Clinical applications that advance MRI

- Ready Brain
- 3D ASL
- PROPELLER 3.0
- Enhanced DWI
- MR Touch
- Enhance Delta Flow
- Advanced Cardiac MRI
- MR Enabled Therapies

What's near future?

Clinical applications that advance MRI

What's new?

How does it work?
- Automatic localization, Rx, scan, reformating, postprocessing and data management
- Automatic midsagittal plane calculation for 2D/3D Rx and ACPC determination
- Extreme (>45 deg) rotation correction

Benefits
- Fully automated exam for improved productivity
- Accurate planes and reproducible intra- and inter-patient slice positions
- Prescription made simple for non-expert users

Ready Brain & Express Exams

Benefits
- Fully automated exam for improved productivity
- Accurate planes and reproducible intra- and inter-patient slice positions
- Prescription made simple for non-expert users
Clinical applications that advance MRI

What's New?

- 3D Arterial Spin Labeling (3D ASL)

STROKE
T2, DWI & Dynamic EPI

(reveals same information)

 DWI

reveals tissue at risk

Dynamic EPI

Diffusion Provides information about Tissue already Dead
Perfusion Provides information about tissue at Risk

Diffusion = dead
Perfusion = dying

Perfusion Weighted Imaging (PWI)

- Perfusion MRI provides a relative measurement of the parameters of cerebral micro vascularisation
- We have to use a tracer or exogenous gadolinium contrast
- Dynamic injection – Power injector, or quick hand injection
- Acquire the first pass image with a fast EPI GE or EPI SE sequence
- Due to the magnetic susceptibility (T2*) effect of paramagnetic gadolinium there will be signal drop during the first pass of contrast.

Perfusion Graph

Brain Perfusion Haemodynamic maps
3D Arterial Spin Labeling (3D ASL)

How does it work?
- 3D FSE acquisition with spiral readout
- Pulsed continuous labeling close to the imaged slab
- Background suppression for motion insensitivity

Benefits
- Full brain coverage
- High Signal
- Robust with susceptibility & motion
- Free of geometrical distortion (typical for EPI)

Acquire two sets of data, one saturated blood and other without saturated blood

3D ASL

- In ASL the tracer is the arterial blood itself (or we call it as endogenous contrast)
- Magnetically labeled or saturated blood acts as the contrast
- Acquire two sets of data, one saturated blood and other without saturated blood

Robust, SNR-rich ASL in 3D

Clinical applications that advance MR

PROPELLER 3.0
Periodically Rotated Overlapping ParallEL Lines with Enhanced Reconstruciton

Combat Patient motion
Motion during the encoding process corrupts MR images through both displacement-related blurring and motion-related phase artifacts.
- Patient instruction
- Restrain
- Fast scan
- Repeat scan
- Sedation

Propeller
Reduction of in-plane motion and rotation,
Phase changes due to motion, and
Through-plane motion

Propeller Technology
How does it work?

Conventional FSE
- Each TR, one fast spin echo train collects all phase-encoded lines for a 'shot'
- Shots are repeated, until k-space fills
- Only ONE shot crosses the center of k-space

Propeller Technology
How does it work?
- Each TR, one fast spin echo train collects all phase-encoded lines for a 'blade'
- The blades are successively rotated in k-space by an incremental angle, Radial k-space filling
- Center of k-space over sampled... signal-rich FSE
PROPELLER
- Infant and pediatric Applications

Usual scan
PROPELLER scan

Benefits
- Significantly reduced motion and flow effects
- Enhanced tissue contrast
- Reduced susceptibility artifacts in DWI
- Contrasts – T1 FLAIR, T2, T2 FLAIR, DWI

Combat patient motion, flow and susceptibility artifacts

PROPELLER 3.0

Benefits
- Physiologic motion pushed to background
- Effort-free consistency
- Reliable fine detail delineation
- Small FOV imaging – “No phase wrap”
- Over sample k-space center – high SNR

FSE PROPELLER 3.0

PROPELLER 3.0 provides virtually artifact-free images with fine anatomical detail and superb tissue contrast

For everyday usage – helping to leave rescans behind

PROPELLER 3.0
More Contrasts, All Planes, Everywhere

Benefits
- Significantly reduced motion effects such as peristalsis and flow
- Excellent tissue contrast
- Same scan time
- Free breathing acquisition with respiratory gating

*Compared to conventional techniques

Combat patient motion, flow and susceptibility artifacts
Clinical applications that advance MRI

Enhanced Diffusion Weighted Imaging - eDWI

How does it work?
• Adjustable multiple B values
• Tetrahedral encoding provides more SNR
• STIR for robust fat suppression (1.5T only)

Benefits (vs. conventional DWI)
• Accurate, reproducible ADC maps
• Improved SNR and contrast
• Reduced scan time

Pseudo-3D DWI at 1.5T
• FOV 22*24
• Matrix 128x128
• Slice 2 mm
• TR=8500
• TE=87.8
• BW=125 kHz
• TI 150
• NEX 4: 4:49 min

More SNR, less scan time, more accurate ADC

eDWI: Enhanced Diffusion Imaging

Benefits (vs. conventional DWI)
• Improved quantification
• Improved SNR and contrast
• Reduced scan time … smart averaging
• Improved spatial resolution
• IR-prep DWI oncology staging and treatment monitoring

More SNR, less scan time, more accurate ADC

MR Touch-Elastography

What’s New?
MR Elastography - A unique and non-invasive method for evaluating tissue stiffness
• Non-invasive staging
• Early detection
• Reduce biopsy
• Patient biopsy refusal

Tissue Stiffness
Normal
Fibrosis
Cirrhosis

MR Elastography - Concept

Drop a pebble in a pool of water

Drop a pebble in a pool of gel

New Touch in MR Imaging – extension of diagnosing by Touch

MR Elastography

Drop a pebble in a pool of gel

Wave Length

Stiffness

Hard

Soft

Long

Short

Lon

Gel

Water

MR Touch-Elastography
MR Elastography - Technology

- Vibration
  - Active driver
  - Passive driver

- Acoustic Transducer
  - Shear waves generated by external acoustic driver

- Active Vibrator
  - Shear waves transmitted to tissue by passive driver

- Motion Synthesis
  - MRE gradient synchronized with external acoustic vibrations

- Image Acquisition
  - Shear wave captured using phase contrast gradient GRE with modified cyclic motion-encoding gradients

- Reconstruction
  - Inversion algorithm used to convert wave images into stiffness map

New Touch in MR Imaging – extension of diagnosing by Touch

Clinical applications that advance MRI - Vascular Imaging

- Inhance Delta Flow
  - 2D TOF
  - 3D TOF
  - 2D PC
  - 3D PC
  - 3D Inhance
  - Inflow IR

Inhance 3D DeltaFlow

- How does it work?
  - 3D FSE acquisition with cardiac gating
  - Subtracted systolic from diastolic phase to help eliminate venous and background signal
  - Deploys interleaved acquisition with k-space optimization and ASSET

- Benefits
  - Excellent arterial flow visualization with high contrast and robust venous and tissue subtraction
  - Reduced misregistration due to motion
  - Better visualization of slow flow arteries compared to current runoff techniques
  - Short scan time (< 5 min for 40 cm coronal coverage)

Clinical applications that advance MRI - Cardiac

- Cine IR
  - 3D Heart

Viability Imaging ... Cine IR

- How does it work?
  - Multiphase FGSE-Cine acquisition
  - Captures image contrast evolution at different TI times
  - Adiabatic Inversion Recovery (IR)
  - Myocardium suppression robust to B1 inhomogeneity

- Benefits
  - Quick assessment of optimal TI time for NDE
  - Detection of amyloid, vasculitis and other tissue abnormalities, delineates through TI curve
  - Rapid, single breath hold acquisition
  - Simple, easy to use, fast

No-miss myocardial tissue viability, aids in confident diagnosis
Coronary Artery Imaging … 3D Heart

How does it work?
- Fat sat FIESTA (1.5T) & IR-Prep FGRE (3.0T)
- Enhanced 3D FIESTA with more SNR & less artifacts
- Multi-slab acquisition for increased inflow effect
- More CNR with Special fat-sat & T2 prep
- Improved Navigator with algorithm optimization
- Prospective motion correction with slice tracking

Benefits:
- Excellent anatomic coronary, aorta & cardiac chamber assessment- virtual radiation, contrast media or IV3D injections
- High SNR and contrast, high spatial resolution
- Reduced motion averaging
- Easy prescription
- No anesthesia needed (free breathing)

Sedation-free robust CHD and coronaries assessment

MR Enabled Therapies
One MR with numerous clinical capabilities

Multi-use Workflow
HD Image Quality

Benefits
- Excellent anomalous coronaries, aorta & cardiac chamber assessment- without radiation, contrast media or US limitations
- High SNR and contrast, high spatial resolution
- Reduced motion averaging
- Easy prescription
- No anesthesia needed (free breathing)

Coronary Artery Imaging … 3D Heart

MR for Radiation Therapy Planning
Helping to improve tumor targeting accuracy

MR Strengths for Radiation Therapy Planning

Prostate, GYN, Brain, H&N, Spine

MR – CT Workflow for Radiation Therapy

GE MR Surgical Suite
Extending surgical vision and helping to improve outcomes in neurosurgery
**Simplicity in design**

- Multi-Functional Patient Transport
  Single transfer board between prep, OR, MR and recovery
- Fully compatible with standard diagnostic 1.5 and 3.0T GE MR
- Engineered for maximum utilization of OR and MR assets
- Lower infrastructure cost versus other high field iMRI systems

**Integration with strategic partner’s solutions**

Helping to improve intra-operative surgical navigation and outcomes.
- Integrates multiple GE and industry leading strategic partners to improve surgical outcomes and workflow.
- Flexible multi-room design offers uncompromised surgical freedom while maximizing MR productivity.

**Intra-operative 6 Channel Flex Coil**

Intra-operative MR (iMRI) scans enhance surgical decision-making prior to concluding surgery.
- Innovative open design allows for flexible coil placement
- Coils provide exquisite high resolution imaging for intra-operative imaging

**GE iMRI – 3T HDxt – Meningioma Case Study**

Pre-operative imaging

![Pre-operative imaging](image)

Intra-operative imaging

![Intra-operative imaging](image)

Demonstrating successful resection

T1 +/- C

**GE iMRI Surgical Suite**

Enhancing Neurosurgery
Helping to improve outcomes
- Uncompromised OR and MR suites
- Simplified integration between OR and MR
- Integrated with OR industry leading strategic partners
- Cost effective asset maximizing solution

**ExAblate® 2000**

Non-invasive targeted treatment for uterine fibroids using MR guided Focused Ultrasound
How does ExAblate work?
MR guided focused ultrasound combines:
• High intensity focused ultrasound that heats and destroys targeted tissue, non-invasively.
• Magnetic Resonance Imaging system (MRI) which allows the physician to identify and target tumors, and provides temperature monitoring of the treated tissue in real time.

Focused Ultrasound generates heat by focusing ultrasound waves, ablating tissue only at the focal point... an effect similar to a magnifying glass used to focus the sun’s energy on a single point.

Why is MR important for guidance and control?
Because it provides you with:
• Imaging in 3 orientations for precise tumor targeting and accurate identification of pathology
• Beam path visualization for controlled treatment
• MR thermometry for real-time temperature feedback allowing you to see temperature changes in the tumor during treatment
• Post treatment contrast imaging for precise treatment validation

To improve accuracy in treatment!
MRgFUS for Breast Cancer

The positioner is used as an interface for the breast treatment in MRgFUS. A breast MR coil is embedded into it as well as a cooling device.

- Cooling device
- Breast coil
- Positioner

MRgFUS for Breast Cancer

Table Setup

- Platform table
- FUS power zone

ExAblate for Prostate Probe

- Transducer is inside a balloon filled with cooled degassed water.
- Transducer frequency: 2.3MHz (higher than in the body system)

Positioner and Probe

- Pitch

Treatment Demonstration

- Supine head first
- Trans-rectal transducer is inserted and then fixed
- Balloon is inflated with cold circulating water
Offer your patients cutting edge technology...... without the cutting.

Closed Loop Treatment Concept

Thank You

SIMPLY POWERFULL POWERFULL Y SIMPLE