Use of Cone Beam CT (CBCT) in the angio suite improves safety and outcomes in interventional tumor treatment

Evidence shows syngo DynaCT affects patient care in up to 46% of cases

Executive summary

Syngo DynaCT can improve both the safety and outcome of interventional tumor treatment. Research shows that syngo DynaCT frequently affects a change of diagnosis, treatment planning, or treatment delivery.

For patients undergoing chemoembolization for hepatocellular carcinoma (HCC), additional information from syngo DynaCT has been shown to affect a change in diagnosis, treatment planning, or treatment delivery in 28% of cases [1]. Moreover, the use of CBCT in addition to angiography is associated with significantly higher (P=0.005) overall survival rates in HCC patients receiving chemoembolization [2].

With the development of ever more sophisticated catheter-based interventions, the range of applications of syngo DynaCT continues to increase. Recently published studies demonstrate the benefits of syngo DynaCT in Prostate Artery Embolization (PAE) for the treatment of benign prostatic hyperplasia (BPH) [3] [4]. In PAE, intra-procedural 3D visualization helps mitigate the dangers of non-target embolization and has been shown to affect patient care in up to 46% of cases.

Overall survival of patients with unresectable hepatocellular carcinoma (HCC) after transarterial chemoembolization (TACE).


Use of CBCT is associated with significantly higher survival rates in HCC patients.


Transcatheter tumor embolization therapy

Transcatheter tumor embolization therapy is an interventional procedure where substances are injected into feeder vessels to block blood flow to the tumor and thereby shrink the lesion. Embolization substances include synthetic particles, drug-eluting beads (chemoembolization) and radioactive microspheres (radioembolization). Embolization can be used to treat both malignant and benign tumors.

Real-time angiographic imaging is essential for transcatheter embolization procedures. In addition to conventional fluoroscopy and single planar digital subtraction angiography (DSA), 3D visualization of vascular and soft tissue detail is often key for procedure success [1]. Cone Beam CT is an advanced imaging technology that acquires C-arm flat-panel projection images in multiple viewing planes to reconstruct (CT-like) 3D images during the procedure in the angiography suite. This technology was pioneered by Siemens Healthcare and launched in 2004 under the product name syngo DynaCT.

Benefits of syngo DynaCT in chemoembolization for hepatocellular carcinoma (HCC)

Hepatocellular carcinoma (HCC) is a leading cause of cancer-related death worldwide [5]. Surgery is the treatment of choice, however, many patients cannot undergo resection due to advanced disease or poor liver function [6] [7]. For these patients, local-regional therapies such as transcatheter arterial chemoembolization can delay tumor progression and even increase survival [7] [8].

Digital subtraction angiography (DSA) remains the primary imaging technique for image guidance during chemoembolization. However, the use of CBCT in addition to DSA is rapidly increasing [10] [11]. 3D volume-rendered images as well as multiplanar reconstructions of the hepatic arteries provide crucial navigational information for super selective catheterization.

Use of syngo DynaCT during embolization treatment improves visualization of the vascular distribution of the selected arterial territories and their corresponding areas of tissue perfusion. Studies confirm that the availability of Cone Beam CT in the angiography suite significantly increases the number and order of subselective hepatic arteries catheterized and treated [1] [12]. This maximizes treatment response while at the same time minimizing collateral damage due to nontarget embolization [1].

Keywords
- Cone Beam Computer Tomography (CBCT)
- syngo DynaCT
- Interventional tumor treatment
- Chemoembolization
- Hepatocellular carcinoma (HCC)
- Benign prostatic hyperplasia (BPH)
- Prostate artery embolization (PAE)

“syngo DynaCT is the most important software application for embolization procedures. It identifies arteries feeding the prostate and helps me avoid non-target embolization.”

Professor Francisco Cesar Carnevale, MD, PhD, Chief of Interventional Radiology, University of São Paulo, Brazil.

Conclusion

syngo DynaCT is an excellent adjunct to DSA and fluoroscopy and can improve safety and outcome of interventional treatment for both malignant and benign tumors. Current research shows that use of syngo DynaCT in embolization therapy frequently affects a change of diagnosis, treatment planning, or treatment delivery [1] [3].

For patients undergoing chemoembolization for hepatocellular carcinoma (HCC), syngo DynaCT has been shown to affect patient care in more than 28% of cases. Moreover, the use of CBCT in addition to angiography is associated with significantly higher overall survival rates (P=0.005) in HCC patients receiving chemoembolization [2].

Recently published research demonstrates the benefits of syngo DynaCT in prostate artery embolization (PAE) for the interventional treatment of benign prostatic hyperplasia [3]. In PAE, intra-procedural 3D visualization helps mitigate the dangers of non-target embolization and has been shown to affect patient care in up to 46% of cases.

According to Tognolini et al. syngo DynaCT provided information which was not apparent or discernible with DSA in 36% of patients. This additional information resulted in a change in diagnosis, treatment planning, or treatment delivery in 28% of the HCC patients. Use of syngo DynaCT enabled visualization of angiographically occult tumors in 15% of patients and indicated incomplete treatment in 7.1% [1].

Virmani et al. demonstrated that Cone Beam CT images caused angiographic operators to place catheters in a position different from that originally anticipated in 39% of patients [13].

Iwasawa et al. reports that the use of CBCT in addition to angiography during transarterial chemoembolization in patients with unresectable hepatocellular carcinoma (HCC) was associated with significantly higher overall (P=0.005) and local progression-free (P=0.003) survival rates than patients receiving chemoembolization with angiography alone [2].

Benefits of syngo DynaCT in prostatic artery embolization (PAE)

Benign prostatic hyperplasia (BPH) affects approximately 210 million men worldwide [14]. While the prevalence rate for men aged 45–49 is 2.7%, it increases to 24% by the age of 80 years [15]. Incidence of BPH is likely to rise in the foreseeable future as the global male population lives longer. Surgical treatment, e.g. transurethral resection of the prostate (TURP) remains the most widely performed therapy, but TURP can have significant side effects, including sterility.

Prostate artery embolization (PAE), a new interventional treatment option for BPH, appears to be safe and effective, resulting in significant improvements in IPSS (International Prostate Symptoms Score), quality of life, maximal flow rate, and prostate volume reduction [4]. However, one of the most challenging aspects of performing PAE is to correctly identify the prostatic arteries and differentiate them from the surrounding non-target arteries.
New research shows the benefits of syngo DynaCT in PAE [3]. Here intra-procedural 3D visualization helps mitigate the dangers of non-target embolization which can lead to major complications and necessitate major surgery. In the study, performed at Inova Alexandria Hospital, a leading US institution for PAE research, syngo DynaCT allowed for the identification of potential sites of non-target embolization in 46% of patients, most notably the rectum, bladder and penis. Embolization of any one of these non-target sites can carry considerable morbidity, which was successfully mitigated with the use of syngo DynaCT [3].

It follows that use of syngo DynaCT can potentially improve both the safety and outcome of PAE procedures by helping operators to clearly distinguish between target and non-target embolization sites.

syngo DynaCT identified potential sites of non-target embolization, most notably in vessels feeding the rectum, bladder and penis.

On account of certain regional limitations of sales rights and service availability, we cannot guarantee that all products included in this brochure are available through the Siemens sales organization worldwide. Availability and packaging may vary by country and are subject to change without prior notice.

Some/All of the features and products described herein may not be available in the United States or other countries.

The information in this document contains general technical descriptions of specifications and options as well as standard and optional features that do not always have to be present in individual cases.

Siemens reserves the right to modify the design, packaging, specifications and options described herein without prior notice.

Please contact your local Siemens sales representative for the most current information.

The statements by Siemens’ customers described herein are based on results that were achieved in the customer’s unique setting. Since there is no “typical” hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.

The concepts and information presented in this paper are based on research.

The product names and/or brands referred to are the property of their respective trademark holders.