# First Impressions of MAGNETOM Vida Fit in Lucerne, Switzerland

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## Introduction

The Lucerne Cantonal Hospital (LUKS) is one of the largest hospitals in Switzerland, with 867 patient beds and approximately 700 000 ambulatory and 430 000 stationary visits per year [1]. It serves as a central hub for five affiliated hospitals, bringing together experts in all clinical specialties and many services including teleradiology. As a pioneer of digital transformation in the Swiss healthcare market, it has its own stringent digitization strategy, and is implementing an all-encompassing new hospital information system (EPIC®).

LUKS is an academic teaching hospital, so our physicians keep their knowledge up to date, constantly translating new research findings into clinical practice and conducting their own research projects. This requires the latest medical equipment, especially in the radiology and nuclear medicine department.

In Lucerne, we have currently three MRI scanners, one 1.5T (MAGNETOM Aera, Siemens Healthcare, Erlangen, Germany) and two 3T systems (MAGNETOM Skyra, Siemens Healthcare, and Achieva, Philips Medical Systems, Eindhoven, The Netherlands). With the 3T MAGNETOM Skyra we have a strong focus on neuroradiology examinations, accounting for approximately 52% of all patients scanned, followed by examinations of the pelvis with 10% and the heart with 8.0% (Fig. 1). Our latest research work in neuroradiology focuses on morphological and metabolic assessement of dementia and Parkinson's disease, as well as the evaluation of quantitative imaging methods [2, 3].

The opportunity of upgrading our existing MAGNETOM Skyra 3T system to a MAGNEOM Vida Fit with BioMatrix Technology was very attractive, as it would enable us to keep up with the latest technological advances in MRI and support our research work at a very effective cost-benefit ratio compared with installing an entirely new system. We decided to purchase the upgrade to improve diagnostic image quality and accelerate data acquisition, which can increase the number of patients scanned per day and also provide better patient comfort.

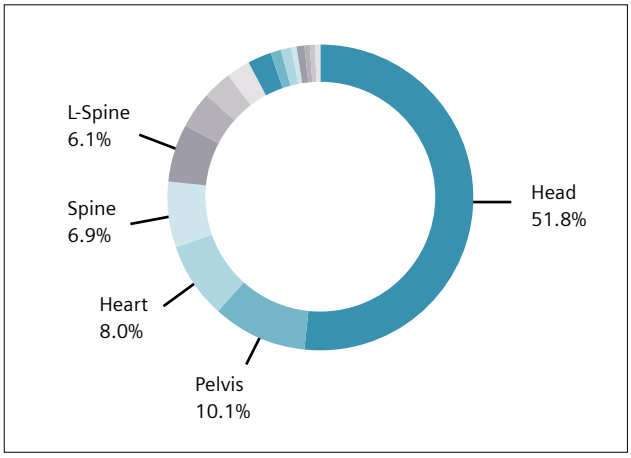
In August 2019, we received the world's first MAGNETOM Vida Fit upgrade here in Lucerne, and in this article we share our first impressions.

## Installation

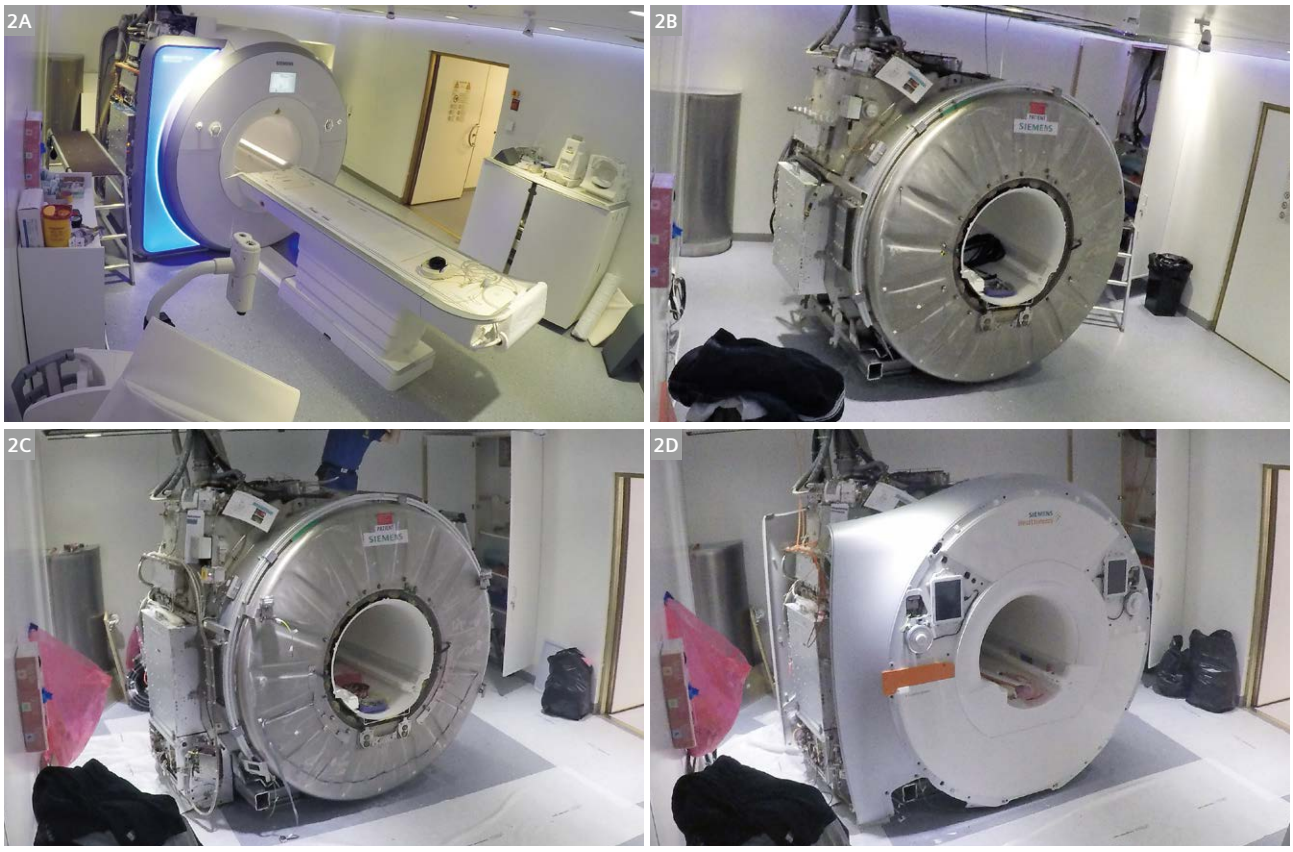
The Vida Fit upgrade (Fig. 2) included new RF components, new electrical cabinets, new covers with one-touch positioning displays, a new patient table including a new 32-channel spine coil with respiratory sensors, and a new MRI workplace with a large screen monitor. Additionally, we received a new tiltable 20-channel head/neck coil with coil shimming technology, a new 18-channel transmit/receive knee coil and an 18-channel high-density flex coil.

A first installation can be unpredictable, but the upgrade went very smoothly and surprisingly fast with a total of 13 days' down time. On the very first day going live the scanner produced high quality brain images. Initial instability and specific absorption rate (SAR) problems, as well as a defective coil heat sensor, were corrected within the first week. During the second week, the system was very stable and MR imaging of all subspecialties (neuro, MSK, body, heart) was performed without any problem.

To bridge the time required for the system upgrade we operated a mobile MR unit in addition to our fixed installations. In retrospect this decision was very wise and helped prevent our waiting list from increasing (Fig. 3).




**1** Case mix on MAGNETOM Skyra (Jan – Jul 2019).




**2** **(2A)** Dismantling the old MAGNETOM Skyra scanner. **(2B)** The stripped magnet. **(2C)** New RF components being installed. **(2D)** Installing new covers. **(2E)** New table being installed.


**3** The mobile MR unit used during the MAGNETOM Vida Fit upgrade.

## New work environment

Besides the many hardware changes, the system upgrade comes with a brand-new user interface and work environment for our technicians (new XA20 software). In particular, it combines planning, viewing and post-processing features into one platform that differs considerably from *syngo* MR E11C, the platform we have been using so far.

New to our technicians was the possibility to train themselves using a simulator, enabling them to get to know the user interface and to play around with planning and viewing the exams. This meant that our technicians were already familiar with the basic features of the new user interface before they scanned their first live case.

Adding to this upfront training with the simulator, local support by an application specialist was very constructive and helped our staff to quickly learn the specifics of the new user interface. The training included our main applications: neurological imaging, musculoskeletal imaging, body imaging, MR angiography and cardiac imaging. Now at the end of training, our MR-technicians feel comfortable enough to use the upgraded system for routine work.

## First clinical impressions

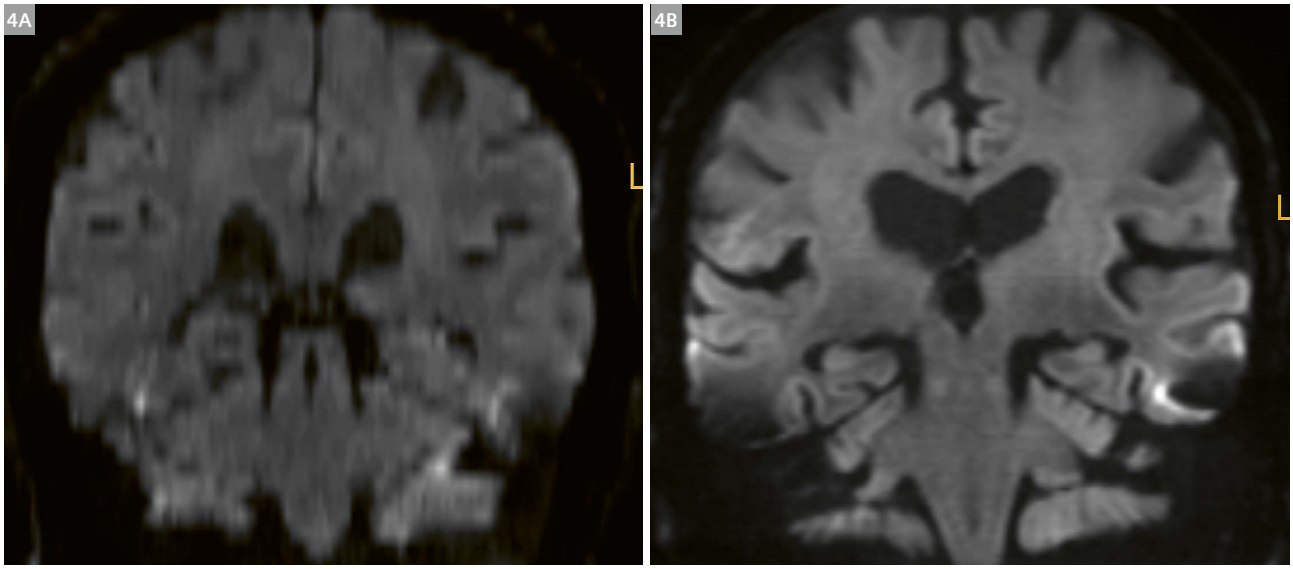
Our standard brain examination consists of a transversal diffusion, T1 MPRAGE, transversal T2 spin-echo sequence, time-of-flight (TOF), postcontrast 3D FLAIR, and, finally, a second T1 MPRAGE. After the upgrade, we can carry out this standard protocol more quickly, by applying compressed sensing accleration for TOF and 3D FLAIR.

At the same time images can be acquired with thinner slices and higher resolution, especially for diffusion (DWI) by using simultaneous multi-slice. With a 1-mm isovoxel DWI from the whole brain it is now unnecessary in most cases to acquire additional planes, for example of the brainstem (Fig. 4).

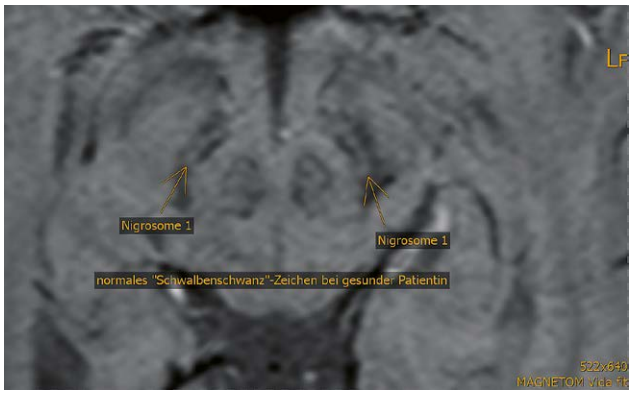
We were also able to acquire high resolution susceptibility-weighted images (SWI), helping us to detect the "swallow tail sign" of Parkinson's disease. This is revealed through nigrosomes, dopaminergic cells that return high signal in SWI sequences. The presence of nigrosome within the posterior substatia nigra is often difficult to detect, but with the high resolution SWI on our MAGNETOM Vida Fit, we're now able to find this sign with higher confidence (Fig. 5).

With the Compressed Sensing GRASP–VIBE 4D sequence, we were able for the first time to acquire motion-insensitive time-resolved images from the neck to better delineate tumor tissue from adjacent mucosa and muscles of the tongue (Fig. 6A). Measuring enhancement characteristics of different tissues is possible and helps us to better delineate tissues. This can be very helpful in tumors of the neck for example, where enhancement curves differ between tumor tissue and mucosa and musculature (Fig. 6B).

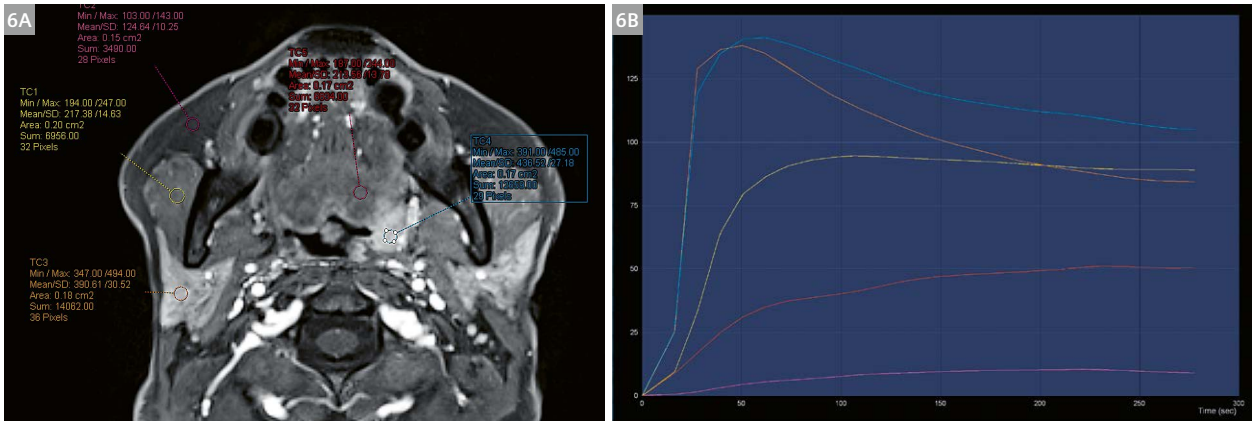
A common referring question from our head and neck department is to rule out endolymphatic hydrops in patients with dizziness. With a 3D real IR sequence acquired four hours after applying a double dose of standard intravenous contrast, the anatomy of the inner ear can be visualized with excellent image quality (Fig. 7). So far, no patient with proven endolymphatic hydrops has been scanned.



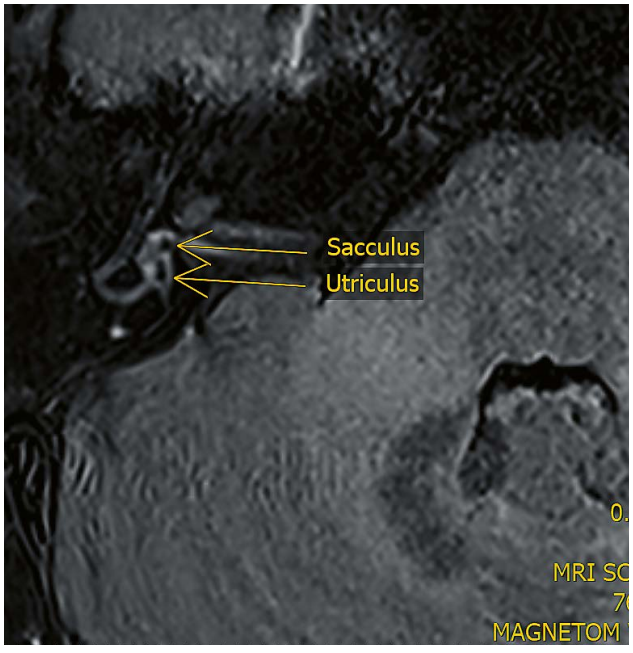

**4** **(4A)** Coronal reconstruction of conventional DWI acquisition on MAGNETOM Skyra.
**(4B)** Coronal reconstruction from isovoxel DWI on MAGNETOM Vida Fit.



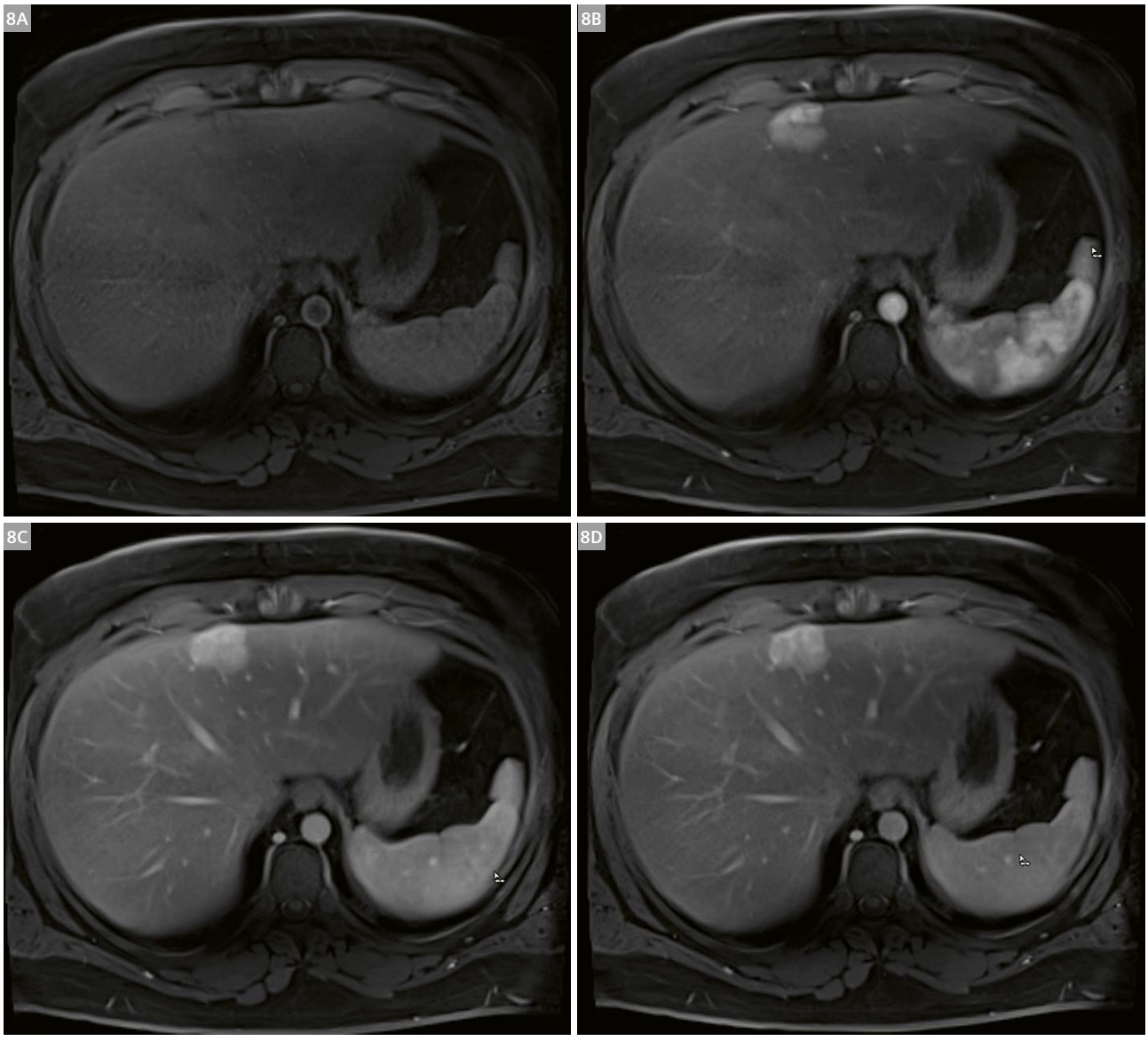

**5** Normal swallow tail sign in a healthy patient. The fine white line caused by the presence of dopaminergic cells (nigrosome 1) can be seen on both sides.




**6** **(6A)** Late arterial image from a dynamic GRASP sequence (only one late arterial image shown here). On *syngo*.via, regions of interest (ROI) can be drawn in tissues of interest and specific enhancement curves, helping to distinguish tumor from normal tissue.
*To access the time-resolved images/video please visit www.siemens-healthineers.com/vidafit*
**(6B)** Enhancement curves from figure 6A, nicely visualizing the different enhancement characteristics of the color coded ROIs.



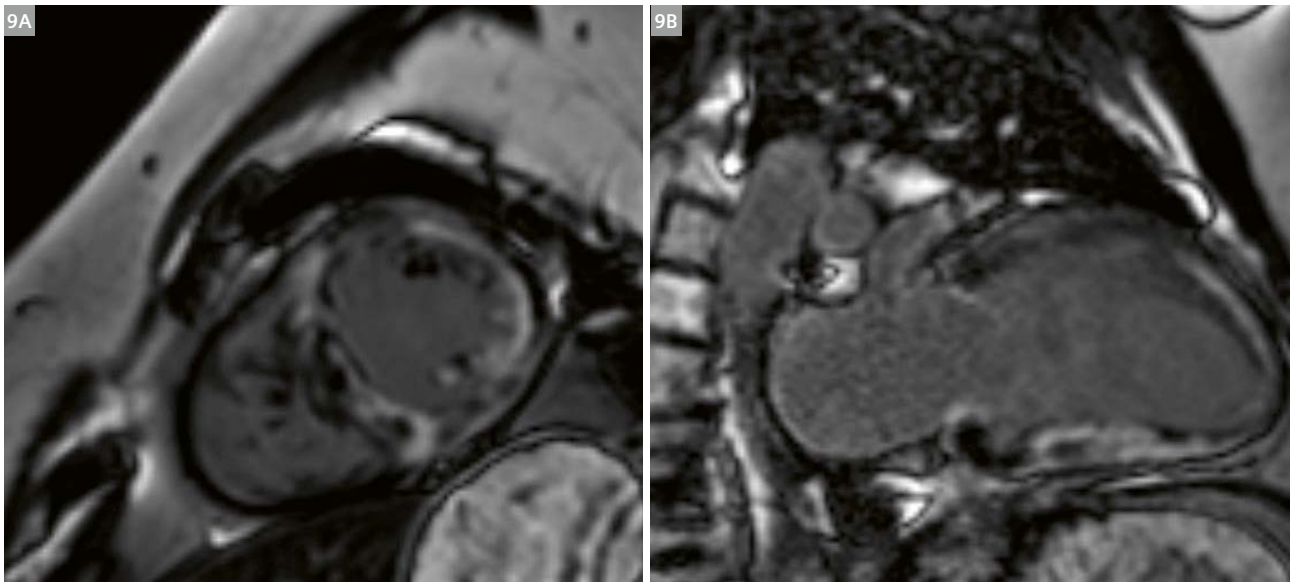

**7** Anatomic example of vestibulum with sacculus and utriculus.




**8** Dynamic GRASP-VIBE 4D sequence demonstrates the perfusion of a focal liver lesion (**8A** non-contrast, **8B** arterial phase, **8C** porto-venous phase, **8D** venous late phase). Despite patient's free breathing and short acquisition time of 5 minutes, the image is free of motion artifacts and demonstrates a very homogenous image quality.
*To access the time-resolved images/video please visit www.siemens-healthineers.com/vidafit*

The initial promising results in abdominal imaging give us hope of making these exams more robust and easy to acquire. As the BioMatrix respiratory sensors constantly show the respiratory cycle of the patient throughout the whole examination, sequence strategies can be planned upfront without any hustle. Figure 8 demonstrates excellent image quality of dynamic liver imaging using a 4D GRASP-VIBE sequence. The image quality is outstanding even though the sequence was acquired with the patient free-breathing, and with an image acquisition time of only 5 minutes.

The improvement in cardiac imaging was apparent from the very first patient we scanned. Accelerated image acquisition due to new compressed sensing capabilities allowed us to cover more short-axis (SAX) cine images within a single breath-hold (Fig. 9A). Furthermore, the scanning of delayed enhancement (DE) images – normally a very delicate task given the patients fatigue toward the end of a cardiac study – was very impressive, as images can be acquired with free breathing, with an image quality comparable to traditional breath-hold DE image acquisitions (Fig. 9B).




**9** Short-axis **(9A)** and 2-chamber long axis **(9B)** delayed-enhancement (DE) images in a patient with familial cardiomyopathy, acquired with free breathing. Image quality and the amount of motion artifacts are comparable with traditional breath-hold images.

## Conclusion

After using the MAGNETOM Vida Fit for two weeks, early results give us confidence that we will be able to achieve our goals to shorten many examinations while maintaining high image quality – or even improving it in some areas, such as abdominal and neurological scans. With this upgrade we can take advantage of the latest innovations from Siemens Healthineers while keeping investment costs down. The overall cost-benefit ratio of an upgrade to MAGNETOM Vida Fit was the decisive factor for us, and the upgraded system effectively brings the same benefits as a new system.

We are looking forward to the full benefits of our investment, once we have implemented all the new features available with the scanner, and integrated it into our clinical routine as we gather more experience.

**References**

1 Luzernen Kantonspital Jahres- und Finanzbericht 2018. Luzerner Kantonsspital Luzern; 2019 March 22 [cited on 2019 Sep 6]. Available from: https://www.luks.ch/sites/default/files/2019-04/luks_jahres_und_finanzbericht_2018.pdf
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