



FACULTY OF MEDICINE | UNIVERSITY OF CALGARY

The role of exercise in the care of patients with chronic kidney disease

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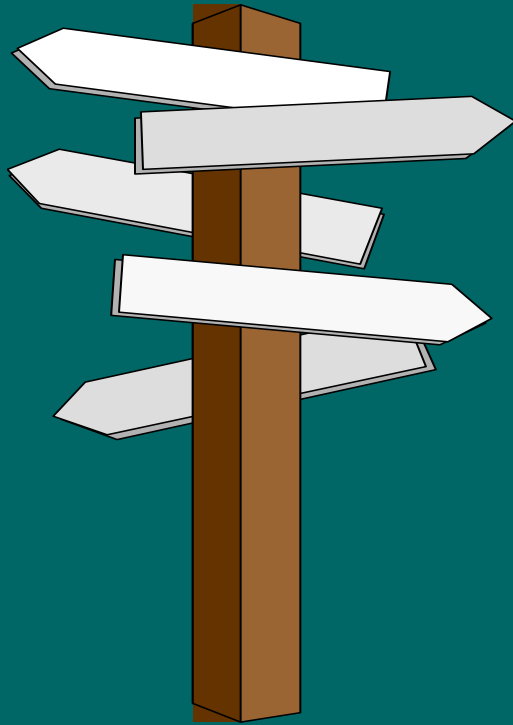
Overview

- Why exercise?
- ACSM guidelines and local situation
- Assessment tools
- Research highlights
- Dialysis exercise program
- Conclusion

Numbers

- Four years of local experience
- 80 patients (CKD and TX)
- More than 50 HD patients
- ~400 cardiopulmonary exercise tests
- >300 supervised exercise classes

The 5 E's of Rehabilitation



- **Exercise**
- **Encouragement**
- **Education**
- **Evaluation**
- **Employment**



Exercise - Definition

- Planned, structured physical activity requiring physical effort, done for the purpose of **sustaining or improving fitness and/or health**

Evidence for Exercise

- Diabetes
- CHF
- CVD
- COPD
- ESRD
- Renal Tx
- CKD

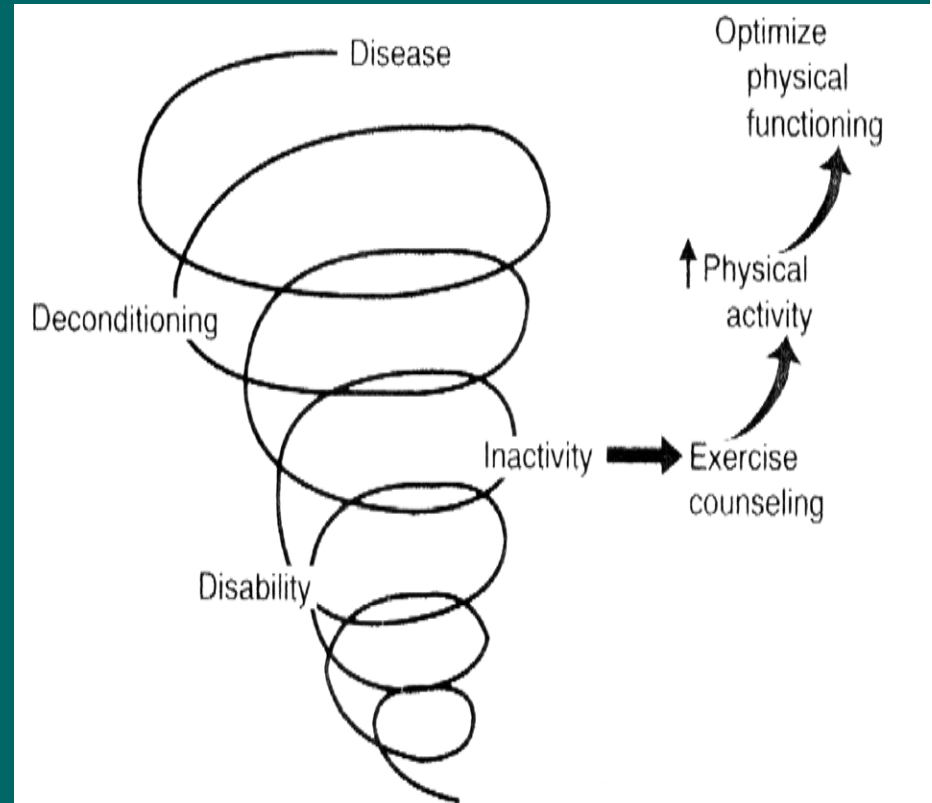
Sigal et al, Ann Intern Med 2007
Hambrecht et al, JAMA 2000
Casaburi et al, Chest 2005
Painter et al, Am J Kidney Dis 2002

Improved systolic BP
Improved insulin sensitivity
Improved glycemic control
Improved blood lipid profile
Improved autonomic tone
Improved endothelial function
Reduced systemic inflammation
Increased bone density
Increased endurance
Increased strength
Improved body composition
Improved physical function

Improved mood
Decreased fatigue
Increased energy for daily activities
Improved quality of life

Typical Patient Profile

- Chronic disease
- Multiple co-morbidities
- Aging
- Sedentary lifestyle



Painter 1996

Prescription for DX patients

Cardiovascular exercise:

- Mode (walking, cycling, swimming, low-level aerobics)
- Frequency (4-5 days/week)
- Intensity (12-15 RPE)
- Duration (work up to >30 min of continuous exercise)
- Progression (interm. to continuous)

BORG RPE Scale

Training Zone

6	
7	Very, very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Very, very hard
20	

Prescription for DX patients

Strengthening exercise:

- Mode (theraband, isometric, very low level weights)
- Frequency (2-3 days/week)
- Sets (x3 for major muscle groups)
- Repetitions (12-15 of each exercise)
- Progression (1 set of 12 reps with low weights and increase gradually)

Prescription for DX patients

Special considerations:

- Pts will have very low fitness levels
- Coordinate timing with DX sessions
- Expect freq. hospitaliz./setbacks
- Gradual progression is critical
- Use RPE instead of PHR (invalid)
- Use performance-based testing
- Motivate patients/educate staff

Prescription for TX patients

Cardiovascular exercise:

- Mode (walking, jogging, cycling, swimming, aerobics, sports)
- Frequency (4-5 days/week)
- Intensity (65-80% PHR, 12-15 RPE)
- Duration (work up to >30 min of continuous exercise)
- Progression (interm. to continuous)

Prescription for TX patients

Strengthening exercise:

- Mode (theraband, weights)
- Frequency (three times/week)
- Sets (x3 for major muscle groups)
- Repetitions (12-15 of each exercise)
- Progression (1 set of 12 reps with low weights and increase gradually)

Prescription for TX patients

Special considerations:

- Gradual progression
- Weight management
- MSK and orthopedic discomfort
- Avoid infectious situations
- Role of drugs (Prednisone) and rejections

Question

Of the patients followed in the CKD, DX and TX Wellness Clinic in Calgary, how many exercise according to the ACSM guidelines?

- 1) 100%
- 2) 65-70%
- 3) 50%
- 4) 30-35%
- 5) < 10%

Profile of exercise behavior in a sample of renal Tx patients

- 208 kidney Tx patients
- 42.3% sedentary
- 57.7% formal exercise program
- **Only 7% meeting the ACSM guidelines**

Kristal Kiland, Stefan Mustata, Serdar Yilmaz
JASN 18: 2007, 440A, SA-PO454

How do we improve this?

- Increase awareness among health providers of importance of exercise
- Provide consistent message
“appropriate exercise is safe and beneficial”
pre-dialysis → dialysis → post-transplant
- Add a new member to team

POSITION: Kinesiologist/Physiotherapist

KEY DUTIES:

- Promote benefits and safety of exercise/physical activity
- Lifestyle coaching, counseling & education
- Exercise/functional fitness evaluation, patient screening
- Exercise prescription & progression, exercise supervision
- Research

QUALIFICATIONS:

- Degree in exercise science (Master's preferred)
- CSEP Certified Exercise Physiologist or ACSM Exercise Specialist

SKILLS:

- Demonstrated ability to maintain positive, encouraging attitude while working with a diverse population of adults who live with multiple health challenges

Exercise Prescription



	6		
	7	Very, very light	4-5 days/wk
Aerobic	8	→	RPE 12-15 30 min
	9	Very light	
	10		
Strength	11	Fairly light	2-3 days/wk
	12	→	12-15 reps 1-3 sets
	13	Somewhat hard	
	14		
Flexibility	15	→	daily
	16		
	17	Very hard	
Balance	18	→	3 days/wk
	19	Very, very hard	
	20		

Progression

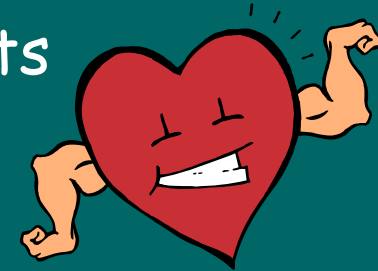
Important Considerations

- Current health status of individual
- Risk factors profile
- Exercise/functional fitness test results
- Individual's response to exercise
- Behavioural characteristics
- Level of motivation and support
- Individual's needs, goals, preferences

Energy Cost of Activities

10 METS

Cycle 200 watts
Run 6 mph



Carry groceries up stairs

Walk up stairs

Golfing (carry clubs)

Digging the garden

5 METS

Walk 3.5 mph

Threshold for Independence

House cleaning, shopping

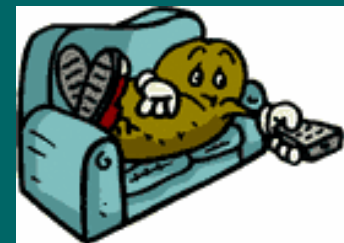
Dressing, grooming, showering

Walk 1.5 mph

Severe functional impairment

1 MET

Resting, watch TV



Assessment tools - CPET

- Evaluate aerobic capacity (VO_2 peak)
- Assess exercise-limiting factors
- Screen for exercise safety
- Determine exercise prescription for rehabilitation

Do all patients need a CPET?



Assessment tools-DASI and 6MWT

- Validity of the DASI and 6MWT for assessing aerobic capacity in patients with chronic kidney disease
 - Kilb B, S Groeneveld, K Kiland, W Giles, S Mustata. *Nephrology* 2008; 13(1): A90.
 - Kilb B, S Groeneveld, K Kiland, W Giles, S Mustata. *Nephrol Dial Transplant Plus* 2008; 1(2): ii63.

Functional Capacity

1 MET ↓	Can you take care of yourself?
	Eat, dress, or use the toilet?
	Walk indoors around the house?
	Walk a block or two on level ground at 2 to 3 mph or 3.2 to 4.8 km per h?
4 METs ↓	Do light work around the house like dusting or washing dishes?
	Climb a flight of stairs or walk up a hill?
	Walk on level ground at 4 mph or 6.4 km per h?
	Run a short distance?
	Do heavy work around the house like scrubbing floors or lifting or moving heavy furniture?
	Participate in moderate recreational activities like golf, bowling, dancing, doubles tennis, or throwing a baseball or football?
Greater than 10 METs	Participate in strenuous sports like swimming, singles tennis, football, basketball, or skiing?

- A fundamental requirement in carrying out many of these activities of daily living (ADL) is primarily the ability to perform aerobic work

Duke Activity Status Index (DASI)

- Brief self-administered questionnaire designed to estimate functional capacity
- Validated in a number of chronic disease populations as an adjunct for cardiopulmonary exercise testing
- Now validated in CKD patients

Can you...	Yes, with no difficulty. (score)
1. Take care of yourself, that is, eating, dressing, bathing, and using the toilet?	2.75
2. Walk indoors, such as around your house?	1.75
3. Walk a block or two on level ground?	2.75
4. Climb a flight of stairs or walk up a hill?	5.50
5. Run a short distance?	8.00
6. Do light work around the house like dusting or washing dishes?	2.70
7. Do moderate work around the house like vacuuming, sweeping floors, carrying in groceries?	3.50
8. Do heavy work around the house like scrubbing floors, or lifting or moving heavy furniture?	8.00
9. Do yard work like raking leaves, weeding or pushing a power mower?	4.50
10. Have sexual relations?	5.25
11. Participate in moderate recreational activities, like golf, bowling, dancing, double tennis, or throwing baseball or football?	6.00
12. Participate in strenuous sports like swimming, singles tennis, football, basketball or skiing?	7.50

Total Score _____

No points for "Yes, with some difficulty;" "No, I can't do this;" or "Don't do this for other reasons."
Adding the point values for all questions above scores the DASI.

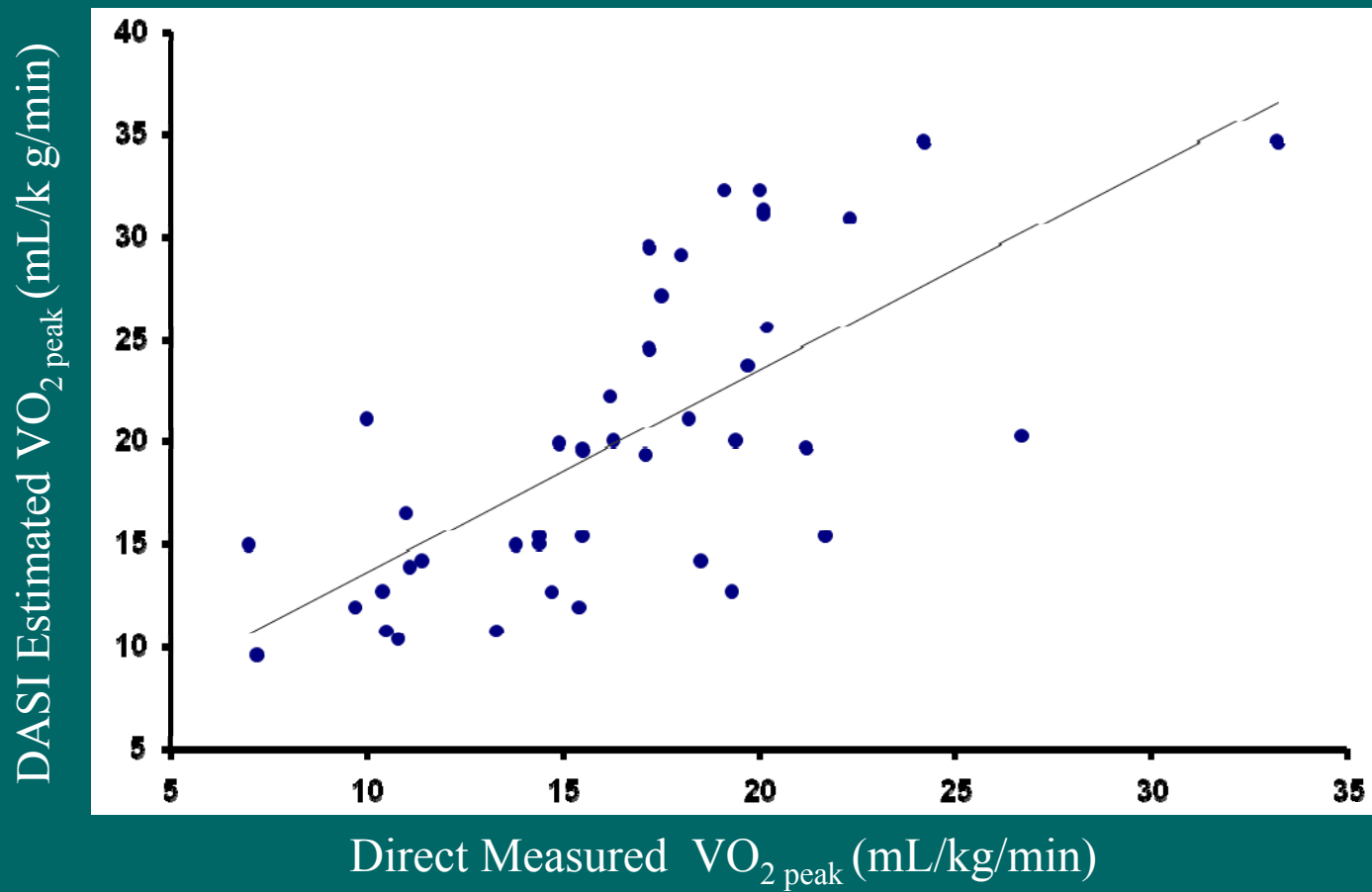
Patient Characteristics

Number of Patients (Native/Transplant)	42 (25/17)
Age (years)	60 (14)
Gender (F/M)	18/24
Diabetes Mellitus	20
Hypertension	36
BMI (kg/m ²)	31 (6.9)
Hemoglobin (g/L)	126 (15.6)
eGFR (mL/min/1.73m ²)	36.3 (13.0)
DASI Estimated VO _{2 peak} (ml/kg/min)	20.1 (7.5)
6-Minute Walk Distance (m)	475 (145)
Direct Measured VO _{2 peak} (mL/kg/min)	16.5 (5.2)

*Data presented as mean ± SD

Results

Figure 2: DASI Estimated Functional Capacity with Respect to Aerobic Capacity



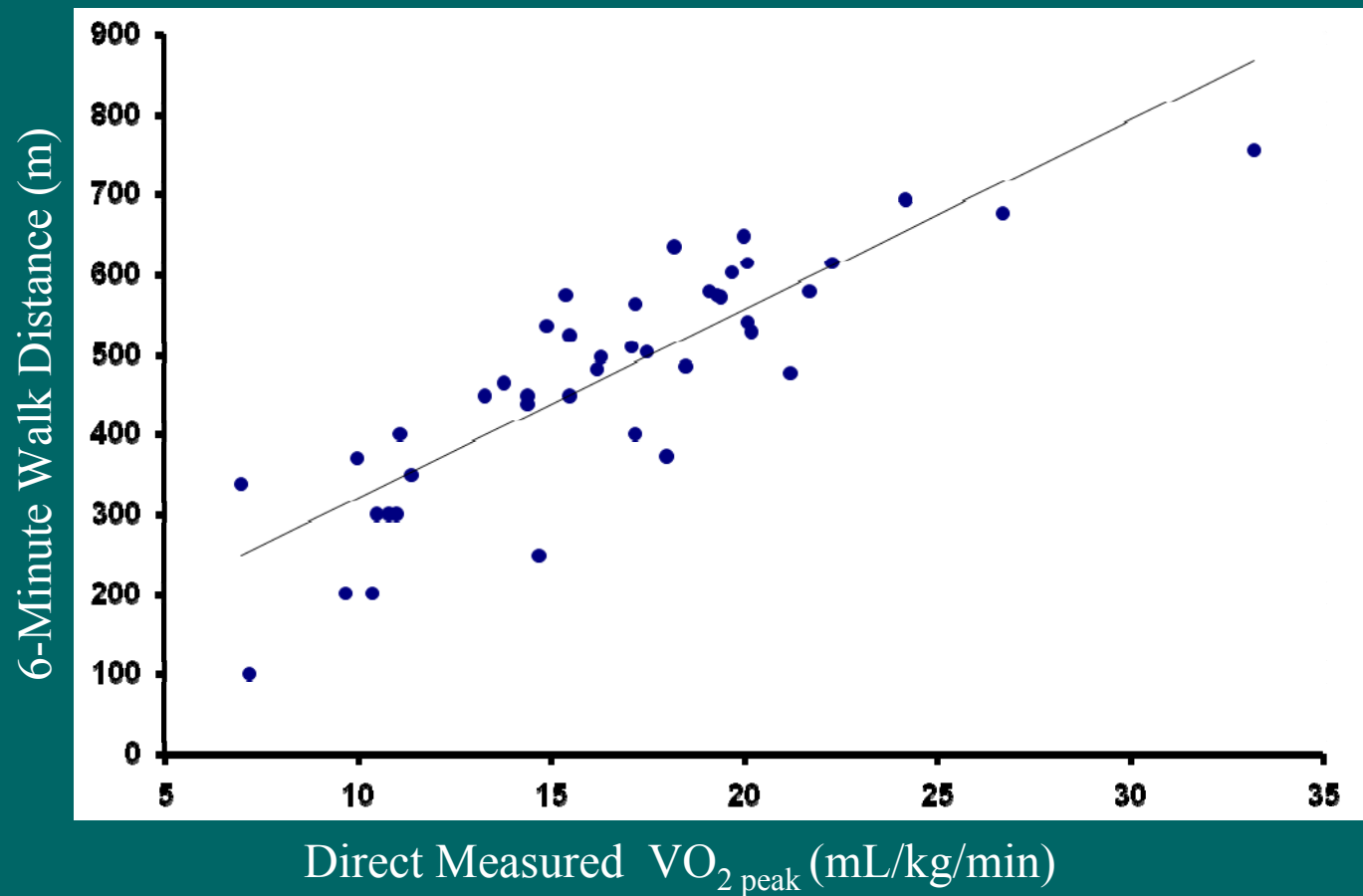
$r = 0.69$
($P < .001$)

Six-Minute Walk Test (6MWT)

- Easy, inexpensive sub-maximal evaluation of functional performance
- Valid across many populations
- A significant relationship has been demonstrated between six-minute walk distance and $VO_{2\text{ peak}}$ in the CKD population

Results

Figure 1: Six-Minute Walk Distance with Respect to Aerobic Capacity



$r = 0.85$
($P < .001$)

Assessment Tools - Conclusion

- DASI and 6MWT - valid tools for the evaluation of an established clinical index of physical fitness
- Allow early identification of individuals with compromised fitness
- Useful when CPET is not feasible or appropriate

Pilot project

Effects of exercise training on physical impairment, arterial stiffness and quality of life in patients with chronic kidney disease

S. Mustata, S. Groeneveld, K. Kiland, J. Stone, B. Manns, W. Davidson, G. Ford
JASN 18: 2007, 585A, SA-PO1096

Study Hypothesis

- In patients with CKD, exercise training in addition to standard care will result in a significant improvement in physical impairment, arterial stiffness and quality of life compared with standard care alone

Study Design

- Prospective randomized
- Duration (12 months)
- Sample size (20 patients)
- Enrollment
 - CKD Clinic (Colonel Belcher Hospital)
- Data collection (baseline, 6, 12 mo)

Patients

- GFR < 40 and > 20 ml/min/1.73 m²
- Sedentary
- Exclusion criteria
 - acute cardiopulmonary disease
 - uncontrolled diabetes or hypertension
 - persistent hyperkalemia
 - severe MSK abnormalities

Intervention - Exercise

- Individualized prescription
- Induction (twice a week for 1 month)
- Build-up (3, 4 and 5/week for 3 months)
- Maintenance (5/week for 8 months)
- Walking (treadmill) or stationary bike, elliptical

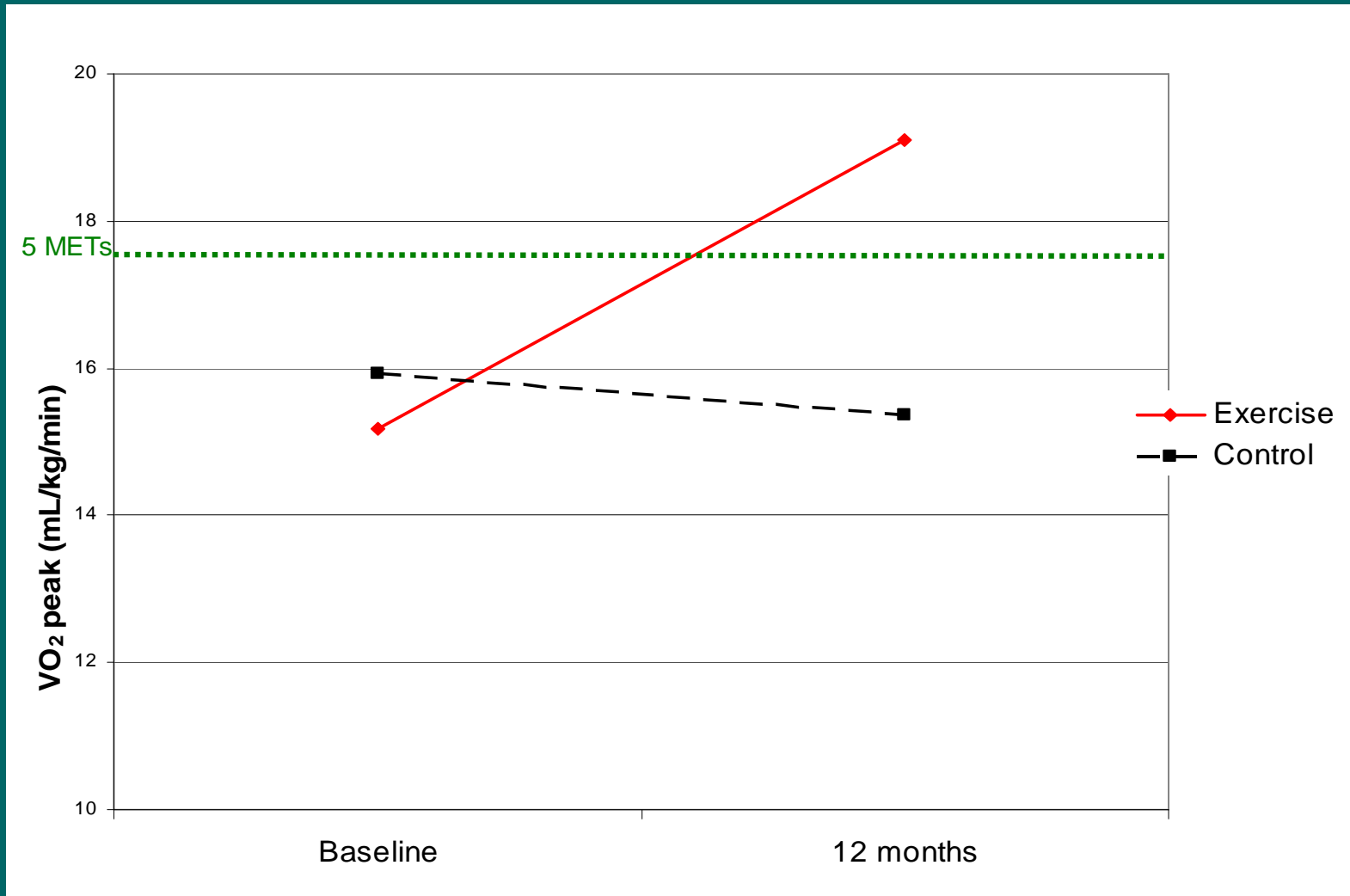
Outcomes

- Physical impairment (VO_2 peak, endurance time)
- Arterial stiffness (augmentation index)
- Quality of life (EQ-5D)

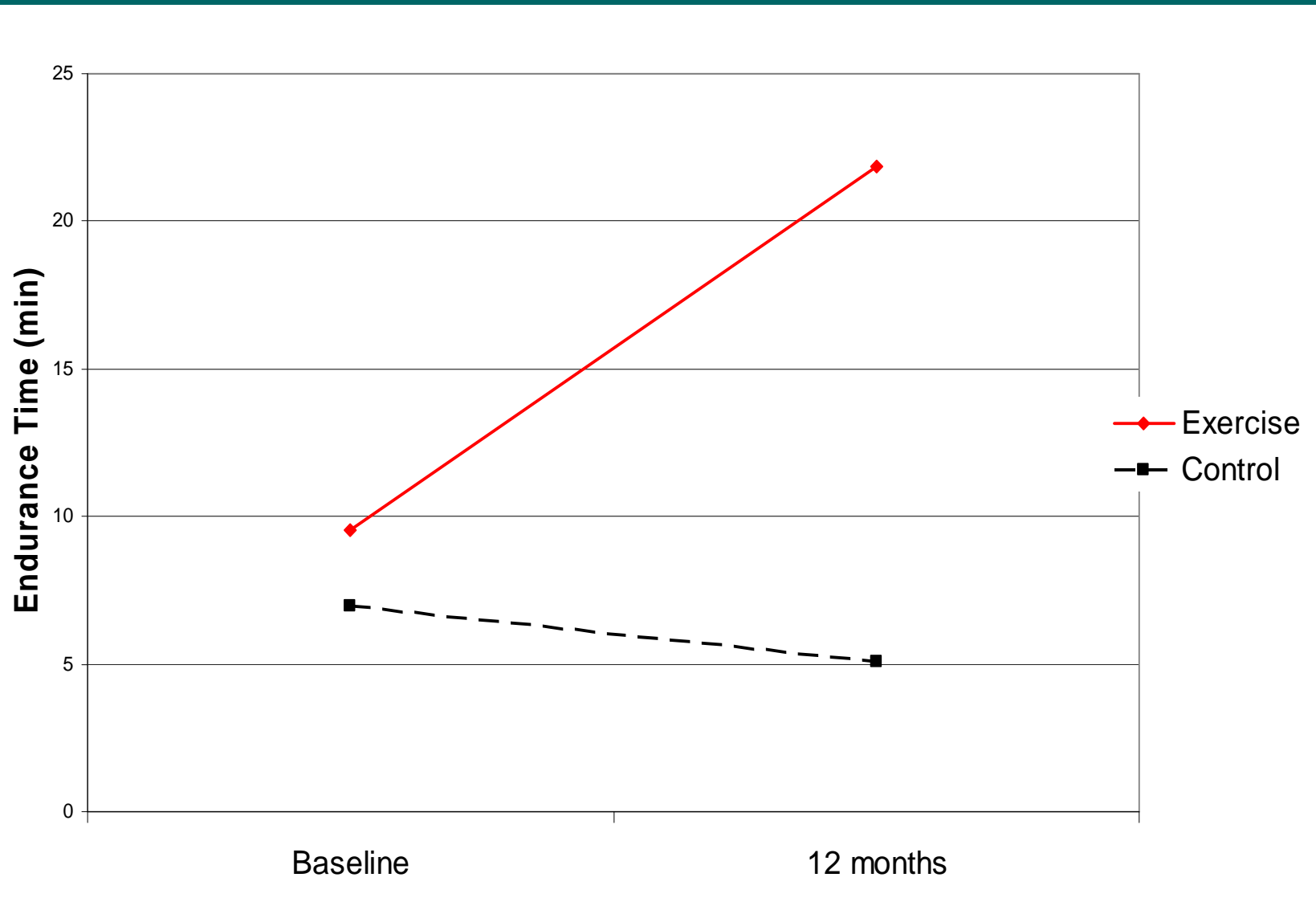
Baseline patient characteristics

Patient Characteristic	Exercise Group	Control Group
Number of patients (N)	10	10
Age (years)	64 (55,73)	72 (59,74)
Gender (F/M)	4/5	3/6
Cause of CKD (DM/Total)	5/9	6/9
BMI (kg/m ²)	27 (25,29)	29 (25,29)
Abdominal Girth (cm)	100 (86,102)	101 (94,102)
Systolic Blood Pressure (mmHg)	140 (135,150)	140 (125,150)
Diastolic Blood Pressure (mmHg)	75 (70,80)	70 (70,80)
GFR (mL/min/1.73sq.m)	28 (20,41)	31 (22,34)
VO ₂ Max (mL/kg/min)	16.4 (14.5,17.4)	16 (13.4,19.5)
Endurance time (min)	8.73 (5.27,14.2)	6.85 (5.58,7.62)
Augmentation Index (%)	30 (25,42)	28 (16,33)

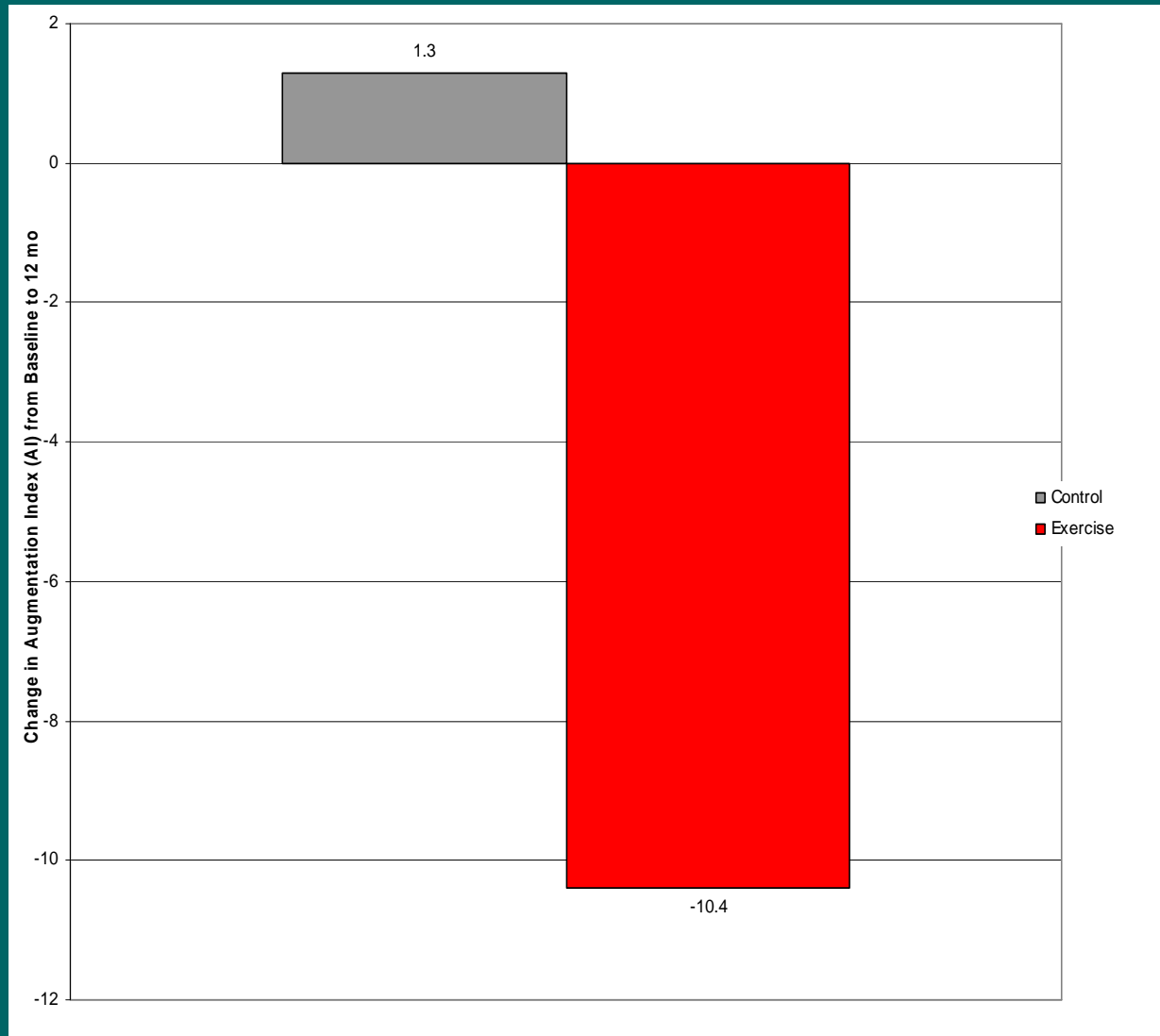
Results – VO_2 peak



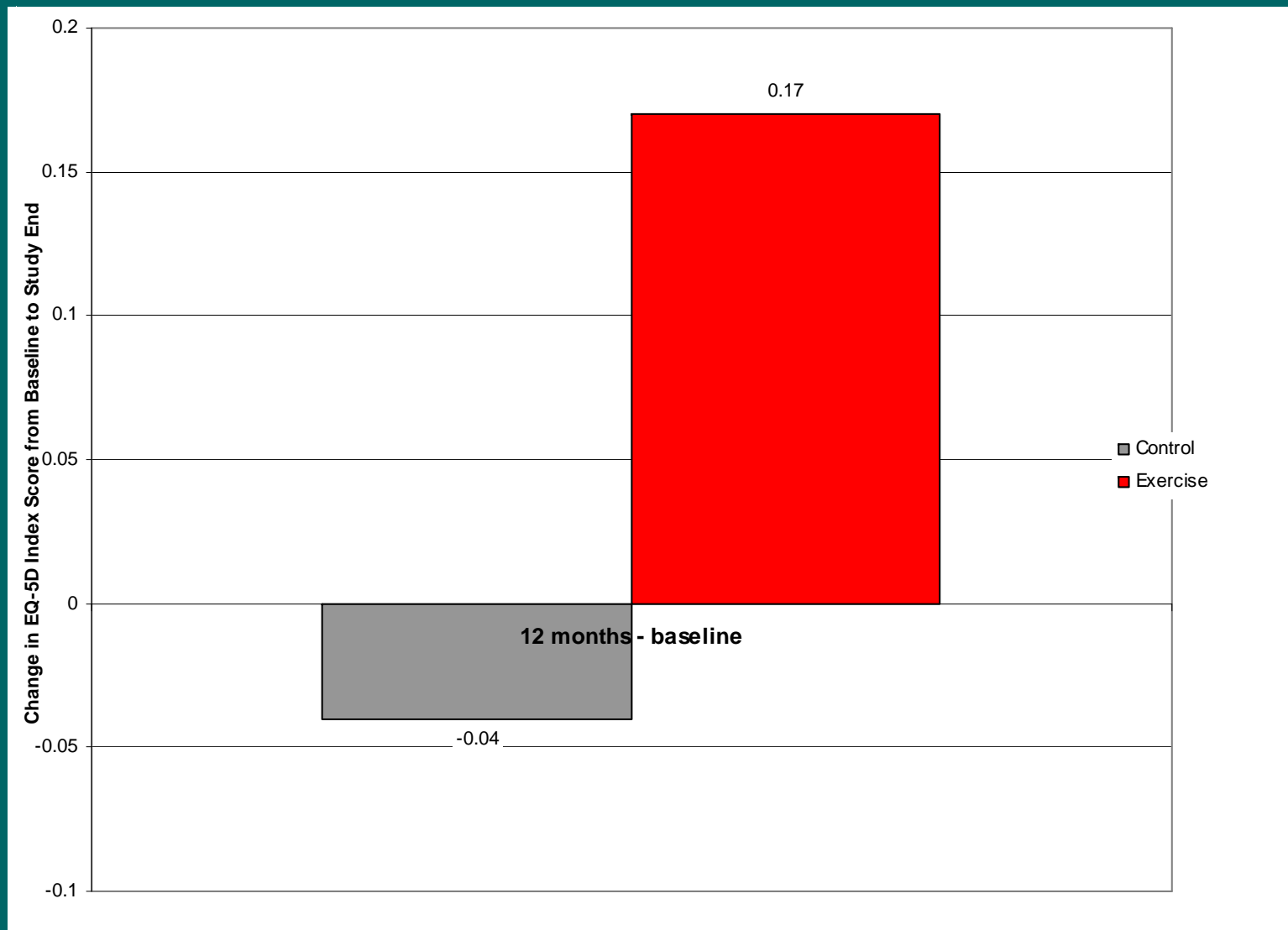
Results – endurance time



Results – Arterial stiffness



Results – quality of life

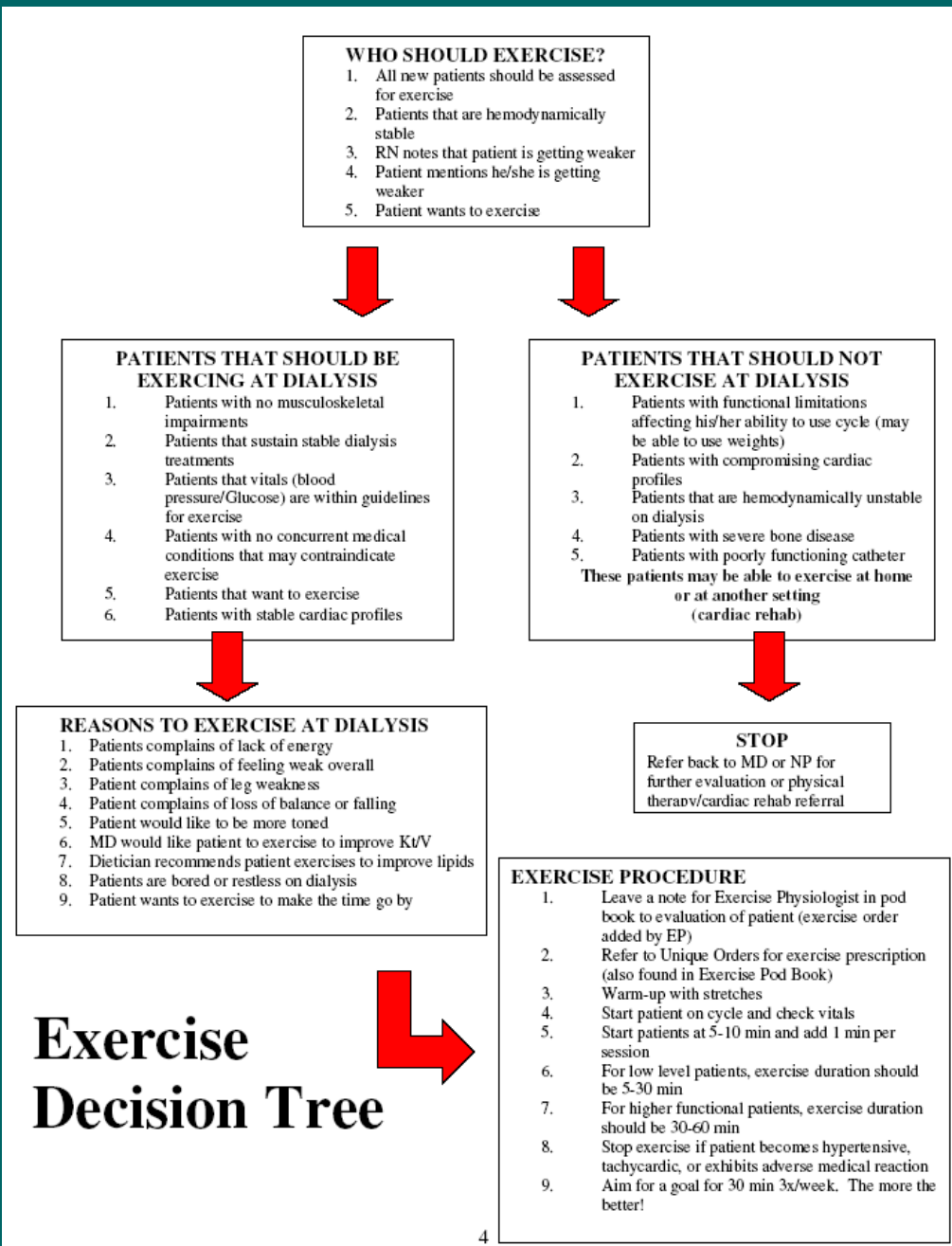


Dialysis Exercise Program

(Calgary, Canada)

- More than 50 pts using bike during dialysis
- Assessed by Kinesiologist
- Medical conditions - cleared by Nephrologist
- Gentle, progressive exercise
- Specific patient prescriptions
- Focus on transplant list patients
- Alternatives to bike
- Home or community exercise program

Patient Triage and Assessment



Adapted from University of Virginia SitFit Exercise Program



"The first thing I noticed after starting my exercise program was that I was more energized. My bones didn't ache as much. Best of all, it puts me in a good mood. It makes me feel better to be able to do this exercise." -Margaret



Future Growth

Short Term Goals



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Future Research

Effects of Exercise on:

- CKD patients
- Dialysis patients
- Renal transplant patients
- Health care costs
- Morbidity/Mortality

Conclusion

Exercise is:

- Needed
- Safe
- Beneficial

Kinesiologist/Physiotherapist plays key role

Further research required

Comprehensive Renal Rehab Program is
necessary

Acknowledgements

- Department of Medicine
- Division of Nephrology (SARP)
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- Faculty of Kinesiology
- Roche Pharmaceuticals
- Sanofi-Aventis Canada Inc.
- Kidney Foundation of Canada (AB branch)



“My doctor told me to start my exercise program very gradually. Today I drove past a store that sells sweat pants.”