



GE HealthCare

CLINICAL CASE SERIES

OEC 3D in Interventional Radiology

A case series highlighting mobile interventional cone beam
CT imaging across embolization procedures

Physician

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System

OEC 3D mobile C-arm

Patient history, diagnosis, symptoms

An 83-year-old male with symptomatic benign prostatic hyperplasia (BPH) presented with persistent hematuria and lower urinary tract symptoms despite medical management. Pre-procedural CT demonstrated significant prostatic enlargement with preserved pelvic arterial anatomy suitable for embolization (Image 1). The patient was referred for prostate artery embolization (PAE) as a minimally invasive alternative to surgical intervention.

Imaging workflow and equipment

The procedure was performed using the OEC 3D mobile C-arm with fluoroscopy, digital subtraction angiography (DSA), and cone-beam CT (CBCT) capabilities. Two-dimensional angiography was used for vessel selection and catheter navigation, while CBCT was used for visualization to confirm target perfusion territories and identify potential non-target embolization pathways

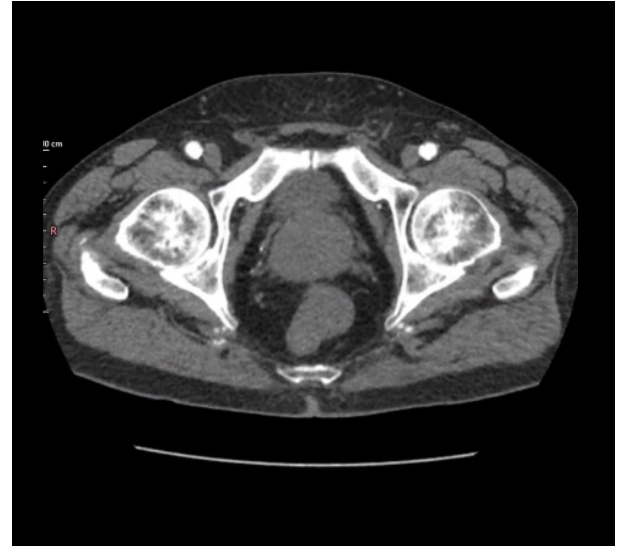


Image 1: Pre-procedure CT showing enlarged prostate

Procedure description

Pre-procedural CT imaging was reviewed to assess prostate volume and pelvic vascular anatomy. Right common femoral arterial access was obtained using a 6F sheath. A Roberts Uterine Catheter (RUC) was advanced into the ipsilateral internal iliac circulation and used to selectively engage the prostatic arterial supply.

Initial DSA imaging was performed using a hand injection of 2–3 mL of undiluted Visipaque 320 contrast to identify the prostatic artery origin and evaluate vessel morphology (Image 2). Depending on laterality and pelvic anatomy, oblique projections between 25° and 40° RAO or LAO were used to optimize vessel visualization.

Following selective catheterization with a 2.4F Progreat microcatheter, CBCT imaging was performed using the OEC 3D system. CBCT acquisition was obtained using a 50:50 contrast dilution delivered through a power injector at 0.1 mL/sec for 30 seconds (total volume 3 mL) (Images 3 & 4). Multiplanar reconstructions were reviewed to confirm enhancement of the target prostatic tissue and identify potential non-target perfusion. Window and level settings were adjusted manually to optimize visualization of the vascular territory.

Following confirmation of appropriate perfusion territory, embolization was performed using calibrated microspheres until near stasis was achieved. A post-embolization DSA was then acquired to confirm reduction of prostatic perfusion and verify successful treatment (Image 5).

Role of cone-beam CT with OEC 3D

Although prostate artery embolization is commonly performed using fixed angiography systems, CBCT acquired on the OEC 3D mobile C-arm provided sufficient visualization of the prostatic perfusion territory and adjacent pelvic vascular anatomy. Three-dimensional imaging improved confidence in target vessel confirmation and assessment of non-target embolization risk, while maintaining workflow within an office-based or ambulatory interventional environment.

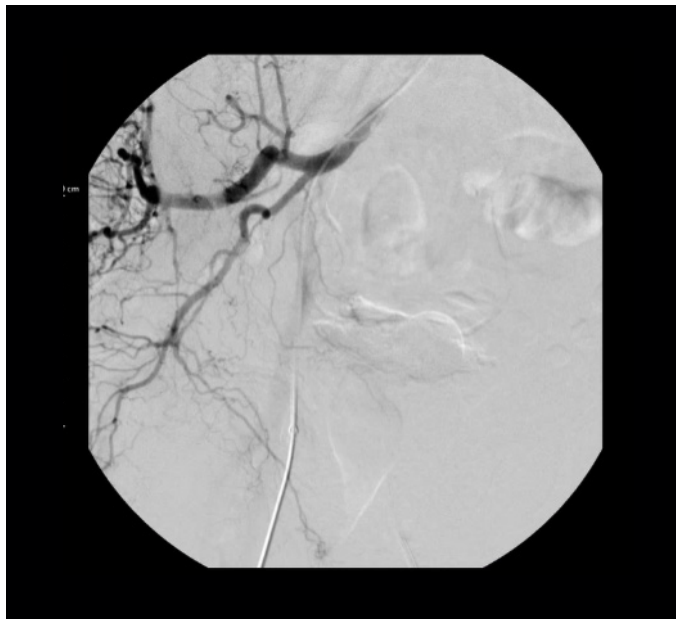


Image 2: DSA showing right prostatic artery



Image 3: Contrast enhanced prostate, right PA injection. 1mm slice thickness, Axial View

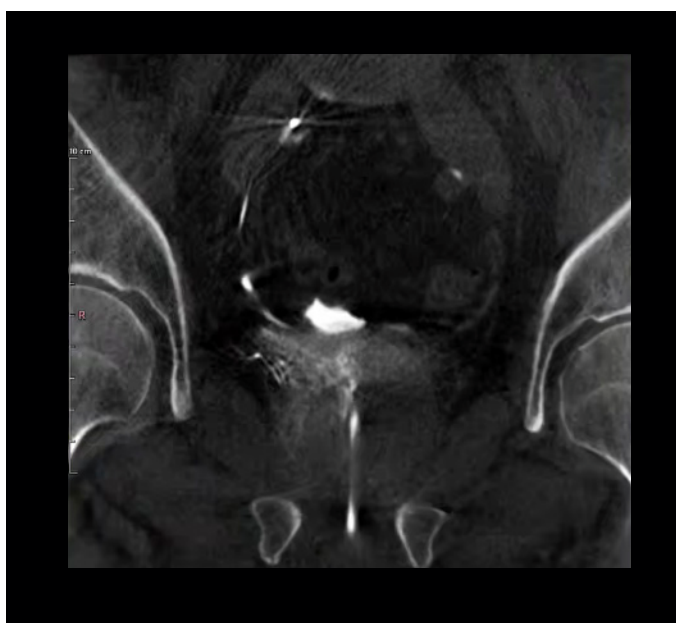


Image 4: Contrast enhanced prostate, right PA injection. 1mm slice thickness, Coronal View

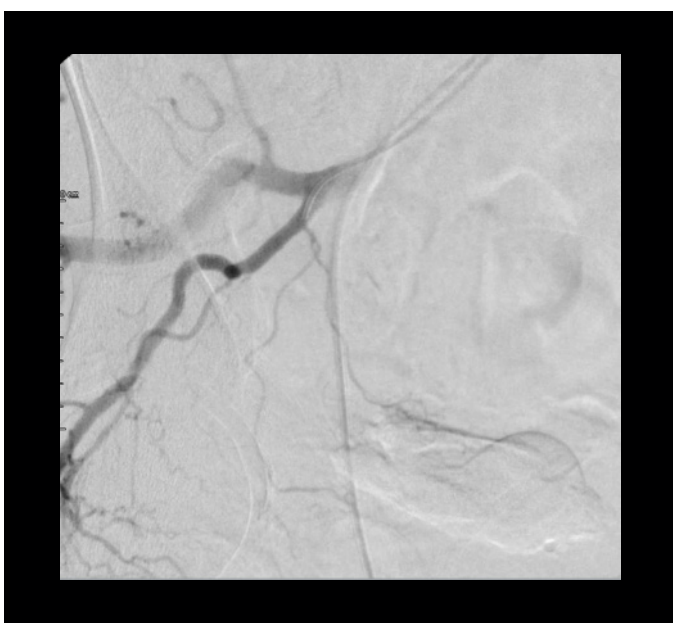


Image 5: Post-embolization DSA showing right PA

Technical pearls

- During early implementation of the OEC 3D CBCT protocol, undiluted contrast was utilized for image acquisition. Subsequent protocol refinement demonstrated that a 50% contrast dilution produced superior image quality, reducing beam-hardening artifact while maintaining adequate vessel and tissue enhancement. The 50:50 dilution protocol is now routinely used for PAE CBCT acquisitions at this site.
- Use ipsilateral oblique projections of approximately 30°-40° during DSA to improve visualization of the prostatic artery origin.
- Utilize digital zoom (Live Zoom) rather than geometric magnification when possible to reduce radiation exposure.
- Employ roadmap guidance for selective catheterization.
- Perform at least one CBCT acquisition after selective prostate artery catheterization on each side to confirm target perfusion.
- In patients with complex pelvic collateral anatomy, additional CBCT acquisitions may be beneficial to exclude non-target embolization.

2D PAE image & injection protocol

Image acquisition protocol	General Profile, DSA 15fps, low dose mode
Contrast used	Visipaque 320
Dilution	100% for 2D DSA

3D PAE image & injection protocol

Acquisition protocol	3D HD CBCT
Image acquisition protocol	3D HD, MAR, eNR and NR2
Contrast used	Visipaque 320
Dilution	50% dilution
Injection volume	3.0 cc
Injection rate	0.1cc / second
Injection delay	0.5 seconds
Injection duration	30 seconds
X-ray delay	None
Power injection	Yes

Transarterial radioembolization (Y90 mapping) of HCC

Case overview & procedure

Physician

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System

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Patient history, diagnosis, symptoms

50-year-old male with metastatic colorectal cancer involving the liver, referred for Y-90 radioembolization evaluation. Pre-procedural imaging demonstrated hepatic metastases considered suitable for locoregional treatment.

Imaging workflow and equipment

The procedure was performed using the OEC 3D mobile C-arm with fluoroscopy, digital subtraction angiography (DSA), and cone-beam CT (CBCT) capabilities. Two-dimensional angiography was used for vessel selection and catheter navigation, while CBCT was used for visualization to evaluate tumor enhancement, identify tumor-feeding vessels, and confirm the perfusion territory prior to radioembolization planning.

Vascular access was obtained using a 6F Terumo sheath. A ProChng catheter was utilized to select the celiac axis and hepatic arterial circulation. A 2.4F Progreat microcatheter was advanced into the target hepatic artery for selective angiography and CBCT acquisition. Contrast injection parameters were adjusted based on vessel size and catheter position to optimize vessel and lesion enhancement.

Procedure description

Pre-procedural cross-sectional imaging was reviewed to assess tumor location, hepatic arterial anatomy, and treatment suitability. Common femoral arterial access was obtained using a 6F sheath, and a ProChng catheter was advanced into the hepatic arterial circulation. Selective catheterization of the target hepatic artery was then performed using a 2.4F Progreat microcatheter.

Initial DSA imaging was obtained using a power injection of undiluted Omnipaque 300 contrast to characterize hepatic arterial anatomy and identify suspected tumor-feeding vessels (Image 1). Depending on vessel orientation and anatomy, AP or mild left anterior oblique projections were used to optimize visualization.

Following selective catheter placement within the target hepatic artery, CBCT imaging was performed using the OEC 3D system. A 50% contrast dilution was administered via power injector during image acquisition. Multiplanar reconstructions were reviewed in real time, with manual window and level adjustments used to optimize visualization of enhancing lesions and associated arterial supply (Images 2 & 3).

The volumetric CBCT dataset was used to confirm that the selected catheter position supplied the intended tumor territory while assessing for potential non-target perfusion. Findings from the DSA and CBCT images were used together to support treatment planning and determine the optimal injection location for subsequent Y-90 radioembolization therapy.

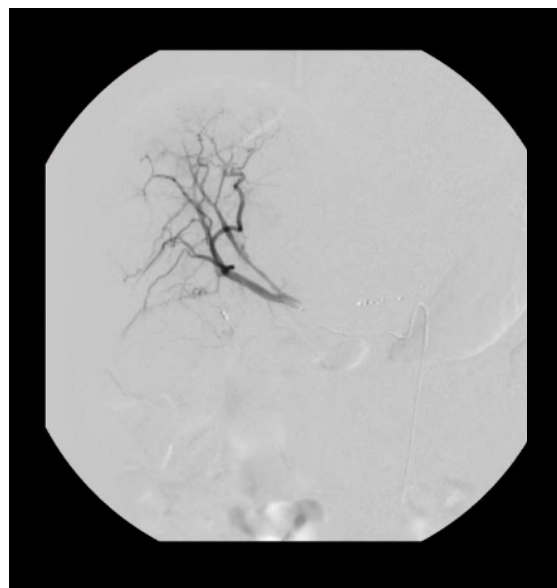


Image 1: DSA of hepatic artery

Role of cone-beam CT with OEC 3D

Selective CBCT performed with contrast injection through the right hepatic artery enabled three-dimensional visualization of tumor enhancement and corresponding arterial supply. The ability to correlate angiographic findings with volumetric contrast enhancement assisted in confirming tumor-feeding vessels and optimizing planned Y-90 treatment position.

The image quality achieved with the OEC 3D system was sufficient to visualize contrast-enhancing hepatic lesions and associated feeding vessels on multiplanar reconstructions. This provided procedural information beyond conventional 2D angiography and supported treatment planning without requiring transfer to a fixed angiographic suite.



Image 2: Contrast enhanced CBCT — hepatic lesion enhancement. 1mm slice thickness, axial view



Image 3: Contrast enhanced CBCT — hepatic lesion enhancement. 1mm slice thickness, axial view

Technical pearls

- Y-90 mapping is a critical planning step that allows identification of tumor-feeding arteries and simulation of the anticipated treatment territory.
- Visualization with selective DSA and CBCT can be used together to define hepatic arterial anatomy, confirm lesion perfusion, and assess for potential hepatopulmonary shunting.
- Non-target vessels identified during mapping may be embolized during the same procedure to reduce the risk of radiation delivery to healthy tissue.
- AP or approximately 13° LAO projections were found to provide optimal visualization of the hepatic arterial tree in this case. Appropriate oblique projections are likely needed to optimize hepatic arterial visualization.
- Potential complications are uncommon but include access-site complications and non-target embolization, highlighting the importance of careful vessel selection and treatment planning.

2D Y90 image & injection Protocol

Image acquisition protocol	Vascular Profile, DSA 15fps, low dose mode
Contrast used	Omnipaque 300
Dilution	100% for 2D DSA

3D Y90 image & injection Protocol

Acquisition protocol	HD, MAR, eNR, NR2
Contrast used	Omnipaque 300
Dilution	50%
Injection volume	Ranges from 3cc to 6cc
Injection rate	Ranges from 0.1cc to 0.3cc
Injection delay	0.5 seconds
Injection duration	30 seconds
X-ray delay	None
Power injection	Yes

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Patient history, diagnosis, symptoms

61-year-old female with recurrent hemorrhoidal bleeding and intermittent lower gastrointestinal bleeding despite previous hemorrhoid banding. The patient was referred for hemorrhoidal artery embolization with coils of the right middle rectal artery following failure of prior conservative and procedural treatment.

Imaging workflow and equipment

The procedure was performed using the OEC 3D mobile C-arm with fluoroscopy and digital subtraction angiography (DSA). High-resolution angiographic imaging was used to identify the hemorrhoidal arterial supply, guide selective catheterization, and confirm successful embolization.

Vascular access was obtained using a 6F Terumo sheath. A ProChng catheter was used to access the internal iliac circulation, and a microcatheter system was advanced into the target hemorrhoidal artery branches. DSA imaging was acquired using low-dose settings and hand injections of undiluted Visipaque 320 contrast.

Procedure description

Pre-procedural clinical evaluation and imaging findings were reviewed to confirm recurrent symptomatic hemorrhoidal bleeding and determine candidacy for embolization.

Common femoral arterial access was obtained using a 6F sheath. A Roberts catheter was advanced into the ipsilateral internal iliac artery and selective angiography was performed to identify the arterial supply to the hemorrhoidal plexus. DSA imaging was obtained using hand injection of undiluted Visipaque 320 contrast to characterize vessel anatomy and identify the target branch.

Following angiographic localization of the feeding vessel, a microcatheter was advanced into the selected hemorrhoidal artery branch. Repeat selective DSA was performed to confirm catheter position and visualize the perfusion territory.

Once appropriate positioning was confirmed, embolization was performed using 2 mm × 3 mm Cook Nester coils until stasis of flow was achieved. Post-embolization DSA was then obtained to confirm successful vessel occlusion and absence of residual filling of the treated branch (Image 1).

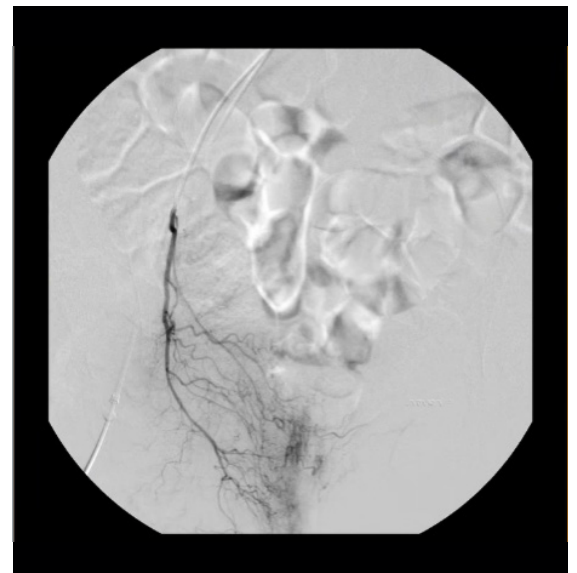


Image 1: DSA shows right iliac artery and middle rectal artery

Why 3D was not required

Although CBCT is not routinely required for hemorrhoidal artery embolization, the OEC 3D system provided high-quality fluoroscopic and DSA imaging throughout the procedure. The platform supported selective catheterization, target vessel identification, and embolization endpoint assessment within an office-based interventional setting. This case demonstrates the versatility of the OEC 3D platform across a range of embolization procedures, including those primarily guided by two-dimensional angiography.

Discussion

- Hemorrhoidal artery embolization has reported technical success rates exceeding 95% and is associated with a low rate of complications.
- The procedure can be performed through either the superior rectal artery, middle rectal artery, or both, depending on the patient's anatomy and the arterial supply to the hemorrhoidal plexus.
- Careful angiographic evaluation is important to identify all contributing vessels and ensure complete treatment of the bleeding source.
- HAE can be used to treat symptomatic hemorrhoidal bleeding, including recurrent bleeding after prior treatments, and may also be considered in select cases of severe rectal bleeding or rectal artery pseudoaneurysm.
- Complications are uncommon and are most often related to vascular access, emphasizing the importance of meticulous catheter and access site management.

2D image & injection protocol

Acquisition protocol	DSA 8fps, low dose, hand injection
Contrast used	Visipaque 320
Dilution	100%
X-ray delay	None

Availability of select models, configurations, and options varies by country.
Please contact your local sales representative.

OEC 3D is a mobile 3D/2D C-arm that provides intraprocedural CBCT images and 2D fluoro images to enable visualization of anatomical structures during diagnostic, interventional, surgical and endoscopic procedures.

Dr. Henry Dalsania is a paid consultant for GE HealthCare and was compensated for his participation in this case study. The statements by Dr. Dalsania described here are based on his own opinions and results that were achieved in his unique setting. Since there is no “typical” hospital and many variables exist, i.e. ambulatory surgery center size, case mix, etc. There can be no guarantee that other customers will achieve the same results.

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