

## Introduction

Intradialytic exercise (IDEX) has been advocated for its feasibility and effectiveness for improving important health outcomes in hemodialysis (HD) patients.



However, IDEX is infrequently implemented, in part due to hypothesized safety concerns in patients with hemodynamic instability, and particularly during the third hour of treatment when these concerns are the greatest.

**Aim :** To evaluate the safety of IDEX by examining its effect on intradialytic cardiovascular (CV) hemodynamics.

## Methods

**Overview:** Intradialytic changes in brachial, aortic and cardiac hemodynamics and autonomic function were examined during a normal HD session without exercise, or when 30-minutes of cycling exercise was performed during either the 1<sup>st</sup> or 3<sup>rd</sup> hour into HD.

### Cross-over design with 3 conditions

- 1) Normal HD (CON)
- 2) IDEX during 1<sup>st</sup>-hr into HD
- 3) IDEX during 3<sup>rd</sup>-hr into HD

\* randomization in the conditions 1) & 2) and the condition 3) ran last

### Inclusion/ Exclusion

- 30-70 yr old, HD at least 3 times per week, on HD > 3months
- No orthopedic problem, COPD, decompensated CHF

### Exercise Protocol

Cycle for 30 minutes at a self-selected pace (11 ~ 13 on RPE scale)

Pre-testing	During-HD	Post-testing
- BIS	- BP every 15min	- BIS
- Arterial Stiffness	- CO, TPR continuous by TFM	- Arterial Stiffness
- Cardiac echo	- ANA continuous by TFM	- Cardiac echo
	- Arterial Stiffness	
	- Hypotensive symptoms	



**BIS:** Bioimpedance Spectroscopy (SFB7, Impedimed Inc., CA, USA), Arterial Stiffness (Mobil-O-Graph), **Cardiac Echo:** Cardiac Echocardiography (ProSound α-7, Aloka), **BP:** Blood Pressure, **CO:** Cardiac Output, **TPR:** Total Peripheral Resistance, **ANA:** Autonomic Nerve System Activity, **TFM:** Task Force Monitor (thoracic bioimpedance, CNSystems), **EX:** Exercise, **HD:** Hemodialysis

### Statistical Analysis

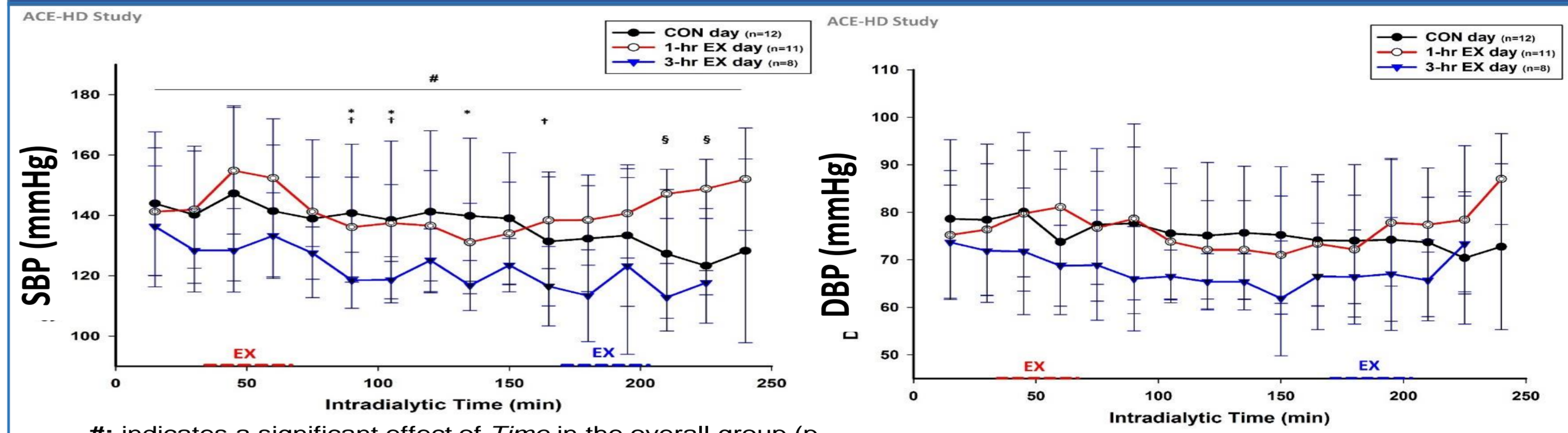
- Mixed Model Analysis (patient: random),
- Repeated Measures over an HD session
- Nested within IDEX day
- Aim 1:** BP = IDEX \* Time \* Patient
- Aim 2:** BP = IDEX \* Time \* Hydration \* Patient
- Additionally, ANOVA between IDEX days on absolute and  $\Delta BP_i = BP_{i-min} - BP_{0-min}$  at every 30 minutes into HD
- Aim 3:** Pearson correlation between changes in BP and other hemodynamics

## Patient Characteristics (n=12)

Variables	Mean ± SD	Variables	Mean ± SD
Age (yr)	55.9 ± 8.6	BMI (Kg/m <sup>2</sup> )	48.5 ± 14.6
Males (n)	7	Weight(kg)	83.3 ± 20.2
HTN (n)	11	Diabetes (n)	4
IDWG (kg)	2.3 ± 1.1	UF (L)	2.8 ± 1.1
bSBP (mmHg)	126 ± 19	SV (mL)	73.2 ± 23.4
bDBP (mmHg)	76.5 ± 17	CO (L)	5.4 ± 1.7
Aix75 (%)	18.3 ± 13.6	TBW (%)	61.0 ± 11.5
PWV (m/s)	8.2 ± 0.7	ECW (%)	44.3 ± 3.5

**BMI:** Body Mass Index, **HTN:** Hypertension, **IDWG:** Interdialytic Weigh Gain, **UF:** Ultrafiltration goal, **bSBP:** Brachial Systolic Blood Pressure at Pre-HD, **bDBP:** brachial Diastolic Blood Pressure, **SV:** Stroke Volume, **CO:** Cardiac Output, **Aix75:** Augmentation Index, **PWV:** Pulse Wave Velocity, **TBW:** Total Body Water, **ECW:** Extra Cellular Water

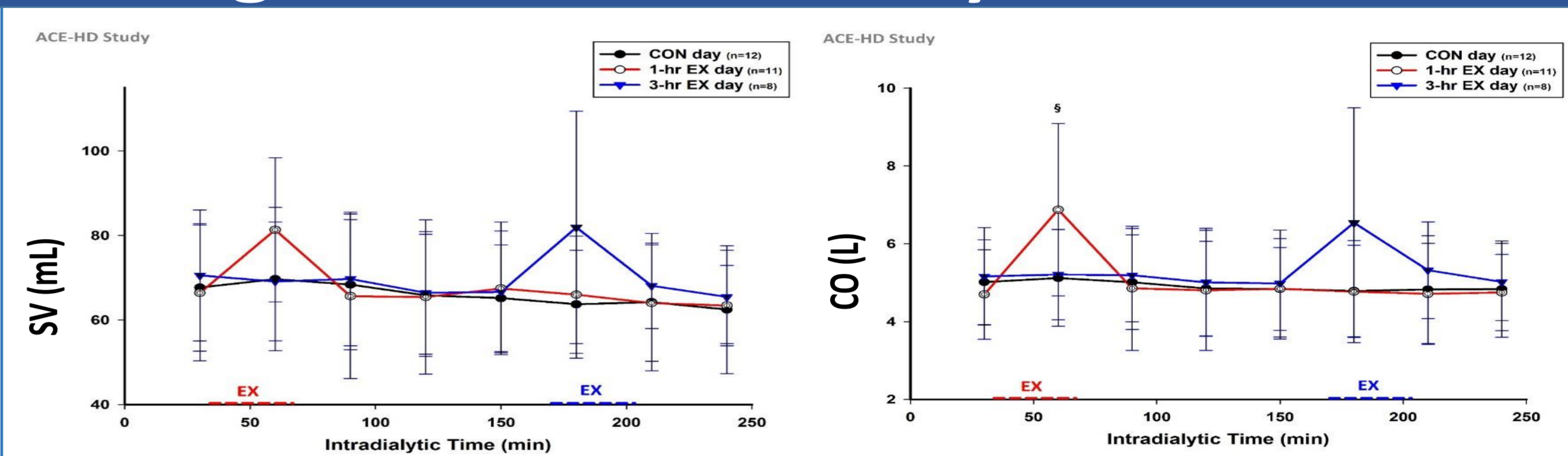
## Changes in Blood Pressure



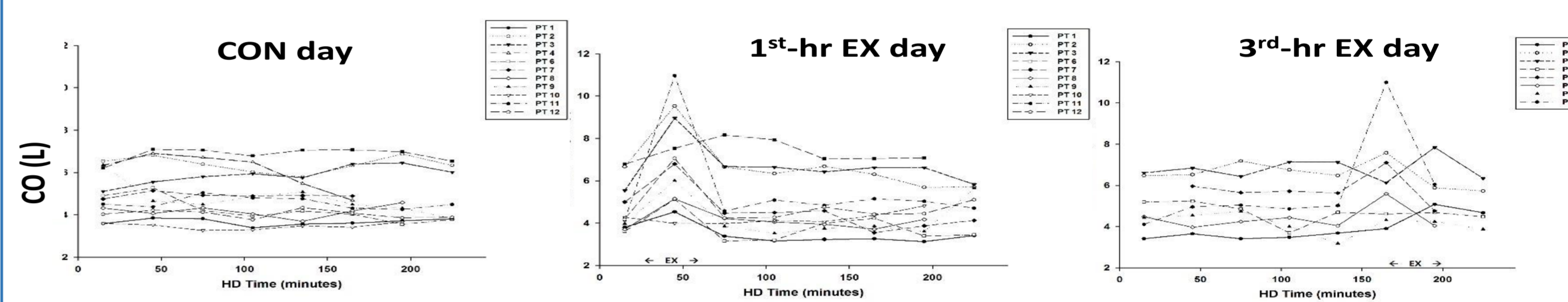
#: indicates a significant effect of Time in the overall group (p < 0.05),  
 §: indicates a significant difference between 1<sup>st</sup>-hour IDEX and CON and 3<sup>rd</sup>-hour IDEX.  
 †: indicates a significant difference between 3<sup>rd</sup>-hour IDEX and CON.  
 ‡: indicates a significant difference between 3<sup>rd</sup>-hour IDEX and 1<sup>st</sup>-hour IDEX.

- No IDEX \* Time effect for brachial or aortic BP
- Overall decreasing Time effect during HD for SBP

## Changes in Cardiac Hemodynamic Variables

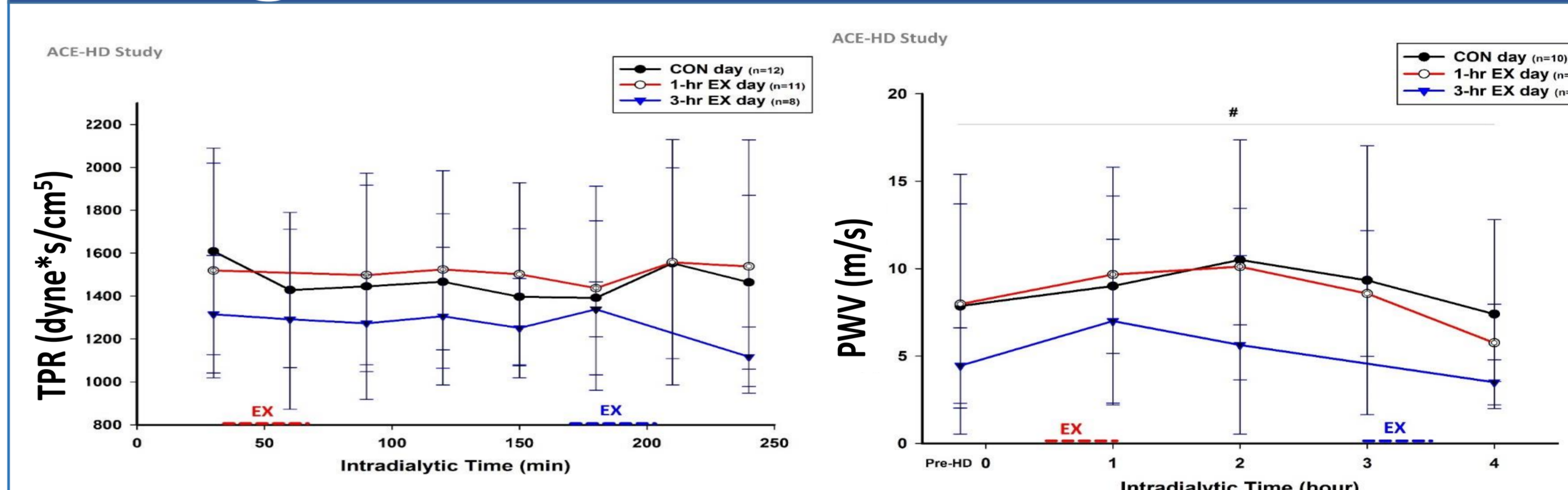


§: indicates a significant difference between 1<sup>st</sup>-hour IDEX and CON and 3<sup>rd</sup>-hour IDEX.



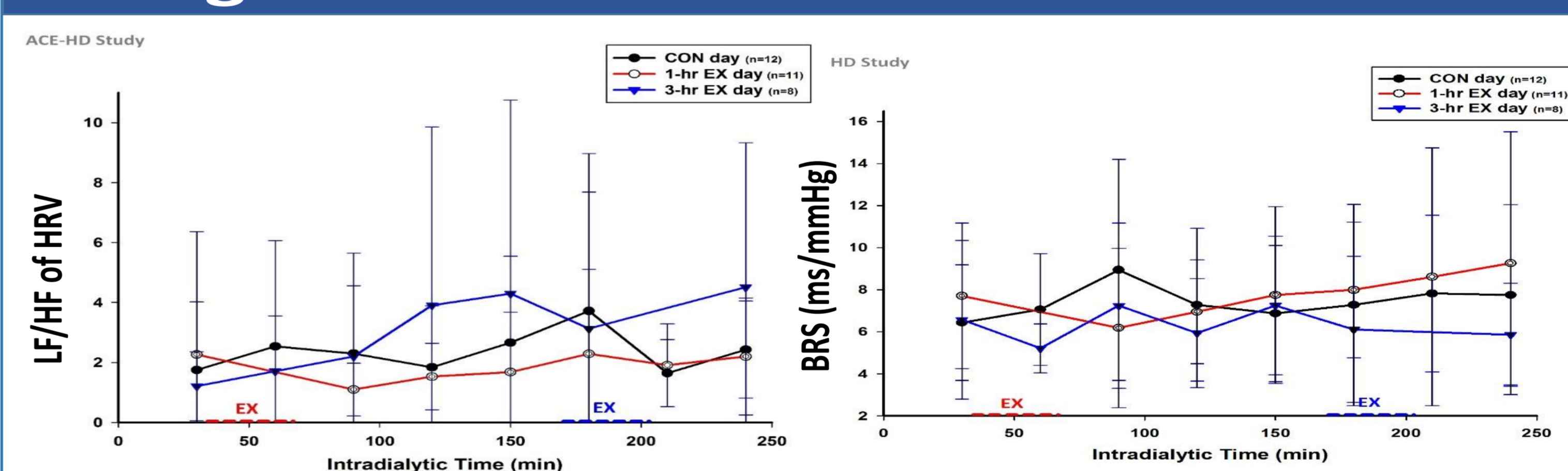
- No IDEX \* Time effect for SV, CO or HR

## Changes in Markers of Vascular Function



- No IDEX \* Time effect in TPR and PWV

## Changes in Markers of Autonomic Function



- No IDEX \* Time effect for Autonomic parameters
- Overall Time effect : ↑sympathetic, ↓parasympathetic activity

## Conclusions

### Primary findings

- IDEX did not cause further hemodynamic fluctuation during HD
- This null effect of IDEX on hemodynamic parameters during HD was demonstrated regardless of the timing of exercise and patients' underlying CV characteristics. *i.e., exercise during the 3<sup>rd</sup> hour of treatment did NOT adversely effect hemodynamic variables*
- There were transient increases in SV, CO and HR during IDEX

### Secondary findings (results from Aim 3; data not shown)

- Autonomic function may play a role in regulating BP during HD
- Overhydration was related to larger BP drops and symptoms

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