Background and Goal of Study

- Established ultrasound-derived parameters (i.e., flow-mediated dilation and peak flow velocity) measured in the brachial artery in response to reactive hyperaemia induced by cuff occlusion allows for the noninvasive assessment of vascular function (specifically endothelium-dependent vasodilation). These parameters have been reported to be reproducible after exercise.

- A more recent vascular parameter utilizes digital thermal monitoring (DTM, Endothelix, Houston, TX, USA) to measure temperature rebound (TR) during reactive hyperaemia.

- We hypothesized that the dynamic effect of acute exercise would increase TR. Secondary objectives were to correlate TR response to exercise ($\Delta$TR = TR$_{post-exercise}$ - TR$_{pre-exercise}$) with 1) established preoperative risk factors and 2) predefined postoperative complications.

Materials and Methods

- Following IRB approval, patients scheduled for major noncardiac surgery were prospectively enrolled.

- Preoperatively, fingertip probes measured TR (in °C) in response to upper arm cuff occlusion (2 minutes) and reperfusion both before and 10 minutes after peak exercise (ramp protocol with cycle ergometer).

- Measured and derived parameters (figure 1):
  - TMP$_{Pi}$: Initial fingertip temperature [°C]
  - TR: Temperature Rebound (TMP$_{max}$ - TMP$_{i}$)
  - TMP$_{min}$: Lowest temperature during 2-min cuff occlusion
  - NP: Nadir to peak
  - TMP$_{max}$: Highest temperature reached after occlusion
  - SLP: Slope

- Data are presented as mean±SD. Statistical analysis utilized ANOVA and Fisher exact test. P-values <0.05 were regarded as significant.

Results and Discussion:

- Thirty patients (mean age, 58±9 years) were studied. Baseline blood pressure and fingertip temperature did NOT differ before and after exercise.

- Following exercise, TR increased significantly (mean absolute, 0.53±0.95 °C vs. 0.04±0.42 °C, p=0.04 and %change, 1.78±3.29% vs. 0.14±1.27%, p=0.03; Figure 2).

- All patients with preoperative cardiac risk factors (modified Lee index >2, hypertension, diabetes mellitus) had $\Delta$TR values in the lower 2 tertiles of the study population ($\Delta$TR <1.1%).

- Postoperative (cardiac, pulmonary, surgical) complications were threefold higher in patients with $\Delta$TR values that in the lower 2 tertiles.

Conclusion:

- Exercise increases TR in response to occlusion-induced reactive hyperaemia.

- Patients with preoperative cardiac risk factors had an impaired TR response to exercise, which in turn was associated with increased postoperative morbidity.

- This inability to mount a dynamic microvascular response to exercise may improve preoperative risk stratification and our understanding of the pathophysiology associated with postoperative morbidity.

References