GE HealthCare

SIGNA™ Hero: 3.0T MR scanner

Advancing patient care at Baptist Health Medical Center - Little Rock, Arkansas, USA

Background

For nearly 100 years, Baptist Health Medical Center in Little Rock has been delivering quality healthcare to the citizens of Arkansas. The 843-bed medical center is the largest private, not-for-profit hospital in the state and provides comprehensive services using the latest in innovative technology.

MR Department Overview

Baptist Health Medical Center has two GE HealthCare 1.5T Optima MR450w systems that have been used for the last 10 years to provide MR imaging to both outpatients and inpatients. Like many facilities the COVID-19 pandemic and staffing challenges had impacted the facility and patient waiting times for MR scans. Demand for MR was growing in areas such as prostate imaging to help guide biopsy decisions and improvements in technology were creating opportunities to improve the quality of images.

These factors highlighted the need for an MRI resource that could keep up with demand by providing increased efficiency and improving their clinical capabilities with high quality imaging.

The Customer

Baptist Health considered that adding a 3.0T system in their facility would add additional clinical capabilities to complement the 1.5T systems and provide efficiency improvements that would help facilitate additional appointment availability in the outpatient setting.[1]

SIGNA™ Hero provides an enhanced experience for patients, technologists and radiologists:

- Head-to-Toe coverage with Whole-Body Imaging workflows & Feet First Scanning.
- The eXpress Detachable Table accommodates patients of all sizes and can be set up in a separate room when patients are waiting for their scan, making workflow more efficient.

AIR™ Recon DL offers exceptional image quality:

- Achieve exceptional images faster for even broader clinical coverage. Plus, scans can be completed up to 50% faster.
- Unmatched productivity with AIR™: Scan patients with more comfort with flexible coils and more positioning options with AIR™ Coils.

Immediate Benefits

The impact of the SIGNA™ Hero was quickly recognized in the MRI department at Baptist Health. Adding a new MR scanner to the facility enabled an immediate increase in capacity as would be expected. Within the first month of use, exam volumes increased by 16.2% during daytime operation. This improvement took place even while the technologists were still training on the system.[2]

The initial drive to integrate SIGNA™ Hero into the site operations did not solely focus on leveraging the gains in scan time to drive increased patient throughput, but the new magnet has helped the facility to eliminate their scheduling backlog. Over time as staffing improves the site plans to further capitalize on the speed of the SIGNA™ Hero to increase volumes.[1]

Following the SIGNA™ Hero installation, staff were trained on the new system and the radiologists and technologists quickly became fluent on the new technology. Building on their experience with their existing GE HealthCare systems facilitated the integration of the new MR system. Even though none of the technologists had prior experience with 3.0T systems, they were able to be quickly trained on the machine. On average after only 2 days of training, all the technologists felt able to perform the majority of exams independently and with confidence.

Technologists agreed that it was easy to operate the SIGNA™ Hero hardware features (table, controls on gantry, controls on console) and software features (e.g. selecting protocols, acquiring images, post processing).[3]

"The system is great! They are really beautiful studies we are doing right now. Everything the SIGNA™ Hero 3.0T does is beautiful."

Dr. Stuckey
Consultant Radiologist

Efficiency

With the new protocols on SIGNA™ Hero, the technologists and department manager immediately observed time reductions with most exam protocols.[4]

Compared to other MRI systems that they have used, 100% of the technologists feel that the SIGNA™ Hero helps them to be more efficient in their daily imaging work; for the majority of users (75%) daily efficiency was driven by the SIGNA™ Hero system hardware features, such as the table, controls on the gantry, and controls on the console. Based on their experience using SIGNA™ Hero, all the technologists would recommend the SIGNA™ Hero to other professionals in their field.[5]

Multi-parametric MRI of the prostate (mpMRI), combines anatomic T2*-weighted imaging with functional and physiologic assessment, including diffusion-weighted imaging (DWI) and Dynamic Contrast-Enhancement (DCE) MRI. Prostate exams accounted for the most significant time savings resulting from faster image acquisition combined with optimization of the protocol by eliminating a full diffusion sequence (since the DWI sequence with SIGNA™ Hero can provide both b values in the same sequence). These factors combined resulted in reducing the prostate scan time by nearly 50% from 40 minutes and 24 seconds to 20 minutes and 57 seconds. This has helped to improve the efficiency of the staff and reduced the amount of time a patient needs to be positioned in the scanner.

The increase in efficiency with prostate exams was leveraged by stacking these exams back-to-back on their patient schedule. This allows technologists working on the SIGNA™ Hero to perform 8-10 prostate exams in a day and still leaves time to fit in patients whose appointments may be running late on the other MR systems. Having the extra time and knowing that the SIGNA™ Hero can acquire images more quickly, technologists can add on nearly any exam, including brains, spines, extremities, abdomens, even breast, and cardiac exams. This all takes place in an 8 hour schedule that starts at 7:00 am each day.

Figure 1: Selected exam protocol times on the Optima MR450w and SIGNA™ Hero

Exam / anatomy type protocol	MR450w protocol time (min: sec)	SIGNA™ Hero protocol time (min: sec)
Prostate	40:24	20:57
Brain with contrast	25:05	21:27
Lumbar	16:08	10:33
Elbow	18:22	14:00
Hand with contrast	20:51	13:10
Shoulder	16:29	10:41

Protocol times for equivalent exams on the Optima MR450w and SIGNA™ Hero based on the exam protocol set-up.

"The 3.0T SIGNA™ Hero is able to do everything faster [than our other scanners] … and that gives me the ability to have a built-in buffer to get back on schedule"

William Morgan
MRI Lead Technologist

More On-time Appointments

Faster scanning and efficiency improvements have helped to enable Baptist Health to deliver improved patient service and technologists working with the SIGNA™ Hero are able to maintain a more consistent patient schedule compared to the other MR systems in their department. Analysis of data provided by the RIS administrator enabled the technologists to compare patients' scheduled appointment times to the actual exam start time. This showed that in the first month of operation, patient exams on the SIGNA™ Hero started within 4.5 minutes of their appointment time compared to 18.8 and 25.6 minutes on the other machines.[2]

This confirmed their feeling that while working on the SIGNA™ Hero, they were able to maintain a more consistent exam schedule and not have to try to "catch up" during the day.

Prostate Imaging: Superior Image Quality

Prostate imaging is becoming increasingly important in men's health. MRI offers increasingly reliable visualization of potentially significant prostate cancers and thus has shown advantages as a means by which to better select patients for biopsy and to facilitate direct targeting of lesions during biopsy.

Baptist Health performs an average of 1,500 prostate exams annually. Prior to installing SIGNA™ Hero, prostate exams were scheduled on their existing 1.5T magnets in between other types of outpatient exams and even ER or inpatients. This created some inefficiencies with needing to frequently change coils and the room set up for different types of exams.

After observing that the SIGNA™ Hero can provide faster imaging and better quality than the 1.5T systems, scheduling of the majority of prostate exams was switched to SIGNA™ Hero. This resulted in additional efficiency improvements because it reduced unnecessary room and coil set up procedures.

There is a high emphasis on image quality with MRI of the prostate because suboptimal imaging can lead to diagnostic errors and create disruptions or delays in the care of the patient.[5] One of the major factors in prostate image quality is the challenge of rectal gas causing motion artifacts and this is especially important when imaging T2 weighted sequences.[6] Although many different rectal preparations have been tested (enemas, dietary changes, anti-peristaltic medications), there is little agreement on whether this reduces motion from rectal gas.[7]

In addition to saving time during the image acquisition, Baptist Health also found that prostate exams scanned on the SIGNA™ Hero were easier to interpret and report. Exams acquired with the Optima MR450w protocol did not allow the T2 and DWI sequences to be scanned in the same thickness, therefore making it difficult to register the images when scrolling. SIGNA™ Hero allows for scanning in 3mm for both sequences so the "anatomy matches up across sequences and that's a big deal". The increased signal of a 3.0T combined with sequences that are designed to give a better image quality for a small field of view, means that abnormalities are easier to identify.

"I believe the 3T SIGNA Hero makes me go faster [in reading] most cases"

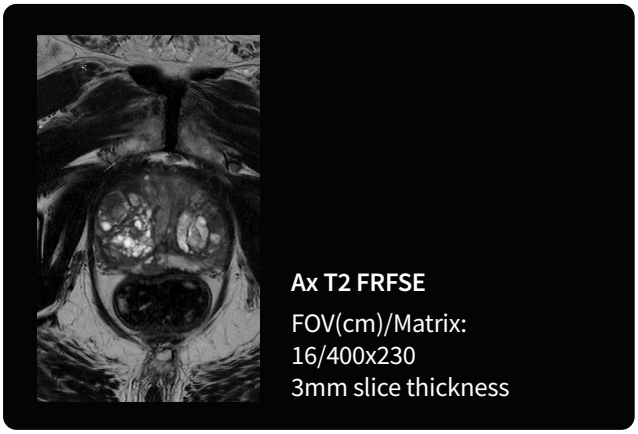
Dr. Stuckey
Consultant Radiologist

Acquiring high quality imaging while minimizing the impact of motion continues to be a challenge with prostate imaging. Baptist Health recently performed an image quality assessment of their prostate exams from the SIGNA™ Hero. Using a pre-determined scorecard, 10 exams were chosen at random and the perception of image quality from the T2 and DWI images was evaluated by a board certified abdominal radiologist.[8]

9/10 exams showed rectal gas artifacts as expected but there were 0 artifacts caused by the machine or hardware. Even with the majority of exams showing rectal gas motion, the images were rated above average in quality.

"Image quality has been outstanding and the improvement in image quality of our SIGNA™ Hero 3.0T system has increased our diagnostic confidence in prostate imaging."

Dr. Stuckey
Consultant Radiologist



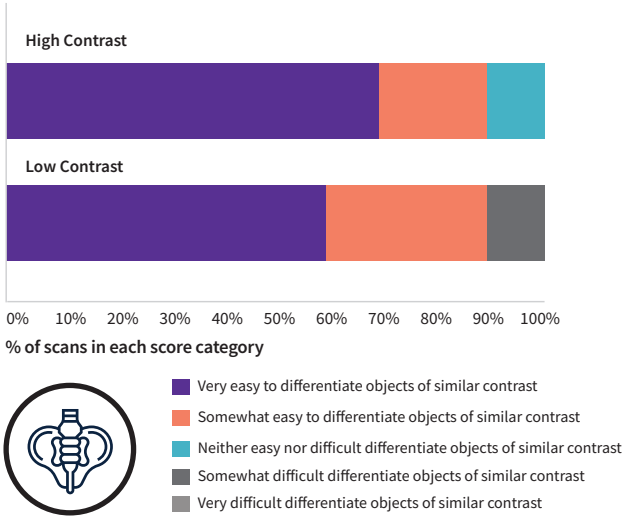
Low-contrast resolution (the ability to identify small objects with only slightly different relaxation times from background) was assessed for all of the exams. 9 out of 10 exams were scored as being somewhat or very easy to differentiate objects of similar contrast.

High-contrast resolution (the ability to detect finely spaced lines or areas with whose signals differ considerably from background) was assessed for all exams. 9 out of 10 exams were scored as being somewhat or very easy to differentiate finely spaced contrast or anatomy.

"Prostate imaging times have been reduced by about 50% and the SIGNA™ Hero 3.0T system makes me go faster [in reading] most cases"

Dr. Stuckey
Consultant Radiologist

Figure 2: Radiologist perception of prostate image quality[9]



References

1. Based on qualitative discussions conducted with stakeholders and evaluation feedback at Baptist Health July – September 2022.
2. Based on data extracted from Baptist Health RIS.
3. Based on online survey responses analyzed from 4 technologists currently using the SIGNA™ Hero system in their clinical practice on their perception of how easy it was to learn how to operate the SIGNA™ Hero hardware and software features. No financial incentives or conflicts exist between GE HealthCare and the survey participants.
4. Based on protocol times from exam protocol set-up taken for individually selected protocols.
5. Sathiadoss, P., Haroon, M., Osman, H., Ahmad, F., Papadatos, P., & Schieda, N. (2022). Comparison of 5 Rectal Preparation Strategies for Prostate MRI and Impact on Image Quality. Canadian Association of Radiologists Journal, 73(2), 346-354.
6. Weinreb JC, Barentsz JO, Choyke PL, et al. PI-RADS Prostate Imaging—Reporting and Data System: 2015, version 2. Eur Urol. 2016;69(1):16–40. doi:10.1016/j.eururo.2015.08.052
7. Schmidt C, Hötker AM, Muehlematter UJ, Burger IA, Donati OF, Barth BK. Value of bowel preparation techniques for prostate MRI: a preliminary study. Abdom Radiol (NY). 2021. doi:10.1007/s00261-021-03046-3
8. Based on a scorecard for the radiologist to evaluate their perception of the image quality of 10 randomly selected prostate exams during the month of August 2022. Image quality was evaluated by the chief abdominal radiologist at Baptist Health. The radiologist reported the presence of image artefacts (physical such as rectal gas; hardware or software related or unknown cause) and scored the low and high contrast resolution of the T2 and DWI sequences using a 5-point Likert scale (i.e. ease of differentiating objects of similar contrast; and ease of differentiating finely spaced contrast or anatomy).

Abbreviations

T2W T2-weighted imaging
DWI Diffusion-weighted imaging
DCE Dynamic contrast-enhanced

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