Monitoring chest compression rate using cerebral oximetry

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INTRODUCTION

Cerebral oximetry is used to monitor regional oxygen saturation in the frontal lobes. The technology is based on measurements of hemoglobin concentration changes (ΔcHb), which if sampled with sufficient time resolution may reflect instantaneous changes caused by cardiopulmonary resuscitation (CPR).

The objective of this study was to evaluate the possibility of monitoring chest compression rates through changes in cerebral hemoglobin concentration during OHCA.

DATA COLLECTION AND ANOTATION

Data collection and extraction

Data source and acquisition

Five out-of-hospital cardiac arrest patients monitored during CPR with:

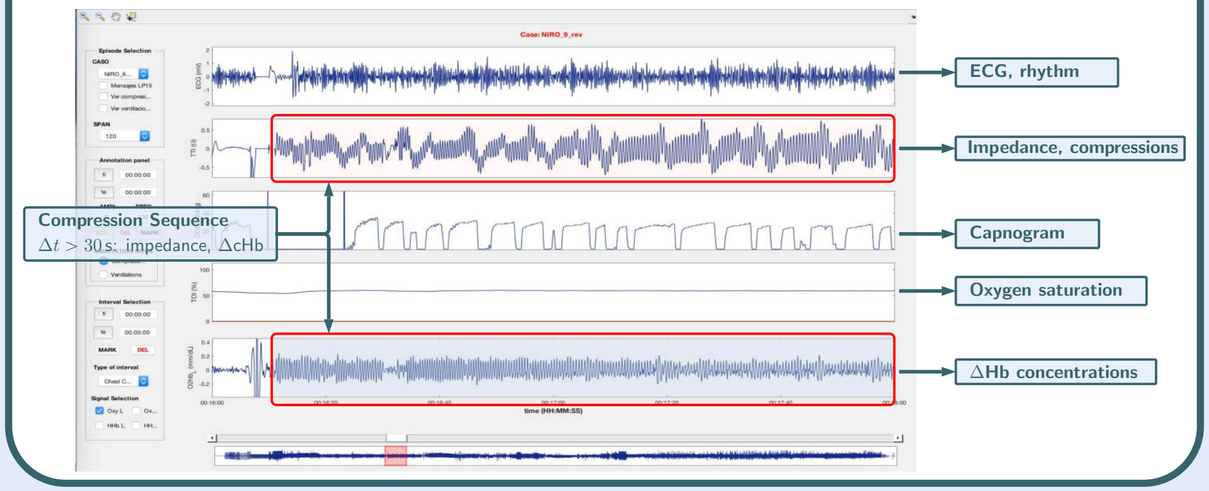
- **Cerebral oxymeter** ⇒ oxygen saturation indexes and hemoglobin concentrations at 20 samples per second.
- **Monitor defibrillator** ⇒ recordings of ECG, impedance and capnogram, exportable in csv format from CodeStat.

Data extraction and annotation

Chest compression sequences longer than 30 s with time-aligned:

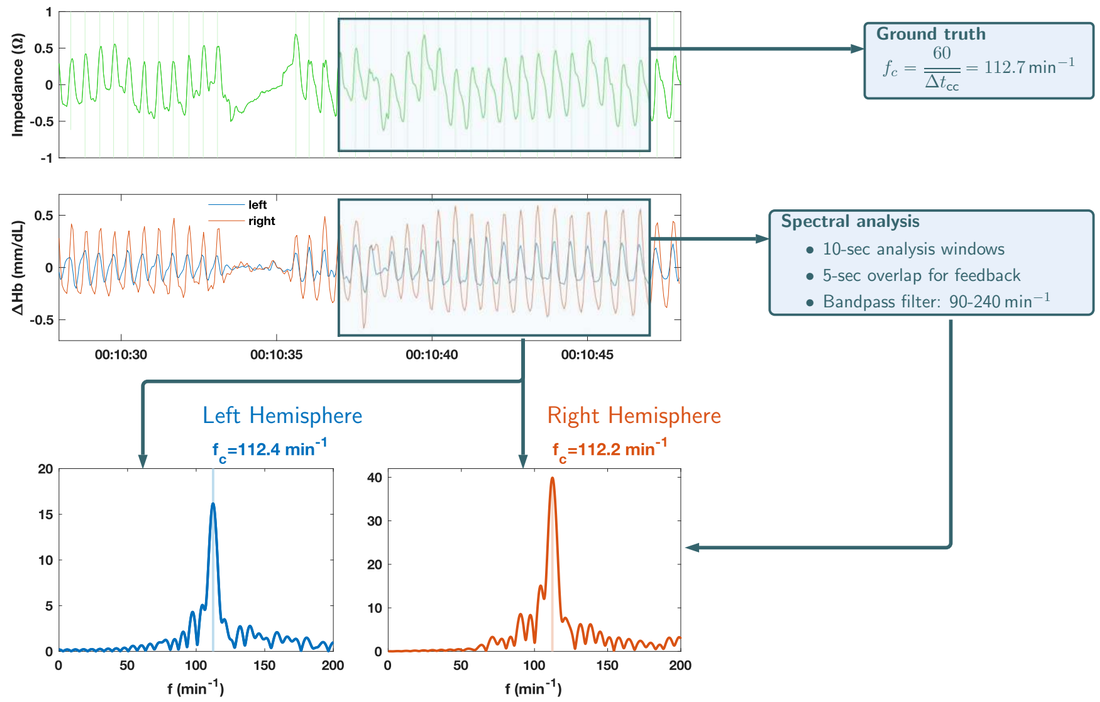
- **ΔcHb** ⇒ algorithm development/testing
- **Impedance** ⇒ ground truth chest compression annotations

Annotation/review tool



METHOD AND RESULTS

Feedback method



Results

Variable	median (quartile range)
Duration (min)	1.1 (0.8 – 1.6)
Rate (min^{-1})	141 (111 – 181)
Compressions (n)	157 (109 – 214)

Table 1. Compression sequences ($n = 42$)

	Feedback error	
Channel	Absolute (min^{-1})	Relative (%)
ΔcHb Left	1.03 (0.19 – 5.79)	0.74 (0.13 – 4.11)
ΔcHb Right	1.14 (0.17 – 10.93)	0.79 (0.12 – 7.18)

Table 2. Median (10-90 percentile) feedback error

CONCLUSIONS

Cerebral hemoglobin concentration sampled at sufficient rate (>10 Hz), contains important information relative to CPR therapy. In particular, this study shows that chest compressions are visible and that their rate can be accurately estimated.

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