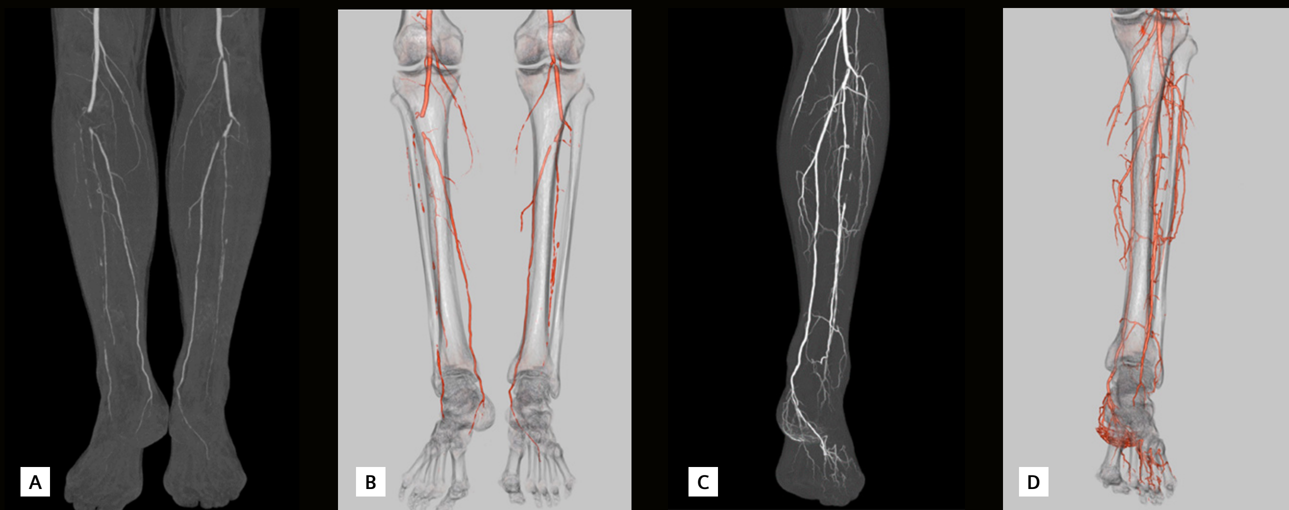


Figure 2
(A) MIP and (B) volume rendering of preprocedural CTA of the whole leg on both sides with intravenous injection.

(C) MIP and (D) volume rendering of peri-procedural CTA of the whole left leg with intra-arterial injection.

CTA images of the foot – Enabled vessel visibility in distal branches with intra-arterial injection

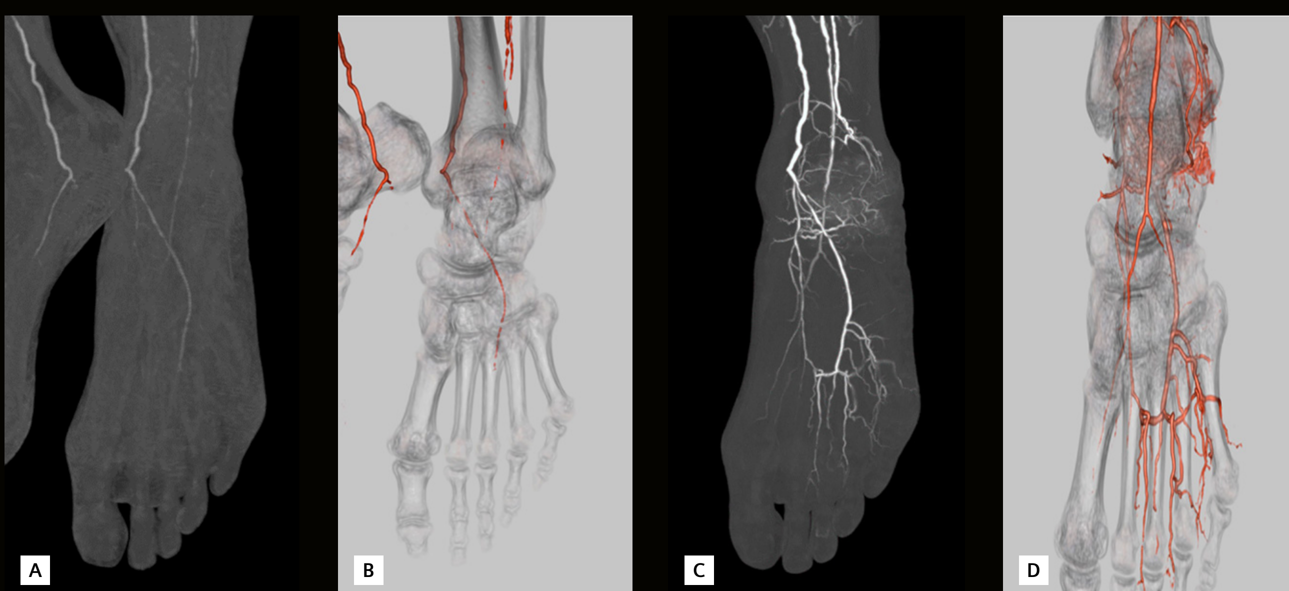


Figure 3
(A) MIP and (B) volume rendering of preprocedural CTA of the whole leg on both sides with intravenous injection.

(C) MIP and (D) volume rendering of peri-procedural CTA of the whole left leg with intra-arterial injection.

Axial MPR images from intra-arterial CTA

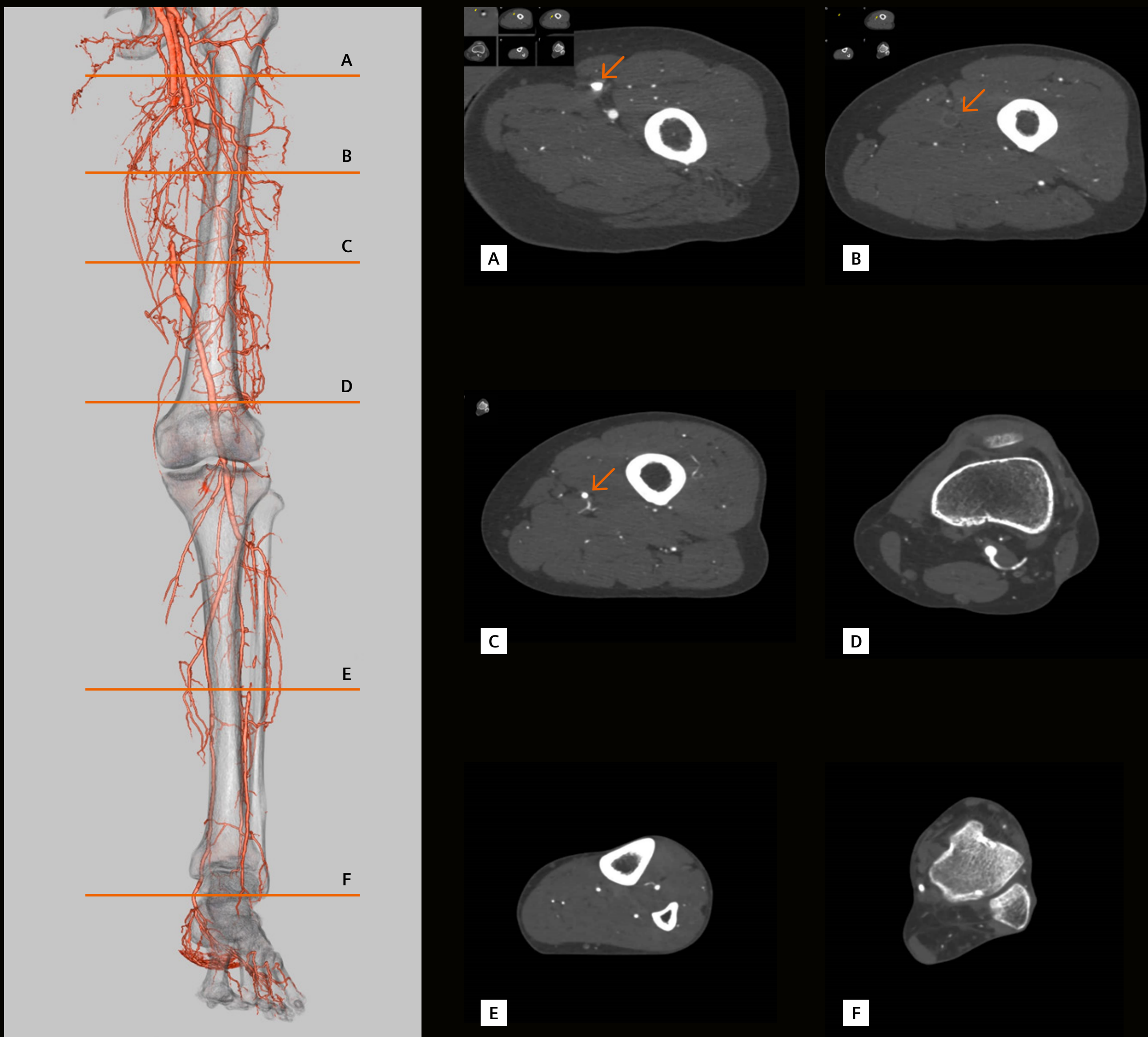
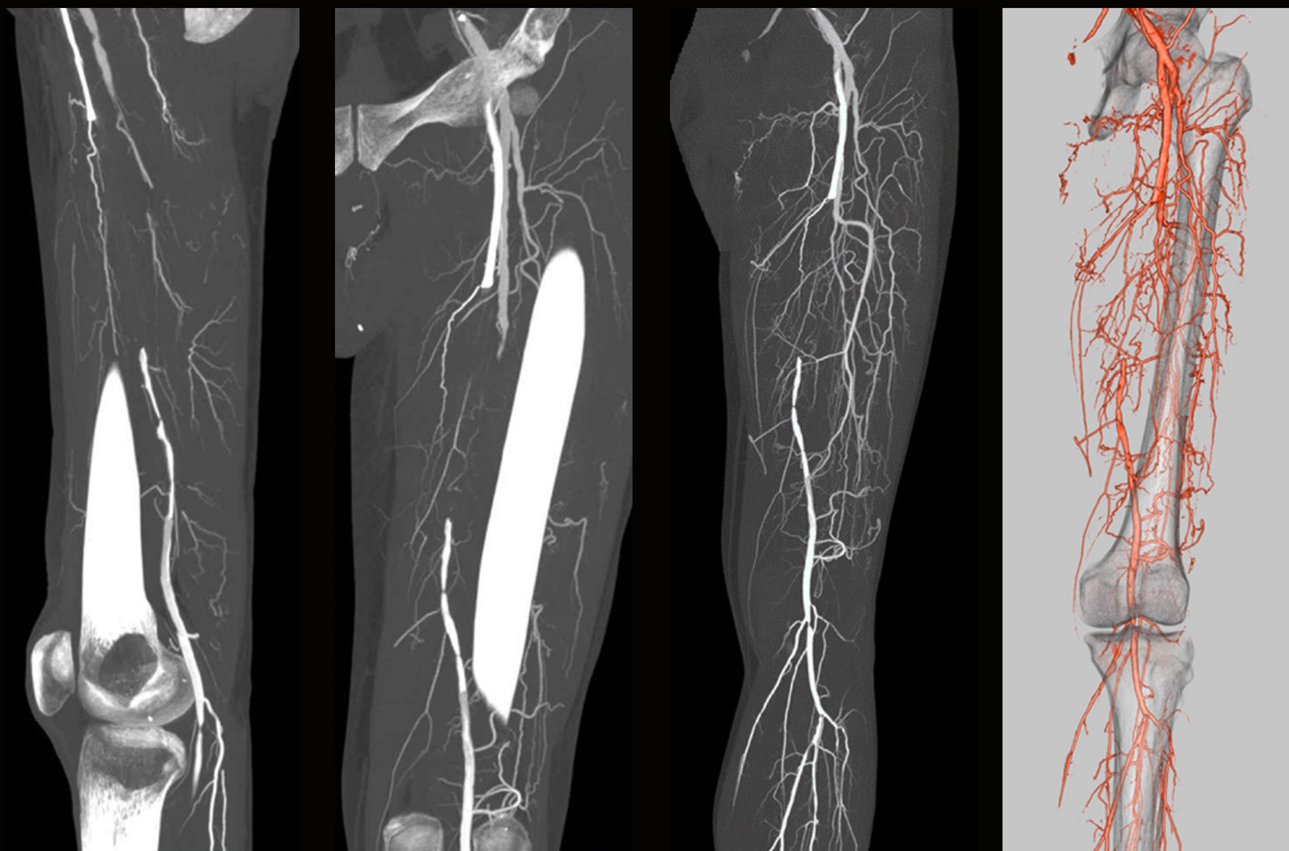


Figure 4
Axial images from IA-CTA also support endovascular treatment. SFA is clearly enhanced in the healthy regions (A, C), on the other side, the thrombus was observed with positive remodeling of the vessel wall at the occluded lesion (B). Collateral flow is confirmed in all axial images.

Slab MIP images from intra-arterial CTA



Slab MIP **Slab MIP** **MIP** **VR**

Figure 5
Multiple slab MIP images are utilized to investigate morphological changes of the vessels.
Subtracted images are useful for vessel examination in various directions.

Treatment

It was concluded that thrombi had accumulated at the mid SFA and a 13 cm occlusion had developed within a month. Aspiration thrombectomy (Thrombuster, Kaneka) was attempted several times, but with little success. A stent graft (VIABAHN 6 mm x 150 mm, Gore) was placed at the distal end of the lesion followed by another of the same type to cover the occluded lesion, based entirely on the information from the IA-CTA (Figure 6).

Subsequently, percutaneous transluminal angioplasty (PTA) was applied to the left popliteal artery as originally planned (Figure 7). The patient had complained of no further symptoms at the time of writing this report.

Stent graft deployment to treat SFA occlusion

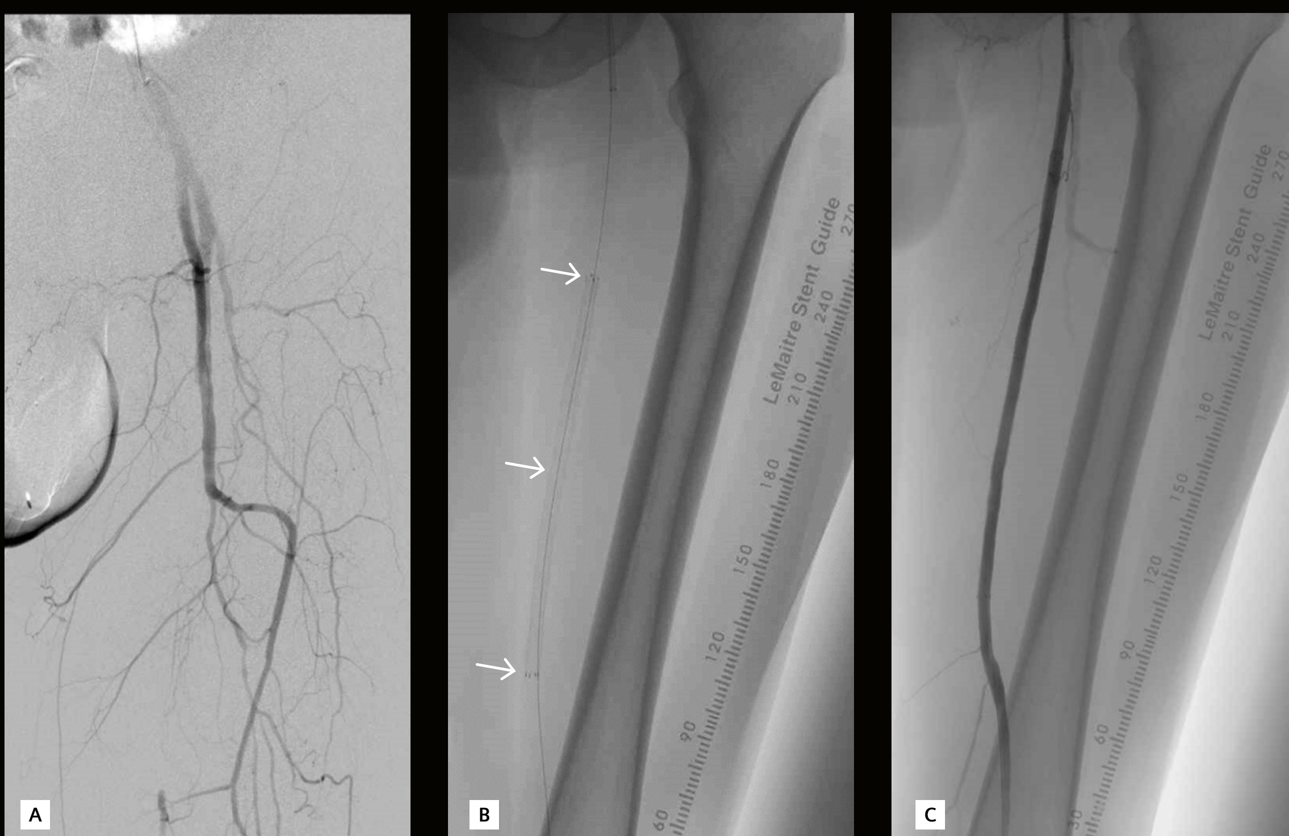


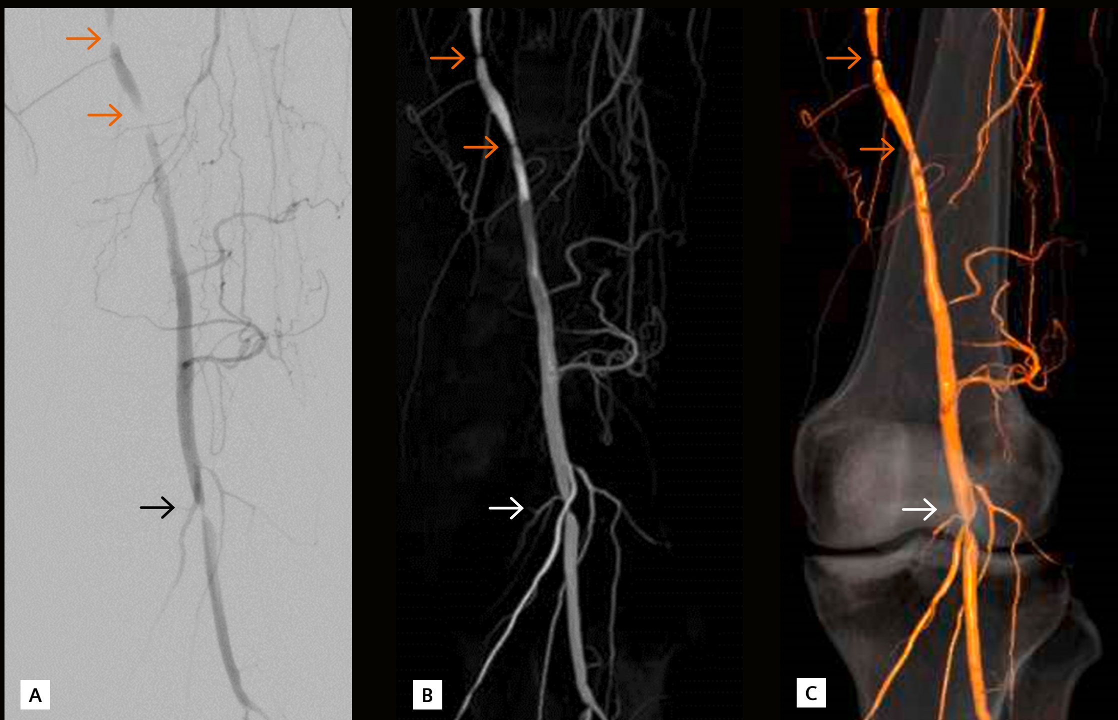
Figure 6

Pre-DSA
DSA image acquired after passing through the occluded lesion with a basket catheter (PARACHUTE, Goodcare) and postdilation balloon (SABER 5 mm x 60 mm).

Deployment of stent graft
VIABAHN (6 mm x 150 mm) was deployed starting at the distal end of the occluded lesion, followed by another VIABAHN (6 mm x 50 mm) at the proximal area.

Post-angiogram
Final 2D angiogram after the completion of SFA treatment, **showing recovered blood flow of SFA.**

POBA in left popliteal artery



DSA MIP VR

Figure 7
(A–C) 95% stenosis was observed in the left popliteal artery before PTA. DSA image (A) is compared with MIP (B) and VR images (C) derived from intra-arterial CTA. Orange arrows indicate the segment treated with the stent graft. White/black arrows show the 95% stenosis treated with a balloon.

PTA

(D) Plain old balloon angioplasty (POBA) was applied to the left popliteal artery.

Injection protocol

Figure 8
IV-CTA

IA-CTA

C	Intravenous CTA	Intra-arterial CTA
Scanner	Diagnostic CT	Angio-CT
Injection Location	Elbow vein	External iliac artery
Contrast medium (mgI/mL)	370	270 (diluted to 20%)
Injection rate (mL/sec)	3.0	1.8
Amount (mL)	110	18.5
Total Iodine (g)	**40.7**	**1.0**

Injection protocol

Conclusion

With Angio-CT, it is possible to perform CT angiography with selective intra-arterial injection. This allows the use of highly diluted contrast medium. In this case, which is part of a feasibility study, only 18.5 ml contrast medium was used to perform the IA-CTA, while 110 ml contrast agent was needed for the IV-CTA. This is especially beneficial for patients with renal insufficiency.

Additionally, the arteries can be visualized with higher density and more detail. This helps to guide the procedure with higher precision.

The Angio-CT is designed for complex IO procedures, but it also opens up new possibilities in a routine case like the endo-vascular treatment for PAD.

It is also worthy mentioning that IV-CTA remains an important tool for evaluating vessel conditions in CLI patients due to its wide availability and non-invasive nature.

Siemens Healthineers Headquarters
Siemens Healthcare GmbH
Henkestr. 127
91052 Erlangen, Germany
Phone: +49 9131 84-0
siemens-healthineers.com

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