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Study Protocols

for Artis systems in Interventional Radiology

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Dear Reader,

Knowledge is key, when experts have the appropriate forum to exchange their valuable experience and insights into a particular clinical case, everyone benefits.

Our newest series of Study Protocols provide precisely this platform for knowledge sharing e.g., practical information and experienced insights – from experts and for experts. And we want you to have first-hand access to these benefits.

Within the Artis World community there is huge mandate to share unique insights in specific study protocols. We know our tools and as with any other group of enthusiastic experts, we are driven to use these to their utmost potential.

These Study Protocols can support your entire team in optimizing their daily work and growing clinical practice as well as serve as a relevant source for reference.

A special word of thanks to our contributors who have kindly shared with us their protocols. We really value their efforts made in detailing their experience and helping colleagues to improve their own clinical practice.

We look forward to hearing your questions, suggestions or feedback. If you have protocols of your own to share, please contact us and keep this valuable forum for and by experts growing.

Sincerely yours,

Angelika Hench,
Customer Care Team
Marketing Department of Advanced Therapies
at Siemens Healthineers

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Thank you

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Content

Content

Embolization of Cerebral AVM *syngo* Dyna4D

Courtesy of

Renè Chapot, MD, Hannes Nordmeyer, MD, Interventional Neuroradiology, Alfried Krupp Hospital, Essen, Germany

Patient History

47-year-old male with aphasia and motoric deficiency of right hand due to edema.

Diagnosis

Symptomatic left hemispheric precentral AVM with giant venous aneurysm and brain edema.

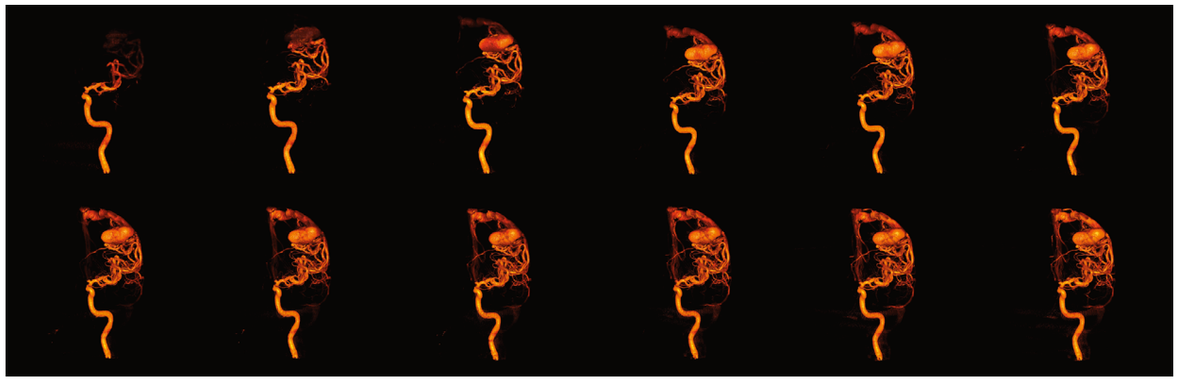
Treatment

Multiple endovascular treatments with embolization (Onyx and PHIL)

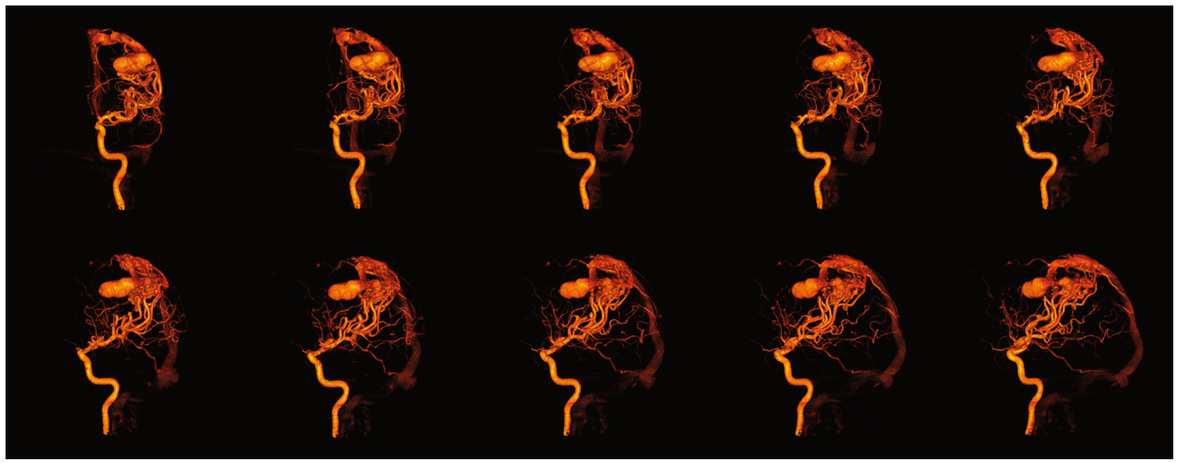
General Comments

Normally we make a couple of DSA runs with different angulations of the C-arm to see the feeding vessels in detail and also observe the drainage of the AVM. Thanks to ***syngo* Dyna4D** this information was readily available after one injection, we could also see the filling and drainage of the AVM in 3D which helped our planning for treatment.

Embolization of Cerebral AVM *syngo* Dyna4D



Flow range
syngo Dyna4D shows flow patterns in 3D



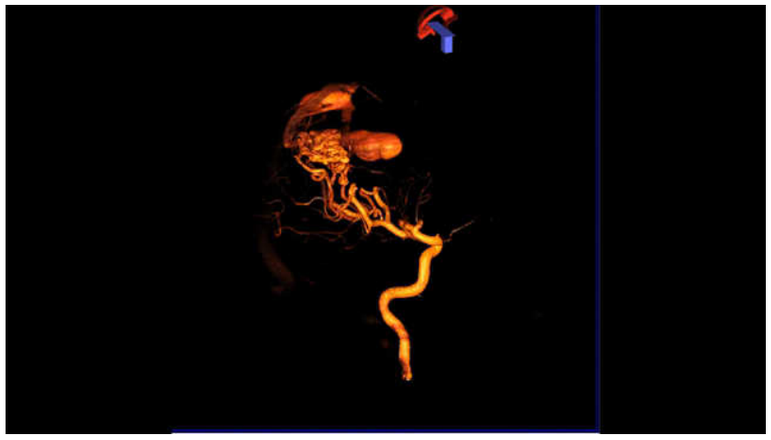
Radial range
syngo Dyna4D shows flow patterns in any angulation

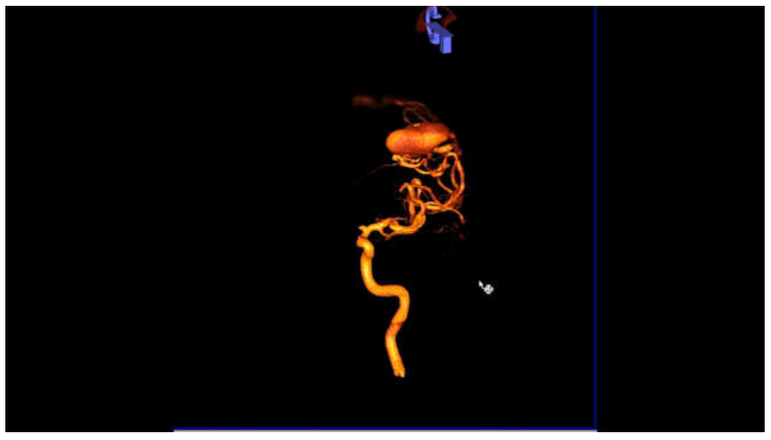
Acquisition Protocol	**6s Dyna4D**
Injection Protocol	
Contrast Medium (CM):	300 mg Iodine/ml
Dilution:	No
Injection Volume:	20 ml
Power Injector Used:	No
Injection Rate:	3.3 ml/s
Duration of Injection:	6 s
X-ray Delay:	0 s
Catheter Position:	ICA extracranial

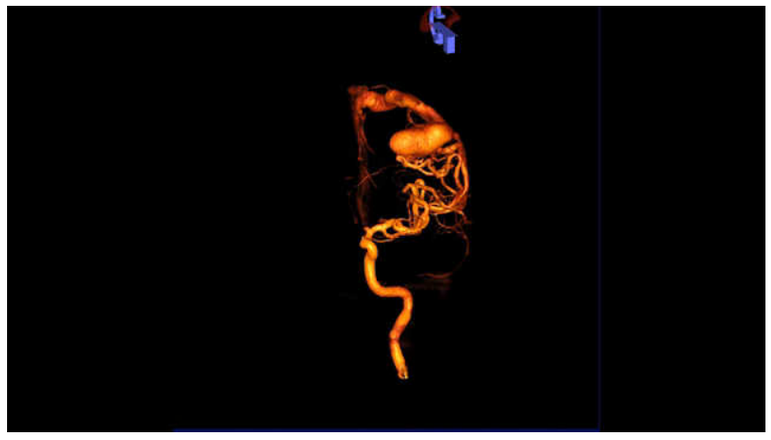
Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	Dyna4D arterial Sub 4D	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	EE	
Image Characteristics:	Auto	
Reconstruction Mode:	Sub	
Viewing Preset:	Dyna4D	

Supported by *syngo* Dyna4D
System & Software: Artis zee biplane with PURE VD11, *syngo* X Workplace VD10

Embolization of Cerebral AVM *syngo* Dyna4D – Videos







Click Button to watch hi-res version

Understanding Complex Angio Architectures of Dural AVF Supported by *syngo* Dyna4D

Courtesy of

Ichiro Yuki, MD, Yuichi Murayama, MD Department of Neurosurgery, Jikei University Hospital, Tokyo, Japan

Patient History

A 67-year-old male presented with diagnosed progressive visual acuity loss. An MR angiogram (MRA) indicated potential dural arteriovenous fistula (dAVF).

Diagnosis

The patient was referred to the endovascular neurosurgery department and underwent a cerebral angiogram. The angiogram revealed a left transversesigmond sinus dAVF with significant venous reflux into the superior sagittal sinus. Normal draining pattern of left transverse sigmoid sinus was impaired, and it was replaced by the high flow shunting between the multiple arterial branches from the left external carotid arteries and the impaired sinus. After completing the conventional 2D DSA, it was not yet clear whether or not the lesion had “cortical venous reflux”, which is decisive in determining the prognosis for the patient. A ***syngo* Dyna4D** run showed a detailed flow pattern of arteriovenous shunting as well as a correlation between the complex angio architecture and the cranium.

The image enables the 3D structure of cortical veins to be distinguished from overlapped vascular structures. A cortical venous reflux was confirmed. The retrograde filling of the contrast in the cortical vein was clearly visible due to the temporal information provided by *syngo* Dyna4D.

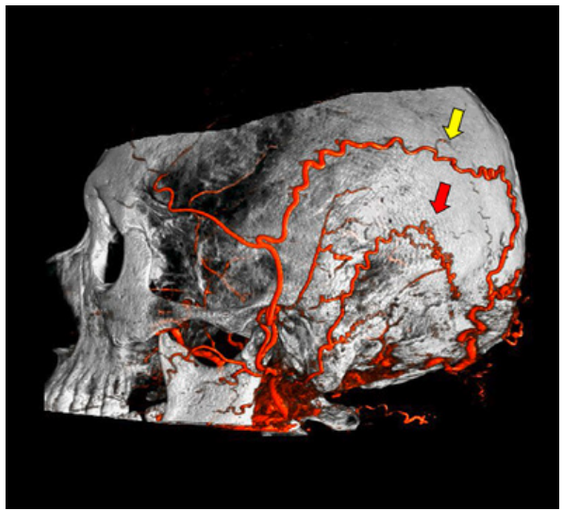
Treatment

Based on the aforementioned image findings, this dAVF was classified as Cognard IIa + B and endovascular treatment was recommended. Transarterial embolization of the feeding artery followed by a transvenous approach and occlusion of the left T-S sinus was performed.

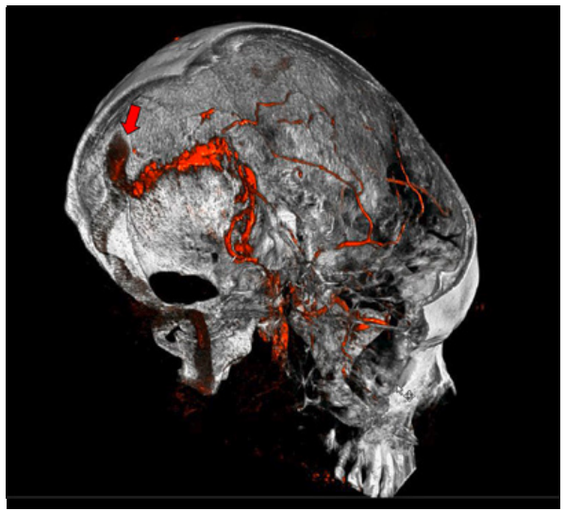
General Comments

syngo Dyna4D breaks down the complex angio architecture of the shunting disease into different phases of contrast fillings, and allows to see the direction, speed, and amount of flow in one acquisition. This information is crucial to the treatment.

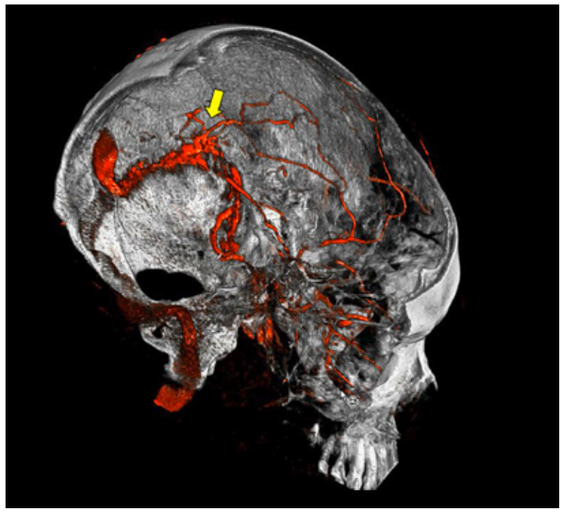
Understanding Complex Angio Architectures of Dural AVF Supported by *syngo* Dyna4D



Yellow arrow: Superior temporal artery
Red arrow: posterior auricular artery



Left external carotid artery angiogram (ECAG) shows the contrast dye welling up in the left sigmoid sinus, then flowing back to the transverse sinus, and finally to the superior sagittal sinus (red arrow).



Cortical venous reflux was seen at the left occipital lobe near the transverse sigmoid junction (yellow arrow).

Acquisition Protocol	**12s Dyna4D**
Injection Protocol	
Contrast Medium (CM):	270 mg Iodine/ml
Dilution:	None
Injection Volume:	21 ml
Power Injector Used:	Yes
Injection Rate:	3 ml/s
Duration of Injection:	7 s
X-ray Delay:	None
Catheter Position:	Left carotid artery

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
VOI Size:	Full	Full
Slice Matrix:	512 x 512	512 x 512
Kernel Type:	EE	HU
Image Characteristics:	Auto	Auto
Reconstruction Mode:	Sub	Mask
Viewing Preset:	Dyna4D	Dyna3D Head
Fused visualization of Sub with Mask reconstruction.		

Supported by *syngo* Dyna4D
System & Software: Artis Q biplane VD11, *syngo* X Workplace VD10

PTA and Mechanical Thrombectomy for Acute Cerebral Stroke Supported by *syngo* DynaCT

Courtesy of

Marios Nikos Psychogios, MD, Department for Diagnostic and Interventional Neuroradiology, UMG Göttingen, Germany

Patient History

64-year-old male patient presented 4.5 hours after symptom onset with a right side paresis.

Diagnosis

Admission non-contrast CT showed a left dense MCA sign and initial ischemic signs of the left insular ribbon and lentiform nucleus (NCCT-ASPECTS 8). MDCTA (CT angiography) confirmed the MCA thrombosis and showed an additional proximal thrombosis of the left ICA, leading to high-grade stenosis.

Treatment

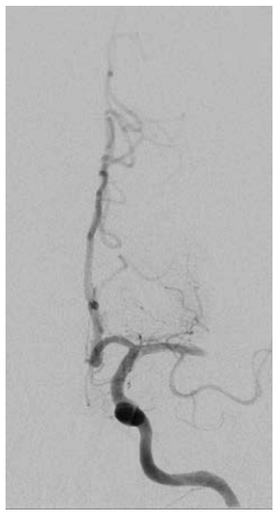
PTA of the proximal ICA with successive thrombectomy of the ICA and left M1 thrombosis. After clot removal and before stenting of the ICA stenosis, a ***syngo* DynaCT** was performed. Interventional Neuroradiology *syngo* DynaCT images showed contrast extravasation in the basal ganglia and suspected blood in the dorsal putamen region.

Having seen the suspicious hemorrhagic lesion, it was decided to stop the treatment at that point and not proceed with ICA stenting and treatment of the patient with Aspirin and Plavix.

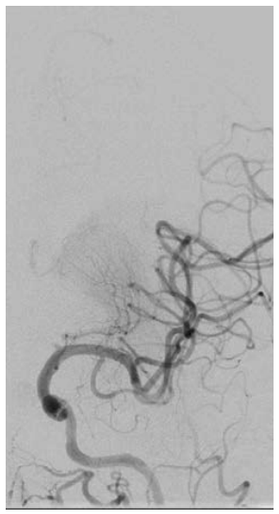
General Comments

syngo DynaCT provides essential information during thrombectomy procedures and supports decision-making on treatment strategy.

PTA and Mechanical Thrombectomy for Acute Cerebral Stroke Supported by *syngo* DynaCT



DSA scenes before thrombectomy show occlusions of ICA and MCA



DSA scenes after PTA and thrombectomy of ICA and MCA

Axial MPR 3 mm shows contrast medium extravasation in the putamen

Acquisition Protocol	**20s DCT Head 109 kV**	
Injection Protocol		
Contrast Medium (CM):	No contrast	
Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body Nat Fill HU Normal	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* DynaCT
System & Software: Artis Q biplane VD10, *syngo* X Workplace VC10

Mechanical Thrombectomy of Left MCA Occlusion

Courtesy of

Prof. Wan-You Guo, MD, Department of Radiology, Taipei Veterans General Hospital, Taiwan

Patient History

A 67-year-old man presented with symptoms of acute right hemiplegia of less than 6 hours duration since onset.The patient was taken to CT immediately to exclude hemorrhage with native CT.

Diagnosis

Left middle cerebral artery (MCA) occlusion. Noncontrast computed tomography (CT) demonstrated a hyperdense MCA sign and excluded intracranial hemorrhage. Flat-detector CT (FDCT) angiography demonstrated the total occlusion of left MCA. A parenchymal cerebral blood volume (*syngo* Neuro PBV IR) map depicted a large area of hypoperfusion in the corresponding left MCA territory, which was similar to the results of multidetector CT perfusion imaging (not shown). After intra-arterial mechanical thrombectomy, recanalization of the left MCA was demonstrated by FDCT angiography. A ***syngo* Neuro PBV IR** map depicted the recovery of CBV values in part of the hypoperfused parenchyma after revascularization.

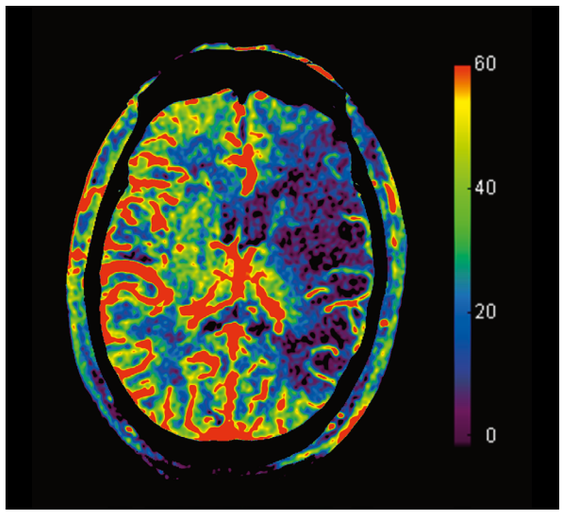
Treatment

Revascularization with intra-arterial approach. MCA occlusion could be successfully reopened.

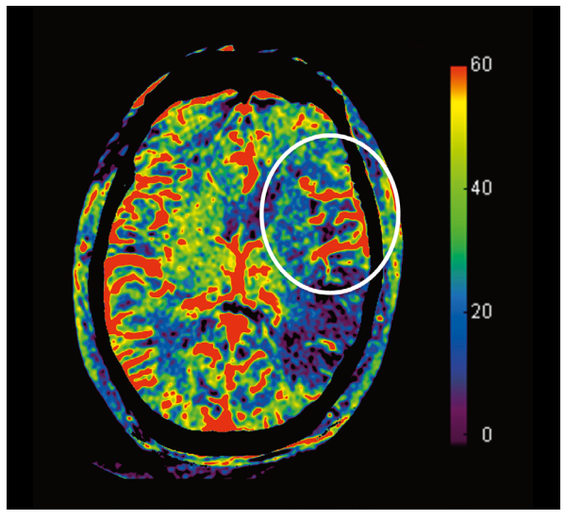
General Comments

By combining C-arm rotational acquisition with intraarterial contrast medium injection from the aortic arch, we can obtain
(1) non-contrast *syngo* DynaCT,
(2) a three-dimensional volume of intracranial vasculature (*syngo* DynaCT reconstruction of fill run), and
(3) a *syngo* Neuro PBV IR map.

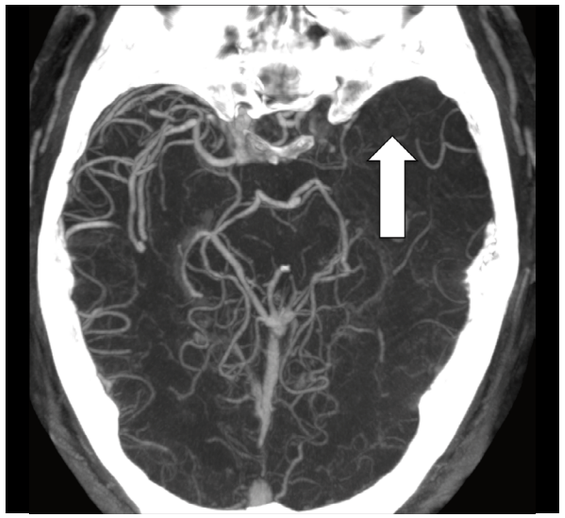
Mechanical Thrombectomy of Left MCA Occlusion



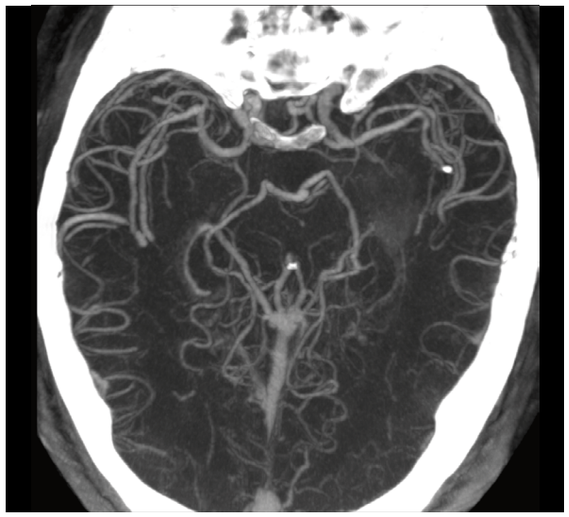
syngo Neuro PBV IR map before thrombectomy.



syngo Neuro PBV IR map after revascularization.



Thick MIP Flat-detector CT (FDCT) angiography demonstrated the total occlusion of left MCA (arrow).



Thick MIP Recanalization of the left MCA was demonstrated by FDCT.

Supported by *syngo* DynaCT, *syngo* Neuro PBV IR, *syngo* iFlow
System & Software: Artis zee biplane VC14, *syngo* X Workplace VB15

Acquisition Protocol	**8s Neuro PBV IR**
Frame Rate:	3 f/s *(only 2D sequences)*
Length of Sequence:	10 s *(only iFlow)*
Injection Protocol	
Contrast Medium (CM):	340 mg Iodine/ml
Dilution:	50%
Injection Volume (CM/Saline):	85 ml (42.5 ml/42.5 ml)
Power Injector Used:	Yes
Injection Rate:	5 ml/s
Duration of Injection:	17 s
X-ray Delay:	Individually analyzed with *syngo* iFlow T_{max} = 9 s for this patient in the superior sagittal sinus
Injection/Catheter Position:	Aortic arch 4 F pigtail catheter

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	Neuro PBV HU Smooth	DynaCT Head Nat Fill HU Normal Reconstruction of the fill run of Neuro PBV 3D acquisition
VOI Size:	Full	Manual
Slice Matrix:	512 x 512	512 x 512
Kernel Type:	HU	HU
Image Characteristics:	Smooth	Normal
Reconstruction Mode:	Neuro PBV	Nat Fill
Viewing Preset:	Neuro PBV	DynaCT Head

Interventional Thrombectomy in Acute Stroke

Courtesy of

Joachim Berkefeld, MD, Institute of Neuroradiology, University of Frankfurt, Germany

Patient History

A 76-year-old female patient was admitted to our stroke unit 2 hours after onset of left-sided hemiplegia and disturbance of consciousness. CT proved beginning hypodensity at the insula and lateral basal ganglia on the right side. CTA showed an occlusion of the main stem of the right middle cerebral artery. The patient was transferred to the angio suite immediately. PBV measurement with IV contrast and selective DSA of the right internal carotid artery were performed.

Diagnosis

Acute stroke with M1 occlusion on the right side and threatening infarct in parts of the MCA territory. PBV was decreased to critical values in the lateral basal ganglia region. DSA confirmed M1 occlusion. Mapping of circulation times with ***syngo* iFlow** showed increased values up to 11 s in the core of the MCA territory corresponding to low PBV values.

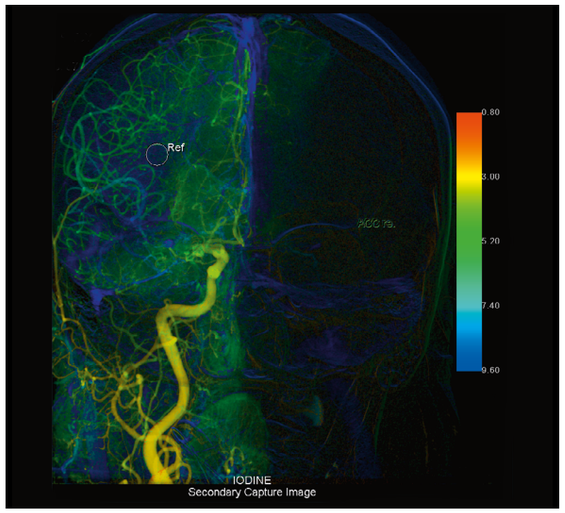
Treatment

Interventional thrombectomy was done and the thrombus could be removed with a stent retriever under aspiration of the balloon-guiding catheter.

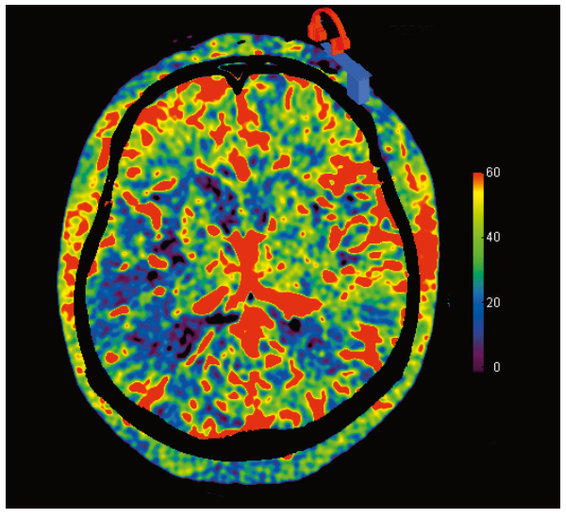
Tips and Tricks

To avoid misinterpretation, the PBV contrast run should start in the late venous phase of the lateral scout DSA.

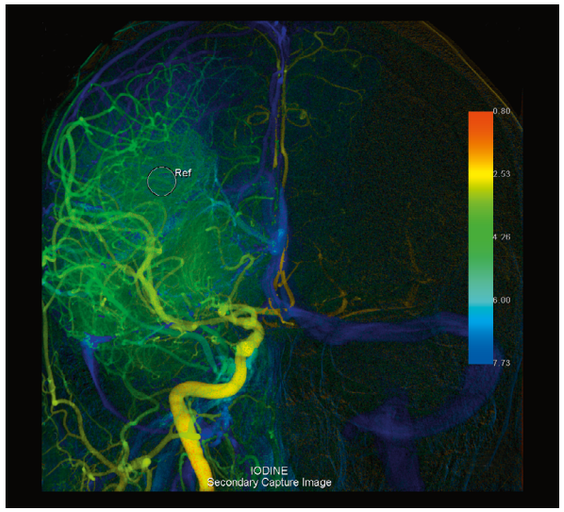
Interventional Thrombectomy in Acute Stroke



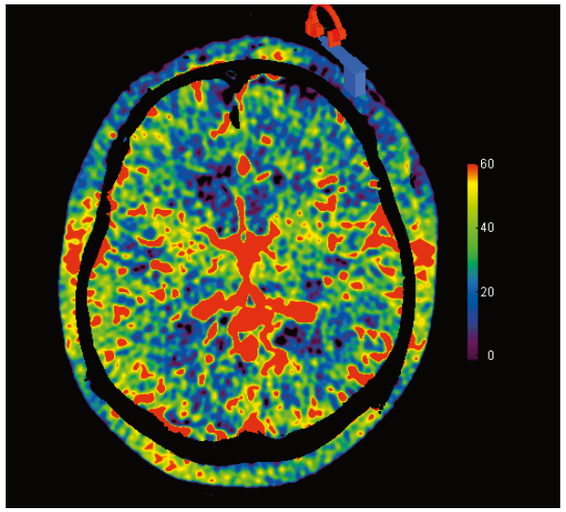
syngo iFlow pre



syngo Neuro PBV IR pre



syngo iFlow post



syngo Neuro PBV IR post

Acquisition Protocol	**8s Neuro PBV IR**	***syngo* iFlow**
Frame Rate (only 2D sequences):		Variable frame rate 4 f/s for 4 s; 2 f/s for 9 s; 1 f/s for 3 s

Injection Protocol		
Contrast Medium (CM):	300 mg Iodine/ml	Ultravist 240
Dilution:	No	No
Injection Volume:	60 ml followed by 60 ml Saline flush (double head injector)	5-6 ml
Power Injector Used:	Yes	No
Injection Rate:	4 ml/s	
Duration of Injection:	15 s	16 s
X-ray Delay:	Variable (scout DSA)	None
Injection/ Catheter Position:	IV	ICA

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	Neuro PBV HU Smooth	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Smooth	
Reconstruction Mode:	Neuro PBV	
Viewing Preset:	Neuro PBV	

Supported by *syngo* DynaCT
System & Software: Artis zee biplane VC21, *syngo* X Workplace VB21

syngo Neuro PBV IR During Balloon Occlusion Test

Courtesy of

Hiroshi Itokawa, MD, PhD, Department of Neurosurgery, Kasai Shoikai Hospital, Tokio, Japan

Patient History

Patient was admitted to the hospital with acute onset of severe headache.

Diagnosis

Right intracranial ICA dissection and subarachnoid hemorrhage.

Treatment

Trapping of the right ICA with high flow bypass surgery.

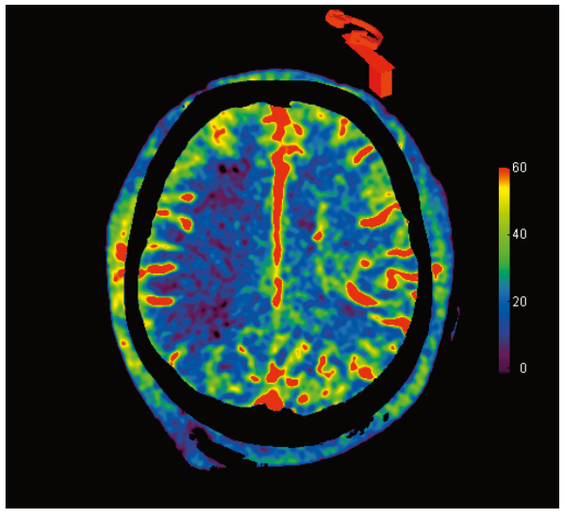
General Comments

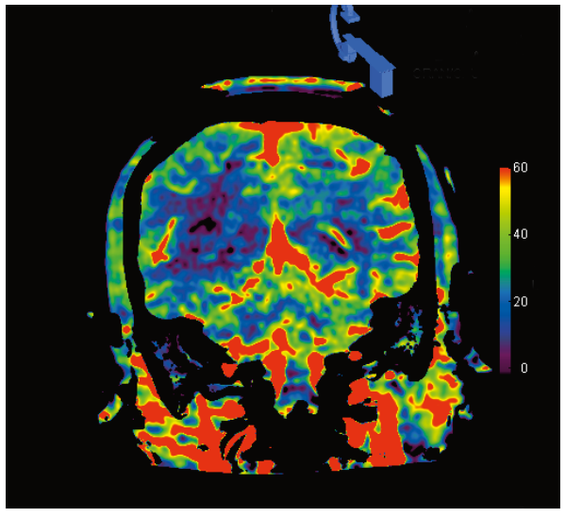
***syngo* Neuro PBV IR** during balloon occlusion test (BOT) showed reduced CBV in the right cerebral hemisphere indicating poor collateral flow. Therefore, bypass surgery was necessary. *syngo* Neuro PBV IR may be able to support treatment decision in BOT cases.

Tips and Tricks

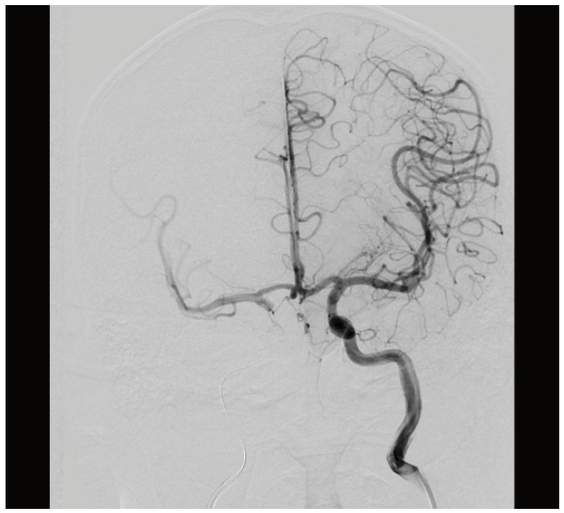
syngo Neuro PBV IR makes it possible to examine BOT results in the angiography suite, without the need to transfer the patient to another imaging modality, such as SPECT.

syngo Neuro PBV IR During Balloon Occlusion Test





Axial and coronal 8mm MPR
syngo Neuro PBV IR shows reduced CBV in the right cerebral hemisphere.



2D DSA image shows poor collateral flow to the right cerebral hemisphere during balloon occlusion test.

Acquisition Protocol	**8s Neuro PBV IR** (70 kV/0.36 µGy/F/8 s)

Injection Protocol	
Contrast Medium (CM):	300 mg Iodine/ml
Dilution:	50%
Injection Volume (CM/Saline):	85 ml (42.5 ml/42.5 ml)
Power Injector Used:	Yes
Injection Rate:	5 ml/s
Duration of Injection:	17 s
X-ray Delay:	9 s
Injection/ Catheter Position:	4F diagnostic catheter placed just above the aortic valve

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	Neuro PBV HU Smooth	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Smooth	
Reconstruction Mode:	Neuro PBV	
Viewing Preset:	Neuro PBV IR	

Supported by *syngo* Neuro PBV IR
System & Software: Artis zee biplane VC14, *syngo* X Workplace VB15

Follow-Up After Stent-Assisted Aneurysm Coiling

Courtesy of

Kiffon Keigher, APN, Demetrius K. Lopes, MD, Rush University Medical Center, Chicago, USA

Patient History

73-year-old female patient. Left middle cerebral artery (MCA) aneurysm that was treated with stentassisted coil embolization in 2005. Because of her history of contrast allergies, we decided to complete a ***syngo* DynaCT** run with IV injection of contrast medium in the angiography suite for the purpose of improved visualization and monitoring the patient post IV injection.

Diagnosis

In 3-D rotational angiography we identified that the left MCA aneurysm was completely occluded, status post stenting and coiling. We were able to obtain accurate visualization of the parent vessel and verify occlusion of this aneurysm and patency of the stent. There was no evidence of instent stenosis.

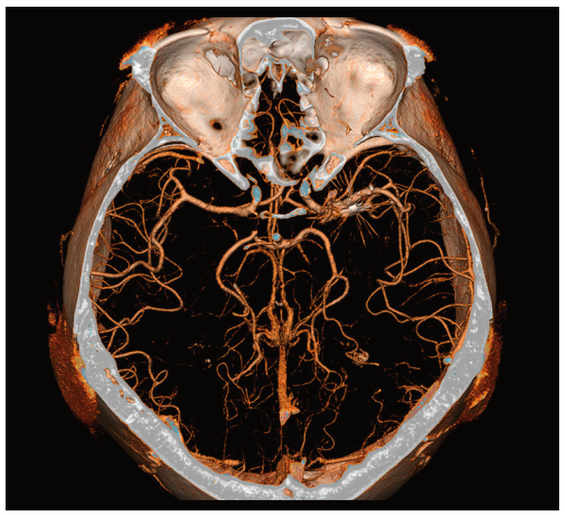
Treatment

The quality of the study was very good, with no evidence of any other abnormalities in the circle of Willis. She tolerated this imaging study without incident and was discharged home. Our plan will be to follow up with this patient in 12 months with repeated imaging study.

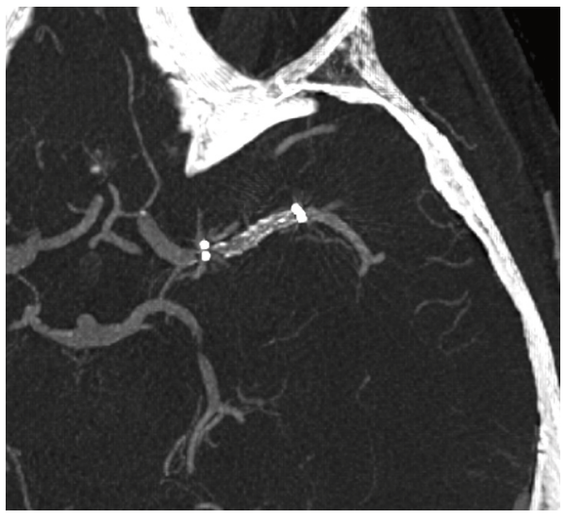
General Comments

At our institution we are using *syngo* DynaCT runs with IV injection routinely for patients with the following concerns: stent patency, in-stent stenosis, residual filling of aneurysms s/p clipping and/or coiling, and vasospasm.

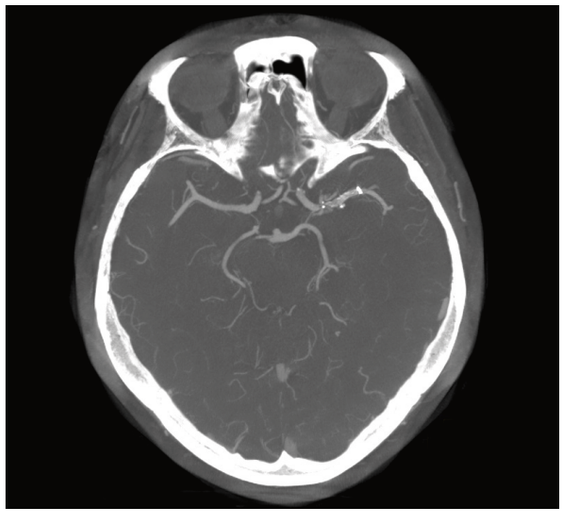
Follow-Up After Stent-Assisted Aneurysm Coiling



VRT (Volume Rendering Technique) of *syngo* DynaCT run with IV injection, visualizing the X stent.



Axial MPR reconstruction outlining full patency of the X stent in the left middle cerebral artery (with secondary reconstruction).



Axial MPR reconstruction showing X stent in the left middle cerebral artery.

Acquisition Protocol	**20sDCT Head 109kV**
Injection Protocol	
Contrast Medium (CM):	370 mg Iodine/ml
Dilution:	No
Injection Volume:	80 ml
Power Injector Used:	Yes
Injection Rate:	4 ml/s
Duration of Injection:	20 s
X-ray Delay:	14 s
Injection/ Catheter Position:	IV injection antecubital vein (18 G) allergy prep medication

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Head Nat Fill HU	**Small VOI** for higher spatial resolution
VOI Size:	Full	Small
Slice Matrix:	512 x 512	512 x 512
Kernel Type:	HU	HU
Image Characteristics:	Normal	Normal
Reconstruction Mode:	Nat Fill	Nat Fill
Viewing Preset:	DynaCT Head	DynaCT Head

Supported by *syngo* DynaCT
System & Software: Artis zee biplane VC21, *syngo* X Workplace VB21

Follow-Up After Bilateral Carotid Stent Placement

Courtesy of

Kiffon Keigher, APN, Demetrius K. Lopes, MD, Rush University Medical Center, Chicago, USA

Patient History

76-year-old female who developed severe bilateral carotid artery stenosis thought to be primarily related to her history of neck radiation for thyroid disease. Re-stenosis of both carotids seen in CTA. Decision for ***syngo* DynaCT** with IV injection of contrast medium for improved stenosis evaluation and stent visualization.

Diagnosis

IA 20sDR DynaCT of the neck region was performed, with a contrast injection through an 18 G IV access in the right antecubital vein, using an X-ray delay of 14 sec. Images were automatically reconstructed on the *syngo* X Workplace and displayed in *syngo* InSpace 3D.

Treatment

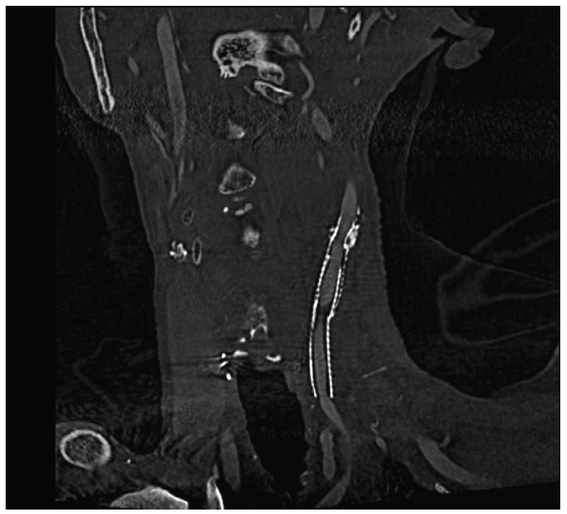
Patient has no new symptoms and no further intervention was recommended with exception of continued dual anticoagulation therapy and stroke risk factor management.

General Comments

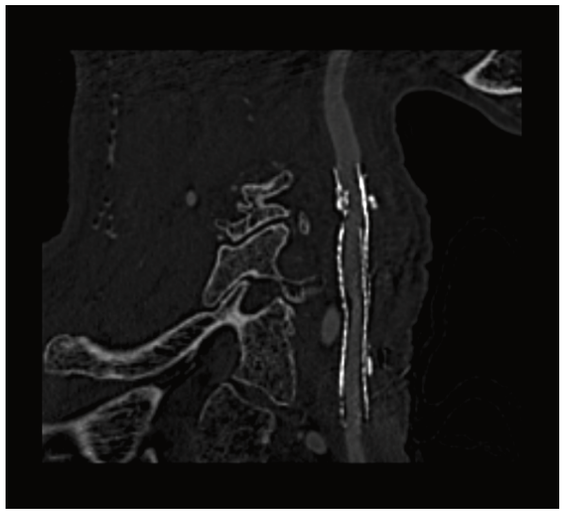
At our institution we are using *syngo* DynaCT with IV injection routinely for patients with the following concerns: stent patency, in-stent stenosis, residual filling of aneurysms s/p clipping and/or coiling, and vasospasm.

Follow-Up After Bilateral Carotid Stent Placement

Coronal MIP showing bilateral stent placement.



Curved MPR demonstrating partial in-stent stenosis (with secondary reconstruction).



Sagittal MPR demonstrating partial in-stent stenosis (with secondary reconstruction).

Acquisition Protocol	**20sDCT Head 109kV**
Injection Protocol	
Contrast Medium (CM):	370 mg Iodine/ml
Dilution:	No
Injection Volume:	80 ml
Power Injector Used:	Yes
Injection Rate:	4 ml/s
Duration of Injection:	20 s
X-ray Delay:	14 s
Injection/ Catheter Position:	IV Injection; Right Antecubital Vein

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Head Nat Fill HU	**Small VOI** for higher spatial resolution
VOI Size:	Full	Small
Slice Matrix:	512 x 512	512 x 512
Kernel Type:	HU	HU
Image Characteristics:	Normal	Normal
Reconstruction Mode:	Nat Fill	Nat Fill
Viewing Preset:	DynaCT Head	DynaCT Head

Supported by *syngo* DynaCT
System & Software: Artis zee biplane VC21, *syngo* X Workplace VB21

Quantification of Interhemispheric Venous Phase Timing During BTO

Courtesy of

Alexander Bock, MD, Head of the Department of Clinical and Interventional Neuroradiology, Vivantes-Klinikum Neukölln, Germany

Patient History

52-year-old male patient presented with severe left eye proptosis and blindness.

Diagnosis

Meningioma of the medial sphenoid wing with predominant infiltration of the orbit.

Treatment

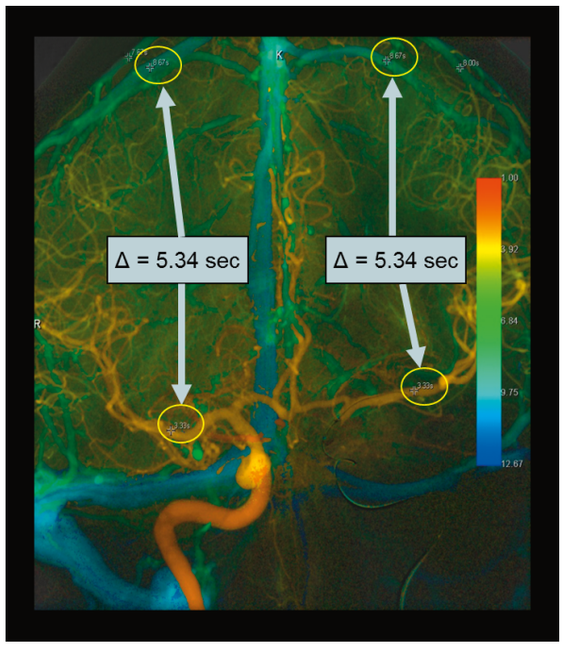
After particle embolization of the external tumor-feeding arteries, exstirpation of the meningioma was planned. Balloon test occlusion was performed under general anesthesia and normotensive conditions for potential resection of left ICA.

General Comments

***syngo* iFlow** exactly quantifies the time of maximal venous opacification in standard angiographic series including the venous phase.

Read case study

Quantification of Interhemispheric Venous Phase Timing During BTO



syngo iFlow data showed no delay of the venous phase between occluded left ICA (8,67 s) and right ICA (8,67 s) due to a patent A_{com} cross-flow. *syngo* iFlow clearly quantifies the synchronicity of the cortical vein filling in both hemispheres.

Acquisition Protocol	**DSA**
Frame Rate (only 2D sequences):	3 f/s
Length of Sequence (only iFlow):	10 s

Injection Protocol	
Contrast Medium (CM):	370 mg Iodine/ml
Dilution:	50%
Injection Volume (CM/Saline):	5 ml (2.5 ml/2.5 ml)
Power Injector Used:	No
Injection Rate:	1.5 ml/s
Duration of Injection:	3 s
X-ray Delay:	Right after mask is set
Injection/Catheter Position:	H1H, Headhunter 5.2 F, Cordis; ICA cervical level C2

Supported by *syngo* iFlow
System & Software: Artis zee biplane VC13

Vasospasm Treatment Post-SAH

Courtesy of

Beverly Aagaard-Kienitz, MD, Department of Radiology, University of Wisconsin School of Medicine and Public Health, Madison, USA

Patient History

56-year-old female with fibromuscular dysplasia, presented with SAH from ruptured left MCA aneurysm, Hunt/Hess grade 4.

Diagnosis

Ruptured aneurysm with SAH-induced vasospasm.

Treatment

Injection of Verapamil following surgical clipping of ruptured aneurysm and development of vasospasm.

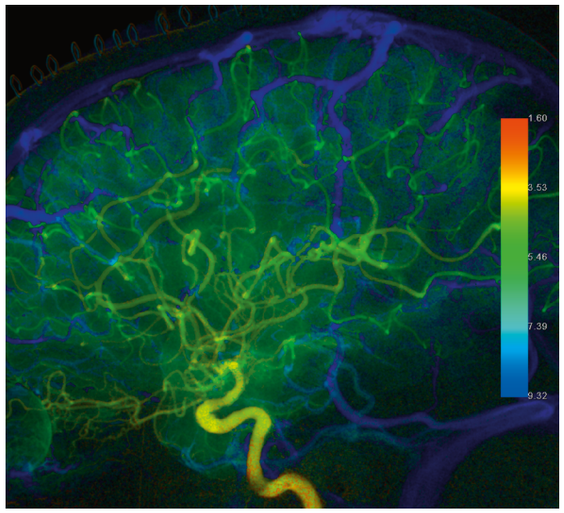
General Comments

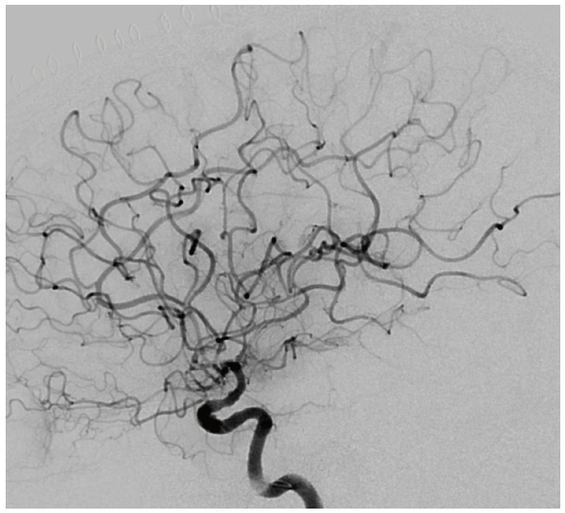
***syngo* iFlow** illustrates better the degree of delayed perfusion and improvement (post Verapamil) than DSA images.

Tips and Tricks

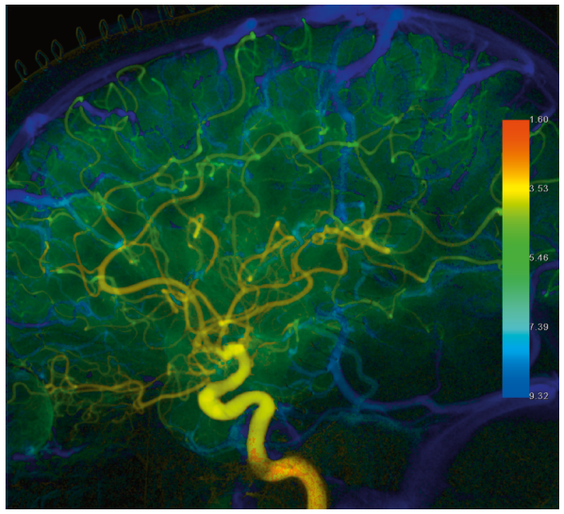
1. Standardized protocol + angiographic approach
2. Prompt and aggressive treatment
3. Pre and post calcium channel blocker infusion. *syngo* iFlow needs to be through same catheter, same vessel level and preferably with power injector.

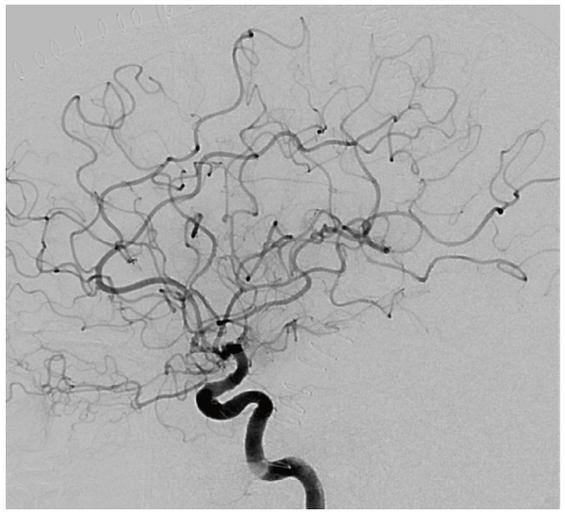
Vasospasm Treatment Post-SAH





Hand-injected pre-treatment DSA run and corresponding *syngo* iFlow image.
Please note the delayed arrival times in the vasculature.





Hand-injected post-treatment DSA run and corresponding *syngo* iFlow image.
Please note the improved arrival times in the vasculature. This is not easily judged from the DSA run itself.

Acquisition Protocol	***syngo* iFlow specific protocol**
	Variable frame rate 4 f/s for 4 s, 2 f/s for 2 s, 1 f/s for 6 s

Injection Protocol	
Contrast Medium (CM):	300 mg Iodine/ml
Dilution:	No
Injection Volum:	9 ml
Power Injector Used:	No
Injection Rate:	Hand Injection
Duration of Injection:	Hand Injection
X-ray Delay:	0 s
Injection/Catheter Position:	Carotid Artery

Supported by *syngo* iFlow
System & Software: Artis zee biplane VC21

Content

Transarterial Chemoembolization of HCC Using *syngo* DynaPBV Body

Courtesy of

Jeff McCann, MD, Ronan Ryan, MD, Department of Interventional Radiology, St. Vincent University Hospital, Dublin, Ireland

Patient History

51-year-old male with Hep C. Hepatocellular BCLC stage A carcinoma (HCC), which is not amenable to radiofrequency (RF) ablation due to its proximity to the gall bladder. Patient is awaiting liver transplant and recommended for TACE treatment.

Diagnosis

Pre-procedural four-phase CT of the liver measured a maximum of 3.5 cm in length of the segment V HCC lesion. The lesion demonstrated arterial hyperenhancement with portal venous and delayed phase washout centrally consistent with a HCC.

Treatment

Selective chemoembolization of the 3.5 cm segment V HCC was performed on the patient. The patient tolerated the procedure well and there were no immediate complications.

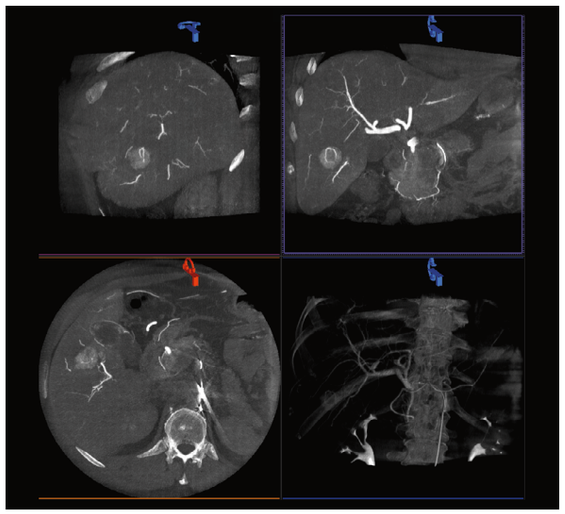
General Comments

The pre-embolization ***syngo* DynaPBV Body** showed that the hypervascular tumor in the inferior right lobe derived supply from the segment V artery. Chemoembolization followed by bland embolization of the arterial supply was satisfactory with excellent angiographic response. The post-embolization PBV run confirmed complete treatment by showing no contrast opacification within the tumor.

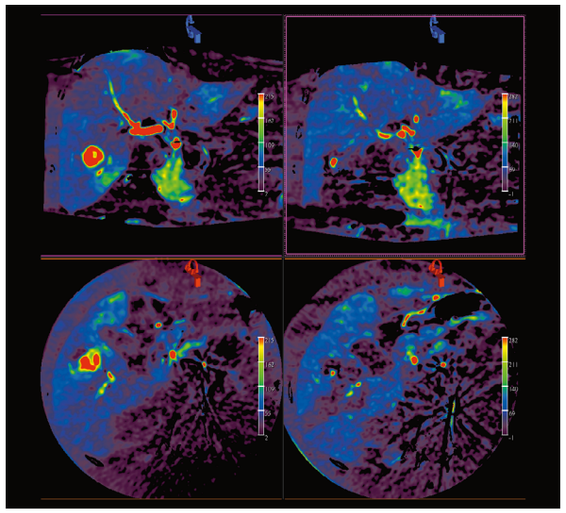
Tips and Tricks

Don’t oversedate the patient as patient cooperation with breathing is very important. Arms should be put above the head during *syngo* DynaPBV Body acquisition.

Transarterial Chemoembolization of HCC Using *syngo* DynaPBV Body



Secondary reconstruction of the fill run of the pre-procedural *syngo* DynaPBV Body run gives good visualization of vessel tree (esp. showing the looped tumor-feeding vessel).



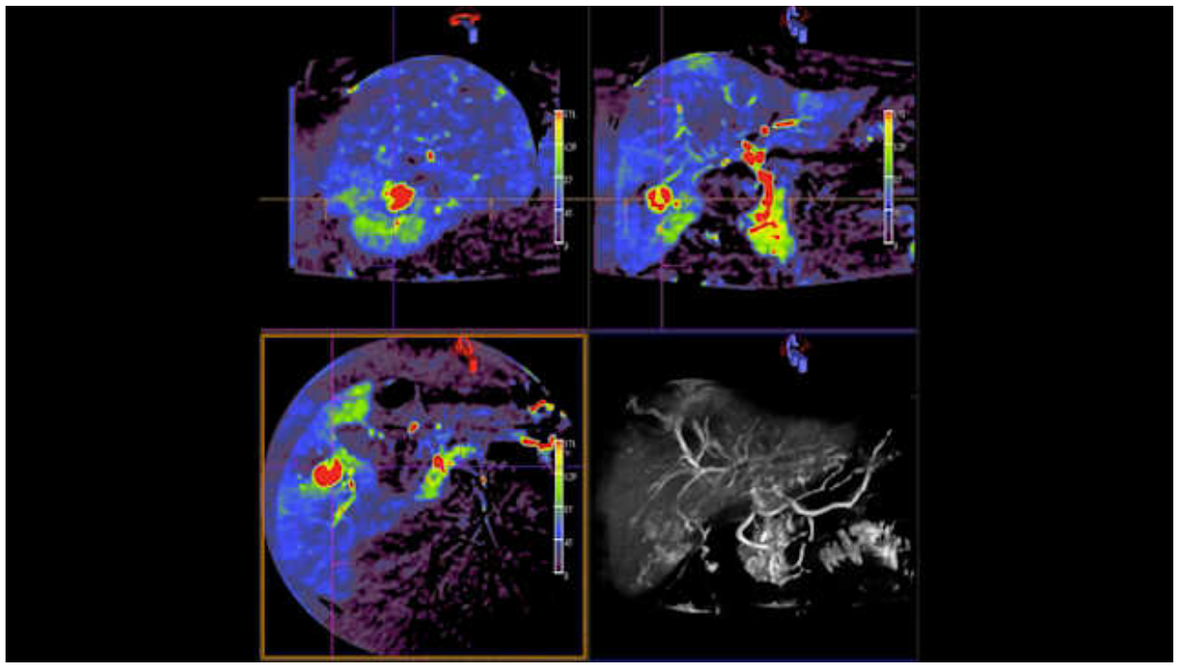
Pre- and post-embolization *syngo* DynaPBV imaging to confirm treatment success.

Acquisition Protocol	**5s DynaPBV Body (automatic)**
Injection Protocol	
Contrast Medium (CM):	340 mg Iodine/ml
Dilution:	33%
Injection Volume (CM/Saline):	36 ml (12 ml/24 ml)
Power Injector Used:	Yes
Injection Rate:	3 ml/s
Duration of Injection:	12 s
X-ray Delay:	Manual CM injection started when C-arm finished mask run 7 s acquisition delay as C-arm returns for fill run
Catheter Position:	Proper hepatic

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaPBV Body Dual PBV	Reconstruct the Nat Fill run
VOI Size:	Large	Large
Slice Matrix:	512 x 512	512 x 512
Kernel Type:	HU	HU
Image Characteristics:	Smooth	Smooth
Reconstruction Mode:	Dual (Sub and Mask)	Nat Fill
Viewing Preset:	PBV Body	DynaCT Body

Supported by *syngo* DynaPBV Body
System & Software: Artis Q ceiling VD10, *syngo* X Workplace VC10

Transarterial Chemoembolization of HCC Using *syngo* DynaPBV Body



Click Button to watch hi-res version

syngo DynaCT for SIRT Planning

Courtesy of

Prof. Bernhard Meyer, MD, Institute for Diagnostic and Interventional Radiology, Hanover Medical School, Germany

Patient History

48-year-old male with colorectal cancer was admitted with multiple hepatic metastases. Atypical right liver lobe resection and normal variant replaced right hepatic artery.

Diagnosis

Progressive disease after resection and palliative systemic chemotherapy.

Treatment

SIRT therapy of right liver lobe planned.

General Comments

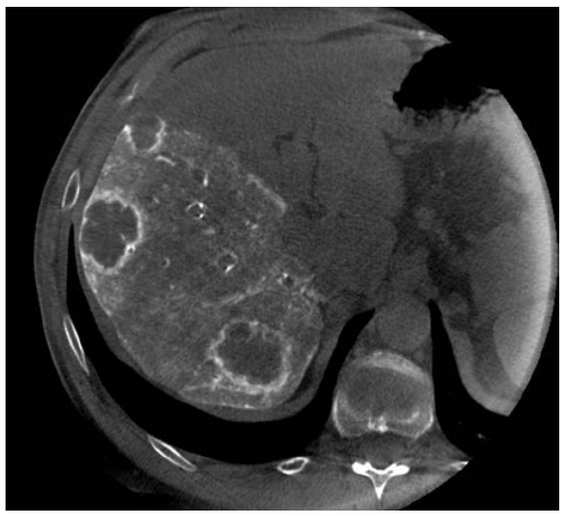
Once a patient has been selected as a candidate for radioembolization, pretreatment angiography and ***syngo* DynaCT** are performed. *syngo* DynaCT is an excellent tool for treatment planning. It enables visualization of the exact location of the tumors, better evaluation of the feeding vessels than with 2D imaging, and identification of a suitable catheter position distal to gastric branches to avoid collateral damage.

Considering the highly variable hepatic arterial anatomy and the potentially deleterious effect of a dystopic spread of radioactive microspheres into extrahepatic sites, it is important to ensure that there is no hepatofugal flow. Preparation prior to radioembolization can also require embolization of vessels such as the gastroduodenal, right gastric, falciform, and cystic arteries, as well as pancreaticoduodenal branches.

Tips & Tricks

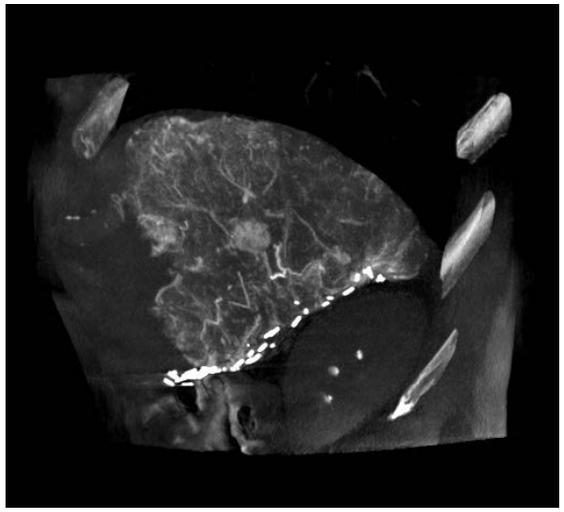
Breath-hold information and patient cooperation are crucial to obtain optimal *syngo* DynaCT results. Practise breathing technique prior to the *syngo* DynaCT spin.

syngo DynaCT for SIRT Planning



Axial MPR 3 mm shows the hepatic metastases

Coronal MIP 20 mm shows feeding vessels



Sagittal MIP 20 mm

Acquisition Protocol	**6sDCT Body**
Injection Protocol	
Contrast Medium (CM):	300 mg Iodine
Dilution:	50 %
Injection Volume (CM/Saline):	50 ml (25 ml/25 ml)
Power Injector Used:	yes
Injection Rate:	2.5 ml/s
Duration of Injection:	20 s
X-ray Delay:	15 s
Injection/ Catheter Position:	Right hepatic artery prior to first bifurcation

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body Nat Fill HU Normal	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* DynaCT
System & Software: Artis Q ceiling VD10, *syngo* X Workplace VC10

Chemoembolization With Drug-Eluting Beads

Courtesy of

Tobias F. Jakobs, MD, Department of Diagnostic and Interventional Radiology, Hospital Barmherzige Brueder, Munich, Germany

Patient History

History of multiple regimes of systemic chemotherapy and anti-hormonal treatment as well as radioembolization (SIRT) of the right liver lobe. Due to the complex arterial anatomy of the left liver lobe, SIRT of the left liver lobe was abandoned.

Diagnosis

Treatment-refractory liver metastases from breast cancer.

Treatment

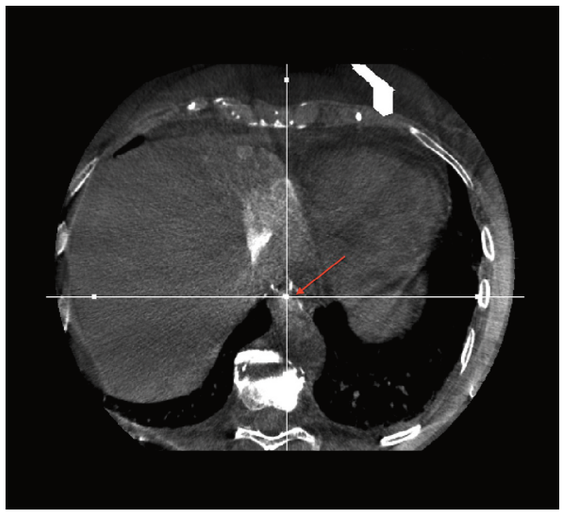
DEB TACE.
Coil embolization of falciform artery prior to delivering the drug eluting beads. DEB TACE was performed with the tip of the micro-catheter well distal to the origin of the inferior esophageal artery.

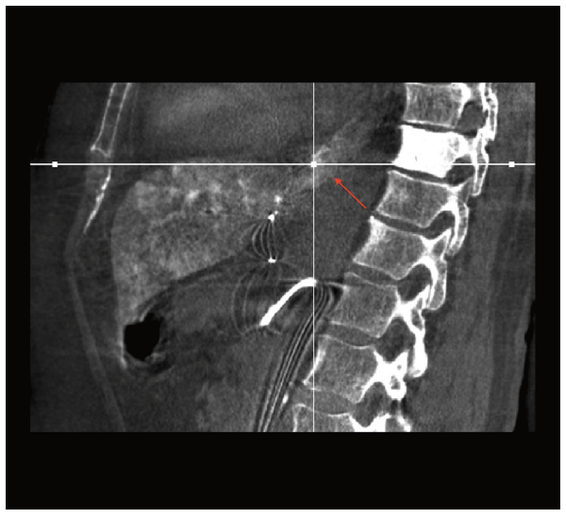
General Comments

***syngo* DynaCT** enhances the identification of aberrant vessels, which leads to improved planning of embolization procedures, increases the confidence of the treating radiologist and reduces potential toxicities for the patient.

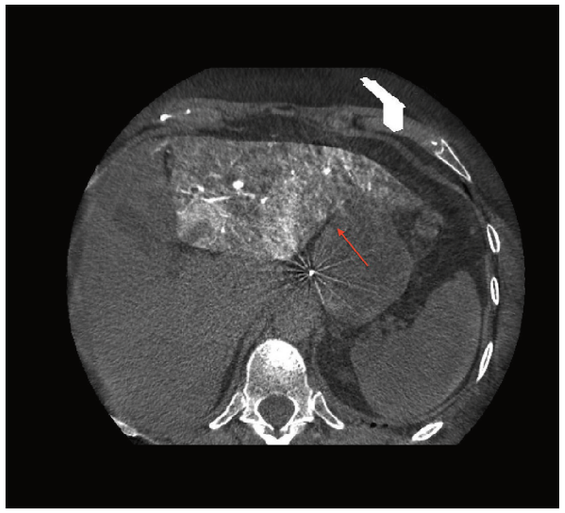
Read case study

Chemoembolization With Drug-Eluting Beads

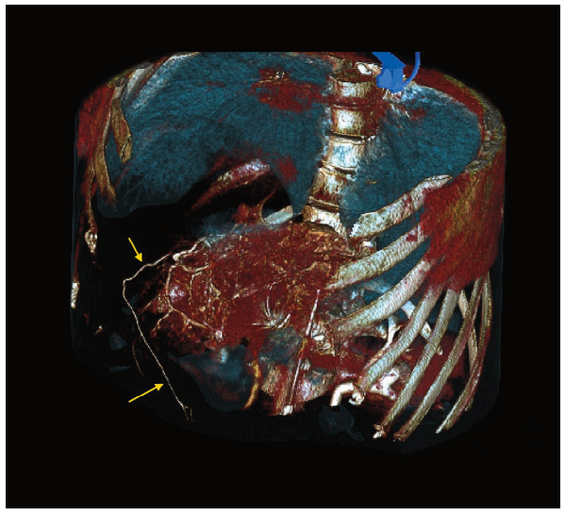




Contrast enhancement of the distal esophagus (arrows) is revealed, which draws the attention to an inferior esophageal artery, which was not recognized initially on the planar angiogram.



MPR thin
Contrast uptake of liver segments 2 and 3, no enhancement of the gastric wall (arrow).



Color-coded VRT
Shows the course of an additional aberrant vessel, the falciform artery (arrows).

Acquisition Protocol	**8sDCT Body**
Injection Protocol	
Contrast Medium (CM):	300 mg Iodine/ml
Dilution:	50%
Injection Volume (CM/Saline):	21 ml (10.5 ml/10.5 ml)
Power Injector Used:	Yes
Injection Rate:	1.5 ml/s
Duration of Injection:	14 s
X-ray Delay:	6 s
Injection/ Catheter Position:	Superselectively in the left hepatic artery distal to the origin of the gastric branches

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body Nat Fill HU Normal	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* DynaCT
System & Software: Artis zee biplane VC14, *syngo* X Workplace VB15

syngo DynaCT in Multiple Phases for HCC

Courtesy of

Norifumi Nishida, MD, and Yoshinori Takao, Osaka City University Hospital, Japan

A 69-year-old male with HCC (hepatocellular carcinoma) and HCV (Hepatitis C virus)-positive hepatic cirrhosis.

Customer Comment

CT scan during hepatic arteriography for HCC shows both tumor stain in first phase and the corona enhancement in second phase (Radiology 1998 206:161- 166. CVIR 2011 34:81–86). Thus this CT scan enables differentiation from an AP shunt which is also densely-stained in the first phase. *syngo* DynaCT scanned in two phases has an advantage in improvement of diagnostic performance for HCC because of its high spatial resolution and precise visualization of corona enhancement in second phase.

Patient History

The HCC was treated by resection of the caudate lobe 9 years ago, segmentectomy of S6 2 years ago, and several RFA series. HCC recurrence was found by ultra-sonography and dynamic contrast-enhanced CT scan during regular follow-up. Because of this recurrence, the patient was hospitalized for TACE treatment.

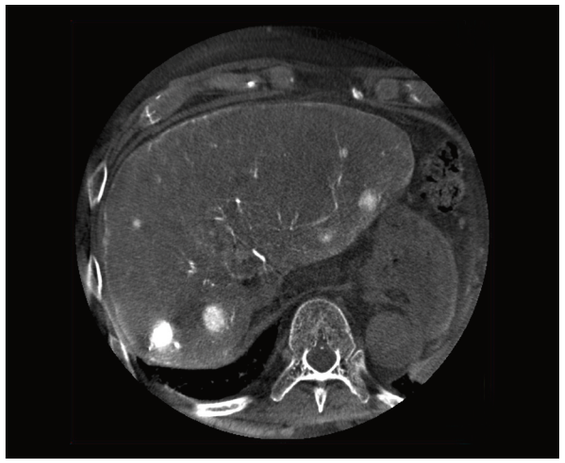
Diagnosis

Perfusion defect was found in both lobes of the liver using *syngo* DynaCT scanned in two phases. These sites also showed early enhancement and corona enhancement in the second phase using the ***syngo* DynaCT** scanned in two phases. The patient was diagnosed with HCC multiple recurrence based on these evaluations.

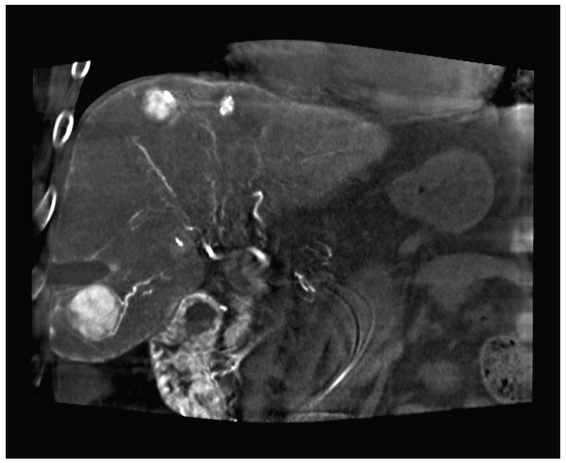
Treatment

TACE was performed using Lipiodolemulsion and Gelpart.

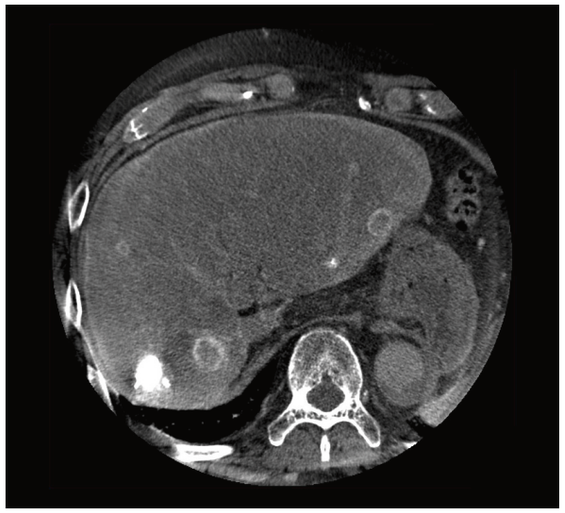
syngo DynaCT in Multiple Phases for HCC



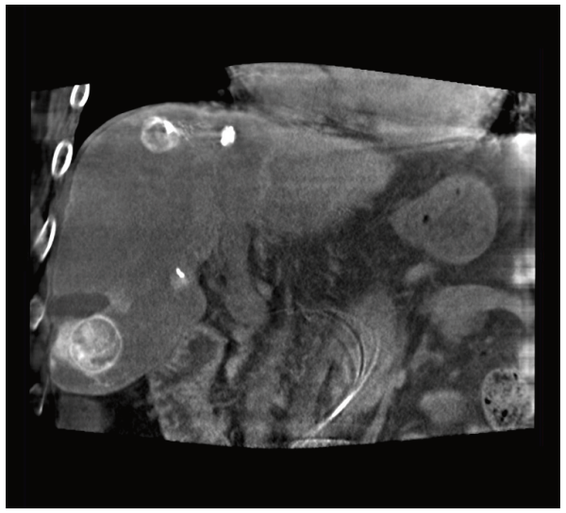
1st phase of *syngo* DynaCT
run Axial MPR 3 mm



1st phase of *syngo* DynaCT
run Coronal MPR 3 mm



2nd phase of *syngo* DynaCT
run Axial MPR 3 mm



2nd phase of *syngo* DynaCT
run Coronal MPR 3 mm

Acquisition Protocol	**6s DSA DCT Body**
Injection Protocol	
Contrast Medium (CM):	300 mg Iodine/ml
Dilution:	50%
Injection Volume (CM/Saline):	32 ml (16 ml/16 ml)
Power Injector Used:	Yes
Injection Rate:	2 ml/s
Duration of Injection:	16 s
X-ray Delay:	6 s DSA DCT run with manual triggering 1st Phase: 10 s X-ray delay time 2nd Phase: 25 s delay time after the 1st run
Injection/ Catheter Position:	Common Hepatic Artery

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body NatMask HU Auto	DynaCT Body Nat Fill HU Auto
VOI Size:	Full	Full
Slice Matrix:	512 x 512	512 x 512
Kernel Type:	HU	HU
Image Characteristics:	Normal	Normal
Reconstruction Mode:	NatMask	Nat Fill
Viewing Preset:	DynaCT Body	DynaCT Body

Supported by *syngo* DynaCT
System & Software: Artis zee biplane VC21, *syngo* X Workplace VB21

Percutaneous Radiofrequency Ablation of Lung Metastasis From CRC

Courtesy of

Olivier Pellerin, MD, MSc, Cardiovascular Radiology Department, Hospital Europeen Georges-Pompidou, Paris, France

Patient History

65-year-old male with colorectal cancer.

Diagnosis

Only two lung metastases (12 + 22 mm) from CRC in left lung.
Stabile after 1 line of chemotherapy.

Treatment

Radiofrequency ablation of lung nodules.

General Comments

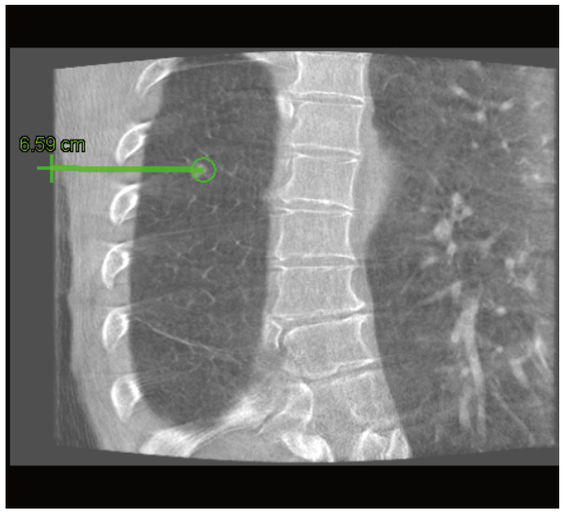
Under general anesthesia, prone installation with selective intubation using a Carlens tube. Right lung ventilated. Left lung lobe is excluded with a positive expiration pressure with oxygen.

Tips and Tricks

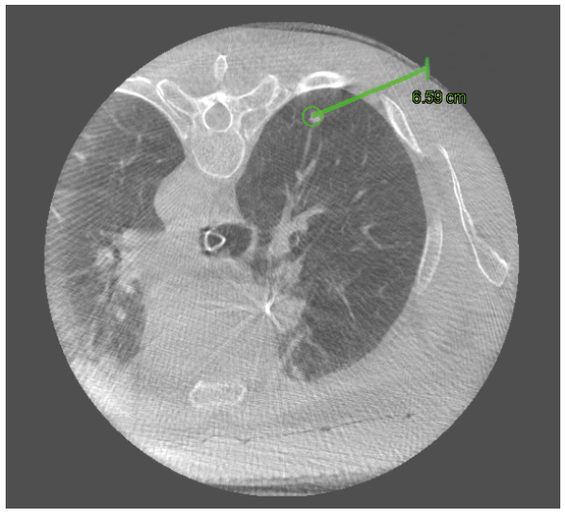
High level of expertise and use of cone-beam CT technology as well as good collaboration with anesthetic team is required.

Read case study

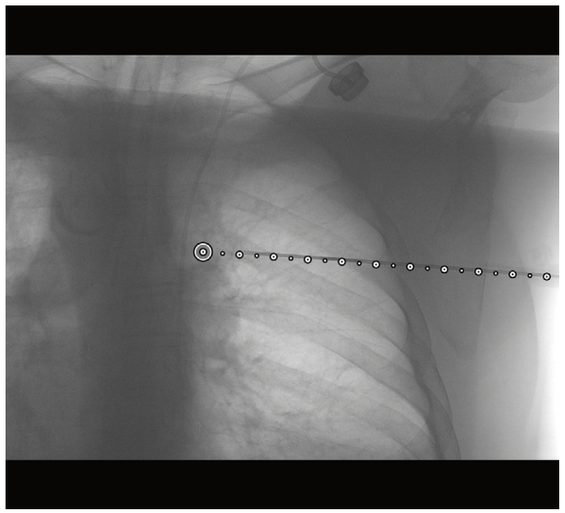
Percutaneous Radiofrequency Ablation of Lung Metastasis From CRC



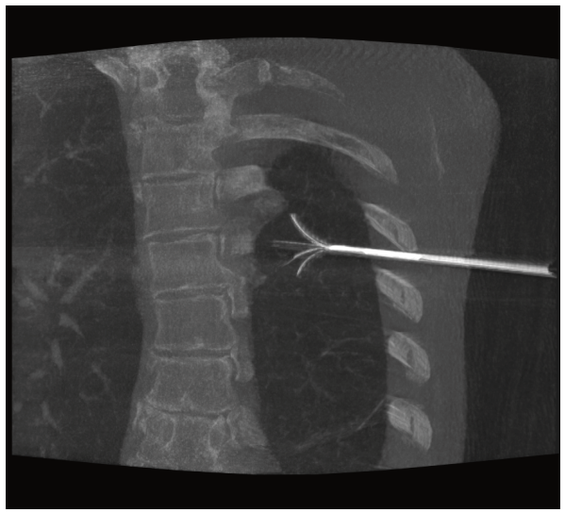
MPR 3 mm frontal view
Needle path planning on *syngo* InSpace 3D



MPR 3 mm transversal view
Needle path planning on ***syngo* InSpace 3D**



Store fluoro
Graphical overlay of planned needle path Protocol: Fluoro normal



MIP 10 mm frontal view
During RF ablation

Acquisition Protocol	**5sDR Body**
Injection Protocol	
Contrast Medium (CM):	No contrast
Dilution:	
Injection Volume (CM/Saline):	
Power Injector Used:	
Injection Rate:	
Duration of Injection:	
X-ray Delay:	
Injection/ Catheter Position:	

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	iGuide Nat Fill HU Normal	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* InSpace 3D, *syngo* iPilot enhanced, *syngo* iGuide
System & Software: Artis zee ceiling VC21, *syngo* MMWP VE52

Transarterial Thoracic Chemotherapy

Courtesy of

Prof. Thomas J. Vogl, MD, Stefan Zangos, MD, Department of Radiology, University of Frankfurt, Germany

Patient History

61-year-old female. Adenocarcinoma of the lung, recurrent tumor after surgery, radiation therapy and systemic chemotherapy. Actual third line therapy protocol.

Diagnosis

No systemic metastases, local intrapulmonary infiltration.

Treatment

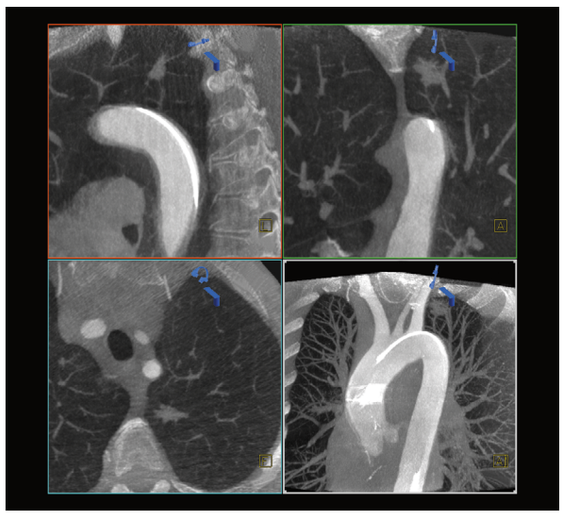
Transarterial thoracic chemotherapy with a mix of Mitomycin, Gemcitabine and Cisplatin injected in the ascending aorta performed after using the ***syngo* Dyna3D HighSpeed** protocol.

General Comments

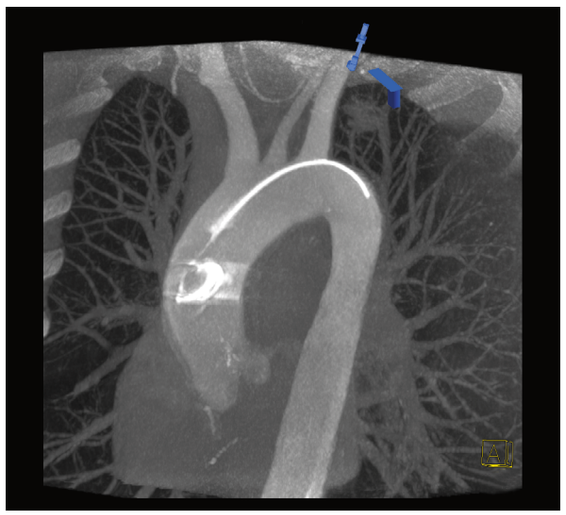
The very short acquisition time of less than 3 s makes it possible to acquire 3D datasets without breathing motion artifacts even in very sick patients. *syngo* Dyna3D HighSpeed allowed performing the 3D acquisition with only 25 ml of contrast and helped to save nearly 30% contrast media compared to a regular 5 s protocol. (A regular 5 s protocol would have required a 7 s injection protocol, resulting in a total volume of 105 ml with 35 ml of contrast).

Read case study

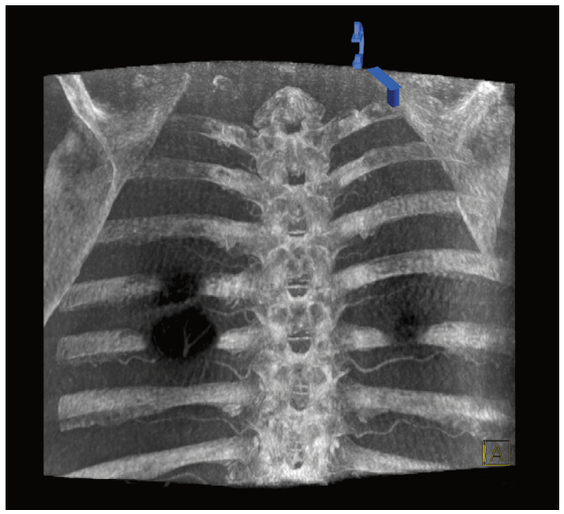
Transarterial Thoracic Chemotherapy



MIP 6 mm Very good and sharp delineation of pulmonary arteries and their small branches.



Thick MIP Visualization of pulmonary arteries with the tumor.



Coronar MIP 29 mm Visualization of intercostal arteries (white arrow).

Acquisition Protocol	**3sDR HighSpeed**
Injection Protocol	
Contrast Medium (CM):	350 mg Iodine/ml
Dilution:	33%
Injection Volume (CM/Saline):	75 ml (25 ml/50 ml)
Power Injector Used:	Yes
Injection Rate:	15 ml/s
Duration of Injection:	5 s
X-ray Delay:	2 s
Injection/ Catheter Position:	Ascending Aorta

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body Nat Fill HU	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* Dyna3D HighSpeed
System & Software: Artis zee biplane VC21, *syngo* X Workplace VB21 (Prototype software)

Content

syngo DynaCT of the Pulmonary Arteries

Courtesy of

Bernhard Meyer, MD, Institute for Diagnostic and Interventional Radiology, Medical School Hannover, Germany

Patient History

Patient with history of recurrent pulmonary embolism and chronic thromboembolic pulmonary hypertension (CTEPH). Pulmonary angiogram and ***syngo* DynaCT** were acquired for diagnostic work-up.

Diagnosis

CTEPH with perfusion defects and web stenoses mainly in the right lung.

Treatment

Diagnostic work-up.

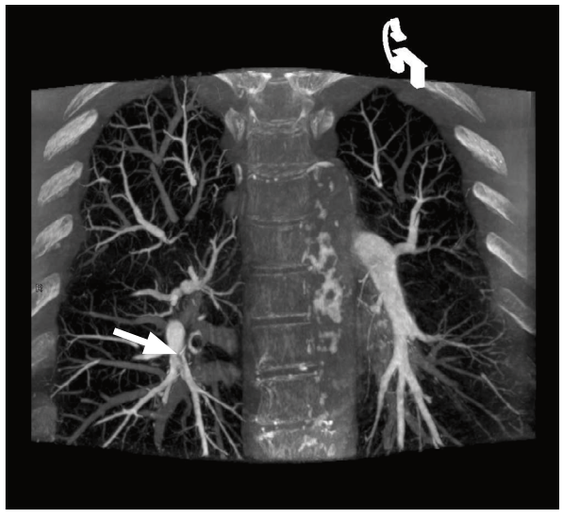
General Comments

Pulmonary angiograms are still the established gold standard for diagnostic workup in patients with CTEPH. *syngo* DynaCT can provide additional information about chronic embolism by depicting web stenoses and occlusions.

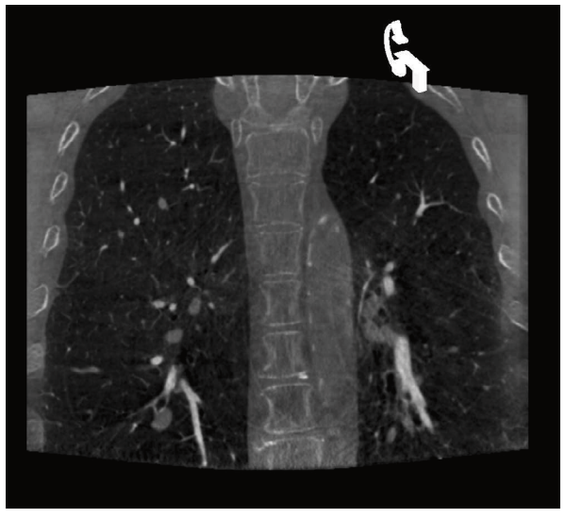
Tips and Tricks

Selective *syngo* DynaCT imaging can be performed in case of insufficient contrast using a central catheter position.

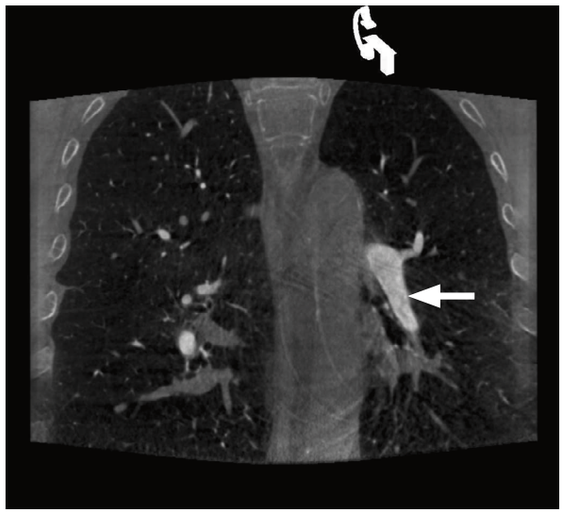
syngo DynaCT of the Pulmonary Arteries



Thick MIP 23 mm
Web stenosis in lower right lobe (arrow)



Thin MPR



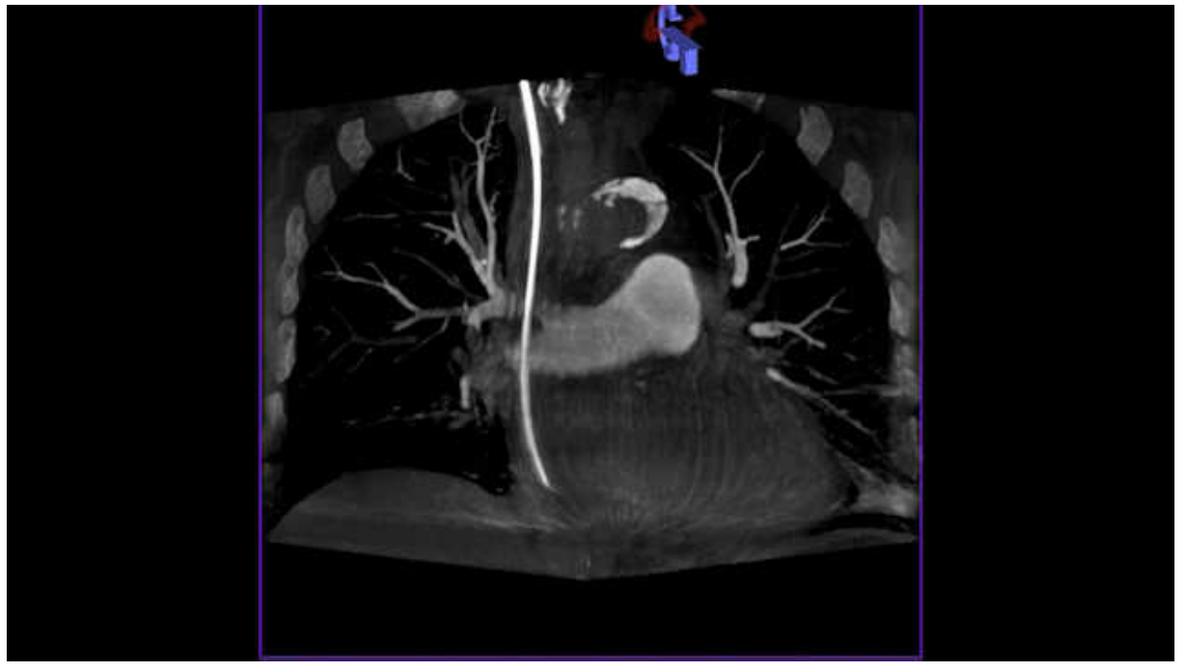
Thick MIP 23 mm
Small Web stenosis in left lobe (arrow)

Acquisition Protocol	**6sDCT Body**
Injection Protocol	
Contrast Medium (CM):	300 mg Iodine/ml
Dilution:	70%
Injection Volume (CM/Saline):	60 ml (42 ml/18 ml)
Power Injector Used:	Yes
Injection Rate:	8 ml/s
Duration of Injection:	7.5 s
X-ray Delay:	1.5 s
Injection/ Catheter Position:	Central Catheter Position

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body Nat Fill HU Normal	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* DynaCT
System & Software: Artis Q ceiling VD10, *syngo* X Workplace VC10

syngo DynaCT of the Pulmonary Arteries – Videos



Click Button to watch hi-res version

TIPS Placement Facilitated by CO_2 *syngo* Dyna3D and Guided by *syngo* Toolbox

Courtesy of

Eric J Hohenwalter, MD, FSIR, and Sarah White, MD, MS. Department of Radiology, Division of Vascular & Interventional Radiology, Medical College of Wisconsin, Milwaukee, WI, USA

Patient History

A 60-year-old female with nonalcoholic steatohepatitis (NASH) cirrhosis and refractory ascites.

Diagnosis

The patient was transferred to the Interventional Radiology Department for transjugular portosystemic shunt (TIPS) insertion.

Treatment

The right hepatic vein was selected via right transjugular vein access. Hepatic venography was performed, demonstrating a normal confluence of the hepatic veins. Wedged CO_2 portal ***syngo* Dyna3D** venography was then performed with images showing normal portal venous anatomy. A target was chosen within the right main portal vein, near the main portal vein bifurcation and marked using ***syngo* Toolbox**. These graphics were overlaid on live fluoroscopy for intraprocedural guidance. Surgical clips were also marked with *syngo* Toolbox to monitor liver motion and misregistration due to respiration or patient movement. A Colapinto needle was placed using the overlaid portal vein marking as a reference, followed by a glidewire. Vascular After the DSA portography acquisition, the GORE® VIATORR® stent was deployed.

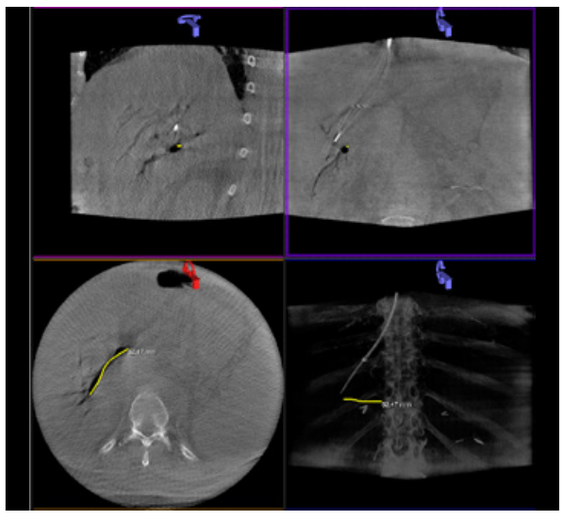
General Comments

One of the most difficult aspects of performing a TIPS is the portal vein puncture. Anything that can help guide this puncture has the potential to decrease the procedure time, fluoro time, and, most importantly, decrease the number of punctures needed. *syngo* Toolbox was extremly helpful in this case.

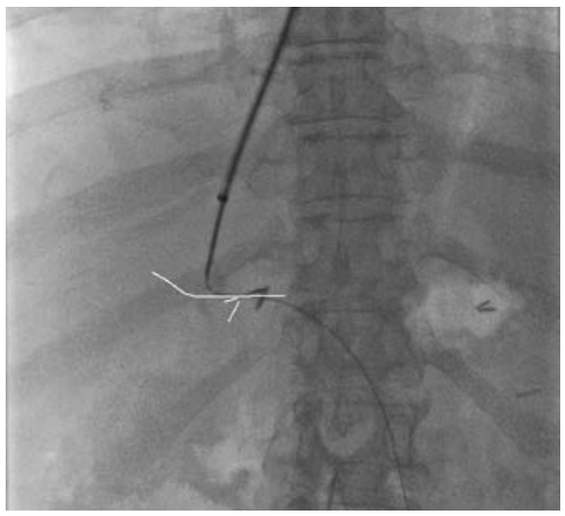
Tips & Tricks

Typically, a 2D CO_2 portogram is performed – standard of care for TIPS cases – prior to the 3D acquisition to confirm that the portal veins will fill, and to avoid the additional radiation if they do not. Reasons for inadequate portal vein opacification include hepatic venous collaterals and inadequate balloon inflation. The CO_2 injection is timed to be coincident with C-arm motion rather than with the spin “trigger”. The acquisition is triggered first and the injection of CO_2 is then administered when the C-arm begins to move. The reason for this is that it is difficult to keep the veins opacified for 5 seconds if the injection is started too early using a 60 mL syringe.

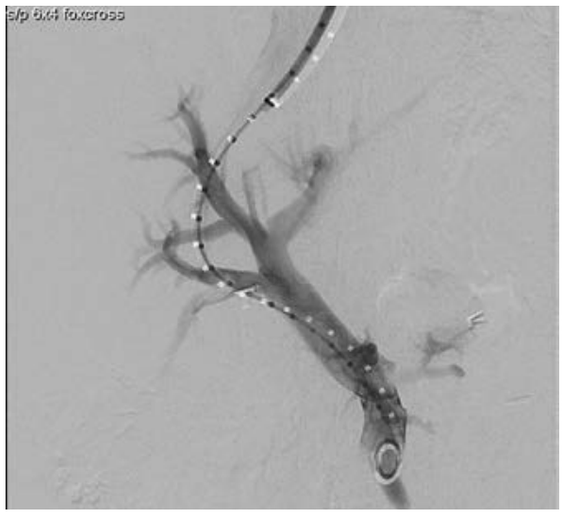
TIPS Placement Facilitated by CO_2 *syngo* Dyna3D and Guided by *syngo* Toolbox



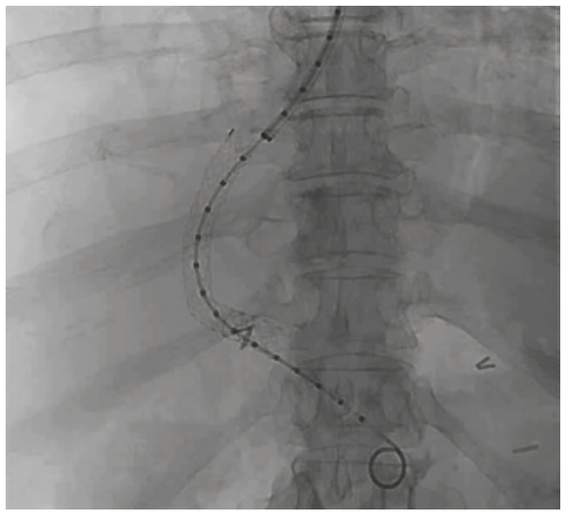
CO2 *syngo* Dyna3D showing the portal vein and *syngo* Toolbox graphics (yellow).



AP fluoroscopy image showing the *syngo* Toolbox overlay after successful portal vein access.



Conventional portal venogram.



Non-subtracted image from a DSA acquisition showing the successfully deployed TIPS stent.

Acquisition Protocol	**5sDR Body**
Injection Protocol	
Contrast Medium (CM):	CO_2
Dilution:	None
Injection Volume (CM/Saline):	60 ml
Power Injector Used:	None
Injection Rate:	Manual injection
Duration of Injection:	5 s
X-ray Delay:	No (injection is coincident with start of C-arm rotation)
Injection/ Catheter Position:	Proximal right hepatic vein

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
		No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Soft Tissue	

Supported by *syngo* Toolbox
System & Software: Artis zee ceiling VC21, *syngo* X Workplace VB21

syngo DynaCT 360 With IV Injection Used for TIPS Planning

Courtesy of

Ulf Teichgräber, MD, Renè Aschenbach, MD, Department of Diagnostic and Interventional Radiology, Jena University Hospital, Germany

Patient History

48-year-old female patient; liver cirrhosis.

Diagnosis

Ascites and portal hypertension with esophageal varices and bleeding.

Treatment

TIPS procedure.
Due to a missing preprocedural contrast enhanced CT study, a ***syngo* DynaCT 360** with intravenous contrast injection was performed to evaluate patency of portal vein. Visualization of right portal vein to plan intervention.

General Comments

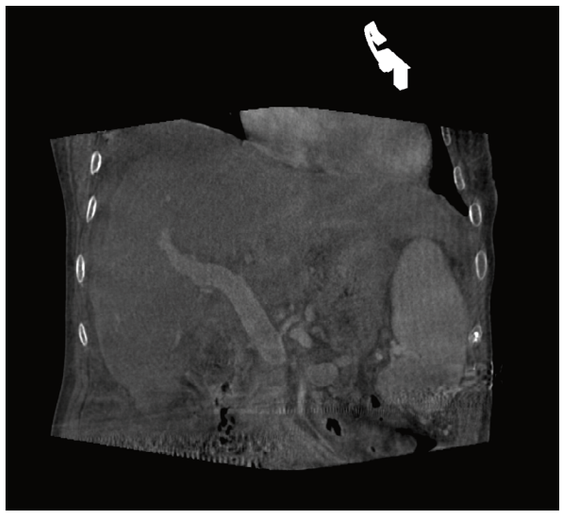
Portal vein patency is crucial for TIPS procedure. Therefore a non-invasive contrast-enhanced (intravenous injection) *syngo* DynaCT was deemed as the best choice due to the lack of previous conventional CT.

Tips and Tricks

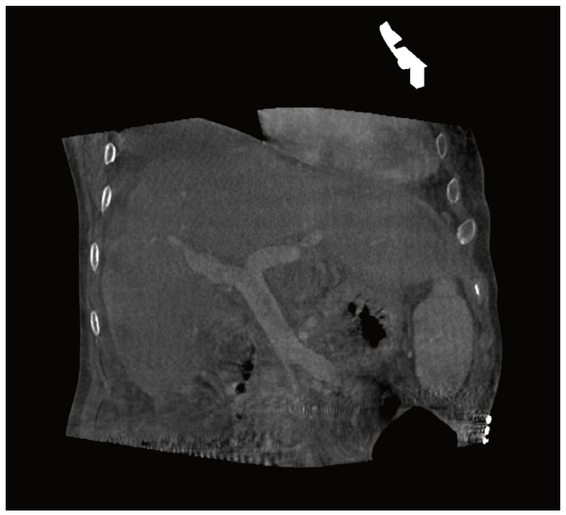
syngo DynaCT 360 offers more coverage compared to conventional cone-beam CT to evaluate portal vein, hepatic vein and other vascular structures in the abdomen.

Read case study

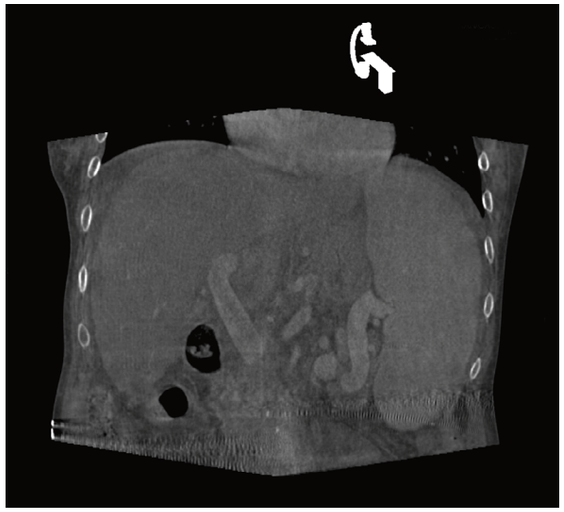
syngo DynaCT 360 With IV Injection Used for TIPS Planning



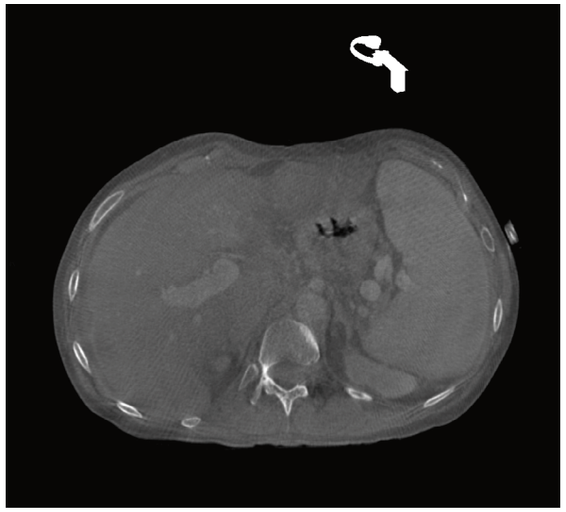
MPR thin coronal portal vein*



MPR thin coronal portal vein*



MPR thin coronal splenic vein and collaterals*



MPR thin axial right portal vein*

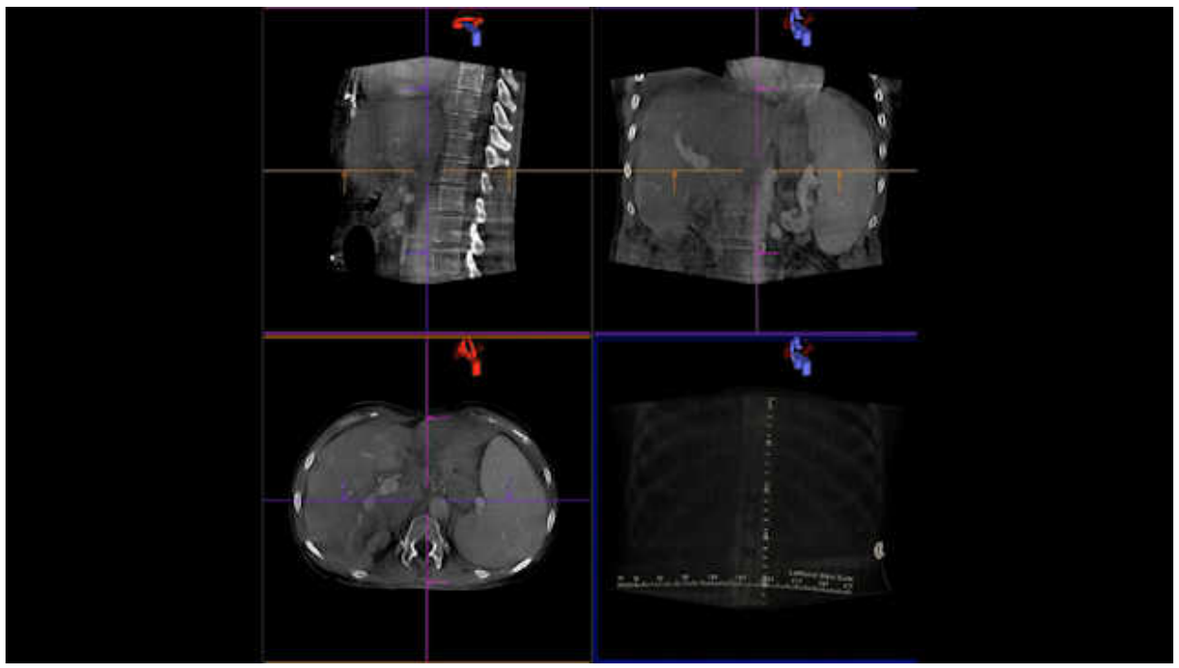
Acquisition Protocol	**6s Large Volume 360°**
Injection Protocol	
Contrast Medium (CM):	370 mg Iodine/ml
Dilution:	No
Injection Volume:	80 ml
Power Injector Used:	Yes
Injection Rate:	3 ml/s
Duration of Injection:	26.6 s
X-ray Delay:	40 s
Catheter Position:	Antecubital Vein

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body Nat Fill HU	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* DynaCT 360
System & Software: Artis zeego with Q technology VD10, *syngo* X Workplace VC10

* Artifacts visible due to ruler taped to patient skin.

syngo DynaCT 360 With IV Injection Used for TIPS Planning – Video



Click Button to watch hi-res version

Embolization of an Aortic Type II Endoleak

Courtesy of

Prof. Oliver Dudeck, MD, Dept. of Radiology and Nuclear Medicine, University Clinic Magdeburg, Germany

Patient History

70-year-old male patient with an abdominal aneurysm, treated 11/2012 with endovascular aortic repair (EVAR), presented with midabdominal pain. CT showed enlargement of the aneurysm sac and a type II endoleak, fed by lumbar arteries. The inferior mesenteric artery was occluded so the patient was scheduled for liquid embolization of the endoleak by direct puncture of the aneurysm sac.

Diagnosis

Type II endoleak after EVAR.

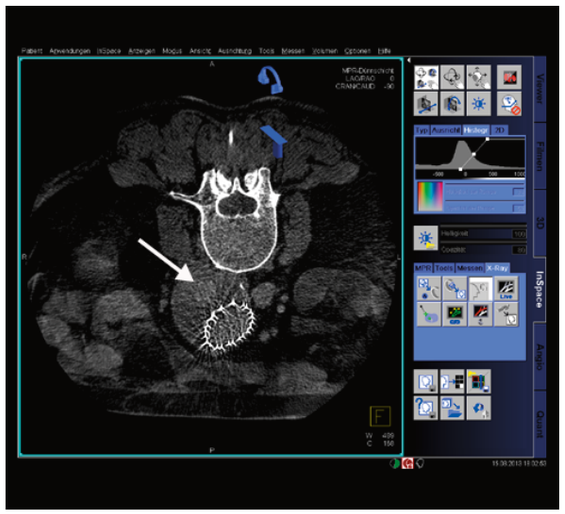
Treatment

Liquid embolization of the endoleak by direct puncture of the aneurysm sac.

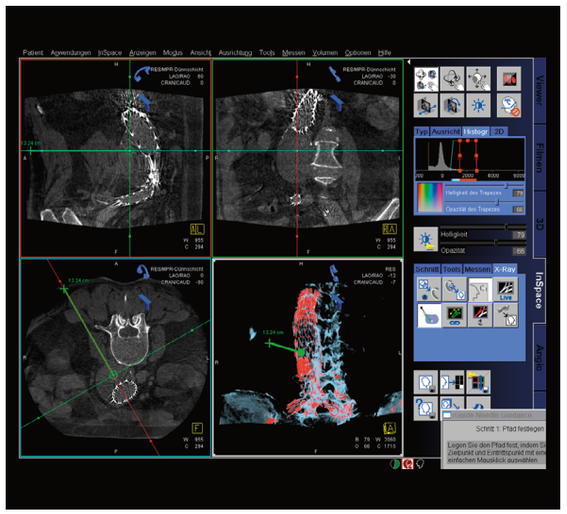
Tips and Tricks

CT-like images of rotational angiography may also visualize endoleak site after administration of IV contrast media.

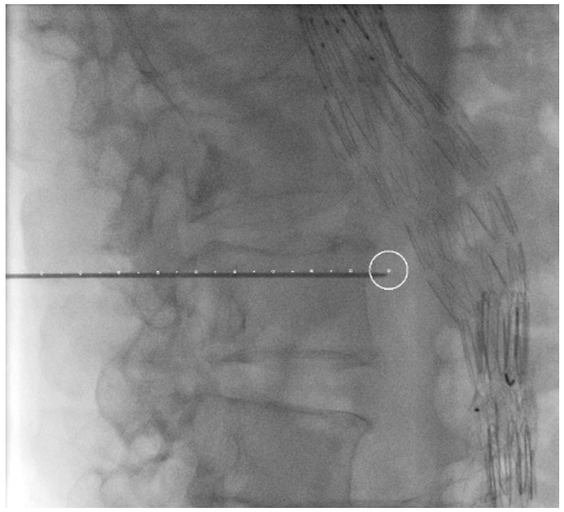
Embolization of an Aortic Type II Endoleak



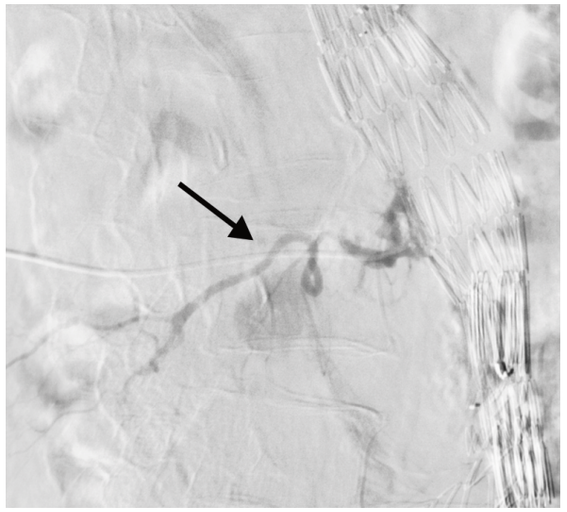
MPR thin transversal slice – visualization of endoleak (arrow) after administration of IV contrast media.



***syngo* iGuide** needle path planning.



Fluoro image with needle and overlaid needle path.



Angiogram confirms precise puncture of the nidus, being fed by a lumbar artery (arrow).

Acquisition Protocol	**8sDCT Body**
Injection Protocol	
Contrast Medium (CM):	300 mg Iodine/ml
Dilution:	No
Injection Volume:	60 ml
Power Injector Used:	Yes
Injection Rate:	3 ml/s
Duration of Injection:	20 s
X-ray Delay:	70 s
Injection/ Catheter Position:	Intravenous

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	iGuide Softtissue Nat Fill HU Normal	No
VOI Size:	Large	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* DynaCT, *syngo* iGuide
System & Software: Artis zeego VC21, *syngo* MMWP VE52

Control *syngo* DynaCT Directly Following Endovascular Aneurysm Sealing Procedure

Courtesy of

Prof. Dietmar Böckler, MD, Department for Vascular and Endovascular Surgery, University Hospital Heidelberg, Germany

Patient History

73-year-old male

Diagnosis

Asymptomatic patient with progressive, penetrating atherosclerotic ulcer (PAU) in the infrarenal aorta (max. diameter 40 mm).

Treatment

Endovascular aneurysm sealing using Endologic Nellix™.

General Comments

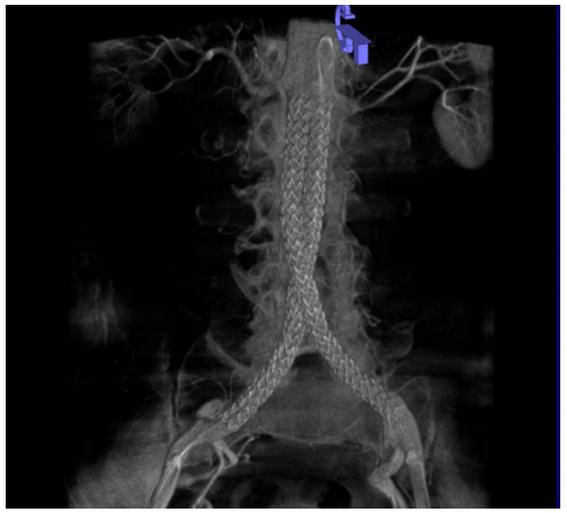
Control ***syngo* DynaCT** directly following aneurysm sealing enables assesment of correct deployment of stent graft, patency of renal, visceral, and iliac arteries. Complications such as endoleaks and stent stenosis also excluded thanks to *syngo* DynaCT.

Tips & Tricks

syngo DynaCT in portrait orientation (24 cm vertical coverage) has a large anatomical coverage that allows visualization of the renal arteries, partially suprarenal aorta, infrarenal aorta and its branches, and the iliac arteries during EVAR procedures. Immediate post-procedural control DynaCT allows the physician to evaluate his treatment so that the physician can see the complications early and change the treatment strategy. *syngo* DynaCT removes the need for further postprocedural CT examinations.

Control *syngo* DynaCT Directly Following Endovascular Aneurysm Sealing Procedure

Coronal MIP 50 mm shows optimal deployment of stent and patency of renal arteries



Coronal VRT shows correct deployment of stent and patency of vessels

Acquisition Protocol	**5s DCT Body CARE Portrait (prototype calibration)**
Injection Protocol	
Contrast Medium (CM):	300 mg Iodine/ml
Dilution:	66%
Injection Volume (CM/Saline):	70 ml (46.6 mL/23.3 ml)
Power Injector Used:	Yes
Injection Rate:	10 ml/s
Duration of Injection:	7 s
X-ray Delay:	2 s
Catheter Position:	Above renal asteries

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body Nat Fill HU	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	Auto	

Supported by *syngo* DynaCT
System & Software: Artis zeego VC14, *syngo* X Workplace VB21

Prostatic Artery Embolization

Courtesy of

Olivier Pellerin, MD, MSc, Cardiovascular Radiology Department, Hospital Europeen Georges-Pompidou, Paris, France

Patient History

66-year-old man; benign prostate hyperplasia with major dysuria.

Diagnosis

Prostate volume 90 cm^3 PSA < 3.

Treatment

Embolization of benign prostate hyperplasia.

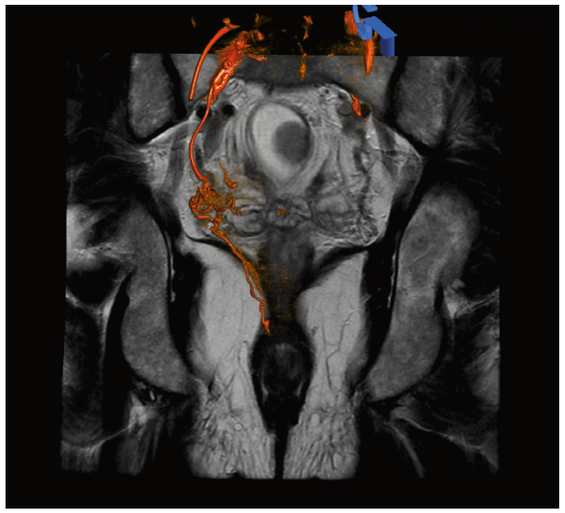
Tips and Tricks

Fusion of MRI data can save dose, because a ***syngo* DynaCT** run in low-dose setting is sufficient.

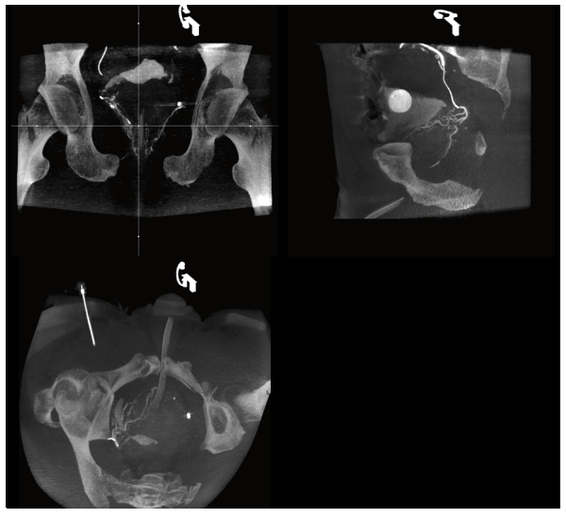
***syngo* Embolization Guidance** provides guidance to the target vessel, thus saving time, contrast media and fluoro time as well as dose.

Read case study

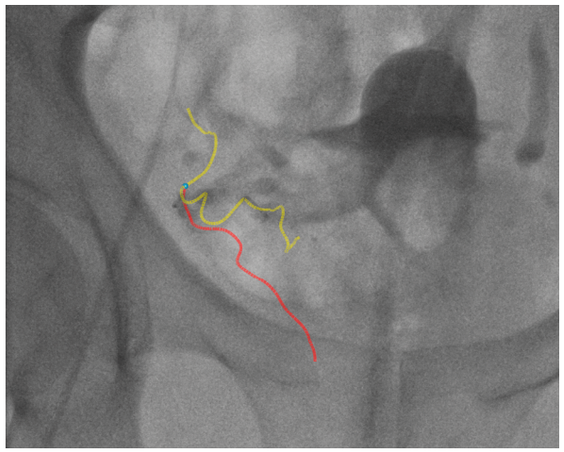
Prostatic Artery Embolization



MRI image fused with *syngo* DynaCT volume (low-dose setting). Visualization in embedded MPR mode.



Thick MIP 48 mm
Frontal, sagittal and transversal view of pelvic vessels out of *syngo* DynaCT volume.



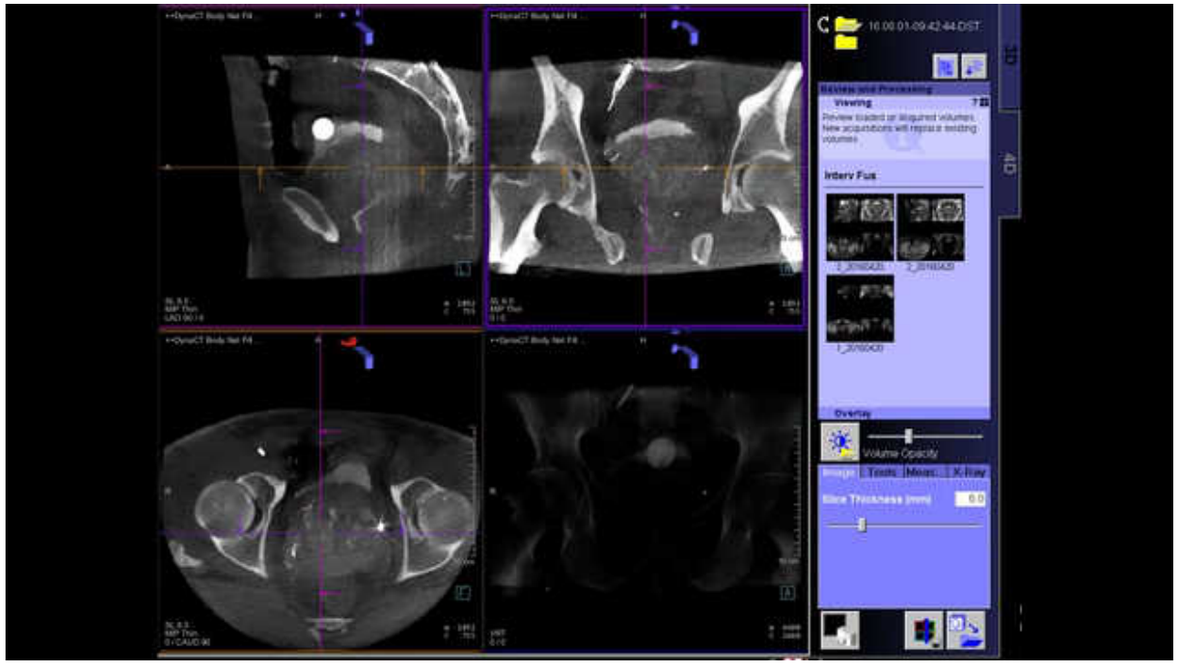
Store fluoro with *syngo* iPilot overlay of *syngo* Embolization Guidance centerlines.
Protocol: Fluoro normal

Acquisition Protocol	**5sDCT Body Care**
Injection Protocol	
Contrast Medium (CM):	350 mg Iodine/ml
Dilution:	50%
Injection Volume (CM/Saline):	5 ml (2.5 ml/2.5 ml)
Power Injector Used:	No
Injection Rate:	~ 1 ml/s
Duration of Injection:	5 s
X-ray Delay:	No
Injection/ Catheter Position:	Prostatic Artery

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	DynaCT Body Nat Fill HU Normal	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	HU	
Image Characteristics:	Normal	
Reconstruction Mode:	Nat Fill	
Viewing Preset:	DynaCT Body	

Supported by *syngo* DynaCT, *syngo* InSpace 3D/3D Fusion, *syngo* iPilot enhanced, *syngo* Embolization Guidance
System & Software: Artis zee ceiling VC21, *syngo* MMWP VE52

Prostatic Artery Embolization – Video



Click Button to watch hi-res version

syngo Dyna3D DSA Imaging of Right Hip After Surgery

Courtesy of

A.D. Montauban van Swijndregt, MD, OLVG, Amsterdam, Netherlands

Patient History

Arterial bleeding after Gamma nail insertion in right hip.

Diagnosis

Immediately after surgery there was swelling of the upper leg. Deep femoral artery bleeding was suspected. CT Angio showed a blush in muscle and the patient was transferred to the angio suite for exact localization of the bleeding and further treatment. A ***syngo* Dyna3D DSA** run was performed and after fully automized reconstruction of all volumes, visualized in ***syngo* Dual-Volume** mode to show vessels in relation to the anatomical structures to find the bleeding.

Treatment

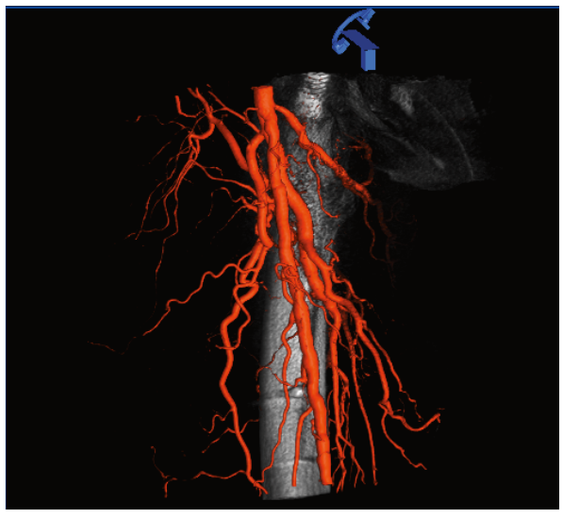
The bleeding had stopped in the meantime, so treatment was not necessary.

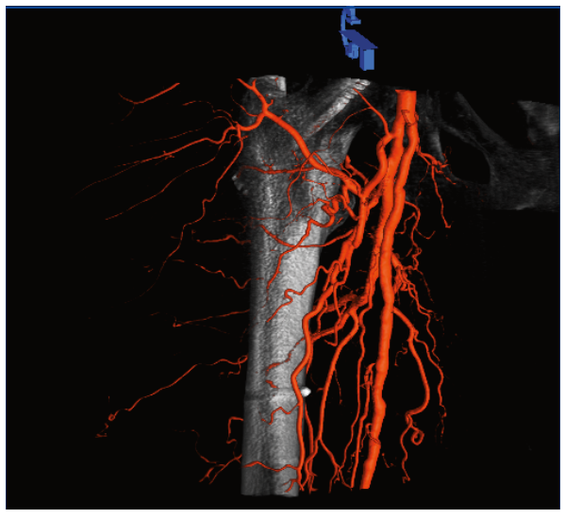
General Comments

Due to the metal artifacts of the Gamma nail we decided for a high-contrast Dyna3D DSA run, rather than using a soft-tissue *syngo* DynaCT run.

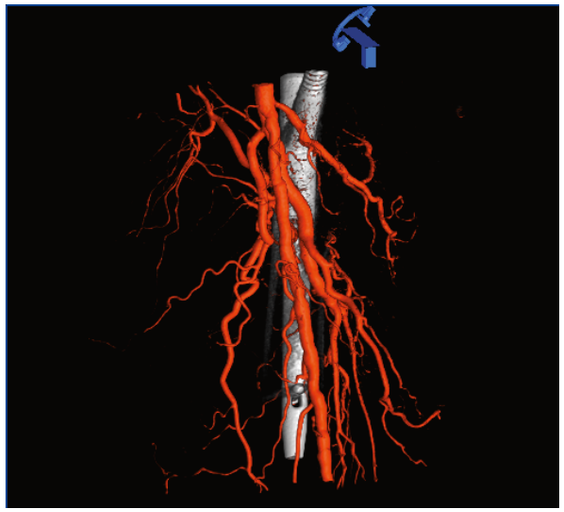
This turned out to be a nice 3D volume, and even nice MPR views of the bony tissue.

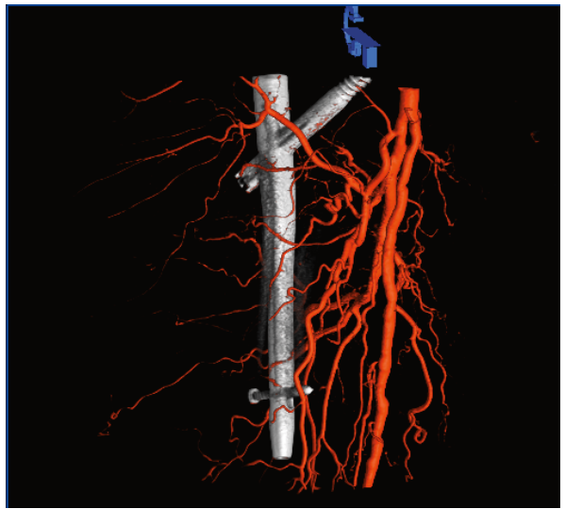
syngo Dyna3D DSA Imaging of Right Hip After Surgery





syngo DualVolume
Combines the reconstruction of mask run with the subtracted reconstruction to show vessels in relation to bones in any angulation.





syngo DualVolume

Acquisition Protocol	**5sDSA Body**
Injection Protocol	
Contrast Medium (CM):	270 mg Iodine/ml
Dilution:	No
Injection Volume:	24 ml
Power Injector Used:	Yes
Injection Rate:	4 ml/s
Duration of Injection:	6 s
X-ray Delay:	1 s
Catheter Position:	Selective in arteria iliaca communis

Reconstruction Protocol	**1. Reconstruction**	**2. Reconstruction**
	Dyna3D DSA Dual Body	No
VOI Size:	Full	
Slice Matrix:	512 x 512	
Kernel Type:	EE for Sub volume/ HU for mask volume	
Image Characteristics:	Auto	
Reconstruction Mode:	Dual	
Viewing Preset:	DualVolume	

Supported by *syngo* Dyna3D
System & Software: Artis Q ceiling VD10, *syngo* X Workplace VC10

Peripheral Angiography Using CO_2

Courtesy of

Ulf Teichgräber, MD, Renè Aschenbach,MD, Department of Diagnostic and Interventional Radiology, Jena University Hospital, Germany

Patient History

74-year-old female patient. Occlusive peripheral artery disease. Patient did not want bypass surgery. Renal insufficiency Grade III (severely limiting the use of contrast media).

Diagnosis

Fontaine IIb. Left superficial femoral artery is occluded in the proximal third and there is distal filling via collaterals.

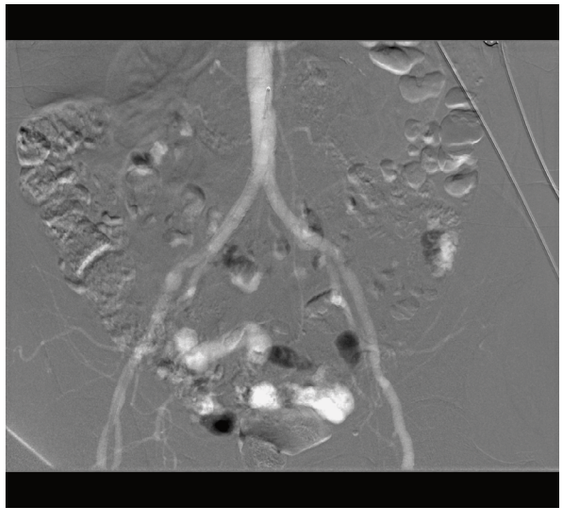
Treatment

Laser atherectomy followed by PTA with drug-eluting balloon. VIABAHN stent graft placed.

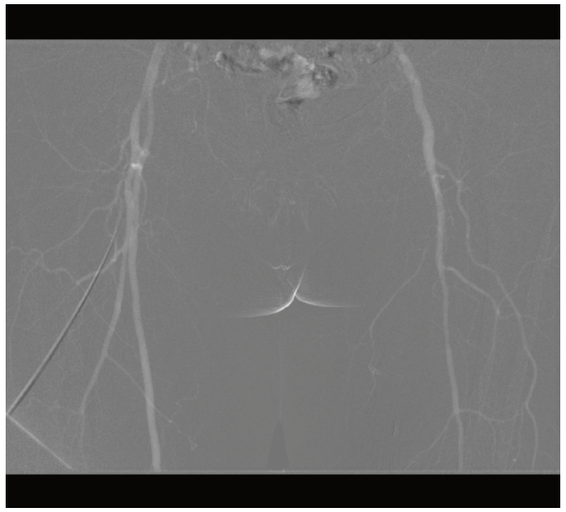
General Comments

CO_2 evenflow acquisition technique provides high image quality. High k-factor creates more homogeneous, bubble-free visualization of vessels.

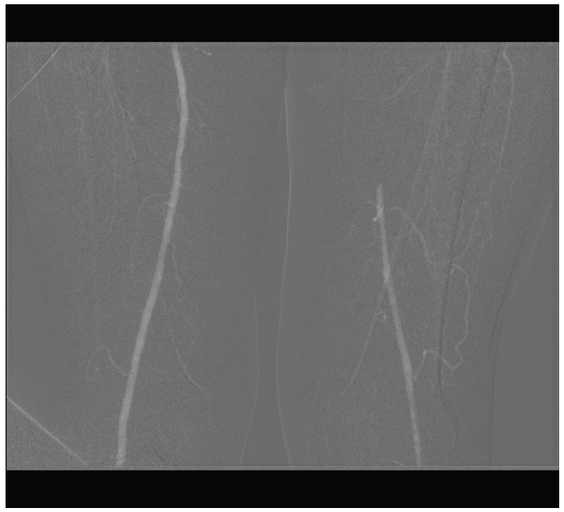
Peripheral Angiography Using CO_2



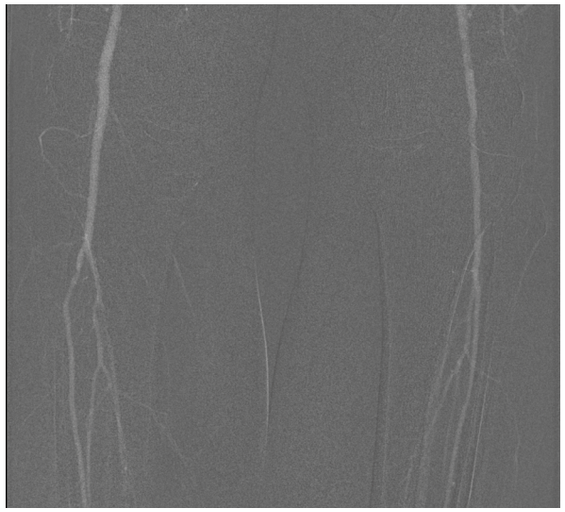
Min OPAC
Iliac arteries



Min OPAC
Femoral arteries



Min OPAC
Occlusion in left superfic. femoral artery



Min OPAC
Vessels below occlusion show collateral filling

Acquisition Protocol	**DSA CO_2 Evenflow**
Frame Rate:	7.5 f/s (higher frame rate, low dose/f, high k-factor)
Length of Sequence:	20 s max
Injection Protocol	
Contrast Medium (CM):	CO_2 1.3 bar
Dilution:	No
Injection Volume:	80 ml for each angiography step/ for intervention 20 ml CO_2
Power Injector Used:	Optimed CO_2 System
Injection Rate:	Manual
Duration of Injection:	Manual
X-ray Delay:	Injection starts right after mask selection (~ 4^{th} frame)
Catheter Position:	Distal abdominal artery
Image Postprocessing	
Pixel Shift:	Automatic
Min OPAC:	Yes

Supported by *syngo* Dyna3D
System & Software: Artis Q ceiling VD10, *syngo* X Workplace VC10

Real-Time Assessment of Revascularization of Peripheral Vascular Disease

Courtesy of

Jianping Gu, MD and Wensheng Lou, MD, Department of Interventional Radiology, Nanjing No.1 Hospital, China

Patient History

A 75-year-old male patient with 8-year history of hypertension suffered from low extremity arterial occlusive disease. Implantation of a stent 3 years prior, presenting with severe pain and numbness in his right lower limb.

Diagnosis

The middle and upper segments of the right superficial femoral artery were occluded, while the lower segment still showed sufficient perfusion due to collateral flow. The popliteal, peroneal, anterior tibial, and posterior tibial arteries were not obstructed but presented with localized plaque formations. A severe stenosis existed at the bifurcation of the posterior tibial artery.

Treatment

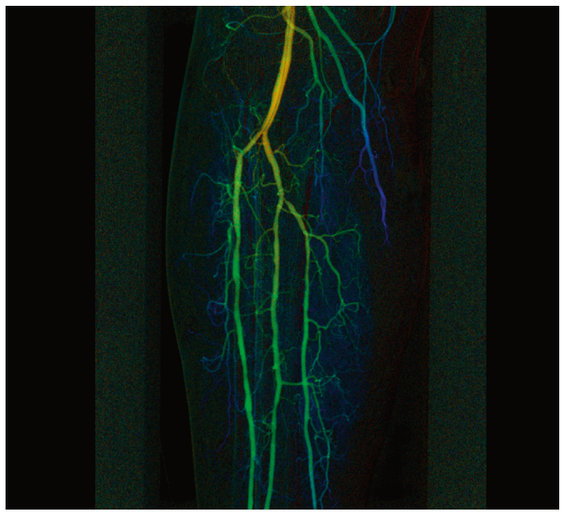
A balloon dilatation and subsequent thrombolysis therapy were performed at the upper segment of the right superficial femoral artery. 2 stents (6 x 150 mm, Protege, EV3) were implanted into the right superficial femoral artery to reopen the vessel.

General Comments

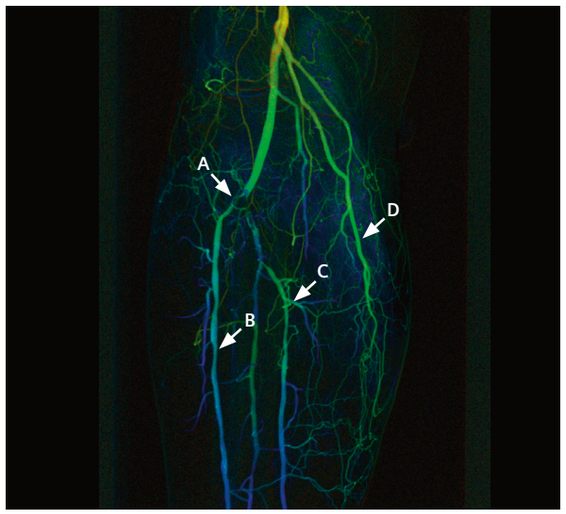
This case demonstrated the capabilities of ***syngo* iFlow** to evaluate the perfusion and circulation in and around distal arteries during the interventional procedure. The functional information was very valuable for choosing the right treatment strategy for the next step.

Read case study

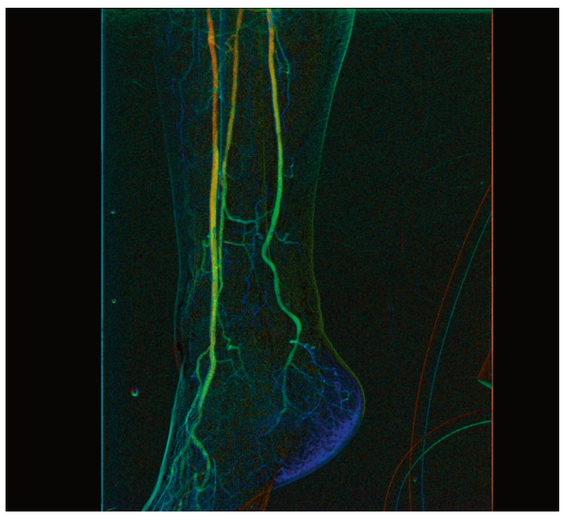
Real-Time Assessment of Revascularization of Peripheral Vascular Disease

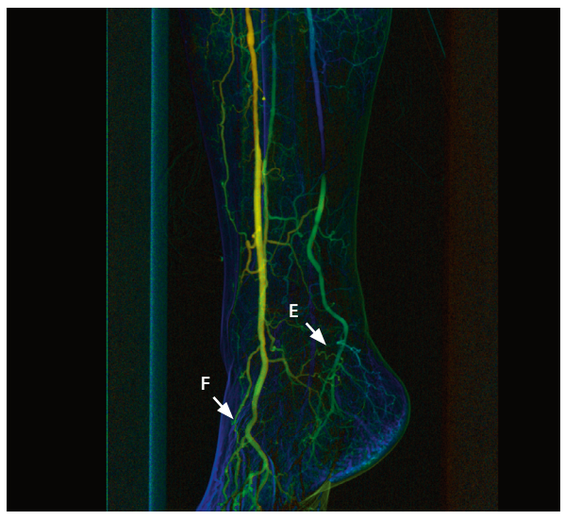


syngo iFlow image before treatment of the stenosed superficial femoral artery.



During stenting of the superficial femoral artery an occlusion of the popliteal bifurcation was caused by an embolus (A).





syngo iFlow measurement shows improved distal blood flow after intervention despite the embolus.

Acquisition Protocol	**DSA 2 f/s**
Injection Protocol	
Contrast Medium (CM):	320 mg Iodine/ml
Dilution:	No
Injection Volume:	8 ml
Power Injector Used:	Yes
Injection Rate:	3 ml/s
Duration of Injection:	2.6 s
X-ray Delay:	0 s/0 s
Catheter Position:	Intravenous

TTP shows that (E) the blood flow in the malleolar artery was almost the same as before (TTP ↑ 0.5 s) and that (F) the blood flow in the dorsalis pedis artery was improved (TTP ↓ 3.5 s).

syngo iFlow shows the hemodynamic changes in the distal vessels. Time-to-peak (TTP) analysis based on the *syngo* iFlow images showed an increased flow in a collateral branch (D) ↓ 2.5 s. At the same time blood flow within the anterior (B) ↑ 2.5 s and posterior tibial arteries (C) ↑ 1.5 s slowed down.

Supported by *syngo* iFlow
System & Software: Artis zee VC14, *syngo* X Workplace VB21

Glossary of Artis and Workplace Applications

Advanced Applications with PURE®	Name before
CLEARstent	CLEARstent
CLEARstent Live	CLEARstent Live
IVUSmap	IVUSmap
syngo 3D Roadmap	*syngo* iPilot, *syngo* iPilot enhanced
syngo 3D Segmentation	–
syngo 3D Stenosis Measurement	*syngo* InSpace 3D Stenosis Measurement
syngo Aneurysm Guidance Neuro	*syngo* Neuro Aneurysm Analysis – Virtual Stent
syngo Aortic Valve Guidance	*syngo* Aortic ValveGuide
syngo Congenital Heart Disease Guidance	–
syngo DualVolume	*syngo* iDentify
syngo Dyna3D	*syngo* Dyna3D/*syngo* Inspace 3D
syngo Dyna3D HighSpeed*/**	*syngo* Dyna3D HighSpeed*/**
syngo Dyna4D*	–
syngo DynaCT Cardiac	*syngo* DynaCT Cardiac

Advanced Applications with PURE®	Name before
syngo DynaCT with HDR Detector*	*syngo* DynaCT with HDR Detector*
syngo DynaCT Large Volume*/**	Large Volume *syngo* DynaCT*/**
syngo DynaCT Micro*	*syngo* DynaCT Micro*
syngo DynaCT SMART	–
syngo DynaCT	*syngo* DynaCT
syngo DynaPBV Body	*syngo* DynaPBV Body
syngo DynaPBV Neuro	*syngo* DynaPBV Neuro
syngo Electrophysiology Guidance	*syngo* InSpace EP
syngo Embolization Guidance	*syngo* Embolization Guidance
syngo Fusion Package	–
syngo 2D/3D Fusion	–
syngo 3D/3D Fusion	*syngo* inSpace 3D/3D Fusion
syngo Toolbox	*syngo* iGuide Toolbox
syngo iFlow	*syngo* iFlow
syngo LA Segmentation	*syngo* InSpace EP
syngo Needle Guidance	*syngo* iGuide
syngo Toolbox	*syngo* iGuide Toolbox

* Only with large detector./** Only with Artis zeego.

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