Preliminary experience with the multisensory HeartLogic algorithm for heart failure monitoring: a retrospective case series report

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Background

In the MultiSENSE study, a novel algorithm for heart failure (HF) monitoring was implemented. The HeartLogic (Boston Scientific) index combines data from multiple implantable cardioverter-defibrillator (ICD)-based sensors and has proved to be a sensitive and timely predictor of impending HF decompensation. The remote monitoring of HF patients by means of HeartLogic has never been described in clinical practice.

Aim

We report post-implantation data collected from sensors, the combined index, and their association with clinical events during follow-up in a group of patients who received a HeartLogic-enabled device in clinical practice.

Methods

Patients with ICD and cardiac resynchronization therapy ICD were remotely monitored. In December 2017, the HeartLogic feature was activated on the remote monitoring platform, and multiple ICD-based sensor data collected since device implantation were made available: HeartLogic index, heart rate, heart sounds (S3 and S1), thoracic impedance, respiration, and activity. Their association with clinical events was retrospectively analyzed.

Results

Data from 58 patients were analyzed. Daily index values were available for analysis over a mean observation period of 5±3 months (a total of 24 person-years), the HeartLogic index crossed the threshold value (set by default to 16) 24 times (over 24 person-years, 0.99 alerts/pt-year) in 16 patients.

The **clinical events** associated with HeartLogic alerts were:

- ✓ **5 HF hospitalizations in 3 patients (0,21 per patient-year)**
- ✓ **5 unplanned in-office visits in 3 patients for HF** (symptoms and signs of clinical deterioration of HF)
- ✓ **5 patients reported symptoms or signs of HF** at the time of 5 scheduled visits
- ✓ **10 additional HeartLogic alerts (7 patients) after discontinuation or reduction of prescribed HF therapy or after events with a direct impact on clinical status or on sensor data collection**

Thus, according to the definition adopted in the MultiSENSE study, these could be regarded as unexplained alerts. Their rate would be 0.41 per patient-year, and the proportion of alerts that were positively associated with HF events, that is, **positive predictive value, would be 58%** (14/24).

The median early-warning time and the time spent in alert were longer in the case of hospitalizations than of minor events of clinical deterioration of HF (Table 1). HeartLogic contributing sensors detected changes in heart sound amplitude (increased third sound and decreased first sound) in all cases of alerts (Table 2).

	Early-warning time (days)	Time spent in the alert state (days)	Maximum HeartLogic index
HF hospitalizations	38 [15-61] [a]	70 [61-71]	40 [28-40]
HF visits	12 [1-19] [a]	36 [21-51]	24 [20-30]
Therapy discontinuation	20 [9-35] [b]	24 [22-31]	24 [19-30]

Table 1: Clinical events: a. Time between HeartLogic crossing and event; b. Time between trigger event and HeartLogic crossing

Sensors with worsening on the day of the alert threshold crossing					
S3	S3/S1	TI	RR	RSBI	NHR
84%	88%	44%	36%	36%	60%

Table 2: Contributing sensors changes: TI, thoracic impedance; RR, median respiratory rate; RSBI, rapid shallow breathing index; NHR, night heart rate;

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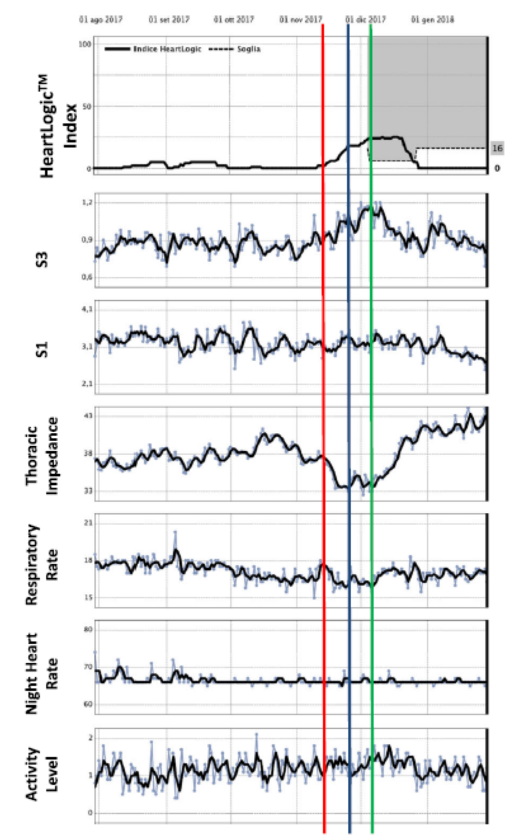

A 74-year-old man with non-ischemic dilated cardiomyopathy, 22% ejection fraction, left bundle brunch block, and persistent atrial fibrillation was implanted with a cardiac resynchronization therapy defibrillator for primary prevention on May 2017 (Table 2, event 15). During follow-up on 1 November 2017 (red line), he discontinued diuretic therapy. At a subsequent in-office medical control on 4 December 2018, he reported weight gain of 4 kg within 7 days; therefore, diuretic therapy was restored (green line). HeartLogic index analysis showed crossing of the alarm threshold value already on 25 November 2017 (blue line) with thus an early warning 10 days in advance compared with clinical evaluation.

That index normalized after therapy restoration. Main sensor contributing were heart sounds and thoracic impedance.

Conclusion

In this first description of the use of HeartLogic in clinical practice, the algorithm demonstrated its ability to detect gradual worsening of HF. HeartLogic allows to early detect non-adherence to pharmacology therapy and enables actions to be taken before clinical signs of HF worsening appear. The strong association between HeartLogic alerts and HF-related clinical events in our study is consistent with the high sensitivity in early detection of worsening HF demonstrated in the validation phase of the MultiSENSE study