

# New Non-Contrast MR Techniques

## *syngo* NATIVE and *syngo* ASL

### MR angiography and Siemens

Contrast-Enhanced Magnetic Resonance Angiography (ce-MRA) remains the gold standard for evaluating vasculature in MR as it enables high spatial and temporal resolution with extremely fast imaging times. Siemens technological innovations in angiography along with the implementation of stronger gradients has pushed imaging times to seconds instead of minutes. High resolution ultrafast ce-MRA techniques from Siemens are in routine clinical usage today along with improved workflow with Siemens unique inline processing, subtraction and image composing speeding up exam time. Innovative applications like *syngo* TWIST and *syngo* NATIVE now provide the user flexibility of choice of technique to do MR angiography. *syngo* NATIVE enables excellent non-contrast angiography imaging and reproducible results.

### NSF (Nephrogenic Systemic Fibrosis) and changes in hospital policies

The use of injected contrast media has come under scrutiny as the common contrast agents containing gadolinium have been linked to a condition called Nephrogenic Systemic Fibrosis (NSF) that can occur in patients with renal insufficiency. The Food and Drug

Administration issued new-boxed warnings for all manufactures of gadolinium, which stated that patients with severe kidney insufficiency who receive these agents are at risk for developing NSF. Their recommendations further state that facilities should avoid use of gadolinium in patients with known risks for developing NSF unless the diagnostic information is essential and cannot be obtained with a non-contrast enhanced MR or other diagnostic procedures. The FDA also stated that facilities should assess renal dysfunction prior to administration of gadolinium as well as not exceed recommended doses. Go to [www.FDA.gov](http://www.FDA.gov) for more information on gadolinium-containing contrast agents.

Due to recent events involving NSF and gadolinium, facilities such as New York University Hospital have implemented a screening process for those patients at risk and modified their routine written consent form. NYU assesses for renal dysfunction prior to administration of MR contrast agents to identify patients at risk for renal insufficiency and thereby potentially at risk for developing NSF. The risk factors include increased serum creatinine, history of renal disease, acute renal failure or recent renal surgery, proteinuria, diabetes mellitus, hypertension, gout or recent intake of nephrotoxic drugs. Documentation of recent BUN, creatinine and estimated Glomerular Filtration Rate (GFR) are

obtained in patients who are at risk for renal insufficiency. NYU's departmental policy for administration of MR contrast agent based on estimated GFR (calculated using the MDRD equation) is as follows:

#### **eGFR >60 (mL/min/1.73 m<sup>2</sup>)**

*No restriction for administration of contrast.*

#### **eGFR >30-60**

*Discuss with the patient the risks of administration of contrast and consider using low dose.*

#### **eGFR 15-30**

*Discuss risks and benefits with referring physician, nephrologist and patient. Consider using low dose but not recommended.*

#### **eGFR <15 or on dialysis**

*Avoid administration of contrast unless benefits outweigh risks based on assessment of the referring physicians, nephrologists and radiologist. Peritoneal dialysis is an absolute contraindication.*

NYU utilizes a non-contrast angiography technique called *syngo* NATIVE when these patients cannot have contrast. When low dose contrast is indicated, NYU utilizes *syngo* TWIST (Time-resolved Angiography With Stochastic Trajectories), a new versatile high-resolution angiography technique that further improves time-resolved ce-MRA.

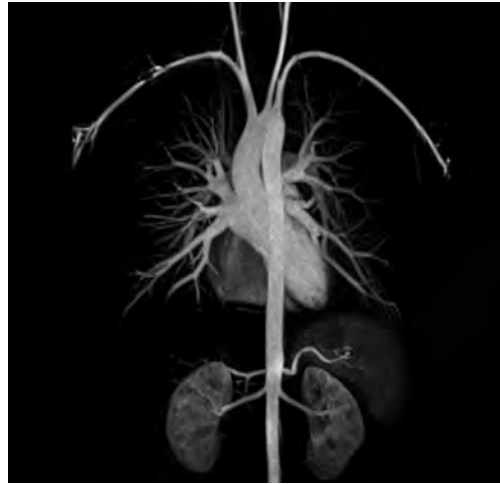


Figure 1: *syngo* TWIST, MAGNETOM Avanto.

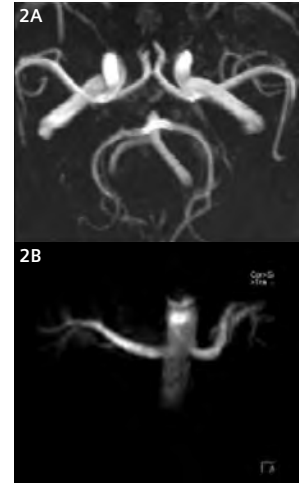


Figure 2A: Time of Flight (ToF).  
Figure 2B: Phase Contrast (PC).

### **syngo TWIST**

The new k-space coverage in *syngo* TWIST provides the user greater flexibility in tailoring temporal and spatial resolution for dynamic MR imaging (Figure 1). *syngo* TWIST is up to 10 times faster\* compared to a standard, full k-space version of dynamic imaging. Excellent background suppression as compared to other available techniques results in accurate and reproducible diagnostic information even with smaller amounts of contrast agent.

The key clinical benefits of *syngo* TWIST are:

- Scalable temporal resolution
- Workflow efficient ultrafast technique
- Lower cost and improvements in diagnostic confidence as additional high-res scan can be acquired in the same setting
- Increased speed
- Head-to-toe applications
- Improved image quality
- Multiple very small dose contrast injections are possible to capture dynamic processes

### **Demand for non-contrast angiography techniques**

Utilization for Contrast-Enhanced Magnetic Resonance Angiography (CE MRA) has been affected by the FDA's new warning. Currently, facilities performing MRA examinations utilizing gadolinium desire non-contrast angiography applications as an alternative backup for patients at risk for developing NSF.

### **Current MRA techniques**

In Magnetic Resonance Imaging, several physical effects of flowing blood are exploited to image the vessels without injection of contrast. Traditional non-contrast techniques encompass:

- Time of Flight MRA (ToF MRA)— (Figure 2A) Contrast mechanism is based on exchanging the signal from inflowing blood during the measurement.
- Phase Contrast MRA (PC MRA)— (Figure 2B) Contrast mechanism is based on the change in phase due to motion or flow.

These techniques are adequate for intra- and extra-cranial circulation.

### **New non-contrast MR techniques**

Siemens is the leader in Innovative Applications and Innovative Workflow with the most comprehensive contrast and non-contrast angiography offerings with the flexibility to fit every clinical scenario. Due to extensive research collaborations, Siemens has developed multiple non-contrast techniques like *syngo* NATIVE and *syngo* ASL for clinical need.

### **syngo NATIVE**

For non-contrast MR Angiography Siemens currently offers two techniques under the category of NATIVE (Non-contrast MRA of Arteries and Veins)— *syngo* NATIVE TrueFISP and *syngo* NATIVE SPACE.

### **syngo NATIVE TrueFISP**

*syngo* NATIVE TrueFISP is based on the sequence TrueFISP (True Fast Imaging with Steady state Precession) which is a balanced steady state gradient echo technique. The contrast mechanism for *syngo* NATIVE TrueFISP comes from the preparation of the imaging volume with a spatially selective inversion pulse, resulting in the suppression of stationary tissue within the imaging volume and suppression of signal from blood in the

\*Data on file.



Figure 3: *syngo* NATIVE TrueFISP.



Figure 4: *syngo* NATIVE SPACE.

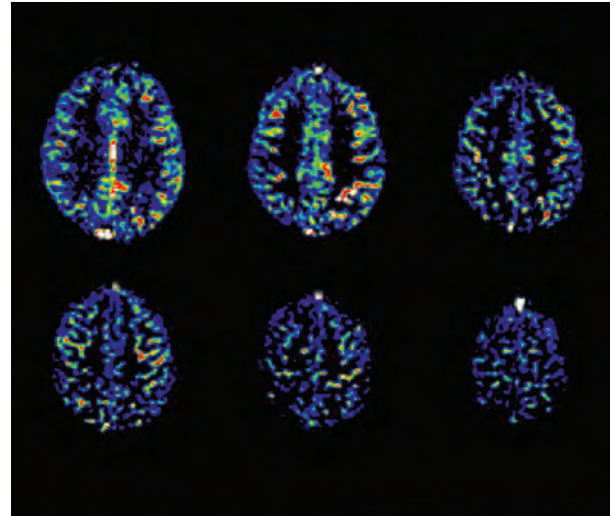


Figure 5: Pulsed ASL perfusion with 3D PACE. Single Shot EPI pulsed arterial spin labeling sequence (Q2TIPS).

imaging volume (e.g. venous blood). Blood which flows into the imaging volume during the inversion time has the same high signal characteristics exhibited in conventional TrueFISP. The contrast is further enhanced by the suppression of the background by the inversion pulse. The sequence can be made selective for arteries or veins by appropriate positioning of the inversion pulse, which can be positioned independently from the imaging volume. The sequence accommodates 3D, 2D, breath-hold, PACE (Prospective Acquisition and CorEction) navigated and respiratory triggered approaches depending on clinical environment (Figure 3).

#### ***syngo* NATIVE SPACE— Siemens exclusive**

*syngo* NATIVE SPACE is based on the SPACE technique which is a modified variable flip angle 3D Turbo Spin Echo sequence in which the contrast mechanism for visualizing vessels is based on the difference in intravascular signal during the cardiac cycle. The subtracted image is calculated in-line and with inline MIP generation, instantaneous clinical results are produced for completely non-invasive MR angiography, further improving workflow at the scanner. The *syngo* NATIVE SPACE technique can also accommodate multi phase imaging that

enables dynamic angiography—for example, in the lower legs (Figure 4).

#### **Non-contrast MR perfusion studies— *syngo* ASL (Arterial Spin Labeling)**

Siemens has been at the forefront in other non-contrast techniques beyond angiography. Arterial Spin Labeling (ASL) is an MR technique using the water in arterial blood as an endogenous contrast agent to evaluate perfusion non-invasively. ASL provides unique insight into human brain perfusion and function physiology by evaluating cerebral blood flow (CBF). ASL is capable of high spatial resolution perfusion imaging, making the technique very appealing in the evaluation of stroke, tumors, degenerative diseases and epilepsy, but also in basic neuroscience, e.g. for studies of functional CBF changes. Siemens is proud to introduce *syngo* ASL, powered by Tim (Total imaging matrix), thereby allowing the use of noncontrast enhanced perfusion imaging in both the clinical and research settings. (Figure 5)

#### **Tim technology**

*syngo* NATIVE and *syngo* ASL are powered by Tim (Total imaging matrix).

Tim is the solution that addresses the real needs of today's clinical MRI environment. Tim provides the flexibility to scan any part of the body without interrupting the exam for coil or patient repositioning. Tim is also the first RF technology optimized for use with parallel imaging.

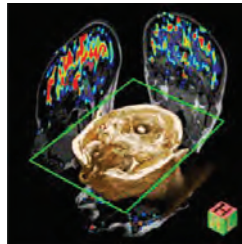
#### **Conclusions**

Siemens technological innovations in angiography along with the implementation of stronger gradients has pushed imaging times to seconds instead of minutes. High resolution ultrafast ce-MRA techniques from Siemens are in routine clinical usage. Improved workflow with Siemens unique inline processing, subtraction and image composing speeds up exam time. Innovative applications like *syngo* TWIST and *syngo* NATIVE provide the user flexibility of choice of technique to do MR angiography in any clinical scenario. *syngo* NATIVE enables excellent non-contrast angiography imaging and is an excellent alternative for patients in whom contrast material needs to be avoided. With Tim and inline processing, non-contrast MRA, head-to-toe is easy and demonstrates excellent image quality.

Head to Toe Coverage with  
Non-Contrast Techniques



Whole body ce-MRA with Tim



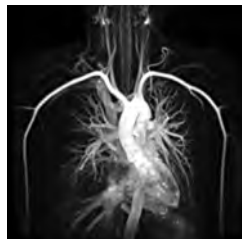
syngo ASL



NEW 3D Time of Flight



2D ToF Carotids



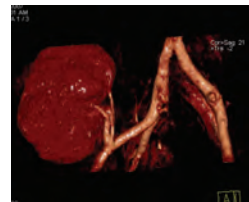
syngo NATIVE SPACE



syngo NATIVE TrueFISP



syngo NATIVE SPACE



syngo NATIVE TrueFISP



syngo NATIVE SPACE