BioMatrix Beat Sensor: Initial Clinical Experience with a MAGNETOM Flow. System

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Introduction

The BioMatrix Beat Sensor is a technological advancement in the field of cardiac magnetic resonance imaging (CMR), offering an effective and simplified alternative to the traditional electrocardiogram (ECG) method [1, 2]. Cardiac synchronization is essential for CMR, but ECG accuracy can be significantly affected by artifacts related to gradient pulses, the magnetohydrodynamic effect, and the patient's physical characteristics and conditions such as body size, chest hair, and arrhythmias [1, 3].

The BioMatrix Beat Sensor is a cardiac triggering system that is independent of the MR image acquisition and represents the cardiac application of the general pilot tone (PT) motion detection technology [3]. The PT technology is based on the principle that a constant continuous wave (CW) RF signal transmitted by a small loop antenna, typically integrated into a body coil, is modulated by physiological motion, among them cardiac movement. The signal captured by the receiving coils, after being modulated by the movement of conductive tissues, corresponds to the cardiac volume curve which used as a trigger signal source [1, 2, 4].

1 MRI examination using the BioMatrix Beat Sensor on a MAGNETOM Flow. scanner at Hospital Beneficência Portuguesa.

We used Beat Sensor on the first 1.5T MAGNETOM Flow. installed in Brazil. The MAGNETOM Flow. Platform features 1.5T MRI systems with DryCool technology. With just 0.7 liters of liquid helium, the sealed-for-life magnet design removes the need to refill the system with liquid helium [5]. The system features three body coils (Contour Small, Medium, and Large) for use with patients of different sizes and all coils provide Beat Sensor functionality.

Initial clinical experience

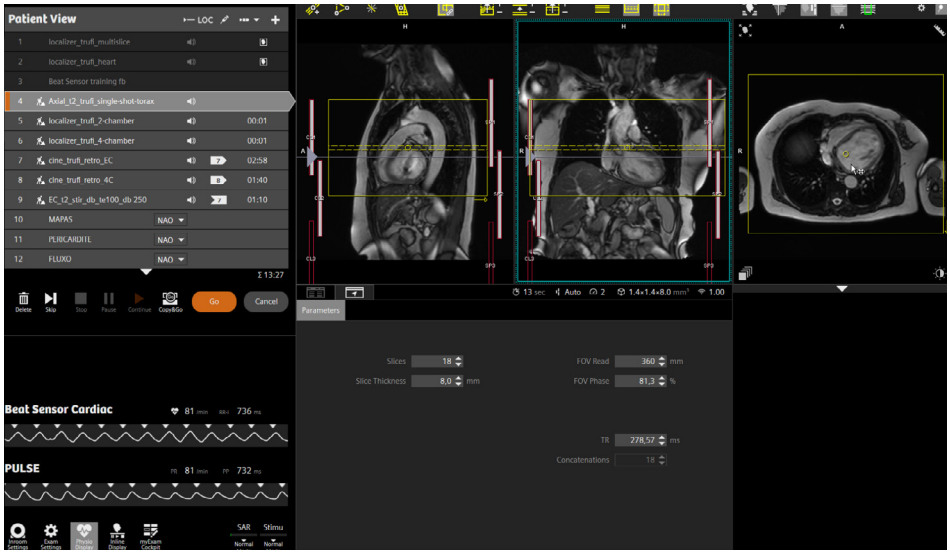
In our work routine the main benefits of using of the BioMatrix Beat Sensor are the gain in practicality and time savings in patient positioning. We observed a reduction of approximately 10 to 15 minutes in patient preparation time, not to mention the time spent repositioning electrodes in cases of failures in the capture of ECG data. Another very important benefit is the patient's experience and comfort, as we can reduce patient exposure compared to electrodes, for which it is necessary to partially open the clothing at the top.

BioMatrix Beat Sensor in routine heart exams

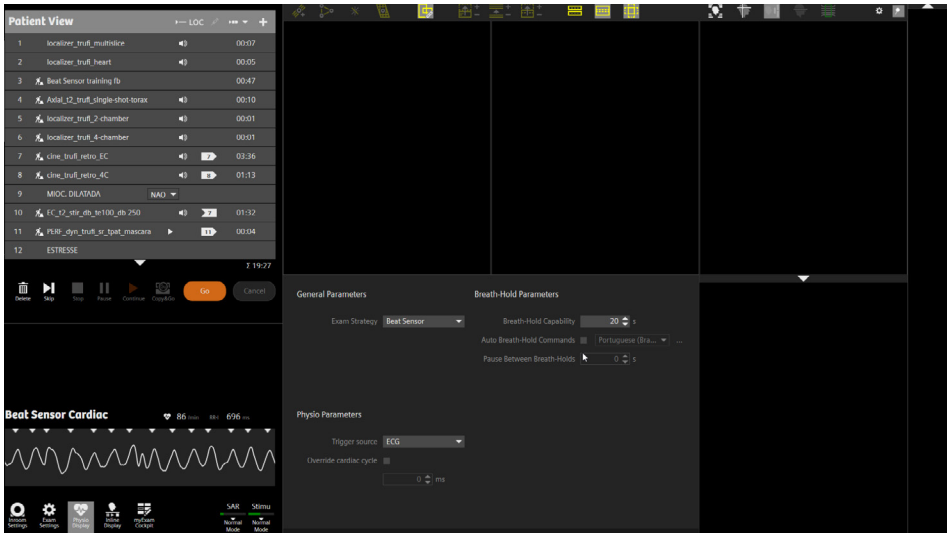
The BioMatrix Beat Sensor training scan must be executed once. It is a crucial preparatory step that aims to calibrate PT signal processing for robust acquisition of cardiac and respiratory data during CMR imaging.

Protocol optimization

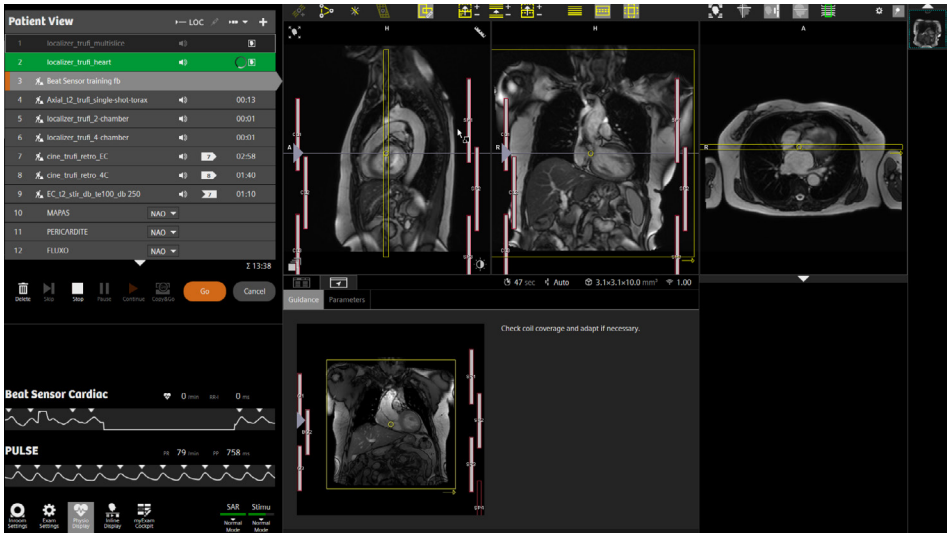
To ensure good practice and better reproducibility when using the BioMatrix Beat Sensor, we follow a number of procedures. They include keeping the patient relaxed during the training scan, and ensuring correct positioning of the coil (in case of doubt, we use the guidance on the Touch Patient Data Display). After the training stage, we check the signal quality before starting the scan. Then we apply the protocol strategy that we defined with the use of the Beat Sensor.



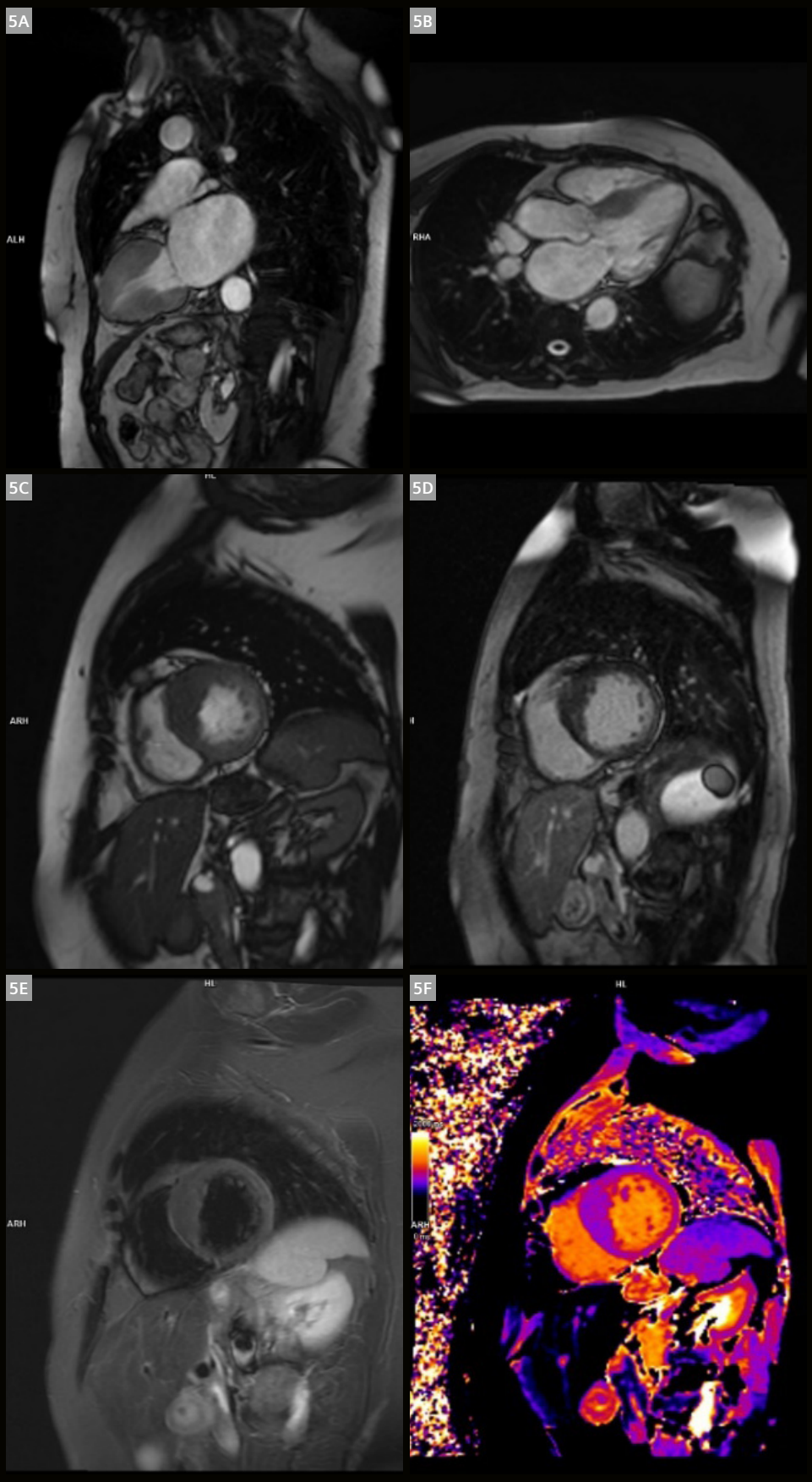
2 The BioMatrix Beat Sensor interface for a cardiac MRI scan.



3 Defining the exam strategy using the BioMatrix Beat Sensor.



4 BioMatrix Beat Sensor training.



5 Example images acquired using MAGNETOM Flow. with the BioMatrix Beat Sensor. **(5A)** 2-chamber view, cine TRUFI; **(5B)** 3-chamber view, cine TRUFI; **(5C)** SAX cine TRUFI; **(5D)** LGE TRUFI,high-resolution PSIR; **(5E)** SAX STIR; **(5F)** T1 map long axis. TRUFI = true fast imaging with steady-state free precession; SAX = short axis; LGE = late gadolinium enhancement; PSIR = phase-sensitive inversion recocvery; STIR = short tau inversion recovery.

Conclusion

In addition to the benefits for optimizing the patient preparation time, we have also been able to verify the versatility of the Beat Sensor technology on the new 1.5T MAGNETOM Flow. Platform.

Using the BioMatrix Beat Sensor provides us with agility and practicality in the execution of exams. It improves the patient's experience during the exam, avoids time lost from repositioning electrodes, and reduces the costs associated with consumables such as carbon electrodes, material for cleaning and preparing the skin, and hair removal devices. In the context of "Cardiac Assist" workflows the trigger signal (ECG or Beat Sensor) is selected centrally at the beginning of the exam. Thus, besides the additional training step for Beat Sensor, exam follows same standard flow of slice planning and acquisition, including cardiac synchronization.

References

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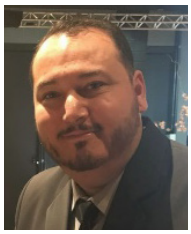

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