To Be Discussed

1. CAIPIRINHA Liver Imaging
2. Prostate Imaging
3. MRE – Elastography
4. Abdomen Dot

CAIPIRINHA

New iPAT² & CAIPIRINHA

Content Overview

- What is CAIPIRINHA?
- How is it done?
- What is the result?

• New syngo MR D13 software comes standard with improved iPAT reconstruction, in particular for iPAT².
• CAIPIRINHA is a clever way of PAT² image acquisition and offers further improvements in image quality.
• CAIPIRINHA is available with syngo VIBE.
**Aliasing, coils: Caprinha 132 pattern**

1st number: PE accel, 2nd number: SS accel, 3rd number: delta kz shift

**Effective acceleration direction**

*Body array*

*Spine array*

**Caipirinha sampling pattern**

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**Apps TIP for improved Caipi Results**

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**New iPAT & CAIPRINHA**

**Content Overview**

- What is CAIPRINHA?
- How is it done?
- What is the result?

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**New iPAT & CAIPRINHA**

- CAIPRINHA pattern distributes k-space points more uniformly
- Better g-factor
- Higher SNR
- Enables higher PAT factors with excellent IQ
- Helps reduce patient stress

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**Case study:**

Full Dixon technique in only one acquisition of 12 s
New iPAT² & CAIPIRINHA – Case study:
Abdominal acquisition with GRAPPA 6 and TA=20 s

MAGNETOM Skyra
New iPAT² & CAIPIRINHA

MAGNETOM Aera
New iPAT² & CAIPIRINHA

Goals for clinical patients

CAIPIRINHA – a game changer in PAT²
Ultra-fast 3D imaging of excellent quality

Optimized accelerated acquisition
Packs even more imaging power into a breath hold

Unique to Siemens
Leading edge technology that comes standard with new syngo MR D13
Prostate Imaging

**syngo MR Men’s Health**
Multi-parametric Imaging

- Full range of applications for state-of-the-art prostate imaging includes:
  - Superb image quality for high-resolution morphology for 2D as well as 3D
  - Diffusion Weighted Imaging (DWI)
  - Perfusion Imaging (3D T1w DCE)
  - Metabolic Imaging (3D MR Spectroscopy)

**Magnetic Resonance**

syngo

**syngo MR Men’s Health**
New Generation of DWI with **syngo RESOLVE**

- Resolve Provides
  - less distortion
  - less susceptibility artifacts
  - less ghosting
  - more detail
  - available with syngo MR D13

(note: Optional)

National University Hospital Singapore, Singapore

**Morphological and functional exams can assist surgical planning:**

- Detailed evaluation of capsule and seminal vessels
- Improved intraprostatic tumor localization by multi-parametric MRI

**Prostate Case: Local Tumor Staging for Radical Prostatectomy**

Endorectal coils are used for multi-parametric imaging and help improve image quality and/or speed.

- Used in combination with body and spine coils.
- New, reusable endorectal coil generation by Sentinelle designed for
  - Improved coil handling (no inflation necessary)
  - Reduced form factor vs. conventional inflatable coil: comparable to endorectal ultrasound probe
  - Reduced prostate deformation through smaller coil diameter
  - Parallel imaging capabilities
  - Improved patient installation and workflow

**Reusable endorectal coil by Sentinelle**

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MRE - Elastography

Background and Clinical Relevance

- Palpation is a necessary part of the standard clinical exam
- Diseased tissue frequently manifests with a change in tissue stiffness
- Typical examples:
  - Breast
  - Thyroid
  - Prostate
  - Liver
- Palpation exam has limitations:
  - Penetration depth
  - Accessibility of the organ
  - Skin and muscle layers
- MR and Ultrasound techniques have potential to overcome the limitations

Abdomen Imaging

Clinical background of liver fibrosis

- Liver fibrosis is the excessive accumulation of extracellular matrix proteins including collagen that occurs in most types of chronic liver diseases.
- Advanced liver fibrosis results in cirrhosis, liver failure, and portal hypertension and often requires liver transplantation.
- Cirrhosis prevalence was estimated at 0.15% or 400,000 in the USA, where it accounted for more than 25,000 deaths and 373,000 hospital discharges in 1998. Similar numbers have been reported from Europe, and numbers are even higher in most Asian and African countries where chronic viral hepatitis B or C are frequent.
- Diagnosis traditionally requires liver biopsy and follow-up of liver disease is challenging and complex.

Challenges and Discussion Points

- Organs being interrogated are bounded by muscle, bone, and other tissue
- Propagating wave fronts reflect off these boundaries and interfere with forward going wave fronts used in measurements
- Attenuation and the lack of many “hard” boundaries limits this interference to border areas.
- Shear waves can propagate in 3 directions – detection technique is 2D
- Assumption ok in the liver with this set up

Pulse Sequence Specifics

- Motion in “steady state”
- TR a multiple of motion period
- Trigger driver with sequence
- Repeat acquisition with different trigger delays to sample wave propagation
- Magnitude images
- Phase-difference images

Displacement Encoding

- Acquire with positive motion encoding gradients
- Acquire with negative motion encoding gradients
- Increment Trigger Delay
- Frame 1
- Frame 2
- Frame 3
- Frame 4
- Phase Difference Reconstruction
MR Elastography package

Hardware and Software:
- Active and passive drivers*
- One sequence and protocols
- Sequence: 2D gradient-echo with motion-encoding gradients (MEG)

Siemens features:
- iPAT enabled ➞ shortened breath-hold time
- Inline Elastogram
- Magnitude, Stiffness, Stiffness with Mask and Wave images are ready to read
- Reading of stiffness can be done with the cursor
- Free windowing of stiffness maps

* Is a product of Resoundant Inc.
Stage 4 Liver Fibrosis

The Scale of 0-8 is in kPa, kilopascal which are the units of shear stiffness. The pixel values in the elastograms are in 10s of Pascal, so 800 = 8kPa. In general physicians spot thresholds to delineate normal from mild and severe disease.

Wave Images

Courtesy of Mellena Bridges M.D.
Mayo Clinic Jacksonville, FL.

MR Elastography – Liver Fibrosis

Wave image
- Obtained by the application of mechanical waves
- While measuring with a motion-sensitive MR sequence

Elastogram
- Calculated from the wave image
- Providing data about tissue stiffness

Northwestern University, Feinberg School of Medicine

MR Elastography – Healthy Liver Tissue

Wave image
- Obtained by the application of mechanical waves
- While measuring with a motion-sensitive MR sequence

Elastogram
- Calculated from the wave image
- Providing reliable data about tissue stiffness

Northwestern University Feinberg School of Medicine, Chicago, IL, U.S.
NASH with possible cirrhosis – Quality Assurance

Confidence mask gives the user a criteria whether the calculated shear wave stiffness values for a specific position/voxel are reliable or not.

This should allow improvement through
- Better fixation of the passive driver to improve coupling
- Recognition of areas with low signal (T2* effect)

Abdominal Dot Engine

What if an MRI System Could Automatically: ???

1. Calculate your FOV on the fly?
2. Set the number of slices needed for total coverage of the organ?
3. Auto-align & Position slices and FOV accurately for exam?
4. Turn on all the coils needed to acquire the images?
5. Propagate a single breath hold change to all the following sequences to run?
6. Provide breath hold commands for the whole study?
7. Calculate when to trigger a perfusion sequence once contrast is injected to properly get arterial and venous phases?
8. Moves all scan to the iso-center of the magnet?
9. Provide guidance views to follow in order to efficiently finish the exam?
10. Produce inline post-processing?

Increases Workflow

That is what the Abdominal Dot Engine does for several routine strategies. This guarantees consistency, great IQ, patient comfort through improved workflow, and increased efficiency.

Thank You for your Attention

I would like to acknowledge and thank certain colleagues for their help with this presentation:

Bradley Bolster PhD. (Siemens)
Brian Dale PhD. (Siemens)
Mellena Bridges MD. (Mayo Clinic, Jax, FL.)
Vibhas Deshpande PhD. (Siemens)