

Using Biomechanical & Physiological Parameters as a Predictive Model for Negative Postsurgical Outcomes

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Objective & Research Question:

The goal is to create a preliminary setup to then assess if dog's gait, heart rate variability (HRV), and posture can be used to make a short-term prediction of post-operative morbidity

Background:

- Hundreds of thousands of dogs undergo spay/neuter surgeries yearly: mortality 0.9/10,000 surgeries in dogs
- Postoperative outcomes following a human cardiac surgery did link frailty and instability with HRV and gait speed
- Polar H10 monitor tracks R-R intervals for HRV and inertial measurement unit (IMU) measures gait and posture change

Aims:

- Establishing a predictive model for canine neuter or spay negative postoperative outcome
- Correlating movement variability parameters to frailty and instability in R-R intervals

Hypothesis:

We hypothesize that an increase in R-R HR interval instability and a decrease in gait speed frailty with steady state postural measurements will lead to a high probability of a negative postoperative surgical outcome following canine spay/neuter

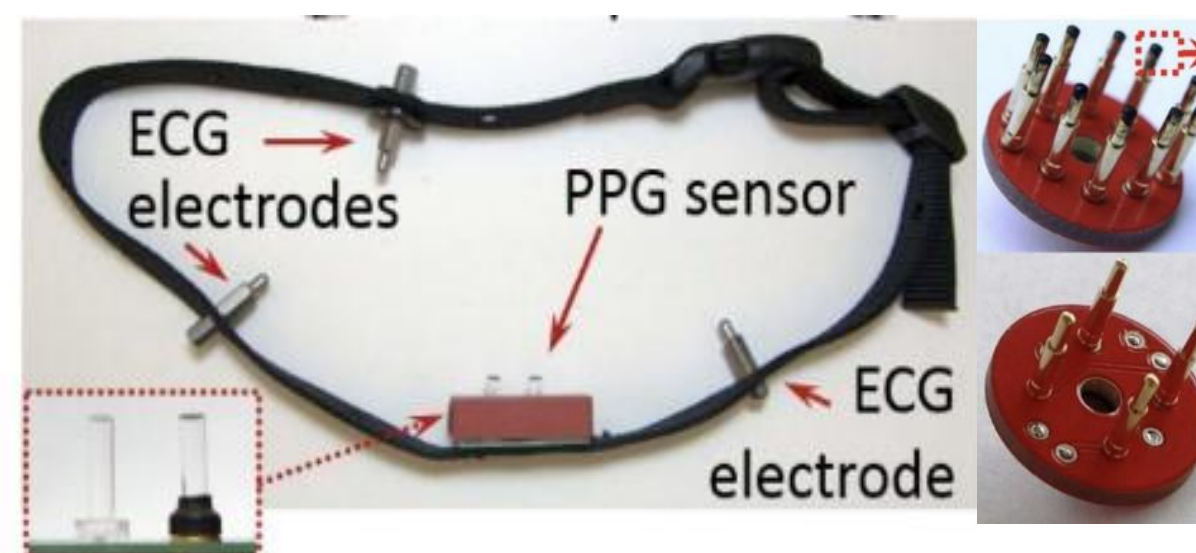


Fig 1. General Devices Set-Up (Brugarolas, 2016)

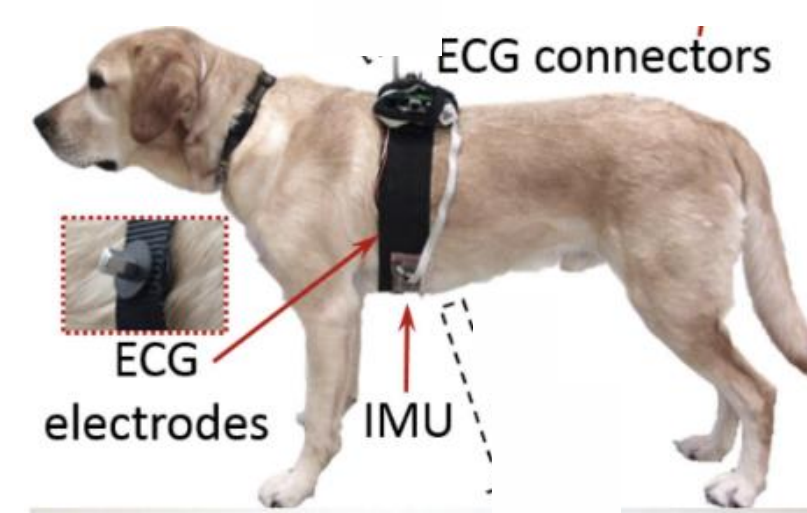


Fig 2. Dog ECG Set-Up (Brugarolas, 2016)

Methods:

- The below IACUC approved procedure will be used:
 - After equipment is put on, dogs will be treated, eye level, forward for a small interval
 - During this time, devices will be recording and researcher must take behavior notes
 - "Follow-ups" are done via reading medical notes following the spay/neuter procedure
- Data analysis includes:
 - Using nonlinear dynamics in chaos theory, following the biomechanical/physiological parameter's trajectories in 3D vector space

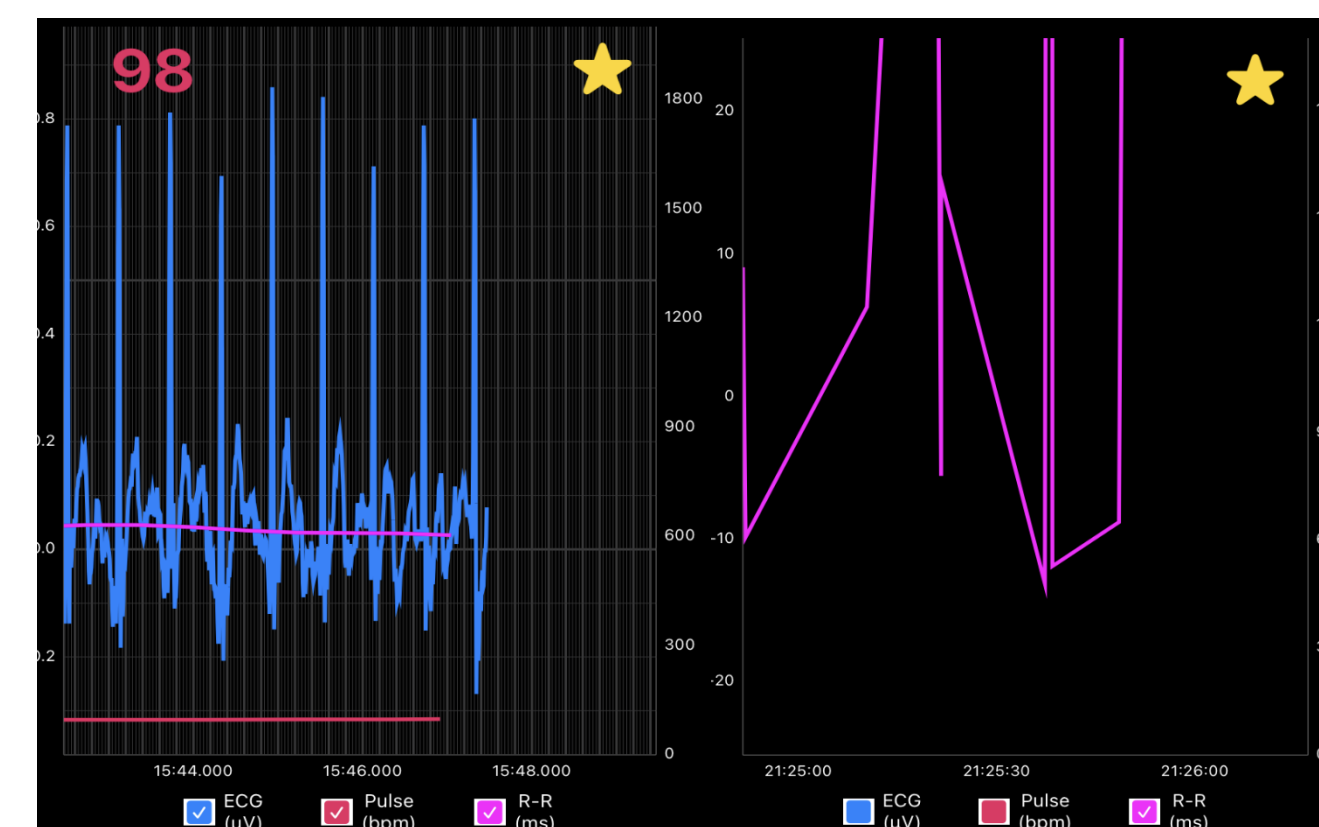
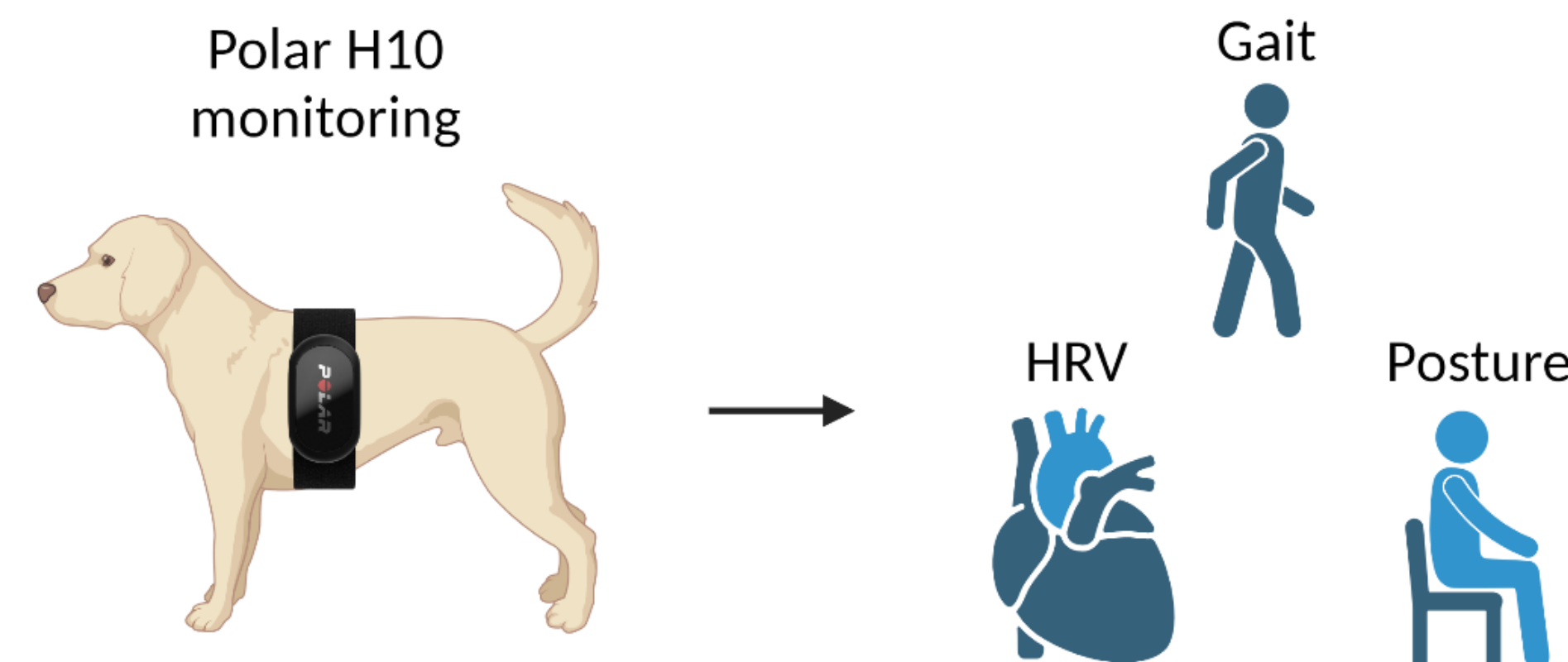


Fig 3. ECG Logger R-R Intervals, (left) has low instability as R-R fluctuations remain at a steady level, while the (right) shows high level of instability. Heart rate (HR)/ECG maintained at steady level

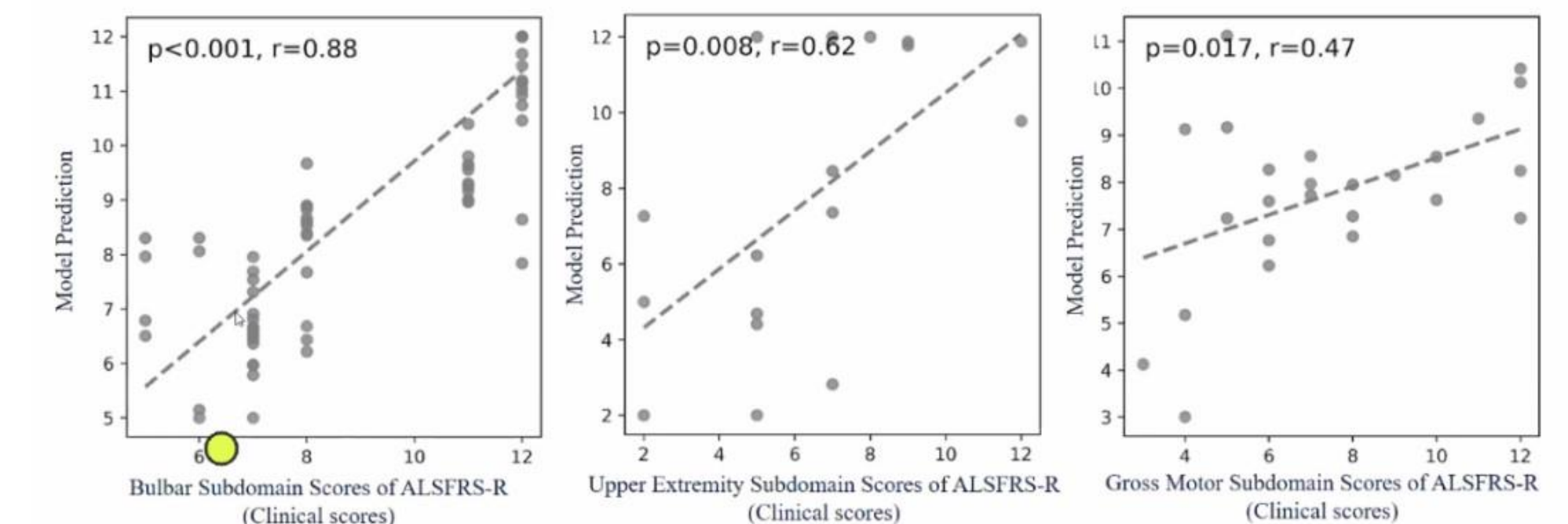


Conclusion:

- The preliminary setup can be used to track R-R intervals to do a HRV analysis for instability
- The GPS from the Polar H10 monitor with the forward velocity of the IMU devices could be used for gait speed
- Two IMU devices should be able to track the motion of moving towards each other as the change in posture

Next steps:

- Comparing the HRV analysis to gold standard ECG recording devices: Holter monitor or PPG
- Integrating the IMU devices to the Polar H10 to then do Chaos theory analysis of the parameters



Project Overview:

