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

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Calgary, Canada
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
NEW USDA DIETARY GUIDELINES

Avoid fatty meats

Get daily exercise

Eat your veggies
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

- 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

Sigal et al, Ann Intern Med 2007
Hambrecht et al, JAMA 2000
Casaburi et al, Chest 2005
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)
<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Very, very light</td>
</tr>
<tr>
<td>7</td>
<td>Very light</td>
</tr>
<tr>
<td>8</td>
<td>Very light</td>
</tr>
<tr>
<td>9</td>
<td>Fairly light</td>
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<td>10</td>
<td>Fairly light</td>
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<tr>
<td>11</td>
<td>Somewhat hard</td>
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<td>12</td>
<td>Somewhat hard</td>
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<tr>
<td>13</td>
<td>Hard</td>
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<td>14</td>
<td>Hard</td>
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<tr>
<td>15</td>
<td>Very hard</td>
</tr>
<tr>
<td>16</td>
<td>Very hard</td>
</tr>
<tr>
<td>17</td>
<td>Very, very hard</td>
</tr>
<tr>
<td>18</td>
<td>Very, very hard</td>
</tr>
</tbody>
</table>
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)
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
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

Frequency | Intensity | Duration | Mode
---|---|---|---
Aerobic | Very, very light | 4-5 days/wk | 67 Very, very light
Strength | Very light | RPE 12-15 30 min | 8 Very light
Flexibility | Fairly light | 2-3 days/wk 12-15 reps 1-3 sets | 9 Fairly light
Balance | Somewhat hard | daily | 10 Somewhat hard

Clinical Exercise Physiology 2003
ACSM's Exercise Management for Persons with Chronic Disease and Disabilities 2003
## 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

5 METS
- Carry groceries up stairs
- Walk up stairs
- Golfing (carry clubs)
- Digging the garden
- House cleaning, shopping
- Dressing, grooming, showering
- Walk 3.5 mph

Threshold for Independence

Severe functional impairment

1 MET
- Resting, watch TV
- Walk 1.5 mph
Assessment tools - CPET

- Evaluate aerobic capacity \((VO_2\text{peak})\)
- 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

- 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

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

**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

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patients (Native/Transplant)</td>
<td>42 (25/17)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>60 (14)</td>
</tr>
<tr>
<td>Gender (F/M)</td>
<td>18/24</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>20</td>
</tr>
<tr>
<td>Hypertension</td>
<td>36</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>31 (6.9)</td>
</tr>
<tr>
<td>Hemoglobin (g/L)</td>
<td>126 (15.6)</td>
</tr>
<tr>
<td>eGFR (mL/min/1.73m²)</td>
<td>36.3 (13.0)</td>
</tr>
<tr>
<td>DASI Estimated VO₂ peak (ml/kg/min)</td>
<td>20.1 (7.5)</td>
</tr>
<tr>
<td>6-Minute Walk Distance (m)</td>
<td>475 (145)</td>
</tr>
<tr>
<td>Direct Measured VO₂ peak (mL/kg/min)</td>
<td>16.5 (5.2)</td>
</tr>
</tbody>
</table>

*Data presented as mean ± SD*
Results

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

![Graph showing the relationship between DASI Estimated VO2 peak and Direct Measured VO2 peak.](image)

$r = 0.69$ (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$_2$ 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\textsubscript{2} peak, endurance time)
- Arterial stiffness (augmentation index)
- Quality of life (EQ-5D)
## Baseline patient characteristics

<table>
<thead>
<tr>
<th>Patient Characteristic</th>
<th>Exercise Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients (N)</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Age (years)</td>
<td>64 (55,73)</td>
<td>72 (59,74)</td>
</tr>
<tr>
<td>Gender (F/M)</td>
<td>4/5</td>
<td>3/6</td>
</tr>
<tr>
<td>Cause of CKD (DM/Total)</td>
<td>5/9</td>
<td>6/9</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27 (25,29)</td>
<td>29 (25,29)</td>
</tr>
<tr>
<td>Abdominal Girth (cm)</td>
<td>100 (86,102)</td>
<td>101 (94,102)</td>
</tr>
<tr>
<td>Systolic Blood Pressure (mmHg)</td>
<td>140 (135,150)</td>
<td>140 (125,150)</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mmHg)</td>
<td>75 (70,80)</td>
<td>70 (70,80)</td>
</tr>
<tr>
<td>GFR (mL/min/1.73sq.m)</td>
<td>28 (20,41)</td>
<td>31 (22,34)</td>
</tr>
<tr>
<td>VO₂ Max (mL/kg/min)</td>
<td>16.4 (14.5,17.4)</td>
<td>16 (13.4,19.5)</td>
</tr>
<tr>
<td>Endurance time (min)</td>
<td>8.73 (5.27,14.2)</td>
<td>6.85 (5.58,7.62)</td>
</tr>
<tr>
<td>Augmentation Index (%)</td>
<td>30 (25,42)</td>
<td>28 (16,33)</td>
</tr>
</tbody>
</table>
Results – VO₂ peak

![Graph showing VO₂ peak changes](image-url)

Baseline 12 months

VO₂ peak (mL/kg/min)

Exercise
Control

5 METs
Results – endurance time

![Graph showing endurance time over 12 months for exercise and control groups.](image)

- **Exercise** group shows a significant increase in endurance time from baseline to 12 months.
- **Control** group shows a decrease in endurance time from baseline to 12 months.

Endurance Time (min)
Results – Arterial stiffness

Change in Augmentation Index (AI) from Baseline to 12 mo

Control
Exercise
Results – quality of life

Change in EQ-5D Index Score from Baseline to Study End

- 12 months - baseline
- 0.17

Control

Exercise
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

WHO SHOULD EXERCISE?
1. All new patients should be assessed for exercise
2. Patients that are hemodynamically stable
3. RN notes patient is getting weaker
4. Patient mentions he/she is getting weaker
5. Patient wants to exercise

PATIENTS THAT SHOULD BE EXERCISING AT DIALYSIS
1. Patients with no musculoskeletal impairments
2. Patients that sustain stable dialysis treatments
3. Patients that have blood pressure/heart rate within guidelines for exercise
4. Patients with no concurrent medical conditions that may contraindicate exercise
5. Patients that want to exercise
6. Patients with stable cardiac profiles

PATIENTS THAT SHOULD NOT EXERCISE AT DIALYSIS
1. Patients with functional limitations affecting their ability to use cycle (may be able to use weights)
2. Patients with compromising cardiac profiles
3. Patients that are hemodynamically unstable on dialysis
4. Patients with severe bone disease
5. Patients with poorly functioning catheter
These patients may be able to exercise at home or at another setting (cardiac rehab)

REASONS TO EXERCISE AT DIALYSIS
1. Patients complain of lack of energy
2. Patients complain of feeling weak overall
3. Patient complains of leg weakness
4. Patient complains of loss of balance or falling
5. Patient would like to be more toned
6. MD would like patient to exercise to improve Kt/V
7. Dietitian recommends patient exercises to improve lipids
8. Patients are bored or restless on dialysis
9. Patient wants to exercise to make the time go by

STOP
Refer back to MD or NP for further evaluation or physical therapy/cardiac rehab referral

Exercise Decision Tree

EXERCISE PROCEDURE
1. Leave a note for Exercise Physiologist in pod book to evaluate patient (exercise order added by EP)
2. Refer to Unique Orders for exercise prescription (also found in Exercise Pod Book)
3. Warm up with stretches
4. Start patient on cycle and check vitals
5. Start patients at 5-10 min and add 1 min per session
6. For low level patients, exercise duration should be 5-30 min
7. For higher functional patients, exercise duration should be 30-60 min
8. Stop exercise if patient becomes hypertensive, tachycardic, or exhibits adverse medical reaction
9. Aim for a goal of 30 min 3x/week. The more the better!

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
  - New patient growth = 10% per month
  - More bikes, therabands, and Wii themes, contests, or annual events to "create a culture"
  - Creation of outcome measures: KDQOL, DASI, Sit-To-Stand, BERG, URR, BP, BMI

- Long-Term Goals
  - Staffing, more sites, Renal Rehab Center
Future Research

Effects of Exercise on:

- CKD patients
- Dialysis patients
- Renal transplant patients
- Health care costs
- Morbidity/Mortality
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)
- ALTRA
- 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.”