Video + AI solution captures peripheral oedema data automatically without requiring patient compliance

Prabhvir Marway[1], Oriane Chausiaux[2], Melanie Keyser[2], Michal Nieznanski[2], Gareth Williams[2] and Shamus Husheer[2]

1- University of Cambridge School of Clinical Medicine, Trinity College, Cambridge, UK

2- Heartfelt Technologies, Cambridge, UK

Introduction: Chronic heart failure leads to the hospitalisation of many patients, particularly those who are elderly and non-compliant with treatment[1]. This hospitalisation can often be predicted by weight gain[2] and increasing peripheral oedema in the preceding weeks. For patients who are non-compliant with daily weight recordings, we hypothesize that reliable data collection from a zero-compliance fully automatic telemonitoring solution to assess peripheral oedema will lead to a reduction in hospitalisations and improvement in care.

This pilot study assesses whether use of a zero-compliance home based solution allows the collection of data from heart failure patients and if this data is of sufficient quality for analysis using proprietary artificial intelligence methods to automatically obtain lower leg volumes (fig 1).

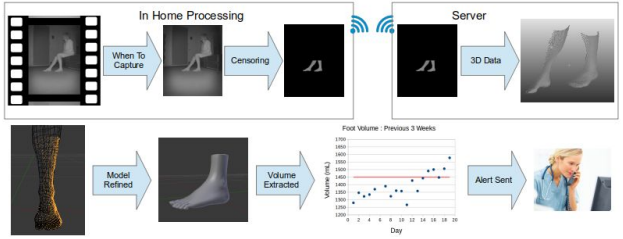

Figure 1: Data processing summary

Methods: Six patients (one woman and five men) with chronic heart failure who had displayed peripheral oedema in the past, prior to hospital admission. Inclusion criteria included non-compliance with traditional management (e.g. do not weigh themselves regularly). Exclusion criteria included bandages on the feet and being bedbound.

Figure 2: Heartfelt device installed in the patient's residence

Data collection using the remote camera (HF-3, Heartfelt Technologies) in the residences of the patients, without any changes to their lifestyle, normal care or specific actions necessary (fig 2). Data was collected continuously during the period of 14/05/2019 - 17/06/2019.

Our primary outcome was the percentage of patient days where the suitable images for analysis contained a certain number of different orientations of the lower limbs (where each orientation is separated by 45 degrees, giving a maximum of eight different orientations), and number of days without data.

Results: 98% of patient days had at least one orientation, with half of the patients achieving this on every day. Considering a conservative target of ≥4 different orientations to obtain adequate accuracy in an AI model, we find that 87% of days had enough data to achieve this (fig 3). There were four days without any data measured. These were due mostly to WiFi connection problems and the patient wearing shoes, socks and long trousers.

Conclusions: The performance of the HeartFelt device in collecting usable data for assessment of peripheral oedema is promising. This zero-compliance method appears to obtain useful patient data more reliably in this patient group than other methods such as daily weight measurements. Incorporating the assessment of peripheral oedema via telemonitoring into heart failure management may help to prevent readmission to hospital. This is particularly important for patients with reduced mobility and/or cognitive function.

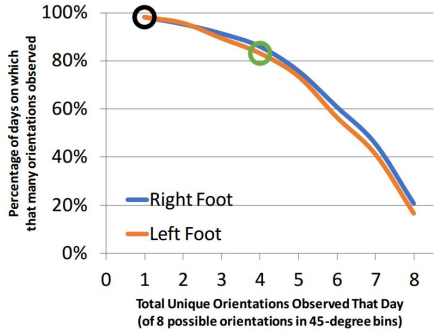

Figure 3: Proportion of days versus unique orientation captured

References: 1- Ruppar TM et al. 2016. 2- Chaudhry SI et al. 2007

All patients have provided consent to their data being used in scientific communications

Doi : This research project was co-funded by Trinity College, Cambridge and Heartfelt Technologies. All authors, except for Prabhvir, work at the company.