Prostate MRI

New certainty in prostate cancer assessment
Uncover what lies behind Siemens’ leading MRI technology.
Tim Technology
Deliver exceptional image quality and speed in MRI

DotGO Workflow
Go for consistent results, efficiently

Trendsetting Applications
Expand your MRI services

Life Design
Maximize patient friendliness and investment protection

The DNA of Siemens MRI
An intensifying demographic shift, the rise of chronic diseases, patients turning into consumers, the pace of innovation, and broader access to medical imaging across the globe lead to a constantly growing number of examinations, including MRI. At the same time, this development raises central questions for you as healthcare- and us as
equipment-provider alike: How to manage volume growth with limited resources? How to control costs without compromising quality of care? How to expand services in either established or growing markets? How to continuously strive for clinical excellence in the interest of patients despite economic restraints?

Siemens MR provides answers to these questions by offering a unique combination of MRI technology, software and clinical applications, supporting you in turning these challenges into opportunities.
“Multiparametric MRI is the hope for the future.”

One in seven men will develop prostate cancer at some point during their lifetime. In the U.S., one million men undergo a biopsy for the disease each year. Conventional diagnosis uses transrectal, ultrasound-guided biopsy, which is not only a painful and invasive procedure, but also misses cancer in up to 20% of cases. Leading urologists state the need for a non-invasive and reliable test to detect and exclude prostate cancer, and eliminate unnecessary biopsies.

Multiparametric MRI can exclude life-threatening cancer with at least 89% certainty and help reduce the need for biopsy in patients with suspected prostate cancer by up to 51%.
New certainty in prostate cancer assessment

From diagnostic imaging to staging and therapy follow-up

**Setup**
Perform a non-invasive prostate MRI exam with surface coils only

Based on the excellent SNR provided by Tim 4G, high-quality prostate MR imaging can be performed with surface coils only. (→ page 10 -13)

**Scan**
Perform multiparametric prostate examination in a standard exam slot at 1.5T and 3T

Achieve exceptional image quality with unique techniques like RESOLVE – using readout segmented diffusion-weighted imaging to significantly improve lesion conspicuity. (→ page 14 -17)
Reading and reporting

Communicate findings in an easy, standardized way

Advanced post-processing of complex functional MR data and intuitive PI-RADS reporting of findings in a pictogram. (→ page 18-19)

Targeted biopsies and follow-up

Gain reliable insight for staging and therapy follow-up

Benefit from the combined accuracy of MRI and ultrasound. And use OncoCare to monitor the disease. (→ page 20-21)

Multiparametric non-invasive prostate MRI in 10 minutes

(→ page 8-9)
72-year-old, biopsy-naive patient with rectal stenosis

Due to continuously rising PSA levels – prior to biopsy: 12 ng/ml – the patient was referred for a diagnostic prostate MRI scan. The examination was performed with surface coils only at 3T.

**Morphology:** MRI revealed a suspicious lesion in the peripheral zone in the left apical part of the prostate extending over 4 slices in the z direction.

All images: MAGNETOM Skyra T2 TSE TR/TE 8300/107 ms matrix 320 FoV 160 x 160 mm SL 3 mm TA 3:11 min

Dr. Engelhard, Martha-Maria Hospital, Nuremberg, Germany
**Cellularity:** DWI with RESOLVE showed a hyperintense finding in the respective position in both $b = 800 \, \text{s/mm}^2$ images and the calculated $b = 1600 \, \text{s/mm}^2$ images and a corresponding diffusion restriction (ADC = 910 mm$^2$/s).

All images:
MAGNETOM Skyra RESOLVE
Top row: $b = 800$
Middle row: ADC map
Bottom row: Calculated $b = 1600$
GRAPPA 2
TR/TE 4190/69 ms
matrix 114
FoV 160 x 160 mm
SL 3 mm
TA 4:42 min

Dr. Engelhard,
Martha-Maria Hospital,
Nuremberg, Germany
Standardized reading and reporting:
Using the syngo.via Prostate Engine, the location of the finding was indicated in a standardized pictogram of the prostate. According to the PI-RADS 2.0 standard, the lesion was rated as follows: T2W = 4; DWI = 5; DCE = “+”; resulting in an overall score of 5 (DWI is dominant in the peripheral zone).

Vascularization: Dynamic-contrast-enhanced images were post-processed with syngo.via Tissue4D by applying the Tofts model. As illustrated, the suspicious lesion in the prostatic apex shows focal, early enhancement and a fast washout.
Fast T2W control images: The correct needle positioning in the lesion was confirmed. Two tissue samples were taken. Histopathology revealed a Gleason 3 + 3 = 6 acinar adenocarcinoma.

MR-guided biopsy: Based on the result of the diagnostic MRI, the patient was scheduled for an MR-guided biopsy. Using a contrast-filled needle guide and a simple projection technique, the trajectory to hit the target was defined.

Both images: MAGNETOM Aera
T2 TSE
TR/TE 5000/100 ms
matrix 256
FoV 200 x 200 mm
SL 3.5 mm
TA 50 s

Dr. Engelhard,
Martha-Maria Hospital,
Nuremberg, Germany
Improve process efficiency with SEEit

Multiparametric non-invasive prostate MRI in 10 minutes

SEEit combines ultra-high coil density on the hardware side with the unique RESOLVE sequence, which helps achieve significantly better lesion conspicuity and overall image quality.

All images: Dr. Engelhard, Martha-Maria Hospital, Nuremberg, Germany

MAGNETOM Skyra
T2 TSE
GRAPPA 2
TR/TE 7500/101 ms
matrix 320
FoV 160 x 160 mm
SL 3.0 mm
TA 3:11 min
“Thanks to the latest MRI technology, we can clarify whether a patient simply has an enlarged or chronically inflamed prostate, or a serious case of prostate cancer that could result in death if it is not optimally treated.”

Professor Jelle Barentsz, Radboud University, Nijmegen Medical Center, Nijmegen, Netherlands

Excellent spatial resolution: Depiction of small lymph nodes (arrow) in T2-weighted images (parameters above) and clear allocation of positive findings in high-resolution RESOLVE images.
Perform a non-invasive prostate MRI exam with surface coils only

**Body 18 and Spine 32:**
30 channels with 18 channels from Body 18 and 12 channels from Spine 32

**MRI systems** | **Coil combinations**
---|---
MAGNETOM ESSENZA & Spectra* | Body 6 / Spine 24
MAGNETOM Amira | Body 13 / Spine 24
MAGNETOM Aera 24ch & Skyra 24ch* | Body 6 / Spine 24
MAGNETOM Aera & Skyra 48/64ch & Prisma* | Body 18 / 30, Body 60 / Spine 32

Additional availability: * Medrad Endorectal Coil, ** Sentinelle 2ch
MAGNETOM Aera 1.5T:
Combination of Body 18
and Spine 32

Both images:
MAGNETOM Aera
T2 TSE
GRAPPA 2
TR/TE 7330/111 ms
matrix 320
FoV 200 x 200 mm
SL 3 mm
TA 4:16 min

MAGNETOM Aera
RESOLVE, b 800
GRAPPA 2
TR/TE 4490/52 ms
matrix 128
FoV 200 x 200 mm
SL 3.5 mm
TA 5:22 min
“We routinely perform prostate MRI without the use of an endorectal coil with each of our Tim 4G systems. Day by day.”

Leonardo K. Bittencourt, M.D., Partner at Carlos Bittencourt, Diagnóstico por Imagem, Rio de Janeiro Area, Brazil
MAGNETOM Skyra 3T:
Combination of Body 30 and Medrad Endorectal Coil

MAGNETOM Skyra
T2 TSE
GRAPPA 2
TR/TE 9640/107 ms
matrix 320
FoV 170 x 170 mm
SL 3 mm
TA 5:08 min

Both images: Radiologie Bamberg, Germany

MAGNETOM Skyra
T2 TSE
GRAPPA 2
TR/TE 9030/100 ms
matrix 256
FoV 145 x 145 mm
SL 3 mm
TA 3:55 min

MAGNETOM Amira
RESOLVE, b 700 and ADC map
TR/TE 4430/64 ms
matrix 100
FoV 200 x 200 mm
SL 3.5 mm
TA 6:05 min
Scan

Perform multiparametric prostate examinations in a standard exam slot at 1.5T and 3T

**RESOLVE**: Excellent diagnostic image quality in the most challenging cases. Experience outstanding diagnostic performance with sharp, high-resolution DWI. 3D distortions are reduced by a factor of 3 to 0.5 mm. Maximum distortion reduction from 13 to 3 mm. Significantly better lesion conspicuity and overall image quality.

With syngo MR E11, the acquisition time for RESOLVE was reduced by 43% without compromising image quality.
ZOOMit: High-resolution imaging with a zoomed field of view with no aliasing artifacts thanks to application of dynamic excitation pulses. Imaging is faster, with fewer susceptibility artifacts and geometric distortions. You benefit from faster imaging and 20% better SNR with TimTX Acceleration.

MAGNETOM Skyra
REVEAL, b 800
GRAPPA 2
TR/TE 4900/74 ms
matrix 114
FoV 200 x 200 mm
SL 3.5 mm
TA 6:17 min

MAGNETOM Skyra
REVEAL
ZOOMit b 800
TR/TE 4600/72 ms
matrix 96
FoV 100 x 200 mm
SL 3.5 mm
TA 5:45 min

MAGNETOM Skyra
RESOLVE, ADC map
GRAPPA 2
TR/TE 4430/71 ms
matrix 114
FoV 200 x 200 mm
SL 3.6 mm
TA 4:58 min

Dr. Engelhard, Martha-Maria Hospital, Nuremberg, Germany

Patient with hip prothesis
**SPACE**: Acquire high-resolution 3D datasets with excellent reformatting capabilities. SPACE is an ideal choice for image-guided biopsy and surgical planning.

**3D CSI Spectroscopy**: Probe metabolic tissue activity. Designed for higher quality, a better baseline and reduced acquisition times based on a new phasing technique and GRE shimming with syngo MR E11.
“We use the TWIST-VIBE sequence in every prostate patient for dynamic contrast-enhanced MRI. This sequence allows us to increase the temporal resolution without compromising spatial resolution. This makes qualitative and quantitative evaluation more robust.”

Mike Notohamiprodjo, M.D., University of Tübingen, Tübingen, Germany

**TWIST-VIBE:** Benefit from high-temporal and high-spatial resolution to see very small and early enhancing lesions.
Reading and reporting

Communicate findings in an easy, standardized way

**Computed b-values:** Interactively choose the b-value which best depicts the lesion; increased accuracy in comparison to measured $b = 1400 \text{ s/mm}^2$ images, no additional examination time required\(^1\).
**syngo.MR General Engine for routine prostate reading:** Automatic display and synchronization of 2D, 3D and 4D series; on-the-fly mean-curve analysis; computed b-values; structured reports.

**syngo.MR Prostate Engine for expert prostate reading provides additionally:** syngo.MR Tissue 4D, elastic registration, permeability quantification, automatic post-processing of CSI spectroscopy.

**Standardized and easy reporting according to PI-RADS:** Intuitive pictogram visualization of findings and standardized rating of lesion appearance on a 5-point Likert scale help referrers to understand findings at a glance.
Prostate MRI staging and therapy solutions

Gain reliable insight for staging and therapy follow-up

Fully integrated prostate biopsy
By partnering with Eigen, Siemens offers a fully integrated solution for virtual MR guidance of TRUS-assisted prostate biopsies. Combining the Acuson S3000 and the Artemis™ solution enables an easy and standardized integration of multiparametric MR information into a TRUS-assisted prostate biopsy workflow. A targeted biopsy is three times more likely to identify cancer than a systematic biopsy (21% vs. 7%), and with a targeted biopsy, 38% more high-risk cancers (Gleason 7 or higher) can be detected.14,15

“Beyond detection of suspected lesions, better targeted biopsies of cancer-suspicious regions at highest risk of harboring the most aggressive lesion are needed.”8

Professor Anwar R. Padhani,
Mount Vernon Cancer Centre and Institute of Cancer Research,
Royal Marsden Hospital, London, UK
Whole-body diffusion: Case of a 60-year-old male patient with metastatic castration-resistant prostate cancer and diffuse metastatic bone involvement. Whole-body diffusion-weighted imaging was performed prior to 12 weeks post treatment. Under chemotherapy, the PSA decreased from 2000 to 500 µg/l.

**syngo.MR OncoCare:** For advanced oncology reading, designed for early assessment of therapy response. It offers quantitative evaluation of functional lesion response to treatment.

Sagittal ADC maps processed with syngo via OncoCare. Histogram analysis of the (semi-automatically) segmented spine region clearly shows a shift to higher ADC values when comparing the pre- (top) and the 12 weeks post-treatment examination (bottom).

All Images: Dr. Tunariu, The Royal Marsden Hospital, London, United Kingdom
Siemens’ global MRI community offers peer-to-peer support and information. Radiologists, cardiologists, technologists, and physicists all contribute with publications, presentations, training documents, case studies, and more—all freely available to you via this unique network.

Siemens’ MR customer magazine MAGNETOM Flash is published quarterly. It features up-to-date clinical case studies, application tips, as well as technical and product information relevant to you. In fact, 98.5% of readers report that MAGNETOM Flash is clinically relevant.
Dot Exchange
A peer-to-peer online community within the Siemens Healthcare User Forum. You can register free of charge via www.siemens.com/Dot-Exchange. Share your experiences in MRI operation, upload and discuss protocol files, and engage in dialog with colleagues from all over the world.

IDEA
The open development platform supports the largest and most active 3T research community in the world. It brings users from across the globe together and fosters innovation in the field of MRI. Members collaborate online at www.mr-idea.com.

On MAGNETOM Flash: “An excellent and useful combination of technological and clinical articles that both keep one up to date with advances in MRI and provide practical assistance for day to day practice – good and interesting learning material.”

Mark Lourensz, St Vincent’s Hospital, Fitzroy, Victoria, Australia
**The clinical and financial value of MRI in prostate cancer management**

A urologist’s perspective on the clinical and economic value of an MRI pathway in prostate cancer care: by reducing the number of unnecessary biopsies and supporting therapy decisions through better characterization of the disease, MRI has found its way into the NICE guidelines.

*Emberton M.* Is prostate magnetic resonance imaging going to break the bank? European Urology. 2014;66:3

Evaluation of mpMRI as a non-invasive triage test for men at risk of prostate cancer. Non-endorectal MRI at 1.5T has been shown to exclude significant prostate cancer in biopsy-naive patients with 89%-certainty.


Comparison of standard TRUS-guided prostate biopsies with a magnetic resonance (MR) image-based targeted biopsy pathway in men with elevated prostate-specific antigen, underlining the benefits of the MR pathway.


Standardization of the reading and reporting process in prostate cancer: PI-RADS scoring performs well as a predictor for biopsy outcome and may be used in the decision-making process for prostate biopsy. The negative predictive value of a PI-RADS score of ≤2 for clinically significant prostate cancer was 97.7%.

*Grey A,* et al. Diagnostic accuracy of magnetic resonance imaging (MRI), prostate imaging reporting and data system (PI-RADS) scoring in a transperineal prostate biopsy setting. BJU International 2014 doi: 10.1111/bju.12862

Meta-analysis of 12 articles investigating the role of mpMRI in detecting significant PCa in biopsy-naive males and men with prior negative biopsies. The negative predictive value of mpMRI is important to the clinician because mpMRI could be used to rule out significant disease. This may result in fewer or no systematic or targeted biopsies in patients with a PSA level that could indicate prostate cancer.


Comparison of costs and quality of life (QoL) of the standard “blind” diagnostic technique with an MR image-based technique for men with suspicion of prostate cancer. The results suggest that costs are comparable, with higher QoL for the image-based technique.


**The role of MRI in therapeutic management**

In a randomized study, the MR pathway outperformed the standard TRUS-guided biopsy pathway in terms of the number of detected significant cancers, and has shown to be helpful for the stratification of patients for active surveillance.

*Panebianco V,* et al. Multiparametric magnetic resonance imaging vs. standard care in men being evaluated for prostate cancer: a randomized study. Urologic Oncology 2015;17:e1–17

Patients undergoing pre-operative MRI have a significantly lower rate of positive surgical margins compared with that in a control group without imaging.

*Petralia G,* et al. Robot-assisted radical prostatectomy: Multiparametric MR imaging-directed intraoperative frozen-section analysis to reduce the rate of positive surgical margins. Radiology 2015;274:434-44

Hypo-fractionated radiation therapy induces a significant prostate swelling during treatment. Recommendation of adaptive radiotherapy with MRI-based re-planning before each fraction.


**Calculated high b-values**

The benefit of computed high b-values in clinical practice and the positive impact on tumor detection.


**RESOLVE**

Comparison of conventional single-shot EPI DWI and RESOLVE shows that RESOLVE delivers improved image quality and is well suited to perform high-resolution DWI in the pelvis.

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1 Schröder F, Lancet; doi: 10.1016/S0140-6736(14)60525-0
4 http://www.nhs.uk/Conditions/Cancer-of-the-prostate/Pages/Diagnosis.aspx
5 Abd-Alaeez M, Prostate Cancer Prostatic Dis. 2014;17:40-46
8 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.
9 The MRI restrictions (if any) of the metal implant must be considered prior to patient undergoing MRI exam. MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.
10 Foltz, et al. IJRO 2013
11 Results may vary. Data on file.
12 Available only with syngo MR E11A. The product may not be commercially available in all countries. Due to regulatory reasons, its future availability cannot be guaranteed. Please contact your local Siemens organization for further details.
15 The information shown herein refers to products of 3rd party manufacturers (Artemis™, Eigen) and thus are in their regulatory responsibility. Please contact the 3rd party manufacturer for further information.
16 The product/feature (mentioned herein) is not commercially available. Due to regulatory reasons, its future availability cannot be guaranteed.