Rehabilitation for Postural Tachycardia Syndrome (POTS)

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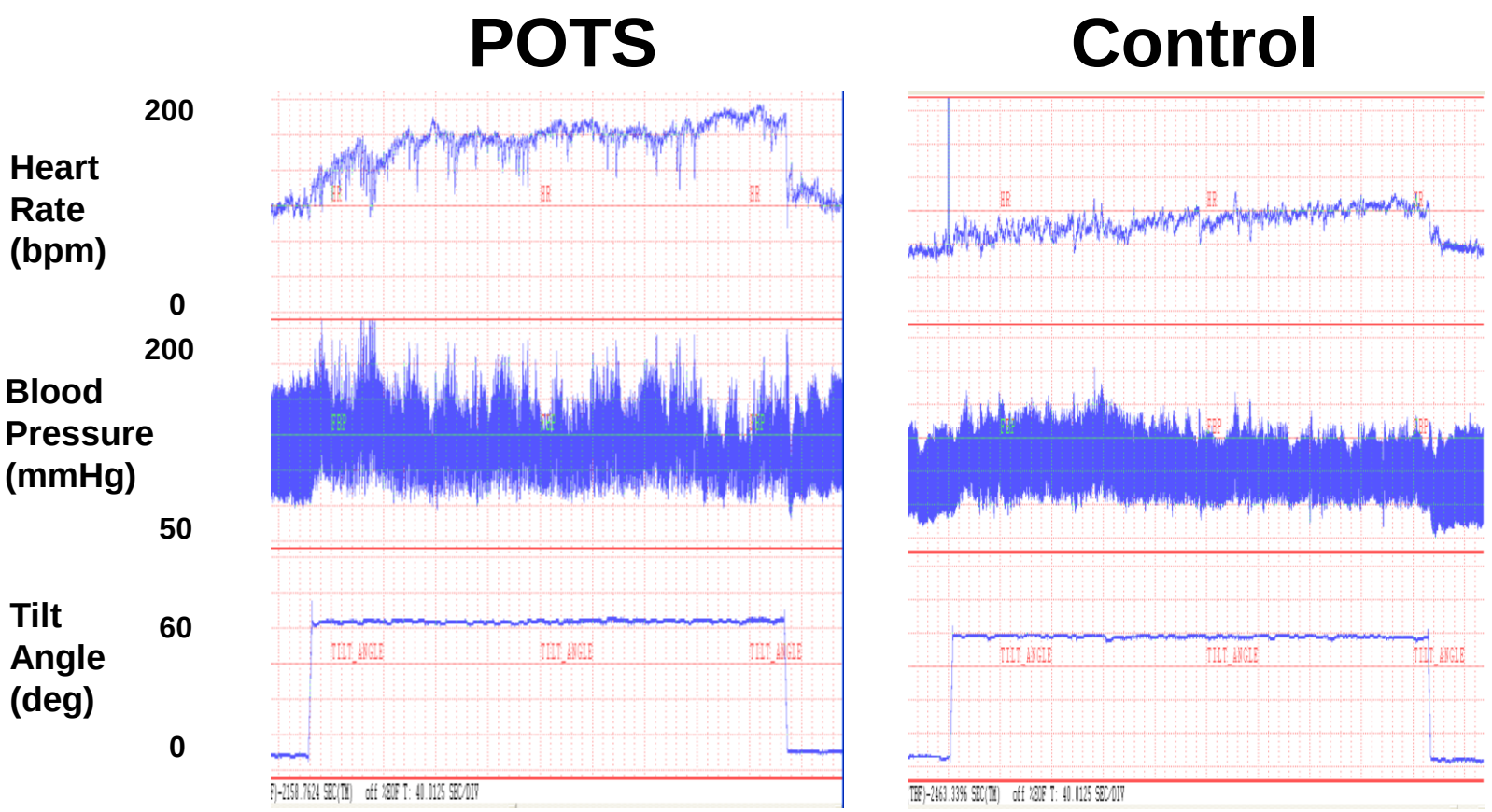
Postural Tachycardia Syndrome - Common Criteria

Phillip Low MD
Mayo Clinic

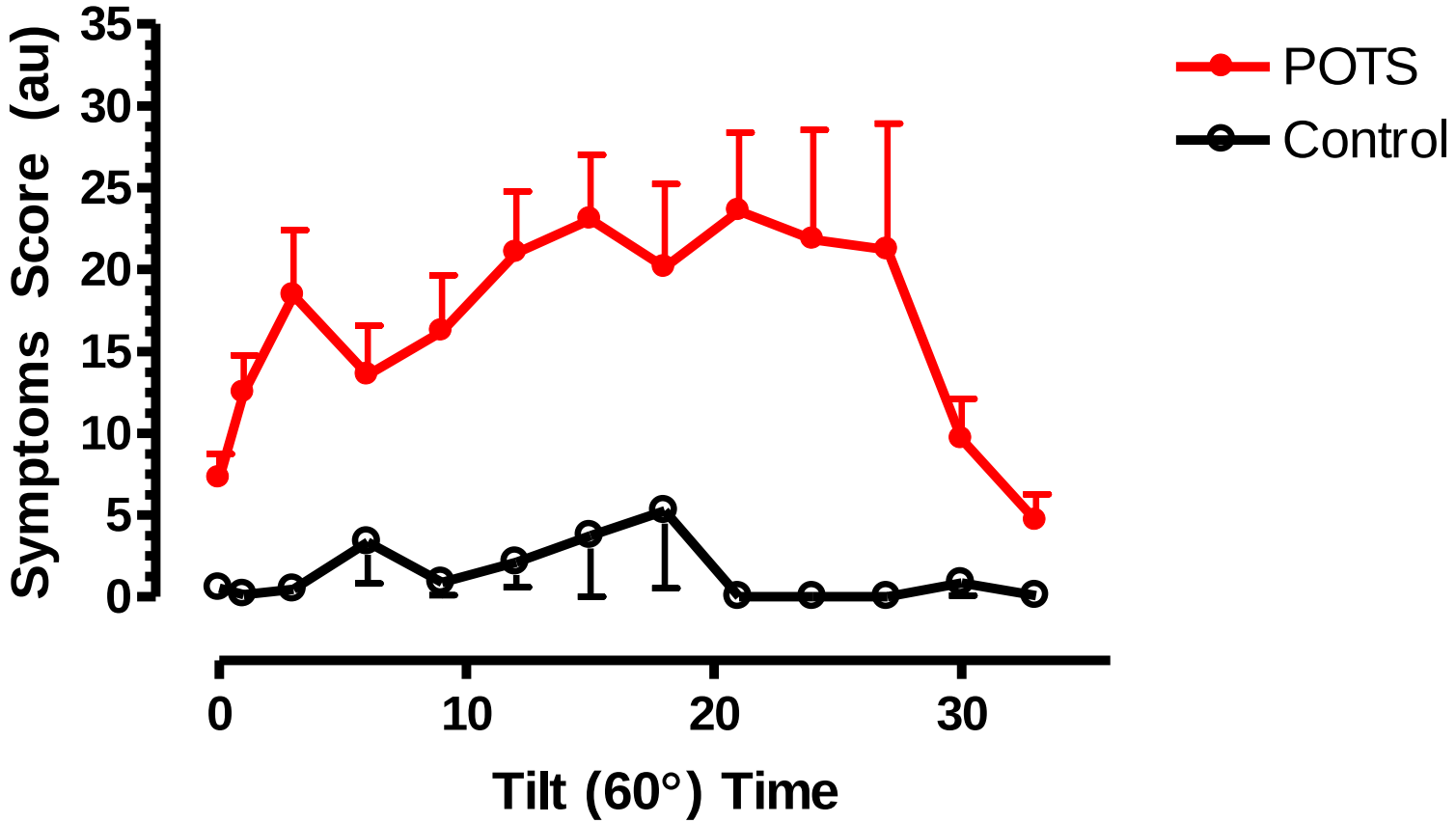
- Orthostatic tachycardia > 30 bpm
  - >40 bpm required if <18 years
- No consistent orthostatic hypotension
  - ΔBP > 20/10 mmHg
- Symptoms of sympathetic activation
  - Worse upright; better recumbent
- Chronic symptoms > 6 months

Tilt Testing



SR Raj, Indian Pacing Electrophysiol J. 2006;6:84-99

POTS: Feel awful when upright

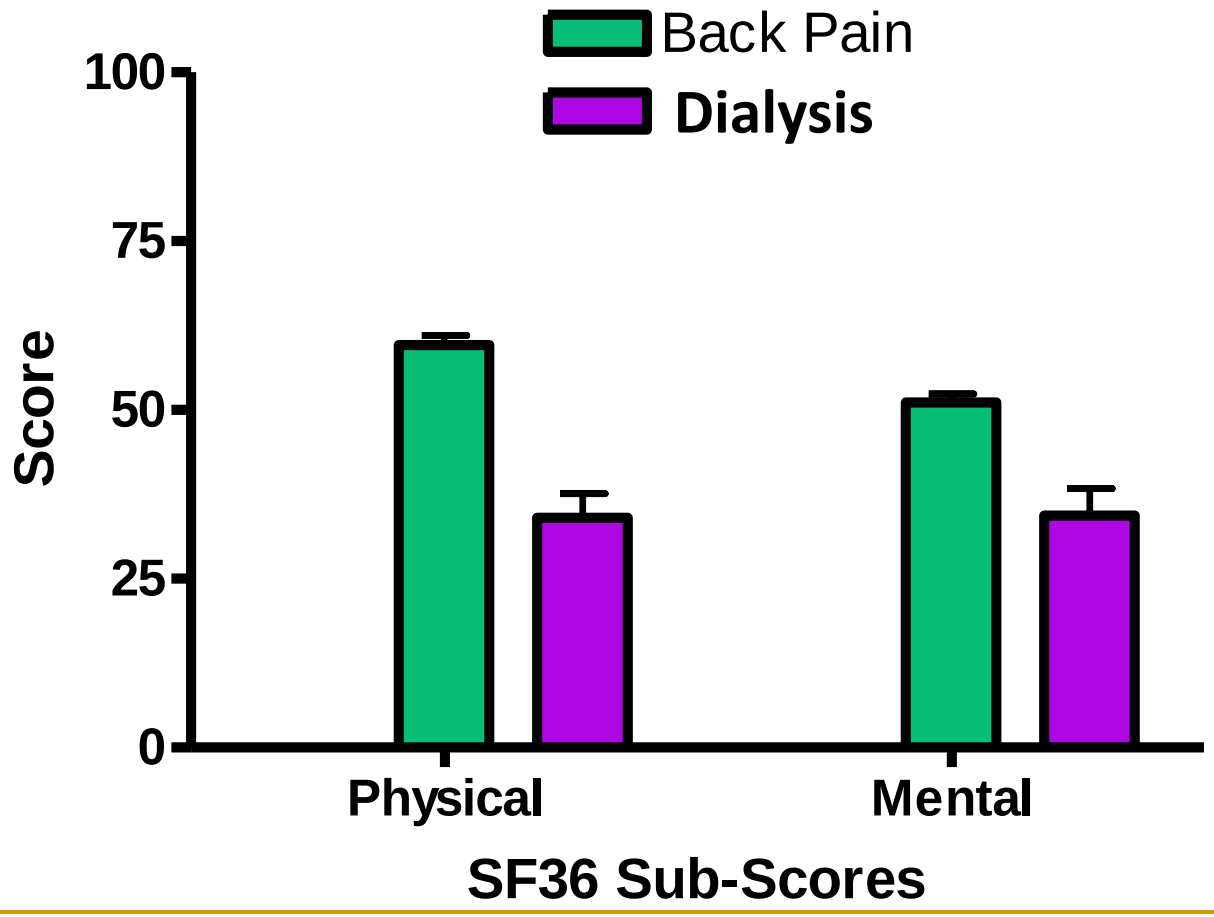


SR Raj & RS Sheldon, *Tilt Table Testing* in
S Saksena & AJ Camm Electrophysiological Disorders of the Heart 2nd Ed. (2011)

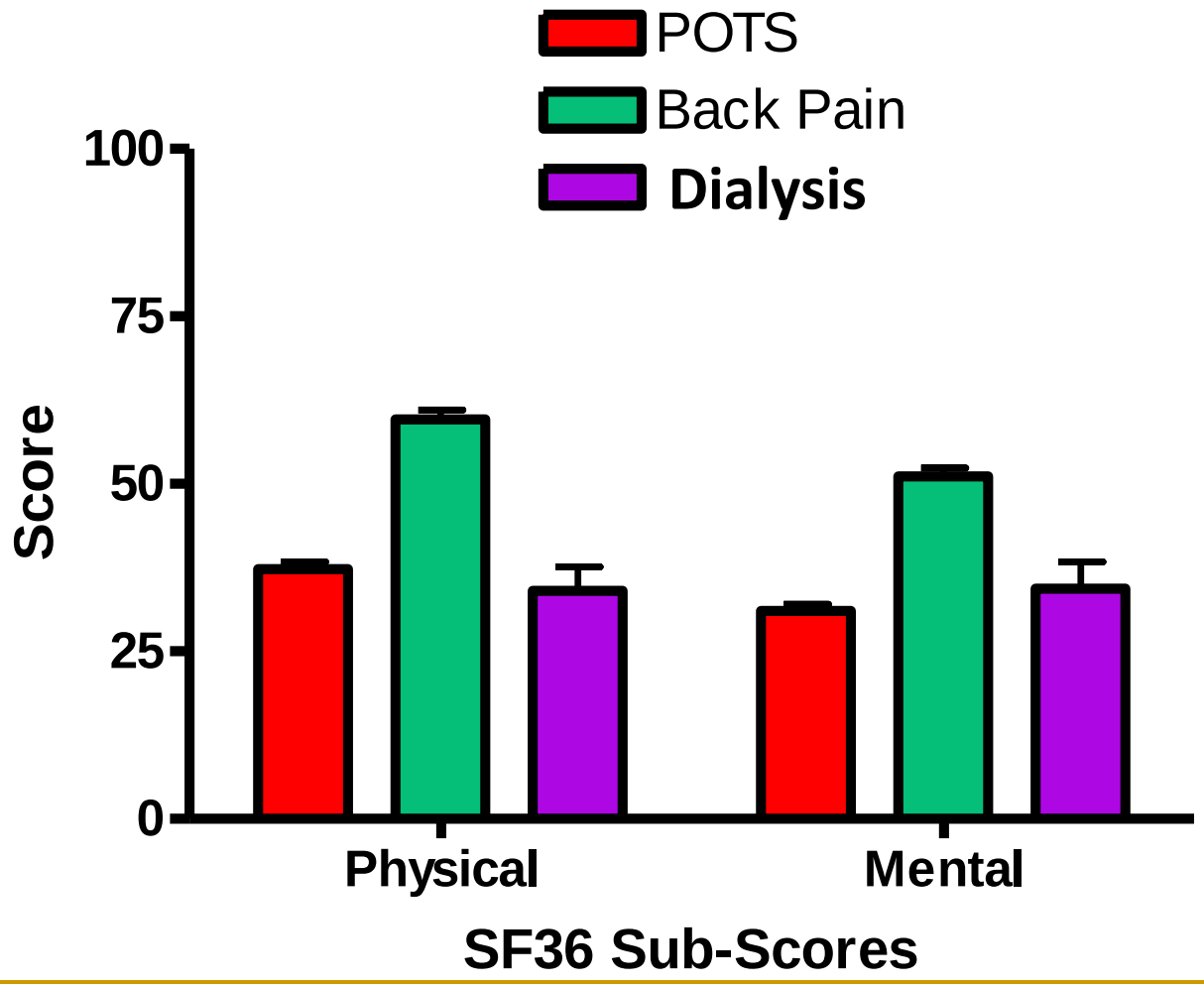
Quality of Life in POTS

Kanika Bagai

Health Related Quality of Life (SF-36) – Chronic Illnesses



Health Related Quality of Life (SF-36) – Chronic Illnesses



Modified from K Bagai et al., J Clin Sleep Med 2011

POTS: Treatment Approaches

- **Exercise**
- **Increase Blood Volume**
- **Hemodynamic Agents**
- **Behavioral Therapies**

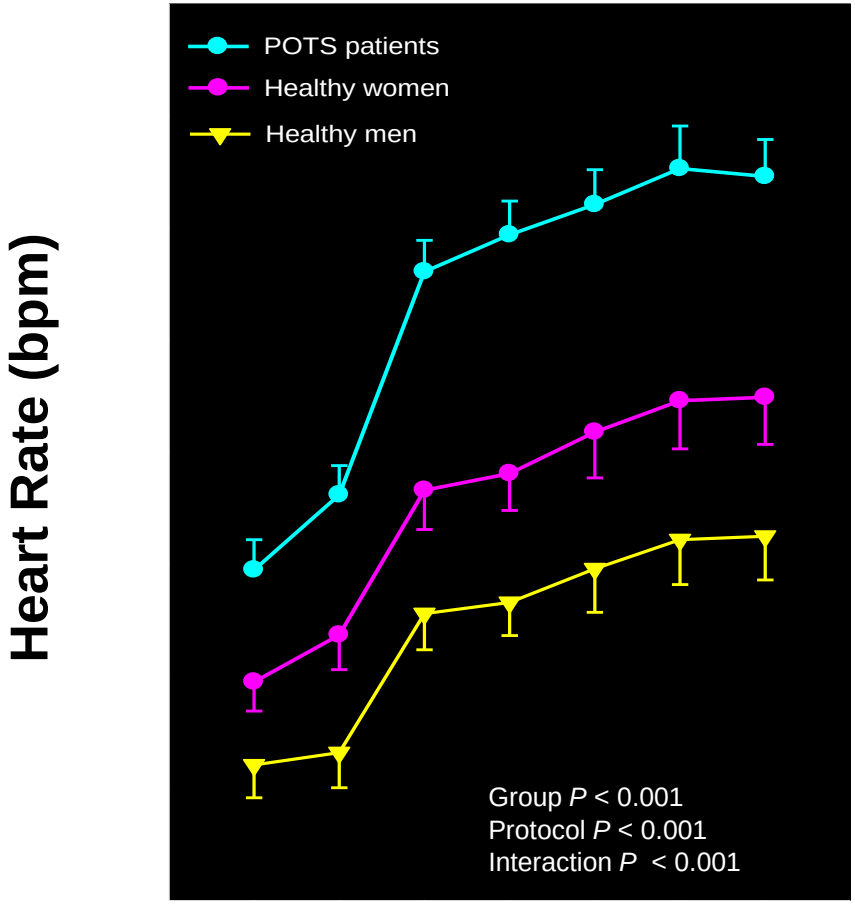
Exercise in POTS

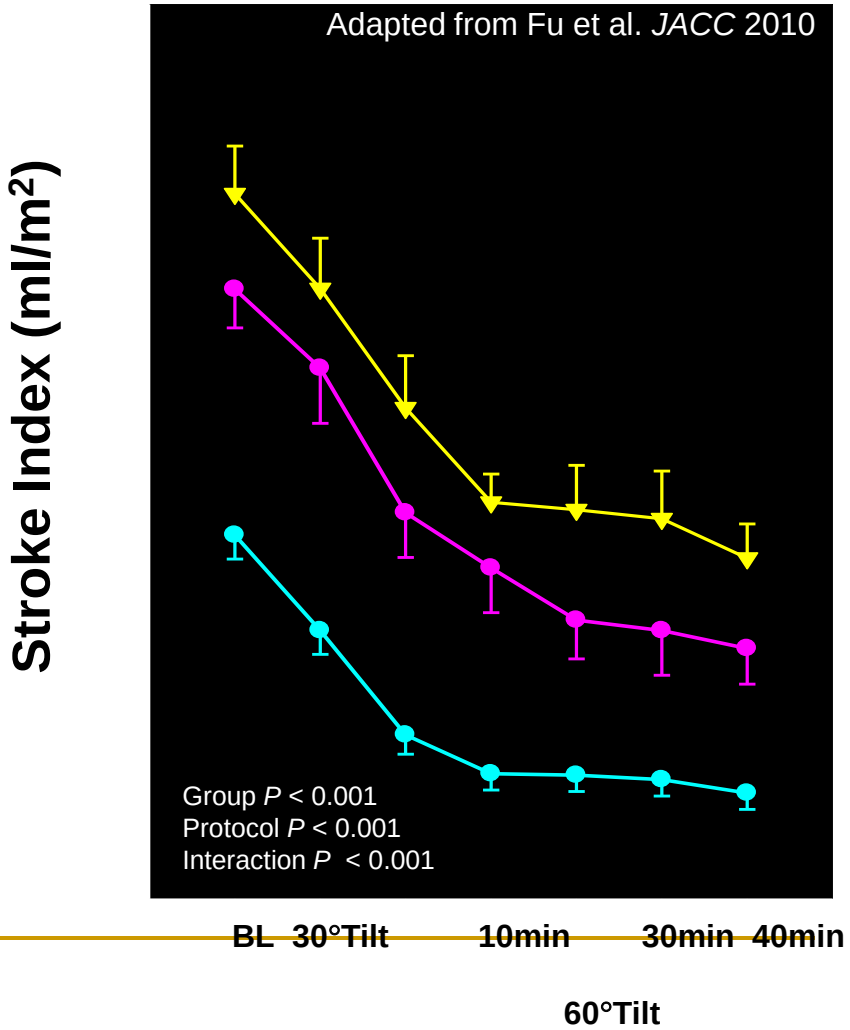
- **Historically**
  - **“good thing to do”**
  - **Many patients could not/would not**
    - **excessive fatigue (~days) and intolerance**
  - **Anecdotally, those patients that did exercise did better over time**
    - **Cause/effect vs. selection bias**
- **Now**
  - **Recent data on effects of exercise training in POTS from Dallas, Vienna, & Mayo…**

Hemodynamic Physiology in POTS

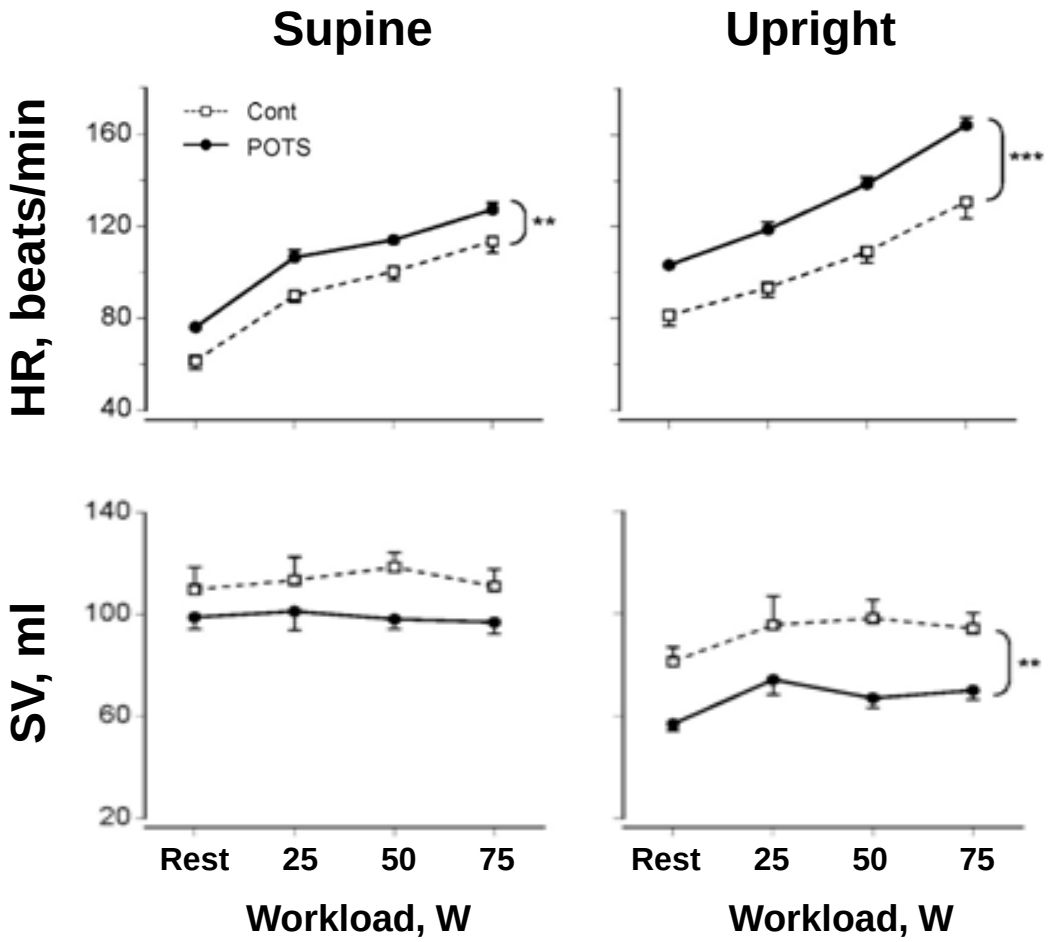
Why Exercise Training is Important

High Upright HR in POTS – Compensation for a small stroke volume





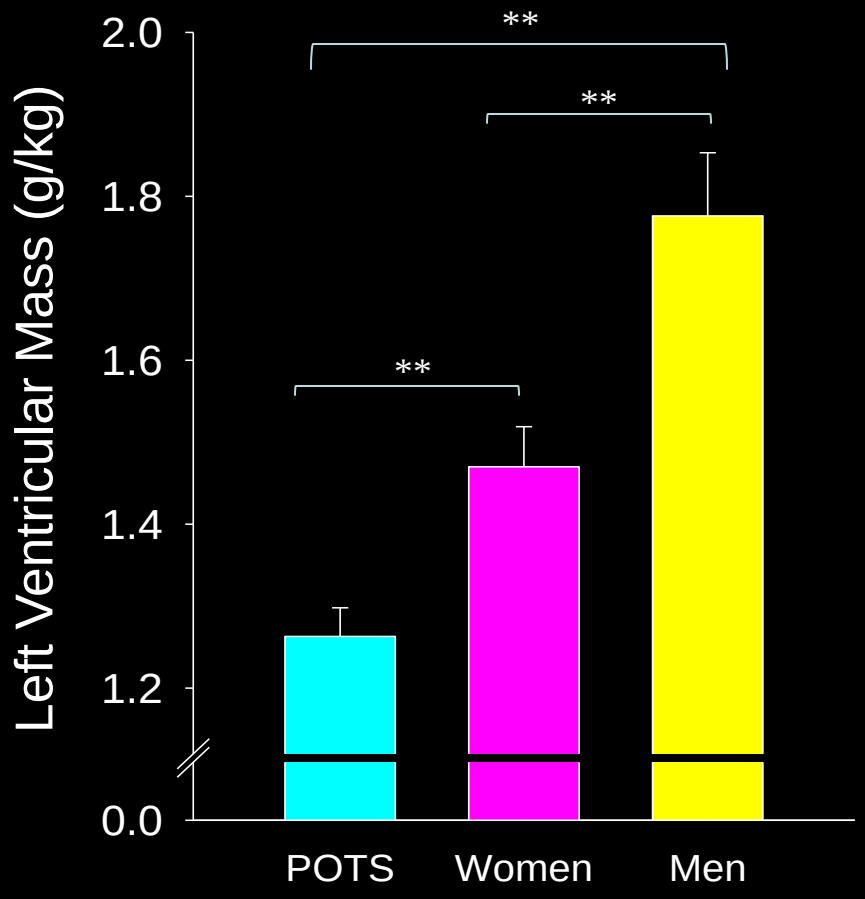
High HR in POTS with Exercise – Lower stroke volume & Ex intolerance

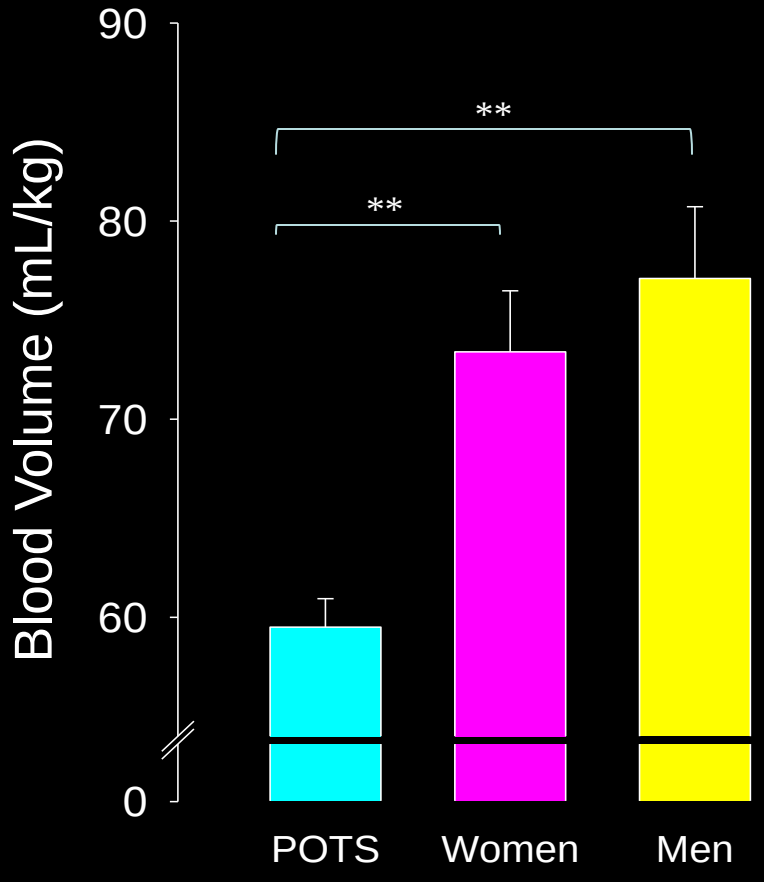


Adapted from Masuki et al. *J Appl Physiol* 2007

POTS patients have a small heart coupled with reduced blood volume

Adapted from Fu et al. *JACC* 2010





OTHER MODELS OF CARDIOVASCULAR DECONDITIONING

Cardiac atrophy

Reduced blood volume

Courtesy of Qi Fu

Exercise Training as Countermeasures for Human Spaceflight and Bed Rest Deconditioning

Courtesy of Qi Fu

Can exercise training be used as an effective therapy for patients with POTS?

Courtesy of Qi Fu

Dallas Exercise Program

EXERCISE TRAINING

semi-recumbent exercise

Courtesy of Qi Fu

Month 1

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 ALL WEEK **1.5 L H_20 &** **7000mg Na+**	**2** **Base Pace** 10min Warm-Up 30min RBike/Row 10min Cool-down	**3** **Weight Training**	**4** **Base Pace** 10min Warm-Up 30min RBike/Row 10min Cool-down	**5** **Weight Training**	**6** **Base Pace** 10min Warm-Up 30min RBike/Row 10min Cool-down	**7**
8 ALL WEEK **2.0 L H_20 &** **8000mg Na+**	**9** **Base Pace** 10min Warm-Up 30min RBike/Row 10min Cool-down	**10** **Weight Training**	**11** **Base Pace** 10min Warm-Up 30min Swim/Row 10min Cool-down	**12** **Weight Training**	**13** **MSS** 10min Warm-Up 20min RBike/Row 10min Cool-down	**14** **Recovery** 40min RBike/Swim
15 ALL WEEK **2.5 L H_20 &** **9000mg Na+**	**16** **Base Pace** 10min Warm-Up 30min RBike/Row 10min Cool-down	**17** **Weight Training**	**18** **Base Pace** 10min Warm-Up 30min RBike/Row 10min Cool-down	**19** **Weight Training**	**20** **Base Pace** 10min Warm-Up 30min Swim/RBike 10min Cool-down	**21**
22 ALL WEEK **3.0 L H_20 &** **10,000mg Na+**	**23** **Base Pace** 10min Warm-Up 30min RBike/Swim 10min Cool-down	**24** **Weight Training**	**25** **MSS** 10min Warm-Up 25min RBike/Row 10min Cool-down	**26** **Weight Training** **Recovery** 40min RBike/Swim	**27** **Base Pace** 10min Warm-Up 30min Swim/Row 10min Cool-down	**28**
	RBike = Recumbent Bike					

Month 2

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 ALL MONTH 3.0 L H_20 & 10,000mg Na+	**2** **Base Pace** 10min Warm-Up 30min RBike/Row 10min Cool-down	**3** **Weight Training**	**4** **Base Pace** 10min Warm-Up 20min UBike 10min Cool-down	**5** **Weight Training**	**6** **Base Pace** 10min Warm-Up 20min UBike 10min Cool-down	**7**
8 **Base Pace** 10min Warm-Up 30min Row/UBike 10min Cool-down	**9** **Weight Training**	**10** **Base Pace** 10min Warm-Up 30min UBike/Row 10min Cool-down	**11** **Weight Training**	**12** **MSS** 10min Warm-Up 25min UBike/Row 10min Cool-down	**13** **Recovery** 40min RBike/Swim	**14**
15 **Base Pace** 10min Warm-Up 40min UBike/Row 10min Cool-down	**16** **Weight Training**	**17**	**18** **MSS** 10min Warm-Up 30min UBike/Row 10min Cool-down	**19** **Recovery** 40min RBike/Swim	**20** **Weight Training**	**21** **Base Pace** 10min Warm-Up 35min UBike/Row 10min Cool-down
22	**23** **Weight Training**	**24** **MSS** 10min Warm-Up 35min UBike/Row 10min Cool-down	**25** **Recovery** 40min RBike/Swim	**26** **Base Pace** 10min Warm-Up 30min UBike/Walk 10min Cool-down	**27** **Weight Training**	**28** **Base Pace** 10min Warm-Up 45min UBike/Row 10min Cool-down
	RBike = **recumbent bike** **UBike =** **upright bike**					

Month 3

Sun	Mon	Tue	Wed	Thu	Fri	Sat
2 ALL MONTH 3.0 L H_20 & 10,000mg Na+	**3** **Base Pace** 10min Warm-Up 35min Walk/UBike 10min Cool-down	**4** **Weight Training**	**5** **Base Pace** 10min Warm-Up 35min Walk/Row 10min Cool-down	**6** **Weight Training**	**7** **Base Pace** 10min Warm-Up 35min Walk/UBike 10min Cool-down	**8**
9	**10** **Base Pace** 10min Warm-Up 40min Walk/UBike 10min Cool-down	**11** **Weight Training**	**12** **MSS** 10min Warm-Up 30min Walk/Ellip 10min Cool-down	**13** **Recovery** 25min Walk/RBike **Weight Training**	**14** **Base Pace** 10min Warm-Up 35min Row/Ellip 10min Cool-down	**15**
16	**17** **Base Pace** 10min Warm-Up 60min Walk/UBike 10min Cool-down	**18** **Weight Training**	**19** **Base Pace** 10min Warm-Up 30min Ellip/Row 10min Cool-down	**20** **MSS** 10min Warm-Up 35min Walk/Ellip 10min Cool-down	**21** **Recovery** 25min Walk/RBike **Weight Training**	**22** **Base Pace** 10min Warm-Up 50min Row/Ellip 10min Cool-down
23	**24** **Base Pace** 10min Warm-Up 35min Walk/Ellip 10min Cool-down	**25** **Weight Training**	**26** **Base Pace** 10min Warm-Up 45min Walk/UBike 10min Cool-down	**27** **MSS** 10min Warm-Up 40min Walk/Ellip 10min Cool-down	**28** **Recovery** 25min Walk/RBike **Weight Training**	**29**
	RBike = recumbent bike **UBike = upright bike**					

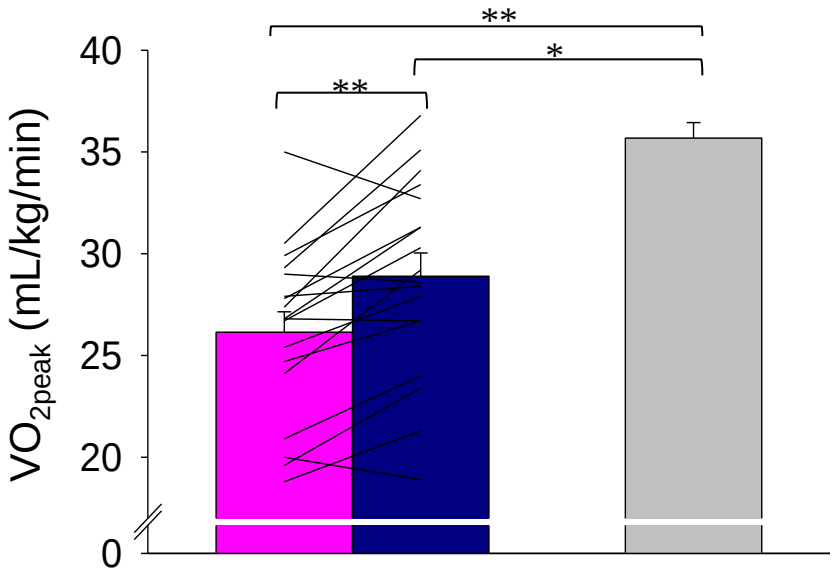
OTHER INTERVENTIONS

Courtesy of Qi Fu

Dallas Exercise Program

It seems to work…

Adapted from Fu et al. *JACC* 2010



Pre Post
POTS

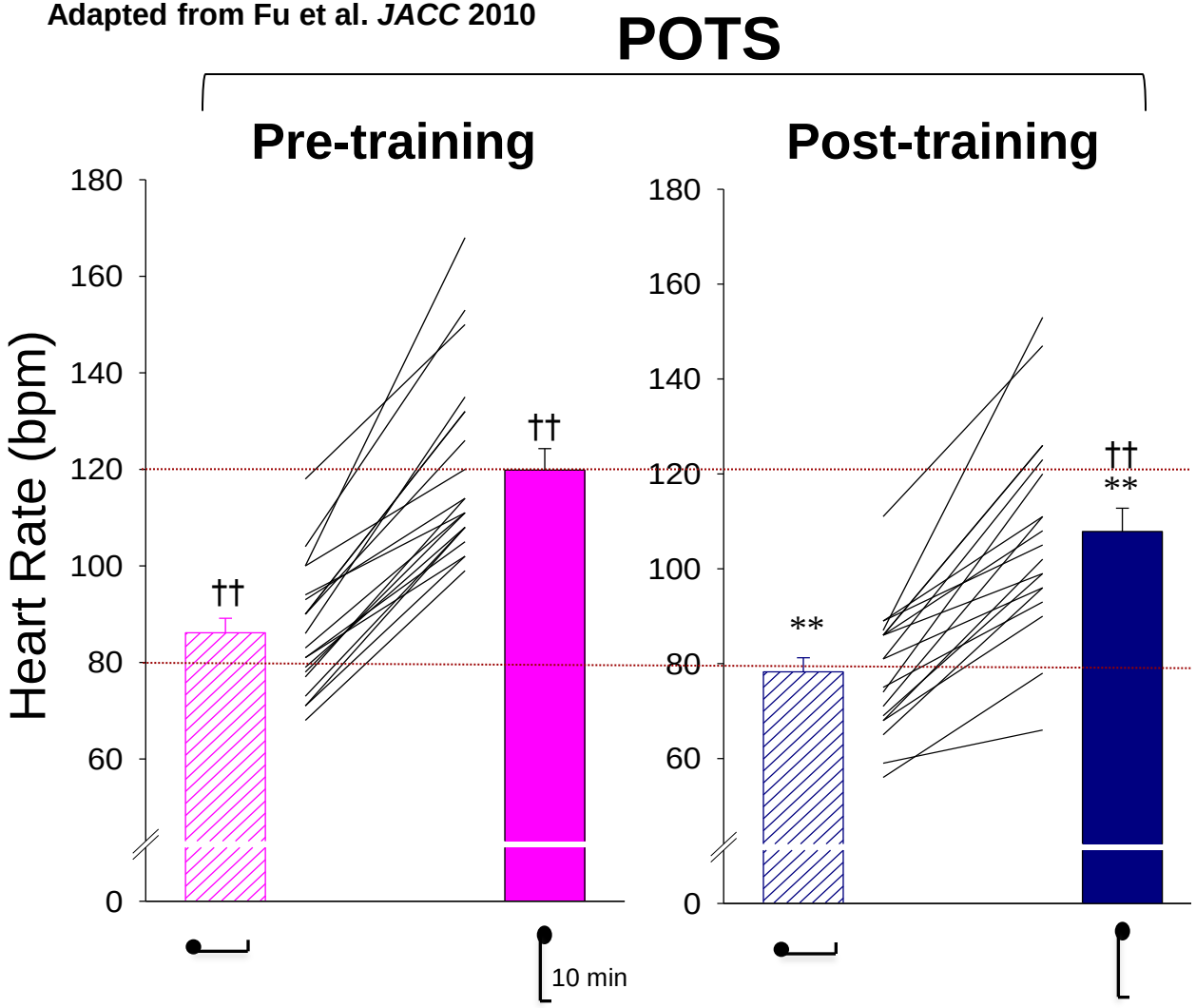
Healthy
Controls

Pre Post
POTS

Healthy
Controls

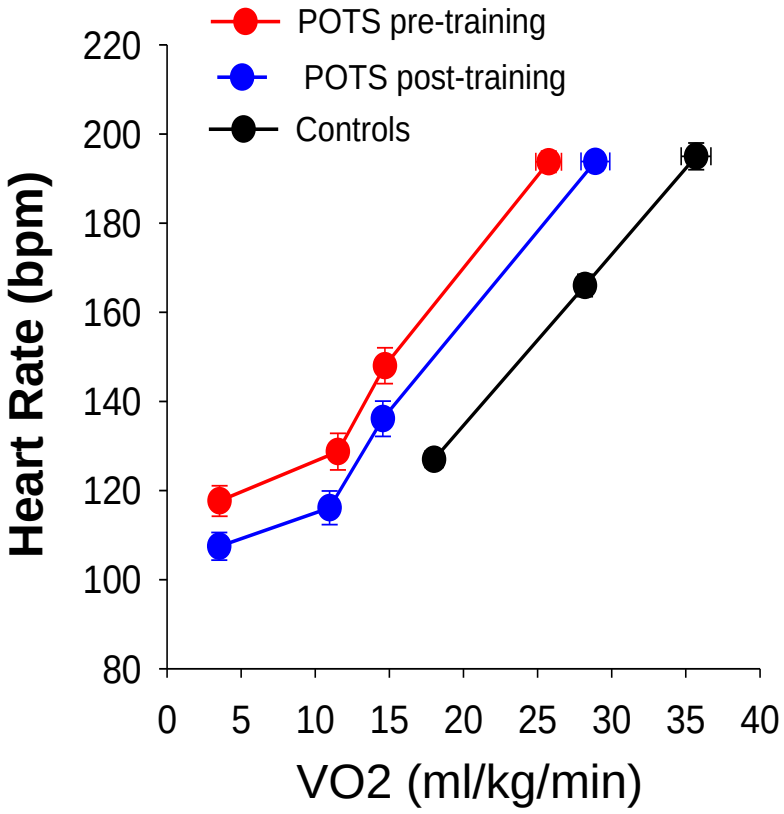
Short-term exercise training decreased heart rate with upright posture

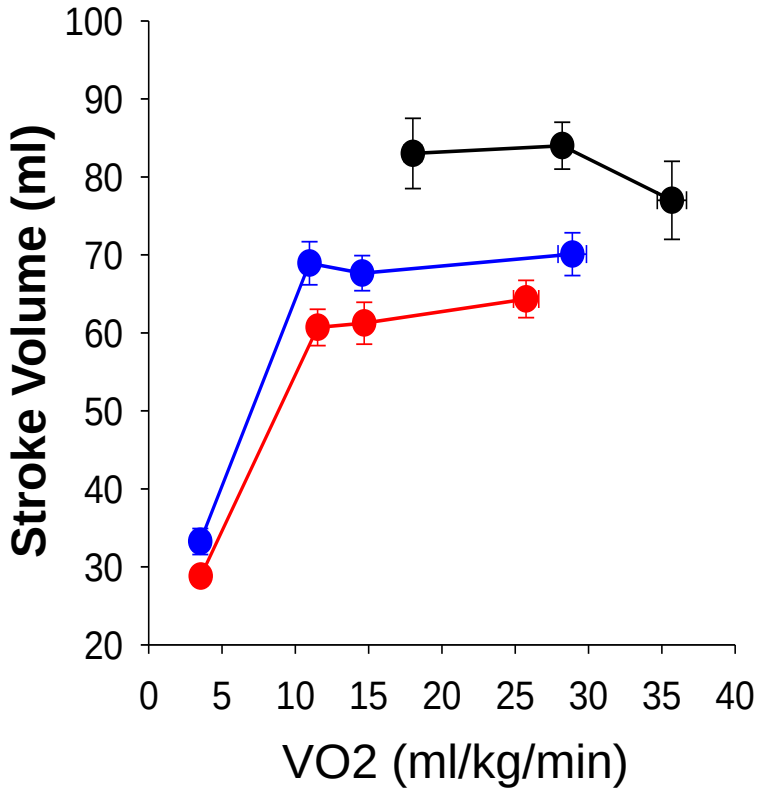
Adapted from Fu et al. *JACC* 2010



***P* < 0.01 compared with pre-training in POTS; ††*P* < 0.01 compared with controls in the same posture.

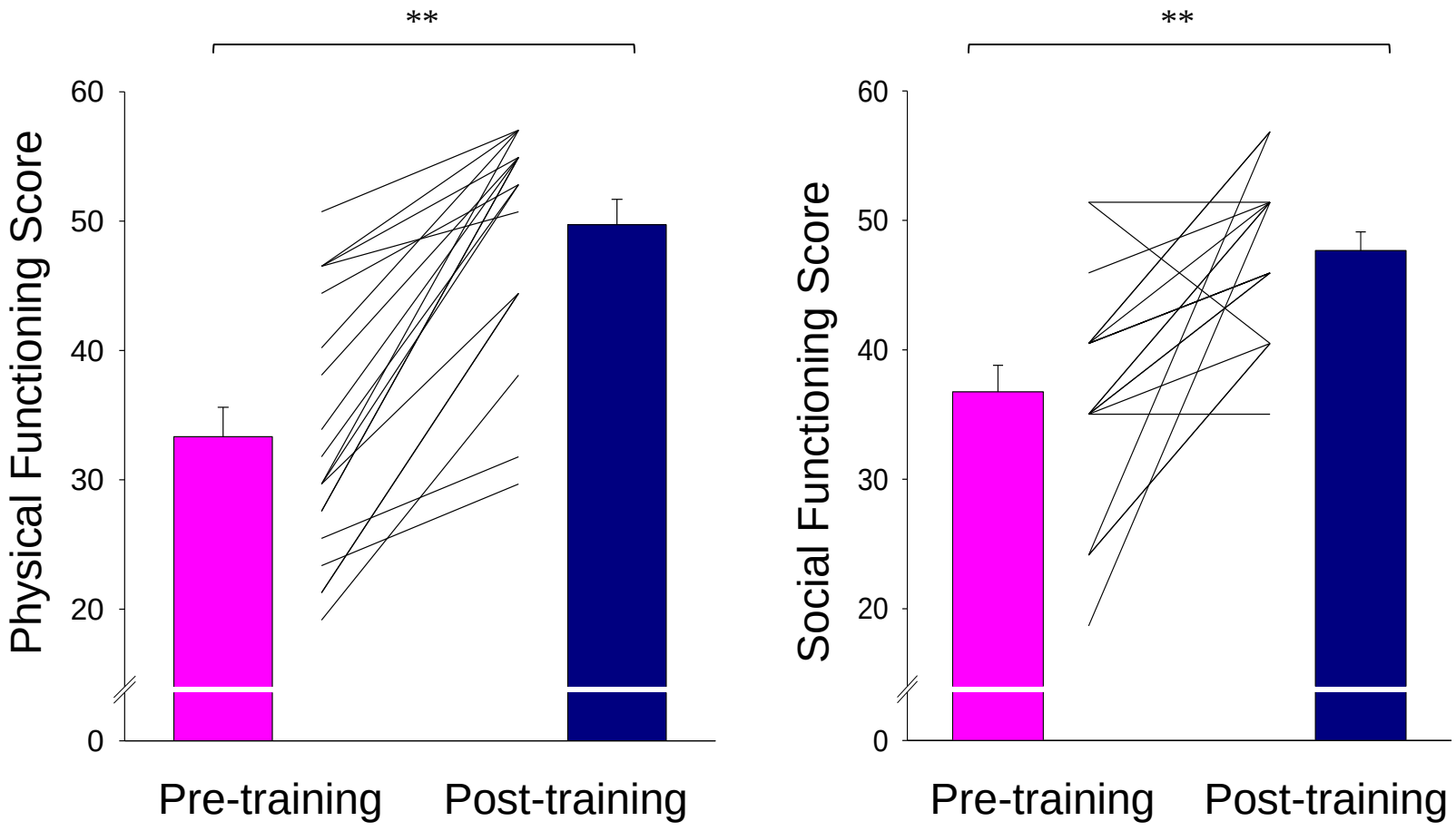
Short-term exercise training improved heart rate and stroke volume during exercise





Data courtesy of Qi Fu

POTS Patient quality of life was improved after training



Adapted from Fu et al. *JACC* 2010

POTS Registry:

N=118; 90% females

~20% drop out rate

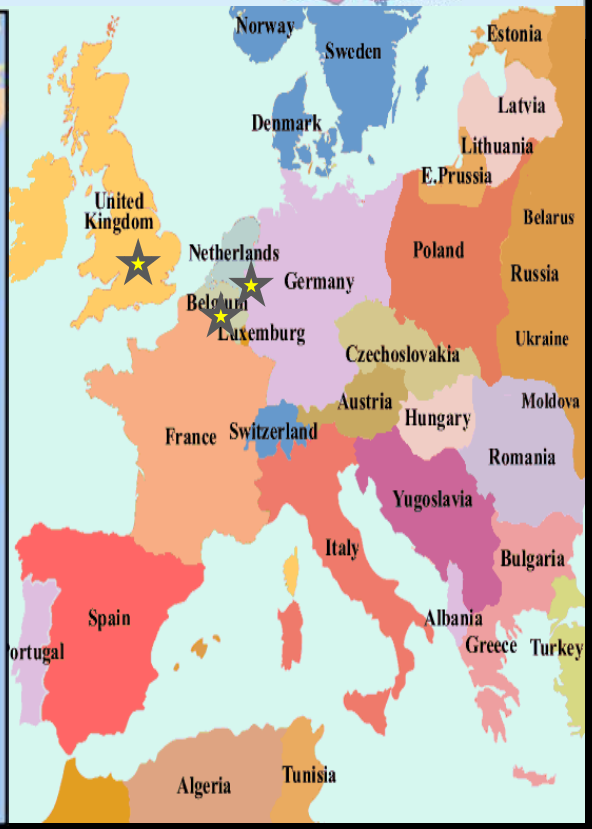
- Standing HR: 123±20 (SD) bpm to 100±13

ΔHR 40±14 to 23±9 (~60-70% “cure”)

- SF-36 physical function score:

32±8 to 44±9 (all *P*<0.001)

THRIEEMPOTSRegistry@texashealth.org



Exercise in POTS - Benefits

- **Short-term exercise training in POTS**
  - **Increases fitness levels**
  - **Increases blood volume**
  - **Cardiac Remodeling**
  - **Normalizes Sympathetic Activity**

  - **Decreases Orthostatic Tachycardia**
  - **Improves Quality of Life**

Qi Fu et al., JACC 2010;55:2858-68

Exercise in POTS – How To?

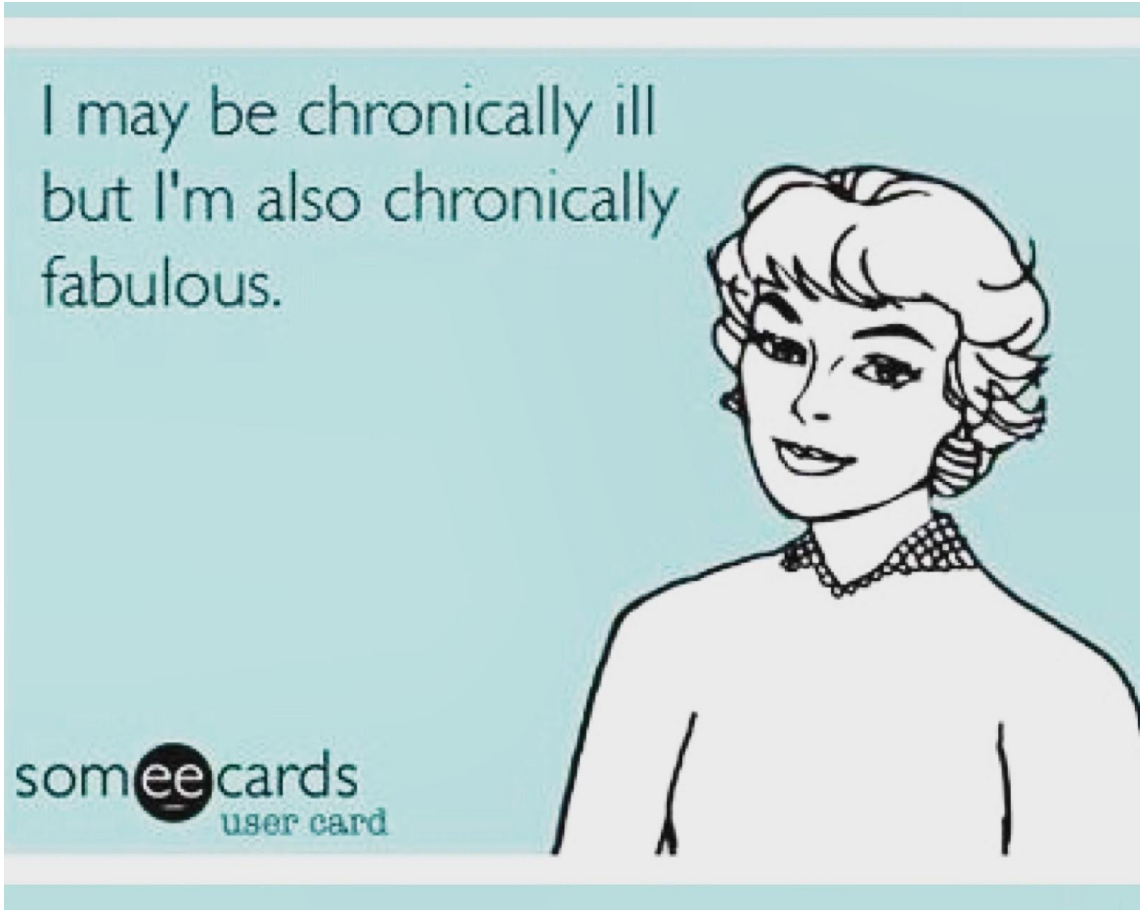
- **Focus on Aerobic Activity**
  - **Some resistance training focused on thighs**
- **Must be Regular**
  - **Every other day (4/week)**
- **30min/session -> 45-60min/session**
- **NO UPRIGHT EXERCISES**
  - **Rowing machines**
  - **Recumbent Cycles**
  - **Swimming**
- **Takes 4-5 weeks to start seeing benefits**

SR Raj, Heart Rhythm 2016;13:951-2

POTS: Treatment Approaches

- **Exercise**
- **Increase Blood Volume**
- **Hemodynamic Agents**
- **Behavioral Therapies**

Patient Motto



"I am convinced that life is 10% what happens to me and 90% of how I react to it. And so it is with you…we are in charge of our Atitudes."

- Charles R. Swindoll

Pediatric Pain Rehab Program (Mayo)

- **3 week pediatric pain rehab program**
  - **Adolescents with chronic disorders**
    - **Including POTS**
  - **Group settings -> social relationships**
  - **17 day OUTPATIENT program**
    - **2 planning days**
    - **15 therapy days**
- **Goals**
  - **Return to regular activities**
  - **Return to school**
  - **Learn Stress Management**

Pediatric Pain Rehab Program (Mayo)

Typical Child's Day

- **8 a.m.** — Stretching
- **8:30 a.m.** — Openers and goals
- **9 a.m.** — Stress management
- **10 a.m.** — Physical and occupational therapy
- **11 a.m.** — Coping strategies
- **Noon** — Lunch
- **1 p.m.** — Family program
- **2 p.m.** — Physical and occupational therapy
- **3 p.m.** — Relaxation and review of goals
- **4 p.m.** — Recreational therapy

Typical Parent's Day

- **8 a.m.** — Stretching
- **9 a.m.** — Parent group or rounds
- **10 a.m.** — Parent group three times a week
- **11 a.m.** — Possible class with teens
- **Noon** — Lunch
- **1 p.m.** — Family program

CONCLUSION:
Multimodal Treatment of POTS

- **Non-pharmacological**
- **Medications**
- **Exercise Program (***)**
- **Coping/Managing Illness**

Questions?

UNIVERSITY OF CALGARY